CONSENT AGENDA
DRAINAGE DISTRICT
BOARD OF DIRECTORS
July 21, 2015
9:00 A.M.

NOTICE is hereby given in accordance with Chapter 551, Texas Government Code, that a SPECIAL MEETING of the Drainage District #1 Board of Directors will be held at the Edinburg Council Chambers 415 W. University Drive, Edinburg, Hidalgo County, Texas. Discussion and possible action relating to the following business will be transacted:

NOTICE TO THE PUBLIC
CONSENT AGENDA

The following items are of a routine or administrative nature. The Drainage District #1 Board has been furnished with background and support on each item, and/or it has been discussed at a previous meeting. All items will be acted upon by one vote without being discussed separately unless requested by a Board Member, in which event the item or items will immediately be withdrawn for individual consideration in its normal sequence after the items not requiring separate discussion have been acted upon. The remaining items will be adopted by one vote.

1. Approval of check register and payment of claims and bills - County Treasurer

2. **AI -50559** Request approval to process the following Line Item Transfers:
A. Admin
B. M&O
C. CIP 133

3. **AI -50478** Request approval of Change Order no. 3 from RDH Site & Concrete, LLC in the amount of $(3,024.00) related to Construction Contract No. HCDD1-14-010-04-09-Pct.2 Rural Drainage Development Seminole Valley Subdivision. The reduction is due to adjustments in quantity for close out reconciliation. Project Engineer: R. Gutierrez Engineering.

4. **AI -50525** Request approval for Change Order No. 3 in the amount of $6,789.47 for GO Underground, LLC related to Construction Contract No. HCDD1-14-031-12-02 Pct.1 Spanish Palms Subdivision Improvements.

5. **AI -50419** Request approval to issue payment on the following items after review & audit procedures have been met:

A. Inv#Jan 15-10 in the amount of $27531.88 from LeFevre Engineering & Management Consulting, LLC related to Work Authorization no. 2-Professional Engineering Services for Kenyon/Mile 17 1/2 Area Drainage Improvements. PO No. 626106 & 628105.

6. **AI -50488** Request approval to issue payments on the following items after review and audit procedures have been met:

Tedsi Infrastructure Group:

A. Inv No. 20152385 in the amount of $3,062.36 related to Work Authorization no. 17-Spanish Palms Outfall Improvements. PO#627013.

B. Inv No. 20152355 in the amount of $11,458.35 related to Work Authorization no. 13-Lower Rio Grande Valley Water Management Program-Preliminary Engineering Report. PO#623666.

C. Inv No. 20152381 in the amount of $46,856.51 related to Work Authorization no. 8-Lower Rio Grande Valley Water Management Program-General Management Consultant Services. PO#623578.

D. Inv No. 20152382 in the amount of $1,799.42 related to Work Authorization No. 12-Lower Rio Grande Valley Water Management Program-Legal Services. PO#623665.

E. Inv. No. 20152353 in the amount of $72,312.44 related to Work Authorization No. 8-Lower Rio Grande Valley Water Management Program-General Management Consultant Services. PO#623578.

F. Inv. No. 20152357 in the amount of $3,734.18 related to Work Authorization No. 17-Spanish Palms Outfall Improvements. PO# 627013.

L&G Consulting Engineers:

G. Inv. No. 11325192 in the amount of $17,272.60 related to Work Authorization No. 6-La Joya Watershed Improvements-US 83 Relief Route Hydraulic Study. PO#627083.

7. **AI -50516** Request approval to issue payment on the following items that have met audit requirements:

L&G Consulting Engineers:

2013 Bonds:

A. Inv No. 11325189 in the amount of $47,089.09 related to Work Authorization No. 6A-La Joya Watershed Improvements -TxDot Outfall to IBWC Levee.

B. Inv No. 11325196 in the amount of $116,833.99 related to Work Authorization No. 2-Pharr McAllen Drain & South Flood Water Channel Watershed Improvements. PO#626939.

C. Inv No. 11325198 in the amount of $10,216.27 related to Work Authorization No. 4-La Joya Watershed Improvements-Liberty Pit Detention

D. Inv No. 11325174 in the amount of $2,089.83 related to Work Authorization No. 1-FM 676 Outfall Analysis and Evaluation of proposed drainage improvements from SH107 to East to Taylor Road. PO#622895.

General Fund:

E. Inv No. 11325195 in the amount of $60,817.80 related to Work Authorization No. 1-Pharr McAllen Drain & South Flood Water Channel Watershed Improvement Project. PO#626860.

S&B Infrastructure Ltd:

F. Inv No. U9444.812-08a in the amount of $89,350.00 related to Work Authorization No.17-MDS PH.2 Design & Expansion of the Raymondville Drain Outfall System. PO#626525.

AI -50559 **2.**

DRAINAGE - CONSENT

Meeting Date: 07/21/2015

Submitted By: Claudette Guerrero, DRAINAGE DISTRICT

Department: DRAINAGE DISTRICT

Information

CAPTION

Request approval to process the following Line Item Transfers:
A. Admin
B. M&O
C. CIP 133

BACKGROUND

Fiscal Impact

Attachments

No file(s) attached.

Form Review

Inbox	**Reviewed By**	**Date**
Budget & Management	Veronica Ortiz	07/17/2015 02:59 PM
Final Approval	Monica Badillo	07/17/2015 05:41 PM

Form Started By: Claudette Guerrero Started On: 07/17/2015 02:39 PM

Final Approval Date: 07/17/2015

AI -50478 **3.**

DRAINAGE - CONSENT

Meeting Date: 07/21/2015

Submitted By: Claudette Guerrero, DRAINAGE DISTRICT

Department: DRAINAGE DISTRICT

Information

CAPTION

Request approval of Change Order no. 3 from RDH Site & Concrete, LLC in the amount of $(3,024.00) related to Construction Contract No. HCDD1-14-010-04-09-Pct.2 Rural Drainage Development Seminole Valley Subdivision. The reduction is due to adjustments in quantity for close out reconciliation. Project Engineer: R. Gutierrez Engineering.

BACKGROUND

Fiscal Impact

Attachments

Change Order No. 3- Seminole Valley

Form Review

Inbox	**Reviewed By**	**Date**
Budget & Management	Veronica Ortiz	07/16/2015 11:24 AM
Final Approval	Monica Badillo	07/17/2015 05:41 PM

Form Started By: Claudette Guerrero Started On: 07/15/2015 04:15 PM

Final Approval Date: 07/17/2015

CHANGE ORDER NUMBER THREE (3)

PROJECT: PCT2 Rural Drainage Development - Seminole Valley Subd Area Drainage Improvements

DATE OF ISSUANCE: _____ **EFFECTIVE DATE:** _____

OWNER: Hidalgo County Drainage District No. 1

CONTRACTOR: RDH Site & Concrete, LLC
1201 E. Moore Rd #89
Pharr, TX 78577

ENGINEER: R. Gutierrez Engineering Corporation
130 E. Park Ave.
Pharr, TX 78577

You are directed to make the following changes in the Contract Documents.

Description: **FINAL QUANTITY ADJUSTMENTS**

1. Construction Exit (Ty II) (Install) reduced to 0
2. Construction Exit (Ty II) (Remove) reduced to zero
3.
4.
5.
6.

Reason:

1. Not installed
2. Not installed so no need to remove
3.
4.
5.
6.

Attachments:

Change in Contract Price:		CHANGE IN CONTRACT TIME:
Original Contract Price $ 307,273.00		Original Contract Time for Substantial Completion: 30 calendar days or dates
Net Changes from previous Change Order $ 7,500.00		Net change from previous Change Orders 23 calendar days
Contract Price prior to this Change Order $ 314,773.00		Contract Time prior to this Change Order Substantial Completion: 53 calendar days or dates
Net Increase (decrease) of this Change Order $ (3,024.00)		Net Increase (decrease) of this Change Order 63 calendar days
Contract Price with all approved Change Orders $ 311,749.00	Net % increase (decrease) from original contract price. 1.50 %	Contract Time with all approved Change Orders Substantial Completion: 116 calendar days or dates

RECOMMENDED:
By: _____, P.E.
Engineer (Authorized Signature)
Date: 5/5/15

APPROVED:
By: _____
Owner (Authorized Signature)
Date: 7/8/15

ACCEPTED:
By: _____
Contractor (Authorized Signature)
Date: 4-27-15

RECEIVED
MAY

CHANGE ORDER NO. 3 TABULATION

PCT2 Rural Drainage Development - Seminole Valley Subd Area Drainage Improvements

C.O. #3 Quantities	Unit	Item Description	Unit Price	Revised Unit Price	Original Contract Cost	Change in Contract Cost of C.O.#1	Revised Contract Cost after C.O.#1	Change in Contract Cost of C.O.#2	Revised Contract Cost after C.O.#2	Change in Contract Cost of C.O.#3	Revised Contract Cost after C.O.#3
SEMINOLE VALLEY SUBDIVISION AREA											
2114.00	SY	Cellulose Fiber Mulch Seeding (Permanent) (Rural) (Clay)	$ 1.50	$ 1.50	$ 3,171.00	$ -	3,171.00	$ -	3,171.00	$ -	3,171.00
25.00	MG	Vegetated Watering	$ 20.00	$ 20.00	$ 500.00	$ -	500.00	$ -	500.00	$ -	500.00
515.00	CY	Cement Stabilized Backfill	$ 30.00	$ 30.00	$ 15,450.00	$ -	15,450.00	$ -	15,450.00	$ -	15,450.00
1361.00	LF	Trench Excavation Protection	$ 2.00	$ 2.00	$ 2,722.00	$ -	2,722.00	$ -	2,722.00	$ -	2,722.00
27.00	CY	Concrete Riprap (CL B) (5")	$ 130.00	$ 130.00	$ 3,510.00	$ -	3,510.00	$ -	3,510.00	$ -	3,510.00
188.00	LF	Concrete Box Culvert (6-Ft x 2-Ft)	$ 32.00	$ 32.00	$ 6,016.00	$ -	6,016.00	$ -	6,016.00	$ -	6,016.00
64.00	LF	Reinforced Concrete Pipe (42-IN) (CL III) (SPL)	$ 95.00	$ 95.00	$ 6,080.00	$ -	6,080.00	$ -	6,080.00	$ -	6,080.00
1252.00	LF	Reinforced Concrete Pipe (60-IN) (CL III) (SPL)	$ 180.00	$ 180.00	$ 225,360.00	$ -	225,360.00	$ -	225,360.00	$ -	225,360.00
1.00	EA	Inlet (Complete) (Ty M w/Grate)	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ -	5,000.00	$ -	5,000.00	$ -	5,000.00
1.00	EA	Junction Box (10-ft x 5-ft x/Grate)	$ 9,000.00	$ 9,000.00	$ 9,000.00	$ -	9,000.00	$ -	9,000.00	$ -	9,000.00
1.00	EA	Junction Box (10-ft x 5-ft)	$ 9,000.00	$ 9,000.00	$ 9,000.00	$ -	9,000.00	$ -	9,000.00	$ -	9,000.00
1.00	EA	Junction Box (16-ft x 5-ft)	$ 12,000.00	$ 12,000.00	$ 12,000.00	$ -	12,000.00	$ -	12,000.00	$ -	12,000.00
0.00	SY	Construction Exit (Ty II) (Install)	$ 6.00	$ 6.00	$ 1,512.00	$ -	1,512.00	$ -	1,512.00	$ (1,512.00)	0.00
0.00	SY	Construction Exit (Ty II) (Remove)	$ 6.00	$ 6.00	$ 1,512.00	$ -	1,512.00	$ -	1,512.00	$ (1,512.00)	0.00
144.00	LF	Temporary Sediment Control Fence	$ 10.00	$ 10.00	$ 1,440.00	$ -	1,440.00	$ -	1,440.00	$ -	1,440.00
40.00	LF	RCP Irrigation Pipe (36-IN)	$ 100.00	$ 100.00	$ 4,000.00	$ -	4,000.00	$ -	4,000.00	$ -	4,000.00
1.00	MO	Barricades, Signs and Traffic Handling	$ 1,000.00	$ 1,000.00	$ 1,000.00	$ -	1,000.00	$ -	1,000.00	$ -	1,000.00
1.00	EA	Manhole Type M	$ -	$ 7,500.00	$ -	$ 7,500.00	7,500.00	$ -	7,500.00	$ -	7,500.00
		Total Seminole Valley Subdivision Area			**$ 307,273.00**	**$ 7,500.00**	**$ 314,773.00**	**$ -**	**$ 314,773.00**	**$ (3,024.00)**	**$ 311,749.00**

4/22/2015
11:56 AM

AI -50525 **4.**

DRAINAGE - CONSENT

Meeting Date: 07/21/2015

Submitted By: Claudette Guerrero, DRAINAGE DISTRICT

Department: DRAINAGE DISTRICT

Information

CAPTION

Request approval for Change Order No. 3 in the amount of $6,789.47 for GO Underground, LLC related to Construction Contract No. HCDD1-14-031-12-02 Pct.1 Spanish Palms Subdivision Improvements.

BACKGROUND

Fiscal Impact

Attachments

Change Order No. 3-Spanish Palms Sub

Form Review

Inbox	Reviewed By	Date
Budget & Management	Veronica Ortiz	07/17/2015 01:10 PM
Final Approval	Monica Badillo	07/17/2015 05:41 PM

Form Started By: Claudette Guerrero Started On: 07/16/2015 08:01 PM

Final Approval Date: 07/17/2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 15 2015
4:12 AM/PM
BY:

CHANGE ORDER #3

PROJECT: Spanish Palms Subdivision

DATE OF ISSUANCE: May 22, 2015 **EFFECTIVE DATE:**

OWNER: Hidalgo County Drainage District No. 1
OWNER's Contract No.: HCCD1-14-031-12-02
P.O. No.: 626176
CONTRACT DATE: 1/8/2015
CONTRACT DAYS: 90 **CONTRACT FIRST WORK DAY:** 2/9/2015

CONTRACTOR: GO UNDERGROUND LLC
217 E Monroe Ave,
Harlingen TX 78550

ENGINEER: TEDSI INFRASTRUCTURE GROUP
1201 East Expressway 83
Mission, Texas 78572

You are directed to make the following changes in the Contract Documents.

Description:
1. Request of Steel Plates for Jack and Bore protection rental approval this is due to change in alignment as per NAWSC water line, the new Jack and Bore location has less cover, therefore during the construction to avoid cave-in would be necessary

Reason for Change Order:
1. Change on alignment due to conflict with NAWSC water line at the west side of FM 1016

Attachments: Change Order No 3 Tabulations
Contractors Quote
Details of adjustments discussed between Contractor and Mr. Fina (TEDSI) concur.

Change in Contract Price:		CHANGE IN CONTRACT TIME:	
Original Contract Price $ 283,595.20		Original Contract Time for Substantial Completion:	90 calendar days or dates
Net Changes from previous Change Order $ 11,653.00		Net change from previous Change Orders	20 calendar days
Contract Price prior to this Change Order $ 295,248.20		Contract Time prior to this Change Order Substantial Completion:	110 calendar days or dates
Net Increase (decrease) of this Change Order $ 6,789.47		Net Increase (decrease) of this Change Order	0 calendar days
Contract Price with all approved Change Orders $ 302,037.67	Net % increase (decrease) from original contract price. 6.50 %	Contract Time with all approved Change Orders Substantial Completion:	110 calendar days or dates

RECOMMENDED:
By: _____
Engineer (Authorized Signature)
Date: 05/27/2015

APPROVED:
By: _____
Owner (Authorized Signature)
Date: _____

ACCEPTED:
By: George Olivares
Contractor (Authorized Signature)
Date: 05/27/2015

DAILY REPORT OF FORCE ACCOUNT WORK
ON CHANGE ORDER FOR 18 IN IRRIGATION OFFSET

COUNTY: HIDALGO

HIGHWAY: FM 1015

DATE APRIL 13, 2015
DATE APRIL 17, 2015

STATION

STATEMENT OF EQUIPMENT AND LABOR

EQUIPMENT					LABOR						OVERHEAD	
DESCRIPTION	HRS	RATE	OPERATION COST	AMOUNT	CLASIFICATION AND NAME	HRS REG	HRS O.T.	RATE REG	RATE O.T.	AMOUNT	LABOR 80%	EQUIPMENT 15%
EXCAVATOR	10	$ 146.15	$ -	$ 1,461.50	GUILLERMO HERNANDEZ	10	0	$ 14.50	$ 20.25	$ 145.00		
410G BACKHOE	0	$ 41.11	$ -	$ -	RAFA CARRIZALES	10	0	$ 12.30	$ 19.50	$ 123.00		
FORD TRUCK #	10	$ 25.62	$ -	$ 256.20	HUGO SANCHEZ	10	0	$ 10.00	$ 19.50	$ 100.00		
DODGE TRUCK#	0	$ 25.62	$ -	$ -	GERRARDO SANCHEZ	10	0	$ 9.86	$ 19.50	$ 98.60		
TRAILER TOP HAT	10	$ 2.89	$ -	$ 28.90	FRANSISCO MENDOZA	10	0	$ 12.00	$ 19.50	$ 120.00		
TRAILER	0	$ 2.89	$ -	$ -		0	0	$ -	$ -	$ -		
QUIKIE SAW	0	$ 8.85	$ -	$ -		0	0	$ -	$ -	$ -		
JACK HAMMER	0	$ 12.00	$ -	$ -		0	0	$ -	$ -	$ -		
624H LOADER	0	$ 59.83	$ -	$ -		0	0	$ -	$ -	$ -		
GENERATOR #1	0	$ 4.43	$ -	$ -		0	0	$ -	$ -	$ -		
GENERATOR #2	0	$ 4.43	$ -	$ -		0	0	$ -	$ -	$ -		
WATER TRUCK	0	$ 56.07	$ -	$ -		0	0	$ -	$ -	$ -		
COMPACTOR	0	$ 34.40	$ -	$ -		0	0	$ -	$ -	$ -		
WATER PUMP 2 IN	0	$ 2.84	$ -	$ -		0	0	$ -	$ -	$ -		
WATER PUMP 8 IN	0	$ 31.77	$ -	$ -		0	0	$ -	$ -	$ -		
	0	$ -	$ -	$ -								
TOTAL		$		1,746.60				TOTAL	$	586.60	$ 1,055.88	$ 2,008.59

STATEMENT OF MATERIALS TO BE USE				MATERIALS
6 PLATES 1 IN THICK 4FT X 8 FT FT STEAL PLATES RENTAL	4	$ 620.00	$ 2,480.00	25%
EXTRA TRAFFIC CONRTOL FOR INSTALLATION AND REMOVAL	1	$ 500.00	$ 500.00	
	0	$ -	$ -	
		TOTAL	$ 2,980.00	$ 3,725.00
			GRAND TOTAL	$ 6,789.47

GO UNDERGROUND LLC
CONTRACTOR

by _____ CARLOS GARZA-- PROJECT MANGER
SIGNIATURE AND TITLE

INSPECTOR

AREA ENGINEER

INCLUDES INSTALLATION AND REMOVAL OF PLATES

AI -50419 **5.**

DRAINAGE - CONSENT

Meeting Date: 07/21/2015

Submitted By: Claudette Guerrero, DRAINAGE DISTRICT

Department: DRAINAGE DISTRICT

Information

CAPTION

Request approval to issue payment on the following items after review & audit procedures have been met:

A. Inv#Jan 15-10 in the amount of $27531.88 from LeFevre Engineering & Management Consulting, LLC related to Work Authorization no. 2-Professional Engineering Services for Kenyon/Mile 17 1/2 Area Drainage Improvements. PO No. 626106 & 628105.

BACKGROUND

Fiscal Impact

Attachments

INV# JAN 15-10-LeFevre

Form Review

Inbox	**Reviewed By**	**Date**
Budget & Management	Veronica Ortiz	07/16/2015 12:02 PM
Final Approval	Monica Badillo	07/17/2015 05:41 PM

Form Started By: Claudette Guerrero Started On: 07/13/2015 01:54 PM

Final Approval Date: 07/17/2015

HIDALGO COUNTY DRAINAGE DISTRICT NUMBER ONE

902 NORTH DOOLITTLE EDINBURG, TEXAS 78542 (956) 292-7080 FAX (956) 292-7089

HCDD#1

GODFREY GARZA, JR.
MANAGER

INVOICE PROCESSING CHECKLIST

Date Received: 01/16/2015

Engineer/Firm Name: LeFevre Engr.

Project Name/Number: Kenyon Rd. Drainage Improvements

Invoice No: Jan 15-10

Logged in and Scanned 4:15 PM By: R. Arce Forwarded to: Joey Garza

Engineer	Name	Date	Comment
Scope of work reviewed			

Accounting	Name	Date	Comment
Encumberance			
Purchase Order Attached			
Audit			
Final Approval for Agenda			

	Name	Date	Comment
Placed on Agenda			

Additional Comments: _____

LeFEVRE
ENGINEERING &
MANAGEMENT CONSULTING, LLC

612 Nolana, Suite 520
McAllen, Texas 78504
Tel. 956.687.LEMC
Fax. 956.687.5363

Texas Registered Engineering Firm F-11722

Invoice

Date	Invoice #
1/15/2015	Jan 15-10

Bill To
Mr. Godfrey Garza Hidalgo County Drainage District No. 1 902 N. Doolittle Edinburg, TX 78542

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JAN 16 2015
4:22 AM PM
BY Rosa Arce

P.O. No.	Terms	Project
Kenyon		

Item	Description	Est Amt	Prior Amt	Prior %	Qty	Rate	Curr %	Total %	Amount
Service	Basic Engineering: Engineering	62,930.00			0	62,930.00	0.00%	0.00%	0.00
Service	Basic Engineering: Hydraulics Study	15,732.50			0.5	15,732.50	50.00%	50.00%	7,866.25
Service	Geotech Engineering	3,600.00			0	3,600.00	0.00%	0.00%	0.00
Service	Survey Topograghy	19,665.63			1	19,665.63	100.00%	100.00%	19,665.63

Total	$27,531.88
Payments/Credits	$0.00
Balance Due	$27,531.88

KENYON ROAD
(80' R.O.W.)

MUSTANG STREET
(80' R.O.W.)

VIRGINIA ROAD
(80' R.O.W.)

JUTLAND STREET
(80' R.O.W.)

KENYON ROAD
(80' R.O.W.)

MILE 17 ROAD
(80' R.O.W.)

KENYON ROAD
(80' R.O.W.)

MILE 17.5 ROAD
(80' R.O.W.)

NO.	DATE	REVISION	APPROV.
1			
2			
3			
4			

KENYON ROAD DAINAGE IMPROVEMENTS

HIDALGO COUNTY, TEXAS

Civil Engineering
Environmental Engineering
Planning
Project Management

612 Nolana, Suite 520
McAllen, Texas 78504
Tel. 956.687.LEMC
Fax. 956.687.5363

Texas Registered Engineering Firm F-11722

LeFEVRE
ENGINEERING &
MANAGEMENT CONSULTING, LLC.

Drawn	H. ORTIZ
Scale	Horz. 1"=40' Vert.
Checked	M.H.
Date	Month/Year
Job No.	P173
Sheet	1 of 1

Z:\15 Projects (Hidalgo)\Project 4\P173 Kenyon Road Drainage\Survey\01DGN\road-surveydwg Jan 15,2015 - 10:18AM HILARIO

AI -50488 **6.**

DRAINAGE - CONSENT

Meeting Date: 07/21/2015

Submitted By: Claudette Guerrero,
DRAINAGE DISTRICT

Department: DRAINAGE DISTRICT

Information

CAPTION

Request approval to issue payments on the following items after review and audit procedures have been met:

Tedsi Infrastructure Group:

A. Inv No. 20152385 in the amount of $3,062.36 related to Work Authorization no. 17-Spanish Palms Outfall Improvements. PO#627013.

B. Inv No. 20152355 in the amount of $11,458.35 related to Work Authorization no. 13-Lower Rio Grande Valley Water Management Program-Preliminary Engineering Report. PO#623666.

C. Inv No. 20152381 in the amount of $46,856.51 related to Work Authorization no. 8-Lower Rio Grande Valley Water Management Program-General Management Consultant Services. PO#623578.

D. Inv No. 20152382 in the amount of $1,799.42 related to Work Authorization No. 12-Lower Rio Grande Valley Water Management Program-Legal Services. PO#623665.

E. Inv. No. 20152353 in the amount of $72,312.44 related to Work Authorization No. 8-Lower Rio Grande Valley Water Management Program-General Management Consultant Services. PO#623578.

F. Inv. No. 20152357 in the amount of $3,734.18 related to Work Authorization No. 17-Spanish Palms Outfall Improvements. PO# 627013.

L&G Consulting Engineers:

G. Inv. No. 11325192 in the amount of $17,272.60 related to Work Authorization No. 6-La Joya Watershed Improvements-US 83 Relief Route Hydraulic Study. PO#627083.

BACKGROUND

Fiscal Impact

Attachments

Tedsi Inv#20152385
Tedsi Inv#20152355
Tedsi Inv#20152381
Tedsi Inv#20152382
Tedsi Inv#20152353
Tedsi Inv#20152357
L&G Inv#11325192

Form Review

Inbox	**Reviewed By**	**Date**
Budget & Management	Veronica Ortiz	07/16/2015 11:24 AM
Final Approval	Monica Badillo	07/17/2015 05:41 PM

Form Started By: Claudette Guerrero Started On: 07/16/2015 08:26 AM

Final Approval Date: 07/17/2015

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Date Received: June 19, 2015

Engineer/Firm Name: TEDSI

Project Name/Number: Spanish Palms Outfall WA No. 17

Invoice No.: 20152385

Purchase Order No.:

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos Date:

Total # of Pages Submitted: 4

Attachments: CD

Forwarded to: Jose N. Saldivar Date:

Forwarded to: Lora Briones Date:

Additional Comments: $3,062.36

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUN 19 2015
2:15 AM / PM
BY: Rosa Ane

TEDSI INFRASTRUCTURE GROUP
TEDSI
TBPE F-1640
Consulting Engineers
1201 East Expressway 83 ♦ Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022

June 17, 2015
Project No: 2013-1128-17
Invoice No: 20152385

Ms. Claudette Guerrero
Hidalgo County Drainage District No. 1
902 North Doolittle Road
Edinburg, TX 78542

Project 2013-1128-17 Spanish Palms Outfall Improvements of Material Testing & Construction Management

Hidalgo County Precinct One
Work Authorization No. 17

Professional Services from May 01, 2015 to May 31, 2015
Fee

Billing Phase	Fee	Percent Complete	Earned	Previous Fee Billing	Current Fee Billing	
Constuction Management	16,000.00	50.6749	8,107.98	5,045.62	3,062.36	
Material Testing	8,507.85	25.2623	2,149.28	2,149.28	0.00	
Total Fee	24,507.85		10,257.26	7,194.90	3,062.36	
		Total Fee				**3,062.36**

Billing Summary	Current	Prior	To-Date
Total Billings	3,062.36	7,194.90	10,257.26
Total Fee			24,507.85
Remaining Fee			14,250.59

Total this Invoice **$3,062.36**

Outstanding Invoices

Number	Date	Balance
20152357	5/27/2015	3,734.18
Total		**3,734.18**

Total Now Due **$6,796.54**

PLEASE REMIT PAYMENT TO:
TEDSI Infrastructure Group, Inc.
738 Highway 6 South, Suite 430
Houston, Texas 77079

Authorized By: _____ Date: 6.17.15
Mark W. Lupher, P.E., RPLS
Executive Vice President

TEDSI INFRASTRUCTURE GROUP
Consulting Engineers
1201 East Expressway 83 ♦ Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022
TBPE F-1640

Project Status Report

TO: Claudette Guerrero	**DATE: June 17, 2015**
FROM: Roberto Fina Carral, P.E.	**TEDSI PROJECT NO.: 2013-1128-17**
REFERENCE:	

Spanish Palms Outfall Improvements of Material Testing & Construction Management

TEDSI INVOICE NO: 20152385 **PROFESSIONAL SERVICES FROM: May 01, 2015 through May 31, 2015**

PHASE	CONTRACTOR	TASK COMPLETED
Construction Management	**TEDSI** 50.6749	Construction Management Inspection did on May 12, 18, and 31. 1 Change Order has been revised and process. The Contractor has 5 days work missed due to conflict with NAWSC and 17 days missed due to weather conditions. Total of missed days 22. One RFP has been revised and approved. Support in RFP preparation has been done.
Material Testing	**RABA** 25.2623%	We have been receiving Laboratory Testing Report from Raba, all the testing have been passed there are not failing test.

TEDSI INFRASTRUCTURE GROUP
Consulting Engineers
1201 E. Expressway 83 ♦ Mission, Texas 78572
(956) 424-7898

Letter of Transmittal

TO:
Mr. Noe Saldivar
Hidalgo County Drainage District No. 1
902 N. Doolittle Road
Edinburg, Texas 78542

DATE: June 17, 2015

REF.: Spanish Palms Outfall Improvements Materail Testing & CM May Invoice

TEDSI PROJECT NO.: 2013-1128-17

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☐ Hand Carry
☐ E-Mail	☒ LoneStar Overnight	☐ FedEx

COPIES	DESCRIPTION
1	Invoice No. 20152385 for Project No. 2013-1128-17
1	Project Status Report
1	CD (digital files of invoice and progress report)

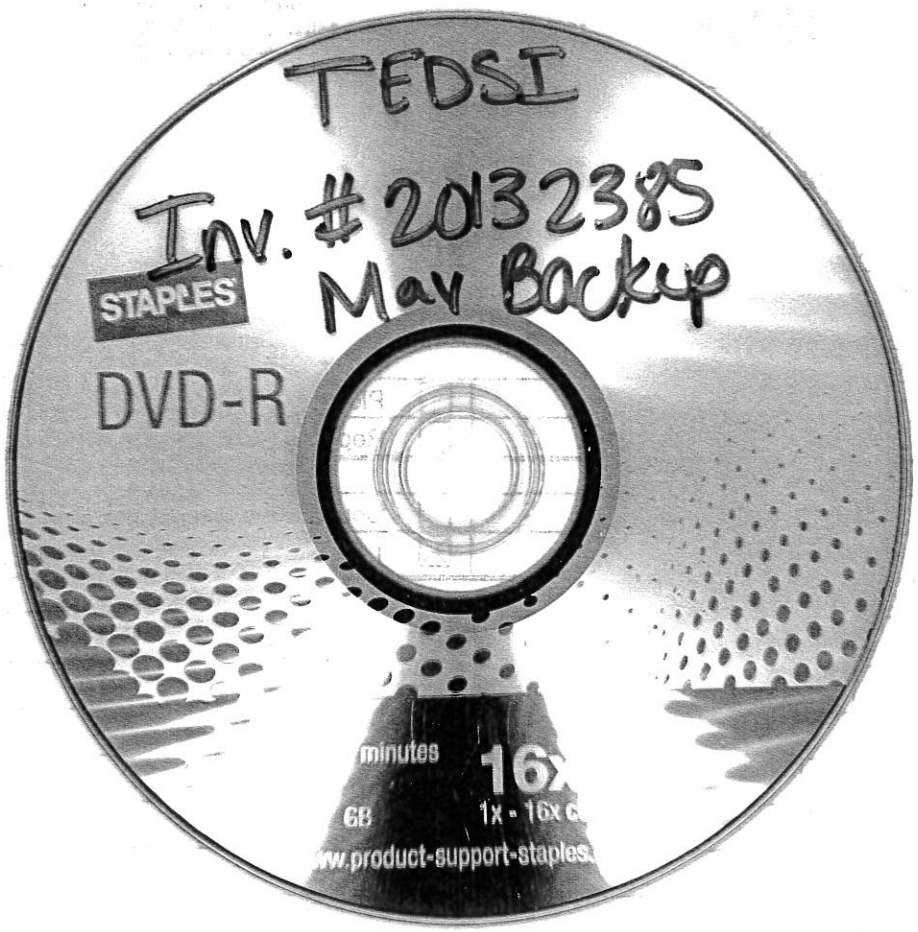
REMARKS:

Thank you,

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUN 19 2015
2:15 AM / PM
BY: Roxanne

Signed: for. Clay
Roberto Fina Carral, P.E.

If enclosures are not as stated, please notify us.


TEDSI
Inv. #2013238S
May Backup
STAPLES
DVD-R
minutes
16x
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1x - 16x
www.product-support-staples

RECEIVED

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080 Fax: (956) 292-7089

Invoice Processing Checklist

Date Received:	6/2/2015
Engineer/Firm Name:	TEDSI
Project Name/Number:	LRGVRWMP- Preliminary Eng. Report
Invoice No.:	20152355
Purchase Order No.:	623666
Received By:	Rosa Arce
Forwarded to:	Joey Garza
Total # of Pages Submitted:	6
Attachments:	CD 1 of 1

Additional Comments: $11,458.35

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUN 02 2015
12:30 AM / PM
BY: Rosa Lee

TEDSI INFRASTRUCTURE GROUP
TEDSI
TBPE F-1640
Consulting Engineers
1201 East Expressway 83 ♦ Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022

May 27, 2015
Project No: 2013-1128-13
Invoice No: 20152355

Ms. Claudette Guerrero
Hidalgo County Drainage District No. 1
902 North Doolittle Road
Edinburg, TX 78542

Project 2013-1128-13 Lower Rio Grande Valley Regional Water Management Program - Preliminary Engineering Report

Precinct No. 1 - 2012 Bond Referendum
P. O. No. 623666
Account Number 13-133-433-360-4330-010-000

Professional Services from April 01, 2015 to April 30, 2015
Fee

Billing Phase	Fee	Percent Complete	Earned	Previous Fee Billing	Current Fee Billing
Preliminary Field Surveying	71,922.36	100.00	71,922.36	71,922.36	0.00
Data Collection	42,610.70	100.00	42,610.70	42,610.70	0.00
Geographical Information	80,256.16	100.00	80,256.16	80,256.16	0.00
Hydrologic Analysis Verification	68,952.49	100.00	68,952.49	68,952.49	0.00
Hydraulic Analysis Verification	68,952.49	100.00	68,952.49	68,952.49	0.00
H&H Subconsultant - CSE	685,957.00	84.9553	582,757.00	582,757.00	0.00
Flood Plain Mapping Verification	100,097.80	31.1365	31,166.95	24,564.00	6,602.95
Water Treatment & Distribution	161,061.24	95.1824	153,301.95	153,301.95	0.00
Alternate Solutions	70,599.48	52.4921	37,059.15	32,203.75	4,855.40
Final Report (Preliminary Engineering)	150,648.64	27.2469	41,047.08	41,047.08	0.00
S.A. No. 1 (P.O. No. 623958)					
Geotechnical Investigations Reports	61,494.09	91.2389	56,106.53	56,106.53	0.00
S.A. No. 2 (P.O. No. 625152)					
WAM Willicy County	163,471.94	95.00	155,298.34	155,298.34	0.00
WAM Hidalgo County	171,876.14	95.00	163,282.33	163,282.33	0.00
S.A. No. 3 (P.O. No. 626144)					
Sub Surface Boring	140,895.00	40.5945	57,195.62	57,195.62	0.00
Total Fee	2,038,795.53		1,609,909.15	1,598,450.80	11,458.35

Total Fee **11,458.35**

Project	2013-1128-13	LRGVRWMP - P.E.R.	Invoice	20152355

Billing Summary	Current	Prior	To-Date
Total Billings	11,458.35	1,598,450.80	1,609,909.15
Total Fee			2,038,795.53
Remaining Fee			428,886.38

Total this Invoice **$11,458.35**

Outstanding Invoices

Number	Date	Balance
20142178	12/22/2014	159,944.34
20142204	1/22/2015	95,442.44
20152272	3/30/2015	68,229.88
20152307	4/23/2015	31,042.88
Total		**354,659.54**

Total Now Due **$366,117.89**

PLEASE REMIT PAYMENT TO:
TEDSI Infrastructure Group, Inc.
738 Highway 6 South, Suite 430
Houston, Texas 77079

Authorized By: _____ Date: 5.27.15

Mark W. Lupher, P.E., RPLS
Executive Vice President

PROJECT: Lower Rio Grande Valley Regional Water Management Program - Preliminary Engineering
INVOICE No. 20152307

TEDSI JOB NUMBER: 2013-1128-13

PROGRESS REPORT NO. 015

Progress Period April 1, 2015 Through April 30, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
III. PRELIMINARY ENGINEERING, DESIGN AND CONSTRUCTION					
(A) PRELIMINARY ENGINEERING					
(1) Preliminary Field Surveying	$71,922.36	100.00%	$71,922.36	$71,922.36	**$0.00**
(2) Data Collection	$42,610.70	100.00%	$42,610.70	$42,610.70	**$0.00**
(3) Geographical Information System	$80,256.16	100.00%	$80,256.16	$80,256.16	**$0.00**
(4) Hydrologic Analysis Verification	$68,952.49	100.00%	$68,952.49	$68,952.49	**$0.00**
(5) Hydraulic Analysis Verification	$68,952.49	100.00%	$68,952.49	$68,952.49	**$0.00**
H&H Sub Consultants - CSE	$685,957.00	84.96%	$582,757.00	$582,757.00	**$0.00**
(6) Flood Plain Mapping Verification	$100,097.80	31.14%	$31,166.95	$24,564.00	**$6,602.95**
(7) Water Treatment and Distribution	$161,061.24	95.18%	$153,301.95	$153,301.95	**$0.00**
(9) Alternate Solutions & Recommendations	$70,599.48	52.49%	$37,059.15	$32,203.75	**$4,855.40**
(10) Final Report- ***"Preliminary Engineering***	$150,648.64	27.25%	$41,047.08	$41,047.08	**$0.00**
SA # 1 Geotechnical Investigations	$61,494.09	91.24%	$56,106.53	$56,106.53	**$0.00**
SA #2 WAM Willacy County	$163,471.94	95.00%	$155,298.34	$155,298.34	**$0.00**
SA #2 WAM Hidalgo County	$171,876.14	95.00%	$163,282.33	$163,282.33	**$0.00**
SA # 3 Sub Surface Boring	$140,895.00	40.59%	$57,195.62	$57,195.62	**$0.00**
SUB TOTAL III.A	$2,038,795.53	78.96%	$1,609,909.15	$1,598,450.80	**$11,458.35**

TOTAL (LABOR AND DIRECT EXPENSES)	$2,038,795.53	78.96%	$1,609,909.15	$1,598,450.80	**$11,458.35**

TOTAL LABOR AND DIRECT EXPENSES	$2,038,795.53	78.96%	$1,609,909.15	$1,598,450.80	**$11,458.35**

TOTAL INVOICE AMOUNT DUE: $11,458.35

LRGVWMP – WA#13
Monthly Progress Report No. #07 – April 2015

Period of Coverage: April 01, 2015 to April 30, 2015
Date of Submittal: May 27, 2015
Submitted To: Claudette Guerrero, HCDD #1
PREPARED BY: Mark Lupher, P.E., TEDSI Infrastructure, Inc.
This study covers the following activities:

1. Coordination and meetings
2. Data collection and assimilation
3. Site visits/field reconnaissance
4. LiDAR topographic data processing
5. Watershed & subbasin delineations
6. Estimation of subwatershed & hydrologic parameters
7. Land use data processing
8. HEC-HMS modeling analysis
9. Main Floodwater Channel topographic data manipulation/ preparation
10. GeoRAS processing for HEC-RAS development
11. HEC-RAS model development and modeling analysis
12. Downstream flow requirements (downstream of Pachita Flood Gate).
13. Floodwater diversion and detention alternative analysis
14. Risk based economic analysis of flood damage analysis
15. Floodplain delineation/mapping
16. Water sources and water availability analysis.
17. Hydraulic analysis of preliminary alternative water development strategy
18. Draft H&H Report

PROGRESS TO REPORT FOR THIS PERIOD

Activity 1 – Coordination and Meetings

Coordination with project team members /Irrigation Districts/Region M & TWDB for discussions on collection & storage of Water

Activity 2 – Data Collection and Assimilation

Activity 3 – Site Visits

Activity 4 – LiDAR topographic data processing

Activity 5 – Watershed & subbasin delineations

Activity 6 – Estimation of subwatershed & hydrologic parameters

Activity 7 – Land use data processing

Activity 8 –HEC-HMS Modeling Analysis

Activity 9 – Main Floodwater Channel cross section topographic data manipulation and preparation

Activity 10 – GeoRAS processing for HEC-RAS development

Activity 11 – HEC-RAS model development and modeling analysis

Activity 12 – Downstream flow requirements (downstream of Pachita Flood Gate).

Activity 13 – Floodwater diversion and detention alternative analysis

Activity 14 – Risk based economic analysis of flood damage analysis

Activity 15 – Floodplain delineation/mapping

Continued efforts on delineating floodplain mapping

Activity 16 – Water sources and water availability analysis.

Activity 17 – Hydraulic analysis of preliminary alternative water development strategy

Continued alternative solutions and recommendations for capturing and storing water in various locations such as Santa Cruz Irrigation Reservoir, Engleman Irrigation Reservoir and the Proposed HCDD#1 Delta Reservoir. Also evaluation of Alternative Solutions needed to implement Phase I to begin pumping Raw Water quickly into the existing reservoirsboth for recapturing and flood control measures.

Activity 18 – Draft H&H report.

TEDSI INFRASTRUCTURE GROUP
TEDSI
Consulting Engineers
1201 E. Expressway 83 ♦ Mission, Texas 78572
(956) 424-7898

Letter of Transmittal

TO:
Mr. Noe Saldivar
Hidalgo County Drainage District No. 1
902 N. Doolittle Road
Edinburg, Texas 78542

DATE: May 28, 2015

REF.: ~~Delta Watershed PER April Invoice~~

TEDSI PROJECT NO.: 2013-1128-13

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☐ Hand Carry
☐ E-Mail	☒ LoneStar Overnight	☐ FedEx

COPIES	DESCRIPTION
1	Invoice No. 20152355 for Project No. 2013-1128-13
1	Progress Report No. 015
1	Monthly Progress Report No. 07
1	CD PDF Files (Invoice Backup)

REMARKS:

Thank you,

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUN 02 2015
12:30 AM / PM
BY: RosaLine

Signed: for: _____
Mark W. Lupher, P.E., RPLS

If enclosures are not as stated, please notify us.

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Date Received: June 19, 2015

Engineer/Firm Name: TEDSI

Project Name/Number: LRGVRWMP

Invoice No.: 20152381

Purchase Order No.: 623578

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos Date:

Total # of Pages Submitted: 8

Attachments: CD

Forwarded to: Jose N. Saldivar Date:

Forwarded to: Lora Briones Date:

Additional Comments: $46,856.51

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUN 19 2015
2:15 AM / PM
BY: Rosa Arce

TEDSI INFRASTRUCTURE GROUP
Consulting Engineers
1201 East Expressway 83 ♦ Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022
TBPE F-1640

June 17, 2015
Project No: 2013-1128-08
Invoice No: 20152381

Ms. Claudette Guerrero
Hidalgo County Drainage District No. 1
902 North Doolittle Road
Edinburg, TX 78542

Project 2013-1128-08 Lower Rio Grande Valley Regional Water Management Program - General Management Consultant

Precinct No. 1 2012 Bond Referendum
General Engineering Management Services
Account No. 13-133-433-360-010-000-43340
P. O. No. 623578
Work Authorization No. 8

Professional Services from May 01, 2015 to May 31, 2015

Billing Phase	Fee	Percent Complete	Earned	Previous Fee Billing	Current Fee Billing	
Preliminary Planning & Development	856,165.48	66.5332	569,634.29	530,584.58	39,049.71	
Preliminary Engineering	261,709.66	25.4459	66,594.38	58,787.58	7,806.80	
Expenses	524,590.34	37.7059	197,801.51	197,801.51	0.00	
Total Fee	1,642,465.48		834,030.18	787,173.67	46,856.51	
		Total Fee				**46,856.51**

Billing Summary	Current	Prior	To-Date
Total Billings	46,856.51	787,173.45	834,029.96
Total Fee			1,642,465.48
Remaining Fee			808,435.52

Total this Invoice **$46,856.51**

Outstanding Invoices

Number	Date	Balance
20152303	4/22/2015	18,686.80
20152353	5/27/2015	72,312.44
Total		**90,999.24**

Total Now Due **$137,855.75**

PLEASE REMIT PAYMENT TO:
TEDSI Infrastructure Group, Inc.
738 Highway 6 South, Suite 430
Houston, Texas 77079

Authorized By: _____ Date: 6.17.15
Mark W. Lupher, P.E., RPLS
Executive Vice President

WORK AUTHORIZATION #8
LABOR DETAIL
DELTA AREA WATERSHED

May 2015	Principal Engineer	Project Manager (VIII)	Sr. Engineer (V)	Sr. Engineer (V)	Project Engineer (III)	Project Engineer (II)	Engr. In Training (E.I.T.)	Sr. Engr. Designer	Engr. Designer	CADD Operator	Sr. GIS Designer	GIS Designer	GIS System Manager	IT System Manager	Project Admin	Assistant Admin
	J. Salinas	M. Lupher	M. Corbitt	J. Sanchez	E. Dietrich		S. DeLeon/J.Adams		R. Cavazos	J. Adams/R. Villarreal	J. Perez		M. Manzano	A. Bray	D. Castillo	C. Garza
	$266.62	$232.61	$187.37	$187.37	$159.15	$144.56	$122.87	$117.57	$109.24	$104.61	$135.00	$90.00	$175.00	$180.00	$178.37	$73.13
Dates:																
5/1/2015													3			
5/4/2015													9			
5/5/2015		9					4.5						9			
5/6/2015		9											9			
5/7/2015							7						9			
5/8/2015													4			
5/11/2015							2				9		9			
5/12/2015											9		7			
5/13/2015											6		9			
5/14/2015											9		9			
5/15/2015											4		4			
5/18/2015											9		9			
5/19/2015											9		9			
5/20/2015							3						9			
5/21/2015													9			
5/22/2015													4			
5/25/2015													9			
5/26/2015											6.5		9			
5/27/2015											9		9			
5/28/2015		9					4.5				9		4			
5/29/2015							1				4					
Total	$0.00	$6,280.47	$0.00	$0.00	$0.00	$0.00	$2,703.14	$0.00	$0.00	$0.00	$11,272.50	$0.00	$26,600.00	$0.00	$0.00	$0.00
	0	27	0	0	0	0	22	0	0	0	83.5	0	152	0	0	0

	Total This Month **$46,856.11**

PROJECT: Delta Watershed Project - GCM
CLIENT: Hidalgo County Drainage District No. 1

TEDSI JOB NUMBER: 2013-1128-08

PROGRESS REPORT NO. 018

Progress Period May 01, 2015 Through May 31, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
I. GCM FOR ENGINEERING MANAGEMENT					
(A) PRELIMINARY PROJECT PLANNING AND DEVELOPMENT					
(1) Administrative Policy & Procedures	$105,432.80	95.00%	$100,164.28	$98,224.32	**$1,939.96**
(2) Project Development Schedule	$53,143.60	84.68%	$45,000.00	$45,000.00	**$0.00**
(3) Construction Estimate	$50,894.20	33.80%	$17,203.31	$15,268.28	**$1,935.03**
(4) QC/QA Program Development	$51,885.22	90.00%	$46,695.19	$46,695.19	**$0.00**
(5) Subcontract Administration	$49,684.28	90.00%	$44,715.85	$44,715.85	**$0.00**
(6) Funding Source	$119,911.08	65.00%	$77,942.25	$71,946.64	**$5,995.61**
(7) Capital Improvement Program	$129,253.80	20.00%	$25,850.76	$12,925.38	**$12,925.38**
(8) Management/ Coordination of Engineering Activities	$133,975.80	70.00%	$93,787.83	$80,819.03	**$12,968.80**
(9) Implementation of QC/QA Program	$46,927.50	45.00%	$21,117.38	$17,832.45	**$3,284.93**
(10) Computer Database Development Platform	$115,057.20	84.44%	$97,157.44	$97,157.44	**$0.00**
SUB TOTAL I.A	$856,165.48	66.53%	$569,634.29	$530,584.58	**$39,049.71**
(B) PRELIMINARY ENGINEERING					
(1) Preliminary Concept Conference	$57,250.80	79.20%	$45,345.12	$37,538.32	**$7,806.80**
(2) Management/Coordination of Engineering	$42,799.96	45.06%	$19,286.44	$19,286.44	**$0.00**
(3) Implementation of QA/QC Program	$36,624.10	5.36%	$1,962.82	$1,962.82	**$0.00**
(4) Preparation of "***Preliminary Engineering***	$84,677.60	0.00%	$0.00	$0.00	**$0.00**
(5) Coordination with all Reviewing Agencies	$40,357.20	0.00%	$0.00	$0.00	**$0.00**
SUB TOTAL I.B	$261,709.66	25.45%	$66,594.38	$58,787.58	$7,806.80
TOTAL LABOR COSTS	$1,117,875.14	$0.92	$636,228.67	$589,372.16	$46,856.51

PROJECT: Delta Watershed Project - GCM
CLIENT: Hidalgo County Drainage District No. 1

TEDSI JOB NUMBER: 2013-1128-08

PROGRESS REPORT NO. 018

Progress Period May 01, 2015 Through May 31, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
DIRECT EXPENSES					
TRAVEL					
Lodging/Hotel (Austin)	$648.00	0.00%	$0.00	$0.00	**$0.00**
Lodging/Hotel Taxes/fees (Austin @ 9%)	$58.32	0.00%	$0.00	$0.00	**$0.00**
Per Diem (Austin)	$426.00	0.00%	$0.00	$0.00	**$0.00**
Lodging/Hotel (Washington DC)	$1,356.00	0.00%	$0.00	$0.00	**$0.00**
Lodging/Hotel Taxes/fees (Washington DC @	$196.62	0.00%	$0.00	$0.00	**$0.00**
Per Diem (Washington DC)	$426.00	0.00%	$0.00	$0.00	**$0.00**
Mileage	$5,650.00	0.00%	$0.00	$0.00	**$0.00**
Rental Car (Taxes/Fees not included; Insurance	$450.00	0.00%	$0.00	$0.00	**$0.00**
Rental Car Fuel	$299.40	0.00%	$0.00	$0.00	**$0.00**
Air Travel -In State- Short Notice (Coach)	$6,000.00	0.00%	$0.00	$0.00	**$0.00**
Air Travel - Out of State - Short Notice (Coach)	$9,000.00	0.00%	$0.00	$0.00	**$0.00**
Luggage (with air travel)	$1,200.00	0.00%	$0.00	$0.00	**$0.00**
Parking	$420.00	0.00%	$0.00	$0.00	**$0.00**
Taxi/Cab fare	$480.00	0.00%	$0.00	$0.00	**$0.00**
Internet	$270.00	0.00%	$0.00	$0.00	**$0.00**
Telephone	$2,700.00	0.00%	$0.00	$0.00	**$0.00**
Conference Calls	$12,000.00	0.00%	$0.00	$0.00	**$0.00**
Postage & Shipping	$9,600.00	0.00%	$0.00	$0.00	**$0.00**
Overnight Mail - letter size	$1,800.00	0.00%	$0.00	$0.00	**$0.00**
Overnight Mail - oversized box	$3,000.00	0.00%	$0.00	$0.00	**$0.00**
Courier Services	$1,200.00	0.00%	$0.00	$0.00	**$0.00**
COMPUTER SYSTEM					
GIS Server, Web Hosting, Work Stations, Software, Licensing, Plotter, Printers, etc.	$382,990.00	51.65%	$197,801.51	$197,801.51	**$0.00**

PROJECT: Delta Watershed Project - GCM
CLIENT: Hidalgo County Drainage District No. 1

TEDSI JOB NUMBER: 2013-1128-08

PROGRESS REPORT NO. 018

Progress Period May 01, 2015 Through May 31, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
PRINTING					
Photocopies B/W (8 1/2" X 11")	$1,050.00	0.00%	$0.00	$0.00	**$0.00**
Photocopies B/W (11" X 17")	$1,650.00	0.00%	$0.00	$0.00	**$0.00**
Photocopies Color (8 1/2" X 11")	$1,800.00	0.00%	$0.00	$0.00	**$0.00**
Photocopies Color (11" X 17")	$6,750.00	0.00%	$0.00	$0.00	**$0.00**
Digital Ortho Plotting (on bond)	$10,000.00	0.00%	$0.00	$0.00	**$0.00**
Bond Paper Plot (Blueline/Blackline)	$4,500.00	0.00%	$0.00	$0.00	**$0.00**
Plots (B/W on Bond)	$12,000.00	0.00%	$0.00	$0.00	**$0.00**
Plots (Color on Bond)	$8,000.00	0.00%	$0.00	$0.00	**$0.00**
Plots (Color on Photographic Paper)	$5,000.00	0.00%	$0.00	$0.00	**$0.00**
Mounting Color Graphics on Foam Board	$10,000.00	0.00%	$0.00	$0.00	**$0.00**
Presentation Boards 30" X 40" Color Mounted	$4,200.00	0.00%	$0.00	$0.00	**$0.00**
Report Binding	$1,200.00	0.00%	$0.00	$0.00	**$0.00**
Notebooks	$720.00	0.00%	$0.00	$0.00	**$0.00**
Reproduction of CD/DVD	$15,500.00	0.00%	$0.00	$0.00	**$0.00**
CDs	$1,550.00	0.00%	$0.00	$0.00	**$0.00**
4" X 6" Digital Color Print	$500.00	0.00%	$0.00	$0.00	**$0.00**

TOTAL DIRECT EXPENSES	$524,590.34	37.71%	$197,801.51	$197,801.51	**$0.00**

TOTAL (LABOR AND DIRECT EXPENSES)	$1,642,465.48	50.78%	$834,030.18	$787,173.67	$46,856.51

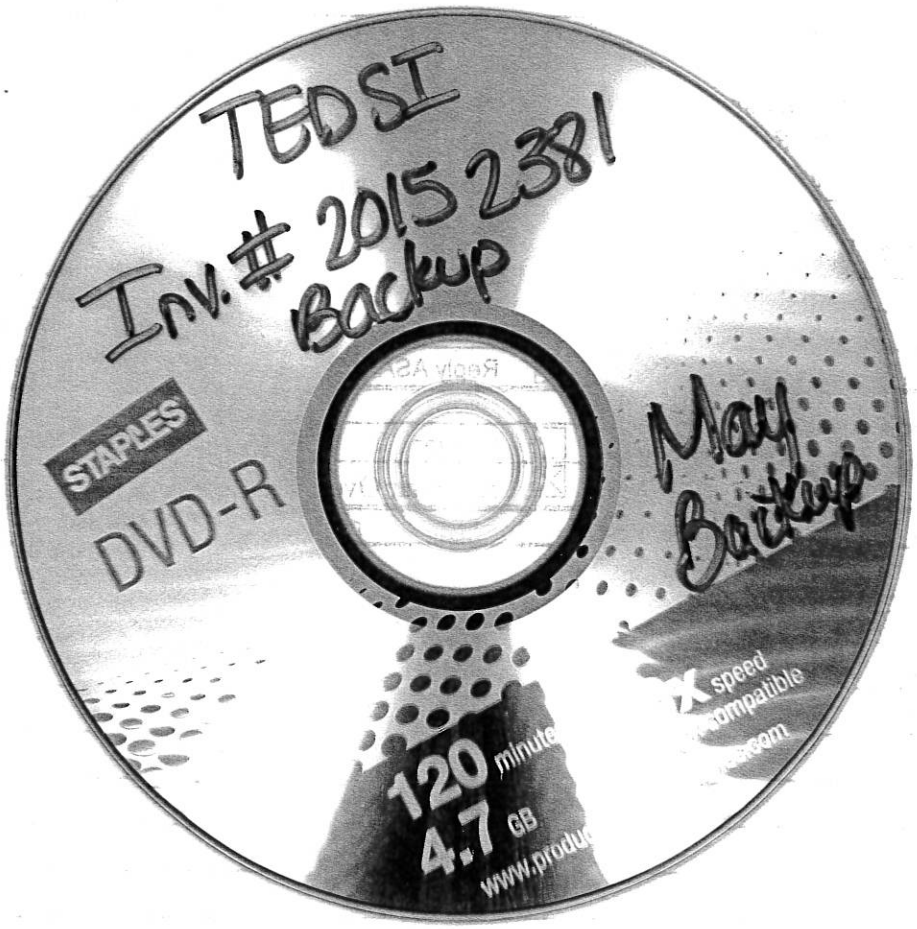
TOTAL INVOICE AMOUNT DUE: $46,856.51

TEDSI INFRASTRUCTURE GROUP *Consulting Engineers* TEDSI TBPE F-1640	Project Progress Report
TO: Hidalgo County Drainage District No. 1	**DATE:** June 17, 2015
FROM: Mr. Mark Lupher, P.E., Project Manager	**TEDSI PROJECT NO.:** 2013-1128-08
REFERENCE: Hourly Progress Report	
Progress Report for Invoice No. 20152381, May 01 thru May 31, 2015	

- Week Report by Week for Mark Lupher
  - Week of: 05-09-15
    - Coordination with team on current status and future project schedule
    - Coordination with HNTB on stakeholders of project
    - Coordination with legislative team on possible funding sources
  - Week of: 05-30-15
    - Review of updated construction estimate
    - Coordination with legislative team on possible funding sources
    -
- Week Report by Week for Julio Perez
  - Week of: 05-16-15
    - Map generation for legislative team
  - Week of: 05-23-15
    - Construction Estimate for possible locations
  - Week of: 05-30-15
    - Construction Estimate for possible locations
    - Fact sheet genration for legislative team

- Week Report by Week for Mariano Manzano
  - Week of: 05-09-15
    - Map generation for legislative team
    - Coordination with HNTB on stakeholders of project
  - Week of: 05-16-15
    - Fact sheet development for legislative team
    - Map generation for legislative team
  - Week of: 05-23-15
    - Coordination with HNTB on public meeting information (maps, locations, hand outs, etc.)
    - Fact sheet development for legislative team
  - Week of: 05-30-15
    - Fact sheet development for legislative team
    - Coordination with consultants of current status

- Week Report by Week for Samantha DeLeon
  - Week of: 05-09-15
    - Coordination with HNTB on stakeholders of project
  - Week of: 05-16-15
    - Fact sheet development for legislative team
  - Week of: 05-23-15
    - Construction Estimate for possible locations
    - Coordination with HNTB on public meeting information (maps, locations, hand outs, etc.)
  - Week of: 05-30-15
    - Coordination with consultants of current status


TEDSI
Inv.# 2015 2381
Backup
STAPLES
DVD-R
May Backup
120 minute
4.7 GB

TEDSI INFRASTRUCTURE GROUP
Consulting Engineers
1201 E. Expressway 83 ♦ Mission, Texas 78572
(956) 424-7898

Letter of Transmittal

TO:
Mr. Noe Saldivar
Hidalgo County Drainage District No. 1
902 N. Doolittle Road
Edinburg, Texas 78542

DATE: June 18, 2015

REF.: Delta Area Watershed May Invoice

TEDSI PROJECT NO.: 2013-1128-08

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☐ Hand Carry
☐ E-Mail	☒ LoneStar Overnight	☐ FedEx

COPIES	DESCRIPTION
1	TEDSI Invoice No. 20152381
1	CD- Digital files for TEDSI Invoice No. 20152381
1	Labor Detail
1	Progress Report No. 18
1	Project Progress Report

REMARKS:

Thank you,

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUN 19 2015
2:15 AM (PM)
BY: RosaArce

Signed: for: _____
Mark W. Lupher, P.E., RPLS

If enclosures are not as stated, please notify us.

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Date Received: June 19, 2015

Engineer/Firm Name: TEDSI

Project Name/Number: LRGVRWMP-Legal

Invoice No.: 20152382

Purchase Order No.: 623665

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos _____ Date: _____

Total # of Pages Submitted: 17

Attachments: CD

Forwarded to: Jose N. Saldivar _____ Date: _____

Forwarded to: Lora Briones _____ Date: _____

Additional Comments: $1,799.42

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUN 19 2015
2:15 AM PM
BY: Rosa Ore

TEDSI INFRASTRUCTURE GROUP
Consulting Engineers
1201 East Expressway 83 • Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022
TBPE F-1640

June 17, 2015
Project No: 2013-1128-12
Invoice No: 20152382

Ms. Claudette Guerrero
Hidalgo County Drainage District No. 1
902 North Doolittle Road
Edinburg, TX 78542

Project 2013-1128-12 Lower Rio Grande Valley Regional Water Management Program – Legal

Precinct No. 1 - 2012 Bond Referendum
Account No. 13-133-433-360-43340-010-000
P.O. No. 623665

Professional Services from May 01, 2015 to May 31, 2015

Phase 200 Water Rights - BBS, PC

Consultants

Reimbursable Consultants Expense

5/31/2015	Beatty Bangle Strama, PC - Invoice No. 17822	1,500.00	
	Total Consultants	**1,500.00**	**1,500.00**

Billing Summary	**Current**	**Prior**	**To-Date**
Consultants	1,500.00	58,725.00	60,225.00
Total Fee			80,000.00
Remaining Fee			19,775.00

Total this Phase **$1,500.00**

Phase 300 Water Rights - BHDA, LLP

Consultants

Reimbursable Consultants Expense

5/31/2015	Bickerstaff Heath Delgado Acosta LLP - Invoice No. 97711	299.42	
	Total Consultants	**299.42**	**299.42**

Billing Summary	**Current**	**Prior**	**To-Date**
Consultants	299.42	54,517.40	54,816.82
Total Fee			65,400.00
Remaining Fee			10,583.18

Total this Phase **$299.42**

Total this Invoice **$1,799.42**

Outstanding Invoices

Number	Date	Balance
20152354	5/27/2015	3,660.00
Total		**3,660.00**

Total Now Due **$5,459.42**

PLEASE REMIT PAYMENT TO:
TEDSI Infrastructure Group, Inc.
738 Highway 6 South, Suite 430
Houston, Texas 77079

Authorized By: _____ Date: 6.17.15
Mark W. Lupher, P.E., RPLS
Executive Vice President

POSTED

BBS BEATTY BANGLE STRAMA PC

May 31, 2015

Jesse Salinas
TEDSI Infrastructure Group
1201 East Expressway 83
Mission, TX 78572

Invoice No. 17822

In Reference To: *Hidalgo County Delta Watershed Project and Hidalgo County Drainage District No. 1*

Professional Services

			Hours	Rate	Amount
05/05/15	ELIII	Review pending correspondence on water rights application.	0.50	300.00/hr	150.00
05/11/15	ELIII	Review various pending correspondence with team.	1.00	300.00/hr	300.00
05/13/15	ELIII	Water brief.	3.00	300.00/hr	900.00
05/19/15	ELIII	Call with TCEQ.	0.50	300.00/hr	150.00
		For professional services rendered	5.00		$1,500.00

Previous balance $2,400.00

TEDSI INFRASTRUCTURE GROUP
Project No. 2013-112-12 Phase No. 200
☐ Lump Sum ☒ Approved ☐ Hold
☒ Hourly ☐ Rejected ☐ Process
Sign MKL Date 6/17/15

Balance due $3,900.00

400 West 15th Street | Suite 1450 | Austin, Texas 78701

T (512) 879-5050 | F (512) 879-5040 | bbsfirm.com

Bickerstaff Heath Delgado Acosta LLP
3711 S. Mo-Pac Expy. Building One, Suite 300 Austin, Texas 78746 (512) 472-8021 Fax (512) 320-5638 Tax ID No 74-2153894

POSTED

Hidalgo County Drainage District No. 1
c/o TEDSI Infrastructure Group, Inc.
1201 E. Expressway 83
Mission, TX 78572

June 09, 2015
Client: 003978
Matter: 000001
Invoice #: 97711
Bill Atty: DM

Page: 1

TEDSI INFRASTRUCTURE GROUP
Project No. 2013-128-12 Phase No. 300
☐ Lump Sum ☒ Approved ☐ Hold
☒ Hourly ☐ Rejected ☐ Process
Sign [signature] Date 6/17/15

RE: Drainage Improvements

For Professional Services Rendered Through May 31, 2015

SERVICES

Date	Person	Description of Services	Hours	
5/12/2015	DFB	Review email from E. Rogers; telephone call to M. Gill, TCEQ, regarding whereabouts of check delivered via overnight by client; email to E. Rogers regarding same.	0.1	
5/28/2015	EWR	Prepare for and attend conference regarding TWDB request.	0.7	
		Total Professional Services	0.8	$225.00

BILLING RECAP

		Level	Hours	Rate	Amount
EWR	Emily Rogers	Partner	0.7	$300.00	$210.00
DFB	Denise Fregeolle-Burk	Legal Assistant	0.1	$150.00	$15.00

DISBURSEMENTS

Description of Disbursements	Amount
Dropoff- Delivery Service- to TCEQ, 05/11/2015	$34.41
Dropoff- Delivery Service- from TCEQ, 05/11/2015	$40.01

DISBURSEMENTS

Description of Disbursements		Amount
Total Disbursements		$74.42
Total Services	$225.00	
Total Disbursements	$74.42	
Total Current Charges		$299.42
PAY THIS AMOUNT		**$299.42**

Please Remit Payment to:
Bickerstaff Heath Delgado Acosta LLP
3711 S. Mo-Pac Expy
Building One, Suite 300
Austin, Texas 78746-8023

Date	Type	Caller	Origin	Destination	Amount

References: 3978.01, 3978.01

05/11/2015 12:21 pm	2HR	Ted Castleberry	Bickerstaff Heath Delgado Acosta LLP 3711 S MoPac Expy Building 1 Suite 300 Austin, TX, 78735	Texas Commission on Enviromental Quality 12100 Park 35 Cir Building F, 3rd Floor Austin, TX, 78753	**$34.41**

POD: v Dixon

Total **$34.41**

Order Number: N142-XD1z-M6J

References: 3978.01, 3978.01

05/11/2015 2:19 pm	ASAP	Ted Castleberry	Texas Commission on Enviromental Quality 12100 Park 35 Cir Building F, 3rd Floor Austin, TX, 78753	Bickerstaff Heath Delgado Acosta LLP 3711 S MoPac Expy Building 1 Suite 300 Austin, TX, 78735	**$40.01**

POD: Sam

Total **$40.01**

Chairman,

This report is for the week ending 5/23/2015.

- The current cycle began on October 25, 2010.
- The pro-rated deficit as of 5/23/2015 is 350,850 AF for this cycle, which is an increase from the 347,165 reported in the 5/16/2015 report.
- During the first year of the cycle, Mexico delivered 288,309 AF, during the second year 100,401 AF, during the third year 392,142 AF, during the fourth year 343,898, and to date 125,770 AF for the fifth year.
- The running total of deliveries for this 5-year cycle is 1,250,520 AF.

On May 23, 2015, the U.S. combined ownership at Amistad/Falcon stood at 54.21% of normal conservation capacity, impounding 1,838,690 acre-feet, up from 40.39% (1,370,100 AF) of normal conservation a year ago at this time.

The Mexican Reservoirs report shows, as a whole, a total of 85.36% average capacity. El Cuchillo is at 115.004% of normal capacity with 203.809 cms / 7,197 cfs discharge to the Rio San Juan and Marte Gomez is at 135.246% of normal capacity with 320.445 cms / 11,316 cfs discharge to the Rio San Juan.

As of 5/23/15:

The United States has 1,157,694 AF in Amistad and 680,996 AF in Falcon.

Mexico has 612,897 AF in Amistad and 618,572 AF in Falcon.

The Amistad Reservoir is currently at:
1088.61 ft -28.39 with a release of 20.0 cms / 706 cfs

Falcon Reservoir is currently at:
282.41 ft -18.79 with a release of 0.0 cms / 0 cfs

BBS BEATTY BANGLE STRAMA PC

EDDIE LUCIO III
elucio@bbsfirm.com
MOBILE (956) 495 3004
TEL (956) 280 5405

May 30, 2015

Via Electronic Mail
Mark Lupher
TEDSI Infrastructure Group
1201 East Expressway 83
Mission, TX 78572

Re: April 2015 Water Brief

Please allow the following information to serve as a resource regarding some of the water issues trending in Texas. It is not a comprehensive summary. Its purpose is to provide information that may be of interest to water stakeholders in our region at this time. In addition, the information provided is only basic information regarding the subject matter herein. Additional information regarding any of the subject matters discussed below is available upon request. This is a work product of Beatty Bangle Strama PC and is intended for the sole use of the firm's clients. Before taking any action in reliance on the information included herein, we ask that you personally consult with an attorney from our firm.

The 84th Legislative Session

The following is a summary of some of the top pieces of water/wastewater legislation from the recently concluded legislative session. We chose to provide you a brief summary of the legislation that may directly impact your daily operations and future plans for expansion. This is not a complete list. If you would like additional information regarding the legislation identified below or other bills passed this legislative session, please let us know.

1. HB 30 by Larson- Relating to the development of seawater and brackish water.
    - This bill seeks to encourage and facilitate the development of brackish groundwater and seawater.
        - It requires each regional water-planning group to include opportunities for large-scale seawater or brackish groundwater desalination in their regional water plan; and
        - It also requires TWDB to conduct feasibility and planning studies on opportunities for such projects.
2. HB 163 by Larson- Relating to interstate cooperation to address regional water issues.

- This bill creates the Southwestern States Water Commission charged with facilitating interstate cooperation to help resolve regional water issues.
- The Commission would be tasked with working with representatives of Arkansas, Oklahoma, Louisiana, New Mexico, and Mexico to discuss and find solutions on water issues.

3. HB 200 by Keffer- Relating to the regulation of groundwater.
   - This is an omnibus groundwater regulation bill.
     - It clarifies vested property rights in the ownership of groundwater;
     - Ensures "loser pay" provisions apply to suits challenging groundwater districts;
     - Establishes science as the determining factor for establishing desired future conditions;
     - Maintains the development, process, and timelines of desired future conditions as a planning tool for the continued local regulation of groundwater resources by groundwater districts;
     - Establishes an appeal process for affected persons to challenge the reasonableness of desired future conditions;
     - Provides a mediation period where parties may reach an agreement before proceeding through the administrative process; and
     - Develops an administrative hearing process for parties in order to develop findings of fact and conclusions of law.
4. HB 655 by Larson- Relating to the storage and recovery of water in aquifers authorizing fees and surcharges, and adding provisions subject to criminal penalty.
   - This bill creates the regulatory framework for aquifer storage and recovery projects.
     - Clarifies that an amendment to a water right permit is not required to obtain an aquifer storage and recovery permit;
     - Grants the TCEQ exclusive jurisdiction to regulate aquifer storage and recovery projects; and
     - Clarifies that an aquifer storage and recovery project does not have to obtain a permit from a local groundwater conservation district as long as native groundwater is not being produced.
5. HB 949 by Lucio III- Relating to the obligation of certain retail public utilities to mitigate their system water loss.
   - Allows the Texas Water Development Board to waive the requirement that a retail public utility that receives a loan from the board use a portion of that financial assistance to mitigate the utility's system water loss, if the board finds that the utility is already addressing the system's water loss.
6. HB 1224 by Lucio III- Relating to the purposes for which the assets of certain revolving funds administered by the Texas Water Development Board may be used.
   - This bill will allow the TWDB to utilize cross-collateralization of certain funds to secure other state revolving funds from revenue shortfalls.
7. HB 1902 by Howard- Relating to regulation and use of graywater and alternative onsite water.

- This bill expands the use of graywater and other recycled water.
  - Expands the sources for which graywater may originate by defining "alternative onsite water" and including it in relevant statutory language governing graywater;
  - Expands the allowable uses for graywater and alternative onsite water;
  - Allows for greater clarity in the rules regarding the storage of graywater; and
  - Clarifies the existing Health and Safety Code regarding graywater and alternative onsite water, and ensures the Water Code conforms to these changes.

8. HB 2031 by Lucio III- Relating to the diversion, treatment, and use of marine seawater and the discharge of treated marine seawater and waste resulting from the desalination of marine seawater; adding provisions subject to a criminal penalty.
   - This bill creates a new chapter within the Water Code creating a regulatory scheme for permitting seawater desalination projects.
     - It provides for an exemption to permitting for intake and discharge of seawater and waste for desalination production from water that originates beyond 3 miles seaward from any point on the coast into the Gulf of Mexico;
     - It also creates an expedited permitting process for projects that use seawater that originates within 3 miles seaward from any point located on the coast, but maintains current permitting requirements for projects within bays and estuaries; and
     - Creates an expedited permitting process to obtain a permit to transport treated seawater through the bed and banks of waters of the state of Texas.
9. HB 2179 by Lucio III- Relating to hearings that concern the issuance of permits by a groundwater conservation district.
   - This bill creates an expedited process for a groundwater conservation district to issue a permit to an applicant when the applicant is simply attempting to renew the permit under the same conditions as the original permit.
10. HB 2467 by Ashby- Relating to a limitation on the authority to curtail groundwater production from wells used for power generation or mining.
    - This bill prevents groundwater conservation districts from curtailing groundwater production to a rate less than that used in 2014 by power plants and mines that fuel power plants to ensure the continuous availability of electricity in Texas and the stability of the state's power grid.
11. HB 2767 by Keffer- Relating to the powers, duties, and administration of groundwater conservation districts; amending provisions that authorize fees.
    - This bill covers various aspects of groundwater conservation districts.
      - It amends the definition of "operating permit" and permits a groundwater district to impose certain fees for water exportation, administration, and production under certain circumstances;

- It requires a financial audit and other financial statements of the district to be performed in accordance with standards adopted by the American Institute of CPA's; and
- It allows certain individuals to file a petition with the TCEQ regarding the failure of a district's actions.

12. HB 4097 by Hunter- Relating to seawater desalination projects.
    - This bill allows for permitting of desalination of seawater for industrial use if the point of diversion is located less than 3 miles seaward of any point located on the coast or the seawater contains a TDS of less than 20,000 mg/l.
        - It also allows for an exemption from permitting requirements if the above requirements do not apply.
13. HB 4112 by Burns- Relating to the rights of an owner of groundwater.
    - This bill establishes that the groundwater ownership and rights recognized by the legislature entitle a landowner, including a landowner's lessees, heirs, or assigns, to have any right recognized under common law and not just the right to drill for and produce the groundwater below the surface of real property without causing waste or malicious drainage of other property or negligently causing subsidence.
14. SB 854 by Zaffirini- Relating to the renewal or amendment of certain permits issued by groundwater conservation districts.
    - This bill creates an exemption and expedited process for certain permit renewals.
15. SB 1336 by Perry- Relating to the powers and duties, the construction of laws, and the election dates of certain groundwater conservation districts.
16. HB 1665 by Bonnen- Relating to notice of water level fluctuations to purchasers of real property adjoining an impoundment of water.
    - This bill requires a seller of residential or commercial property adjoining an impoundment of water, including a reservoir or lake, to provide the purchaser with written notice that the water levels fluctuate.
17. HB 1919 by Phillips- Relating to the applicability of certain provision concerning invasive species.
    - This bill provides that a municipally owned utility is not required to obtain a permit from the Texas Parks and Wildlife Department for the following water transfers:
        - Through a water supply system;
        - From a water body with no known exotic harmful or potentially harmful fish or shellfish to a water body with no known exotic harmful or potentially harmful fish or shellfish;
        - Directly to a water treatment facility;
        - Treated prior to the transfer into a water body; and
        - From a reservoir or through a dam to address flood control or to meet water supply requirements or environmental flow purposes.
18. SB 912 by Eltife- Relating to a volume-based exemption from reporting requirements for certain accidental discharges or spills from wastewater facilities.

- Exempts an individual from notifying the Texas Commission on Environmental Quality of an accidental discharge or spill of treated or untreated domestic wastewater that:
  - Occurs at a wastewater treatment or collection facility associated with another simultaneous accidental discharge or spill;
  - Has a volume of 1,000 gallons or less;
  - Is not associated with another simultaneous accidental discharge or spill;
  - Is controlled or removed before the accidental discharge or spill enters water in the state or adversely affects a source of drinking water;
  - Will not endanger human health or safety or the environment; and
  - Is not otherwise subject to local regulatory control and reporting requirements, and requires an individual to submit to TCEQ at least once a month a summary of accidental discharges that occurred during the previous month.

19. SB 1148 by Watson- Relating to the functions of the Public Utility Commission of Texas in relation to the economic regulation of water and sewer service.
    - This bill requires that a municipally owned water and sewer utility must disclose the number of ratepayers who reside outside the city limits to any person that requests the information.
    - This bill also requires that a municipally owned utility must provide a list of the names and addresses of the ratepayers who reside outside the city limits to any person that requests the information, unless the ratepayer has requested that this information remain confidential.
    - Lastly, this bill allows the State Office of Administrative Hearings, instead of the Public Utility Commission, to give notice of a hearing to a city involved in a contested case hearing in front of that agency.

Mexico Water Debt

In late February of this year, Mexican officials contacted Texas officials to discuss the delivery of water by Mexico to the Rio Grande River out of reservoirs in the San Juan in efforts to diminish the water delivery debt Mexico owes Texas. The timing of this delivery is critical because it is only beneficial to water users in South Texas if they have the need and capacity to divert this water at the time of its delivery. After several discussions, Texas requested that Mexico store this water in Mexico's reservoirs and release it at various agreed to later dates. This is the first time that Mexico has agreed to store water for the benefit of Texas in Mexican reservoirs. However, Mexico's ability to store water for later deliveries is limited by a federal law in Mexico that requires all Mexican reservoirs to diminish their water levels to conservation levels in order to prepare for the rainy season and assist with flood management. Therefore, by the end of June, Mexico must deplete their reservoirs to conservation levels by releasing water to the Rio Grande River. Texas has mandated and will only credit Mexico for the water users are able to divert from the River. Any excess water delivered by Mexico but not diverted by Texas that reaches the Gulf will not be credited to Mexico towards its delivery obligations and debt.

It is a positive that Mexico is storing water and delaying delivery as long as possible so that water users in Texas can divert it for use, but due to all the rain in South Texas there is not a large need for diversions and water use at this time. These Mexican deliveries may not have a significant impact on the debt Mexico owes Texas.

Carlos Rubinstein

Carlos Rubinstein recently announced that he would be retiring from his current position as Chairman of the Texas Water Development Board. Born in Mexico City, Chairman Rubinstein has deep roots in South Texas spending a majority of his childhood in Brownsville. Chairman Rubinstein has vast experience in the field of water working in various capacities, including but not limited to, City Manager of Brownsville, Watermaster of the Rio Grande River, Chairman of the Texas Commission on Environmental Quality, and Chairman of the Texas Water Development Board. Chairman Rubinstein never forgot South Texas and the Rio Grande Valley while he held his statewide positions and has long been an advocate and champion for our region. Chairman Rubinstein's expertise and leadership will be missed. His retirement is officially scheduled for the end of August 2015.

Rain

Over the course of the last few months Texas has experienced significant rainfall such that the President of the United States declared a State of Emergency and the Governor of Texas declared a State of Disaster in 70 Texas Counties. Some estimates have stated that there has been enough rainfall to cover the entire state of Texas with 8 inches of water. Some experts state that these rainfall events have sparked the end of the devastating drought that Texas has been experiencing for the last four years. Not all reservoir levels are at or even near capacity but Texas desperately needed the rain and it has gone a long way to help resolve some of the emergency water shortage situations in our state.

Miscellaneous

http://www.elpasotimes.com/news/ci_28292593/plant-make-brackish-water-good-enough-drink
This is a great article regarding plans for El Paso to increase the amount of potable water is derives from the desalination production process at its current plant. This proposal would take the waste from the current production process and treat it to drinking quality to be sold back to the City. Currently El Paso is able to produce potable water from 80 percent of the water it treats. This new proposal seeks to increase that percentage up to 93%.

Attached please find the Water Delivery Report produced by the Texas Commission on Environmental Quality dated 6/01/2015.

http://yosemite.epa.gov/opa/admpress.nsf/3881d73f4d4aaa0b85257359003f5348/62295cddd6c6b45685257e52004fac97!OpenDocument "The U.S. Environmental Protection Agency and the

U.S. Army have finalized a Clean Water Rule providing clarity in defining and protection of tributaries that impact the health of downstream waters and in defining how far safeguards extend to nearby waters."[1]

[1] http://www.texastribune.org/plus/water/vol-3/no-11/epa-finalizes-clean-water-rule/?mc_cid=210c9c0b2c&mc_eid=d105dfb8b9

PROJECT: Lower Rio Grande Valley Regional Water Supply Program - Legal
CLIENT: HCDD#1

TEDSI JOB NUMBER: 2013-1128-12

PROGRESS REPORT NO. 019

Progress Period May 01, 2015 Through May 31, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
II. GCM FOR PRELIMINARY PROJECT PLANNING AND DEVELOPMENT					
(5) Water Rights, TEDSI	$39,063.14	99.99%	$39,060.95	$39,060.95	**$0.00**
(6) Water Rights Sub Consultant BBS, PC	$80,000.00	75.28%	$60,225.00	$58,725.00	**$1,500.00**
(7) Water Rights Sub Consultant BHDA, LLP	$65,400.00	83.82%	$54,816.82	$54,517.40	**$299.42**
Additional Expenses	$22,000.00	3.12%	$686.73	$686.73	**$0.00**
SUB TOTAL II	$206,463.14	74.97%	$154,789.50	$152,990.08	**$1,799.42**

TOTAL LABOR EXPENSES	$206,463.14	74.97%	$154,789.50	$152,990.08	**$1,799.42**

TOTAL INVOICE AMOUNT DUE: $1,799.42

TEDSI INFRASTRUCTURE GROUP
TEDSI
Consulting Engineers
1201 E. Expressway 83 ♦ Mission, Texas 78572
(956) 424-7898

Letter of Transmittal

TO:
Mr. Noe Saldivar
Hidalgo County Drainage District No. 1
902 N. Doolittle Road
Edinburg, Texas 78539

DATE: June 17, 2015

REF.: Delta Watershed Legal Water Rights Project May Invoice

TEDSI PROJECT NO.: 2013-1128-12

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☐ Hand Carry
☐ E-Mail	☒ LoneStar Overnight	☐ FedEx

COPIES	DESCRIPTION
1	Invoice No. 20152382 for Project No. 2013-1128-12 along with Sub Invoices
1	Progress Report No. 019
1	Water Brief
1	CD-Digital copies of Invoice and Progress Reports and Water Brief

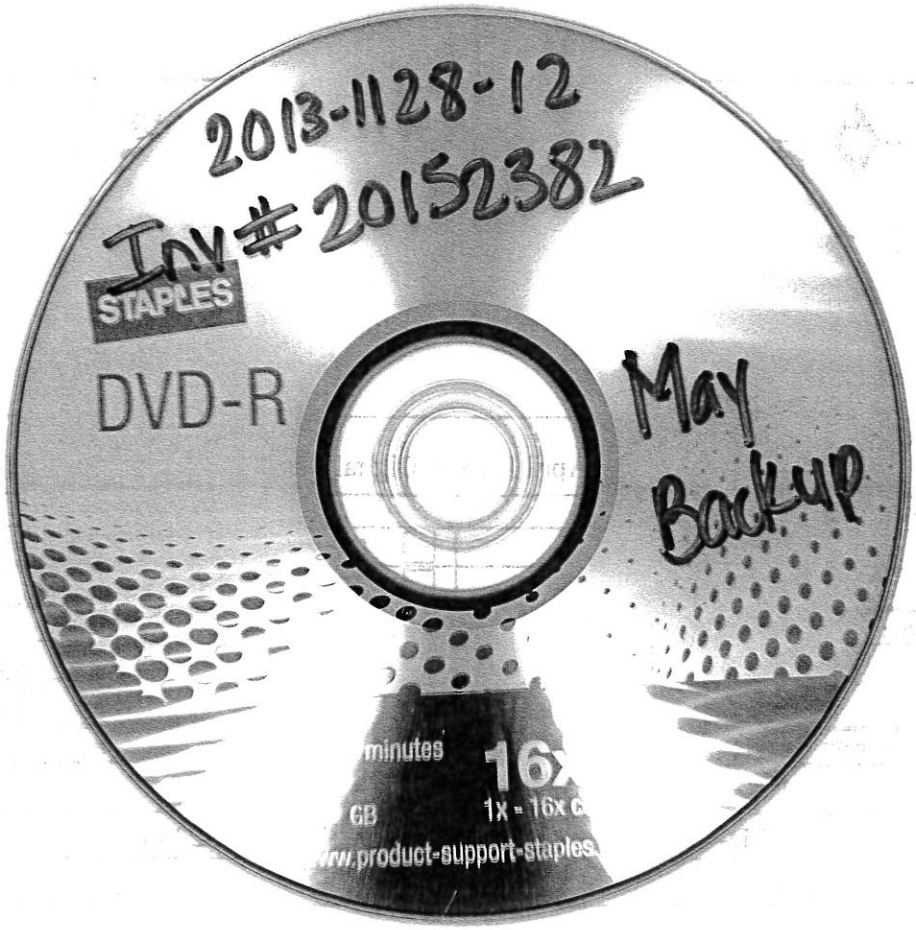
REMARKS:

Thank you,

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUN 19 2015
2:15 AM / PM
BY: Rosa Ane

Signed: for: Clay
Mark W. Lupher, P.E., RPLS

If enclosures are not as stated, please notify us.


2013-1128-12
Inv# 20152382
STAPLES
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May Backup
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www.product-support-staples

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080 Fax: (956) 292-7089

Invoice Processing Checklist

Date Received:	6/2/2015
Engineer/Firm Name:	TEDSI
Project Name/Number:	LRGVRWMP-Management Constultant
Invoice No.:	20152353
Purchase Order No.:	623578
Received By:	Rosa Arce
Forwarded to:	Joey Garza
Total # of Pages Submitted:	8
Attachments:	CD's 2 of 2

Additional Comments: $72,312.44

RECEI
HIDALGO COUN
DRAINAGE DISTRICT #1

JUN 02 2015
12:28 AM / PM
BY: Rosa Ana

TEDSI INFRASTRUCTURE GROUP
TEDSI
TBPE F-1640
Consulting Engineers
1201 East Expressway 83 ♦ Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022

May 27, 2015
Project No: 2013-1128-08
Invoice No: 20152353

Ms. Claudette Guerrero
Hidalgo County Drainage District No. 1
902 North Doolittle Road
Edinburg, TX 78542

Project 2013-1128-08 Lower Rio Grande Valley Regional Water Management Program - General Management Consultant

Precinct No. 1 2012 Bond Referendum
General Engineering Management Services
Account No. 13-133-433-360-010-000-43340P. O. No. 623578
Work Authorization No. 8

Professional Services from April 01, 2015 to April 30, 2015

Fee

Billing Phase	Fee	Percent Complete	Earned	Previous Fee Billing	Current Fee Billing
Preliminary Planning & Development	856,165.48	61.9722	530,584.58	467,742.89	62,841.69
Preliminary Engineering	261,709.66	22.4629	58,787.58	49,316.83	9,470.75
Expenses	524,590.34	37.7059	197,801.51	197,801.51	0.00
Total Fee	1,642,465.48		787,173.67	714,861.23	72,312.44
		Total Fee			**72,312.44**

Billing Summary	**Current**	**Prior**	**To-Date**
Total Billings	72,312.44	714,861.01	787,173.45
Total Fee			1,642,465.48
Remaining Fee			855,292.03

Total this Invoice **$72,312.44**

Outstanding Invoices

Number	Date	Balance
20152222	2/18/2015	1,670.08
20152303	4/22/2015	18,686.80
Total		**20,356.88**

Total Now Due **$92,669.32**

PLEASE REMIT PAYMENT TO:
TEDSI Infrastructure Group, Inc.
738 Highway 6 South, Suite 430
Houston, Texas 77079

Authorized By: _____ Date: 5.27.15
Mark W. Lupher, P.E., RPLS
Executive Vice President

WORK AUTHORIZATION #8
LABOR DETAIL
DELTA AREA WATERSHED

April 2015	Principal Engineer	Project Manager (VIII)	Sr. Engineer (V)	Sr. Engineer (V)	Project Engineer (III)	Project Engineer (II)	Engr. In Training (E.I.T.)	Sr. Engr. Designer	Engr. Designer	CADD Operator	Sr. GIS Designer	GIS Designer	GIS System Manager	IT System Manager	Project Admin	Assistant Admin
	J. Salinas	M. Lupher	M. Corbitt	J. Sanchez	E. Dietrich		S. DeLeon/J.Adams		R. Cavazos	J. Adams/R. Villarreal	J. Perez		M. Manzano	A. Bray	D. Castillo	C. Garza
	$266.62	$232.61	$187.37	$187.37	$159.15	$144.56	$122.87	$117.57	$109.24	$104.61	$135.00	$90.00	$175.00	$180.00	$178.37	$73.13
Dates:																
4/1/2015							9.5						9			
4/2/2015							7			3			9			
4/3/2015																
4/6/2015		9					14						2.5			
4/7/2015		9					16			1			9			
4/8/2015							13						9			
4/9/2015							11			6.5			9			
4/10/2015			3				4			1			4			
4/13/2015		9	2										9	9		
4/14/2015		9	1										8	9		
4/15/2015		7											9	9		
4/16/2015		9	4				4.5						9	9		
4/17/2015		4					4						3.5	4		
4/20/2015		9											9			
4/21/2015													9			
4/22/2015		9											9			
4/23/2015													9			
4/24/2015							4						4			
4/27/2015		9					9						7.5			
4/28/2015		9											9			
4/29/2015													9			
4/30/2015													9			
Total	$0.00	$21,400.12	$1,873.70	$0.00	$0.00	$0.00	$11,795.52	$0.00	$0.00	$1,203.02	$0.00	$0.00	$28,787.50	$7,200.00	$0.00	$0.00
	0	92	10	0	0	0	96	0	0	11.5	0	0	164.5	40	0	0

	Total This Month $72,259.86

PROJECT: Delta Watershed Project - GCM
CLIENT: Hidalgo County Drainage District No. 1

TEDSI JOB NUMBER: 2013-1128-08

PROGRESS REPORT NO. 017

Progress Period April 01, 2015 Through April 30, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
I. GCM FOR ENGINEERING MANAGEMENT					
(A) PRELIMINARY PROJECT PLANNING AND DEVELOPMENT					
(1) Administrative Policy & Procedures	$105,432.80	93.16%	$98,224.32	$98,224.32	**$0.00**
(2) Project Development Schedule	$53,143.60	84.68%	$45,000.00	$45,000.00	**$0.00**
(3) Construction Estimate	$50,894.20	30.00%	$15,268.28	$6,659.94	**$8,608.34**
(4) QC/QA Program Development	$51,885.22	90.00%	$46,695.19	$46,695.19	**$0.00**
(5) Subcontract Administration	$49,684.28	90.00%	$44,715.85	$44,715.85	**$0.00**
(6) Funding Source	$119,911.08	60.00%	$71,946.64	$58,027.40	**$13,919.24**
(7) Capital Improvement Program	$129,253.80	10.00%	$12,925.38	$256.85	**$12,668.53**
(8) Management/ Coordination of Engineering Activities	$133,975.80	60.32%	$80,819.03	$59,020.73	**$21,798.30**
(9) Implementation of QC/QA Program	$46,927.50	38.00%	$17,832.45	$11,985.17	**$5,847.28**
(10) Computer Database Development Platform	$115,057.20	84.44%	$97,157.44	$97,157.44	**$0.00**
SUB TOTAL I.A	$856,165.48	61.97%	$530,584.58	$467,742.89	**$62,841.69**
(B) PRELIMINARY ENGINEERING					
(1) Preliminary Concept Conference	$57,250.80	65.57%	$37,538.32	$32,802.94	**$4,735.38**
(2) Management/Coordination of Engineering	$42,799.96	45.06%	$19,286.44	$14,551.07	**$4,735.37**
(3) Implementation of QA/QC Program	$36,624.10	5.36%	$1,962.82	$1,962.82	**$0.00**
(4) Preparation of "***Preliminary Engineering***	$84,677.60	0.00%	$0.00	$0.00	**$0.00**
(5) Coordination with all Reviewing Agencies	$40,357.20	0.00%	$0.00	$0.00	**$0.00**
SUB TOTAL I.B	$261,709.66	22.46%	$58,787.58	$49,316.83	$9,470.75
TOTAL LABOR COSTS	$1,117,875.14	$0.84	$589,372.16	$517,059.72	$72,312.44

PROGRESS REPORT NO. 017

Progress Period April 01, 2015 Through April 30, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
DIRECT EXPENSES					
TRAVEL					
Lodging/Hotel (Austin)	$648.00	0.00%	$0.00	$0.00	**$0.00**
Lodging/Hotel Taxes/fees (Austin @ 9%)	$58.32	0.00%	$0.00	$0.00	**$0.00**
Per Diem (Austin)	$426.00	0.00%	$0.00	$0.00	**$0.00**
Lodging/Hotel (Washington DC)	$1,356.00	0.00%	$0.00	$0.00	**$0.00**
Lodging/Hotel Taxes/fees (Washington DC @	$196.62	0.00%	$0.00	$0.00	**$0.00**
Per Diem (Washington DC)	$426.00	0.00%	$0.00	$0.00	**$0.00**
Mileage	$5,650.00	0.00%	$0.00	$0.00	**$0.00**
Rental Car (Taxes/Fees not included; Insurance	$450.00	0.00%	$0.00	$0.00	**$0.00**
Rental Car Fuel	$299.40	0.00%	$0.00	$0.00	**$0.00**
Air Travel -In State- Short Notice (Coach)	$6,000.00	0.00%	$0.00	$0.00	**$0.00**
Air Travel - Out of State - Short Notice (Coach)	$9,000.00	0.00%	$0.00	$0.00	**$0.00**
Luggage (with air travel)	$1,200.00	0.00%	$0.00	$0.00	**$0.00**
Parking	$420.00	0.00%	$0.00	$0.00	**$0.00**
Taxi/Cab fare	$480.00	0.00%	$0.00	$0.00	**$0.00**
Internet	$270.00	0.00%	$0.00	$0.00	**$0.00**
Telephone	$2,700.00	0.00%	$0.00	$0.00	**$0.00**
Conference Calls	$12,000.00	0.00%	$0.00	$0.00	**$0.00**
Postage & Shipping	$9,600.00	0.00%	$0.00	$0.00	**$0.00**
Overnight Mail - letter size	$1,800.00	0.00%	$0.00	$0.00	**$0.00**
Overnight Mail - oversized box	$3,000.00	0.00%	$0.00	$0.00	**$0.00**
Courier Services	$1,200.00	0.00%	$0.00	$0.00	**$0.00**
COMPUTER SYSTEM					
GIS Server, Web Hosting, Work Stations, Software, Licensing, Plotter, Printers, etc.	$382,990.00	51.65%	$197,801.51	$197,801.51	**$0.00**

PROGRESS REPORT NO. 017

Progress Period April 01, 2015 Through April 30, 2015

DESCRIPTION	ESTIMATED COST	PERCENT COMPLETE	INVOICE TO DATE	PREVIOUS INVOICE	AMOUNT DUE
PRINTING					
Photocopies B/W (8 1/2" X 11")	$1,050.00	0.00%	$0.00	$0.00	**$0.00**
Photocopies B/W (11" X 17")	$1,650.00	0.00%	$0.00	$0.00	**$0.00**
Photocopies Color (8 1/2" X 11")	$1,800.00	0.00%	$0.00	$0.00	**$0.00**
Photocopies Color (11" X 17")	$6,750.00	0.00%	$0.00	$0.00	**$0.00**
Digital Ortho Plotting (on bond)	$10,000.00	0.00%	$0.00	$0.00	**$0.00**
Bond Paper Plot (Blueline/Blackline)	$4,500.00	0.00%	$0.00	$0.00	**$0.00**
Plots (B/W on Bond)	$12,000.00	0.00%	$0.00	$0.00	**$0.00**
Plots (Color on Bond)	$8,000.00	0.00%	$0.00	$0.00	**$0.00**
Plots (Color on Photographic Paper)	$5,000.00	0.00%	$0.00	$0.00	**$0.00**
Mounting Color Graphics on Foam Board	$10,000.00	0.00%	$0.00	$0.00	**$0.00**
Presentation Boards 30" X 40" Color Mounted	$4,200.00	0.00%	$0.00	$0.00	**$0.00**
Report Binding	$1,200.00	0.00%	$0.00	$0.00	**$0.00**
Notebooks	$720.00	0.00%	$0.00	$0.00	**$0.00**
Reproduction of CD/DVD	$15,500.00	0.00%	$0.00	$0.00	**$0.00**
CDs	$1,550.00	0.00%	$0.00	$0.00	**$0.00**
4" X 6" Digital Color Print	$500.00	0.00%	$0.00	$0.00	**$0.00**

TOTAL DIRECT EXPENSES	$524,590.34	37.71%	$197,801.51	$197,801.51	**$0.00**

TOTAL (LABOR AND DIRECT EXPENSES)	$1,642,465.48	47.93%	$787,173.67	$714,861.23	$72,312.44

TOTAL INVOICE AMOUNT DUE: $72,312.44

TEDSI INFRASTRUCTURE GROUP *Consulting Engineers* TEDSI TBPE F-1640	Project Progress Report
TO: Hidalgo County Drainage District No. 1	**DATE:** May 27, 2015
FROM: Mr. Mark Lupher, P.E., Project Manager	**TEDSI PROJECT NO.:** 2013-1128-08
REFERENCE: Hourly Progress Report	
Progress Report for Invoice No. 20152353, April 01 thru April 30, 2015	

- Week Report by Week for Ace Bray
  - Week of: 04-18-2015
    - Worked on Web Application for Cost Estimate Project

- Week Report by Week for Rebecca Villarreal
  - Week of: 04-11-2015
    - Modified Maps for Water Rights Application

- Week Report by Week for Mark Lupher
  - Week of: 04-11-2015
    - Coordination with team on Water Rights Application
    - Coordination with Black and Vetch on Region M ammendment
  - Week of: 04-18-2015
    - Coordination with team on Water Rights Application
    - Coordinate with Legislative team memebers on funding sources
  - Week of: 04-25-2015
    - Coordination with team on Water Rights Application
    - Coordination with Raba Kistner on piezometer readings and recommendations
    - Coordinate with Legislative team memebers on funding sources
  - Week of: 05-01-2015
    - Coordination with team on Water Rights Application
    - Coordination with Raba Kistner on piezometer readings and recommendations

- Week Report by Week for Juan Enriquez
  - Week of: 04-11-2015
    - Modified Maps for Water Rights Application

- Week Report by Week for Jason Adams
  - Week of: 04-04-2015
    - Modified Maps and information for Region M ammendment
  - Week of: 04-11-2015
    - Coordination with Raba Kistner on piezometer readings

- Week Report by Week for Mariano Manzano
  - Week of: 04-11-2015
    - Coordination with Black and Vetch on Region M ammendment
    - Generate Maps for Region M ammendment
    - Subcontracting Administration
  - Week of: 04-18-2015
    - Coordination with team on Water Rights Application
  - Week of: 04-25-2015
    - Worked on Web Application for Project Cost Estimate

        - Preliminary Concept Conference

    - Week of: 05-01-2015
        - Worked on Web Application for Project
        - Coordination with team on Water Rights Application

- Week Report by Week for Mark Corbitt
    - Week of 04-11-2015
        - Coordination with Black and Vetch on Region M ammendment
        - Coordination with team on Water Rights Application
        - Coordination with Raba Kistner on piezometer readings
    - Week of 04-18-2015
        - Coordination with team on Water Rights Application
        - Coordinate with Legislative team memebers on funding sources

- Week Report by Week for Samantha De Leon
    - Week of 04-04-2015
        - Coordination with Black and Vetch on Region M ammendment
        - Coordination with team on Water Rights Application
    - Week of: 04-11-2015
        - Coordination with Black and Vetch on Region M ammendment
        - Coordination with Raba Kistner on piezometer readings
        - Coordination with team on Water Rights Application
    - Week of: 04-18-2015
        - Coordination with team on Water Rights Application
    - Week of: 04-25-2015
        - Coordination with team on Water Rights Application
        - Coordination with Raba Kistner on piezometer readings and recommendations

- Week Report by Week for Jose Vasquez
    - Week of 04-04-2015
        - Coordination with Raba Kistner on survey in proposed area

TEDSI INFRASTRUCTURE GROUP
TEDSI
Consulting Engineers
1201 E. Expressway 83 ♦ Mission, Texas 78572
(956) 424-7898

Letter of Transmittal

TO:
Mr. Noe Saldivar
Hidalgo County Drainage District No. 1
902 N. Doolittle Road
Edinburg, Texas 78542

DATE: June 1, 2015

REF.: ~~Delta Area Watershed April Invoice~~

TEDSI PROJECT NO.: 2013-1128-08

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☐ Hand Carry
☐ E-Mail	☒ LoneStar Overnight	☐ FedEx

COPIES	DESCRIPTION
1	TEDSI Invoice No. 20152353
1	CD- Digital files for TEDSI Invoice No. 20152353
1	Labor Detail
1	Progress Report No. 17
1	Project Progress Report

REMARKS:

Thank you,

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUN 02 2015
12:28 AM / PM
BY: Rosa Arce

Signed: for: _____
Mark W. Lupher, P.E., RPLS

If enclosures are not as stated, please notify us.

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUN 01 2015
8:40 AM PM
BY: Rosa Cue

TEDSI INFRASTRUCTURE GROUP
TEDSI
TBPE F-1640
Consulting Engineers
1201 East Expressway 83 ♦ Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022

May 27, 2015
Project No: 2013-1128-17
Invoice No: 20152357

Ms. Claudette Guerrero
Hidalgo County Drainage District No. 1
902 North Doolittle Road
Edinburg, TX 78542

Project 2013-1128-17 Spanish Palms Outfall Improvements of Material Testing & Construction Management

Hidalgo County Precinct One
Work Authorization No. 17

Professional Services from April 01, 2015 to April 30, 2015

Fee

Billing Phase	Fee	Percent Complete	Earned	Previous Fee Billing	Current Fee Billing	
Construction Management	16,000.00	31.5351	5,045.62	3,460.72	1,584.90	
Material Testing	8,507.85	25.2623	2,149.28	0.00	2,149.28	
Total Fee	24,507.85		7,194.90	3,460.72	3,734.18	
		Total Fee				**3,734.18**
				Total this Phase		**$3,734.18**

Billing Summary	Current	Prior	To-Date	
Total Billings	3,734.18	3,460.72	7,194.90	
Total Fee			24,507.85	
Remaining Fee			17,312.95	
			Total this Invoice	**$3,734.18**

Outstanding Invoices

Number	Date	Balance
20152275	3/30/2015	1,600.00
20152309	4/22/2015	1,860.72
Total		**3,460.72**

Total Now Due **$7,194.90**

PLEASE REMIT PAYMENT TO:
TEDSI Infrastructure Group, Inc.
738 Highway 6 South, Suite 430
Houston, Texas 77079

Authorized By: _____ Date: 5.27.15
Mark W. Lupher, P.E., RPLS
Executive Vice President

TEDSI INFRASTRUCTURE GROUP
Consulting Engineers
1201 East Expressway 83 ♦ Mission, Texas 78572
Tel: (956) 424-7898
Fax: (956) 424-7022
TBPE F-1640

Project Status Report

TO: Claudette Guerrero | **DATE: May 27, 2015**

FROM: Roberto Fina Carral, P.E. | **TEDSI PROJECT NO.: 2013-1128-17**

REFERENCE:

Spanish Palms Outfall Improvements of Material Testing & Construction Management

TEDSI INVOICE NO: 20152357 **PROFESSIONAL SERVICES FROM: April 01, 2015 through April 30, 2015**

PHASE	CONTRACTOR	TASK COMPLETED
Construction Management	**TEDSI** 31.5351%	Meeting with TxDOT has been done to get approval on the alternative alignment due to conflict with NAWSC water line on 03/31/2015. Approval got on 04/08/2015 to move forward with the alternative changing alignment to the east side of FM 1015 from STA 10+00 to 23+40. Construction Management Inspection did on March 02, 19, 31, April 17, and 30. 2 Change Order have been revised and process. The Contractor has 5 days work missed due to conflict with NAWSC and 17 days missed due to weather conditions. Total of missed days 22.
Material Testing	**RABA** 25.2623%	We have been receiving Laboratory Testing Report from Raba, all the testing have been passed there are not failing test.

TEDSI INFRASTRUCTURE GROUP
TEDSI
Consulting Engineers
1201 E. Expressway 83 ♦ Mission, Texas 78572
(956) 424-7898

Letter of Transmittal

TO:
Mr. Noe Saldivar
Hidalgo County Drainage District No. 1
902 N. Doolittle Road
Edinburg, Texas 78542

DATE: May 28, 2015

REF.: Spanish Palms Outfall Improvements Materail Testing & CM April Invoice

TEDSI PROJECT NO.: 2013-1128-17

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☐ Hand Carry
☐ E-Mail	☒ LoneStar Overnight	☐ FedEx

COPIES	DESCRIPTION
1	Invoice No. 20152357 for Project No. 2013-1128-17
1	Project Status Report

REMARKS:

Thank you,

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUN 01 2015
8:40 AM / PM
BY: Rosalva

Signed: for: Clay
Roberto Fina Carral, P.E.

If enclosures are not as stated, please notify us.

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Invoice/ Backup

Date Received: 7/1/2015

Engineer/Firm Name: L&G Eng.

Project Name/Number: La Joya Watershed WA No. 6

Invoice No.: 11325192

Purchase Order No.: 627083

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos _____ Date: _____

Total # of Pages Submitted: 6

Attachments: CD: WA No. 7 Task 16108 & 16150

Forwarded to: Jose N. Saldivar _____ Date: _____

Forwarded to: Lora Briones _____ Date: _____

Additional Comments: The transmittal on was addressed for: WA No. 6A & Progress report was made for WA No. 7 & the Invoice is for WA No. 6 & CD was addressed for WA No. 7 & backups for WA No. 7

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

L&G Engineering
Transportation Consultants

July 1, 2015

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle
Edinburg, Texas 78542

RE: Work Authorization #7 on La Joya Watershed Improvement Project
Job # 130107
P.O. # 627083

Dear Mr. Sesin,

Attached for your review is our progress report for the services rendered during the month of June 2015 on the subject referenced project.

The following is attached:

TASK		% COMPL
FC 161 - Drainage		
FC 16108 ~ Coordination and Support of Hydrologist for HEC-HMS Modeling Modifications	L&G	87.5%
Meetings, phone conversations, and e-mails are ongoing. L&G has supplied Civil Systems with DGN files as well as PDFs of the project area. The alignment of the proposed route has been submitted to CSE. We continue to coordinate with CSE.		
FC 16150 ~ US 83RR HEC-HMS Model, La Joya MDP HEC-HMS Model, Additional Modeling Modifications	CSE	87.5%
See attached progress report from CSE dated 6-25-2015		

Should you have any questions regarding this submittal or would like clarification on any aspect of the project, please do not hesitate to call me at (956) 585-1909.

Sincerely,

for Armando Sandoval, P.E.
Project Manager
L&G Engineering

2100 W. Expressway 83 • Mercedes, TX 78570 • Office (956) 565-9813 • Fax (956) 565-9018
900 S. Stewart Rd., Ste. 9 • Mission, TX 78572 • Office (956) 585-1909 • Fax (956) 585-1927

L &G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956)565-9813 Fax (956)565-9018

INVOICE#: 11325192
INVOICE DATE: 6/30/2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
12:20 AM / PM
BY: Rosa Arce

BILL TO:
Hidalgo County Drainage District#1
902 N. Doolittle
Edinburg, TX 78542

JOB:130107
La Joya Watershed Imp
WA#6
PO #627083

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
Engineering services for the month of June 2015.						
FC 161 - Drainage						
16108-Coord. and Support of Hydrologist for HEC-HMS Modeling Mo	2,238.40		1,958.60	1,958.60	87.5	279.80
16150-US 83RR HEC-HMS Model, La Joya MDP HEC-HMS Model, Additio	17,500.00		15,314.00	15,314.00	87.5	2,186.00
TOTALS:	19,738.40	0.00	17,272.60	17,272.60	87.5	2,465.80

ORIGINAL CONTRACT SUM	$	19,738.40
CHANGE BY CHANGE ORDER	$	0.00
CONTRACT SUM TO DATE	$	19,738.40
TOTAL COMPLETED TO DATE	$	17,272.60
LESS PREVIOUS INVOICES	$	0.00
CURRENT PAYMENT DUE	$	17,272.60

PROJECT MANAGER'S SIGNATURE

La Joya Master Drainage Plan/US83 Relief Route Hydraulic Study
Monthly Progress Report No. #1 – June 2015

Period of Coverage:	June 2015
Date of Submittal:	June 25, 2015
Submitted To:	Damien Tijerina, P.E.
Prepared By:	Civil Systems Engineering Inc.

This study covers the following activities:

1. Coordination with L&G for design and configuration
2. Updates to the US 83RR HEC-HMS Model
3. Updates to the LaJoya MDP HEC-HMS Model
4. Additional Modeling Modifications
5. Technical Memorandum

PROGRESS TO REPORT FOR THIS PERIOD

Activity 1 – Coordination with L&G for design and configuration
Coordination with L&G on the project data and requirements

Activity 2 – 2. Updates to the US 83RR HEC-HMS Model
Revised the existing US83 HEC-HMS model – channel and basin routing, and outfall structure.

Activity 3 – Updates to the La Joya MDP HEC-HMS Model
Updated the existing La Joya MDP HEC-HMS models - channel and basin routing, and outfall structure, added drainage area along proposed outfall, added interconnections between North, Mod-Reach, and South watersheds.

Activity 4 – Additional Modeling Modifications
Modeled new outfall structures for multiple frequencies, sized structures for ultimate conditions and updated US83RR HEC-RAS model, and sized detention basin outfall and culvert structures.

Activity 5 – Technical memorandum.

Civil Systems Engineering, Inc.

1202 Lake Pointe Parkway
Sugar Land, Texas 77478
(713) 782-3811

INVOICE

Engineering Services
La Joya Watershed Master Drainage Plan/US83 Relief Route Hydraulic Study - WA No. 11

L&G Engineering
2100 W. Expressway 83
Mercedes, Texas 78570
Attention: Mr. Damien Tijerina, P.E.

CSE Invoice Number: LG201510
CSE Project Number: LG201504
Invoice Period: 5/27/2015 Through 6/25/2015
Invoice Date: June 25, 2015

Contract Amount	Contract Amount Remaining
$17,500.00	$2,186.00

Employee Classfication	Rate	Previous		This Period		To Date	
		Hr	Total	Hr	Total	Hr	Total
Project Manager	$205.80			20	$4,116.00	20	$4,116.00
Project Engineer	$178.30			60	$10,698.00	60	$10,698.00
GIS Specialist	$164.64				$0.00	0	$0.00
Expenses					$500.00		$500.00
Subtotal					**$15,314.00**		**$15,314.00**

Deren Li, Ph.D., P.E., D.WRE
Project Manager

TOTAL FEE EARNED:	$15,314.00
LESS PREVIOUSLY INVOICED:	$0.00
TOTAL AMOUNT DUE THIS INVOICE:	**$15,314.00**

L&G Consulting Engineers, Inc
2100 W. Expressway 83
Mercedes, Texas 78570
(956) 565-9813

Project Workhour Report
La Joya Watershed Improvements WA#7
Reference:Inv#11325192
Date: 06/30/15
P.O.#622697

	Hrs		Rate	Total
Senior Project Manager	3.50	X	212.59	$744.07
Senior Engineer	5.25	X	175.07	$919.12
Admin/Clerical	5.25	X	56.27	$295.42

Grand Total of Hours		$ 1,958.61
	(Difference due to rounding hours)	$ 0.01

Invoice Summary

Man Hours	$ 1,958.60
Sub Contract (See Attached Sub Invoice for Man Hour Breakdown)	$ 15,314.00
Total Per Invoice Submitted	**$ 17,272.60**

L&G Engineering
Transportation Consulting Engineers

2100 W. Expressway 83
Mercedes, TX 78570
Phone: (956) 565-9813
Fax: (956) 565-9018
Toll Free: (888) 565-9813

900 S. Stewart Rd., Ste. 10
Mission, TX 78572
Phone: (956) 585-1909
Fax: (956) 585-1927
Toll Free: (866) 585-1909

Firm No. F-4105

Letter of Transmittal

Mr. Raul E. Sesin, P.E. – Drainage District Manager
Attn: Ms. Lora Briones – Chief Financial Manager
Hidalgo County Drainage District #1
902 N. Doolittle Rd.
Edinburg, Texas 78542

DATE: July 1, 2015

REF.: Work Authorization #6A on La Joya Watershed Improvement Project
P.O. #627083
Invoice (11325192)

L&G PROJECT NO.: 130107

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☒ Hand Carry
☐ E-Mail	☐ Lonestar Overnight	☐ Pick up

COPIES	DESCRIPTION
1	Invoice # 11325192
1	CD

REMARKS:
Attached is our invoice and progress report for the month of June. Also attached is a CD containing the information for Tasks FC 16108 and FC 16150.

If you have any questions or comments, please feel free to contact me or Mr. Damien B. Tijerina, P.E. at 956-585-1909.

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
10:35 AM / PM
BY: ADC

_____
Received By

If enclosures are not as stated, please notify us.

L & G Engineering Electronic Data & CAD Disclaimer
By opening the attached files, the user agrees that data provided by this electronic file is for information purposes only and should be used at one's own risk. L & G Engineering, makes no representations, written or verbal, that the information contained in these CAD files are complete or accurate or should be relied upon for construction except to the extent that they are labeled, dimensioned or otherwise noted and reflect exactly what is on the approved and sealed preliminary or final drawings. Any conflict between the information reflected on the sealed plan sheets and that provided via this electronic data file shall be resolved in favor of the sealed plan sheets. Any reproduction of these sheets without the appropriate preliminary stamp, or professional engineering seal and signature, and the express written approval of L & G Engineering, is a violation of the Professional Engineering Practice Act.
HCDD#1
6/30/2015
L & G ENGINEERING
La Joya Watershed Improvement Project (WA#7)
Task 16108 & 16150
L & G Engineering
Highway / Civil
Structural / Bridge
Environmental
Construction Material Testing
900 S. Stewart Rd. Ste 5
Mission, TX. 78572
Phone : (956) 585-1909
Fax : (956) 585-1977

AI -50516 **7.**

DRAINAGE - CONSENT

Meeting Date: 07/21/2015

Submitted By: Claudette Guerrero,
DRAINAGE DISTRICT

Department: DRAINAGE DISTRICT

Information

CAPTION

Request approval to issue payment on the following items that have met audit requirements:

L&G Consulting Engineers:

2013 Bonds:

A. Inv No. 11325189 in the amount of $47,089.09 related to Work Authorization No. 6A-La Joya Watershed Improvements -TxDot Outfall to IBWC Levee.

B. Inv No. 11325196 in the amount of $116,833.99 related to Work Authorization No. 2-Pharr McAllen Drain & South Flood Water Channel Watershed Improvements. PO#626939.

C. Inv No. 11325198 in the amount of $10,216.27 related to Work Authorization No. 4-La Joya Watershed Improvements-Liberty Pit Detention

D. Inv No. 11325174 in the amount of $2,089.83 related to Work Authorization No. 1-FM 676 Outfall Analysis and Evaluation of proposed drainage improvements from SH107 to East to Taylor Road. PO#622895.

General Fund:

E. Inv No. 11325195 in the amount of $60,817.80 related to Work Authorization No. 1-Pharr McAllen Drain & South Flood Water Channel Watershed Improvement Project. PO#626860.

S&B Infrastructure Ltd:

F. Inv No. U9444.812-08a in the amount of $89,350.00 related to Work Authorization No.17-MDS PH.2 Design & Expansion of the Raymondville Drain Outfall System. PO#626525.

BACKGROUND

Fiscal Impact

Attachments

L&G Inv#11325189 Submitted 07-01-2015
L&G Inv#11325196 Submitted 07-01-2015
L&G Inv#11325195 Submitted 07-01-2015
S&B Inv# U9444.812-08a Submitted 07-15-2015
L&G Inv# 11325174
L&G Inv#11325198

Form Review

Inbox	**Reviewed By**	**Date**
Budget & Management	Veronica Ortiz	07/17/2015 11:23 AM
Final Approval	Monica Badillo	07/17/2015 05:41 PM
Form Started By: Claudette Guerrero		Started On: 07/16/2015 03:17 PM
Final Approval Date: 07/17/2015		

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Invoice/ Backup

Date Received: 7/1/2015

Engineer/Firm Name: L&G Eng.

Project Name/Number: La Joya Watershed WA No. 6A

Invoice No.: 11325189

Purchase Order No.: 626941

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos _____ Date: _____

Total # of Pages Submitted: 14

Attachments: CD

Forwarded to: Jose N. Saldivar _____ Date: _____

Forwarded to: Lora Briones _____ Date: _____

Additional Comments: _____

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

L&G Engineering
Transportation Consultants

July 1, 2015

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle
Edinburg, Texas 78542

RE: Work Authorization #6A on La Joya Watershed Improvement Project
Job # 130106
P.O. # 626941

Dear Mr. Sesin,

Attached for your review and approval is our invoice for the services rendered during the month of June 2015 on the subject referenced project.

The following is attached:

- L&G's Invoice #11325189
- CD w/ Electronic Files of Data

		% COMPL
TASK #1 – FC 102 – Feasibility Studies		
FC 10201 ~ Preliminary Design Values	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 10202 ~ Preliminary Route Location on Uncontrolled Mapping	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 10203 ~ Uncontrolled Mapping	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 10204 ~ Preliminary Hydrologic Map	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 10205~ Preliminary ROW Requirements	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 10206~ Preliminary Cost Estimates	L&G	100%
Task is complete – See progress report dated 06-10-2015		

2100 W. Expressway 83 • Mercedes, TX 78570 • Office (956) 565-9813 • Fax (956) 565-9018
900 S. Stewart Rd., Ste. 9 • Mission, TX 78572 • Office (956) 585-1909 • Fax (956) 585-1927

FC 10207 ~ Preliminary Environmental Analysis	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 10208 ~ Project Fact Sheet with Est. Local Cost vs. Total Project Cost	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 10209 ~ Meetings, Coordination & Support for Project Development	L&G	100%
Task is complete – See progress report dated 06-10-2015		
TASK #2 – FC 110 – Route and Design Studies		
FC 11004 ~ Preliminary Cost Estimates	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 11005 ~ Design Schematic	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 11006 ~ Preliminary ROW Requirements	L&G	100%
Task is complete – See progress report dated 06-10-2015		
TASK #3 - FC 130 – Right-of-Way Data		
FC 13008 ~ Coordination and Management of Right-of-Way Data (FC 130) and Field Surveying (FC 150)	L&G	55%
L&G Engineering has been in constant coordination with the Surveyor on determination of the Right-of-way and in receipt of various levels of completion of the Field Surveying.		
FC 13020 ~ ROW Mapping / SUB	ROWSS	20%
See attached progress report from ROWSS dated 6-30-2015		
TASK #4 – FC 150 – Field Surveying		
FC 15030 ~ Field Surveying (Control Horizontal and Vertical Ties)	ROWSS	18.8%
See attached progress report from ROWSS dated 6-30-2015		
FC 15040 ~ Determine Topography, Cross Sections and Pot Holing	ROWSS	88.9%
See attached progress report from ROWSS dated 6-30-2015		
FC 15060 ~ Final Reports and Deliverables	ROWSS	50%
See attached progress report from ROWSS dated 6-30-2015		

FC 15070 ~ Project Management and Oversight	ROWSS	50%
See attached progress report from ROWSS dated 6-30-2015		
TASK #5 - FC 161 - Drainage		
FC 16101 ~ Hydrologic Map	L&G	50%
A Hydrologic map containing contours and LIDAR information was created. Drainage areas that are contributing to the proposed outfall have been created/sized. The amount of flow generated from these areas was calculated and added to the proposed outfall. The discharge determination is an ongoing process with the utilization of HEC-HMS modeling as well as HEC-RAS modeling. **No update.**		
FC 16102 ~ Hydraulic Drainage Study - Culverts	L&G	50%
Utilizing the Federal Highway Administrations' HY-8 7.0 culvert design and analysis program, we analyzed the existing 5'x5' box culvert structure, currently under Old Military Highway, to determine what additional capacity of water is able to flow through that culvert. With the use of the HEC-RAS Model, culvert sizing of the intermediate and final culvert crossings at the Edinburg Main Canal and at the railroad/Chihuahua Rd. is nearing completion. **No update.**		
FC 16103 ~ Hydraulic Drainage Study - Channels	L&G	50%
The HEC-HMS program is being utilized, to ensure that the downstream drainage improvements, south of the Edinburg Main Canal, do not have an adverse affect to the proposed upstream channel that was previously designed. **No update.**		
FC 16104 ~ Hydraulic Drainage Study – Irrigation Canals/Siphons	L&G	75%
Meetings with the Hidalgo County Irrigation District #1 were held to discuss the construction of the proposed culvert under or over the Edinburg Main Canal. The Irrigation district would prefer that the culvert go under the Main Canal. After reviewing design issues, this option looks to be the best option. In our conversations with the Irrigation District it was discussed that at this time there is a maximum of 50 cfs flowing through the Edinburg Main Canal. We placed a bypass pipe in our plan set, to aid in the construction of the proposed culverts at this location, that would convey 50 or more CFS. **No update.**		
FC 16105 ~ Layout, Structural Design and Detailing of Drainage Features - Culverts	L&G	50%
Culvert layouts at the Edinburg Main Canal and at the Railroad/Chihuahua Rd. were created. Plan and profile views of the culvert crossing were included on the sheet.		

Final culvert box designs were placed at these locations based off of the upstream culvert crossing at US 83. Final design of these structures is nearing completion with the use of a HEC-RAS model. **No update.**		
FC 16106 ~ Layout, Structural Design and Detailing of Drainage Features – Storm Sewers	L&G	50%
The proposed pipe system and man hole locations were put in place to best fit the available right-of-way. This system of pipes, from the Edinburg Main Canal south to Old Military Highway, has been placed on sheets that contain the plan and profile of the pipe location. Final design of these structures is nearing completion with the use of a HEC-RAS model. **No update.**		
FC 16107 ~ Layout, Structural Design and Detailing of Drainage Features – Outfall Channel(s) Outside of ROW	L&G	50%
The outfall channel just north of Old Military Highway has a preliminary design that was placed on sheets. Final design is being finalized with the HEC-RAS model. **No update.**		
FC 16108 ~ Layout, Structural Design and Detailing of Drainage Features – Summary of Qtys	L&G	75%
Pipe, ditch, and other various drainage quantities were calculated per sheet for the project. All quantities, item numbers, and description codes were then transferred to the Estimated Quantity Sheet (EQ). These same quantities were placed on the Engineer's estimate and all sheets were submitted to TxDOT. Item and description codes may change based on the findings of the HEC-RAS and HEC-HMS models. **No update.**		
FC 16109 ~ Layout, Structural Design and Detailing of Drainage Features – Storm Water Management Facilities	L&G	50%
Storm water pollution prevention items such as rock filter dams, silt fences, and construction exits, etc…, are being proposed throughout the project. Final sheets will be created once the SW3P plan has been completed. **No update.**		
FC 16111 ~ Storm Water Pollution Prevention Plan (SW3P)	L&G	50%
Review of the entire facility that is being proposed and the effects that the building of this facility will have the natural environment is being reviewed in greater detail. Once the SW3P plan has been discussed in detail the SW3P sheets will be finalized. **No update.**		

TASK #6 - FC 163 – Miscellaneous Roadway		
FC 16306 ~ Special Utility Details (Irrigation Lines)	L&G	75%
A by-pass detail has been created so that construction of the culverts at the irrigation canal can be done as one whole cast-in-place unit. The irrigation canal would need to be dewatered so that construction can take place. **No update.**		
FC 16307 ~ Miscellaneous Structures	L&G	75%
Miscellaneous structures were reviewed in the area of the proposed drainage system. There are several existing structures such as a 24-IN RCP and a 5'x5' box culvert that will remain in place at the request of the stakeholders that own them. We continue to review all topographic information to ensure that all structures are accounted for. **No update.**		
FC 16301 ~ Foundation Studies	L&G	0%
No update		
FC 16302 ~ Utility Agreements and Exhibits	L&G	75%
Meetings with Hidalgo County Irrigation District #1 were held to discuss the use of 30-ft of their 200-ft of irrigation Right-of-way as a joint use agreement with Hidalgo County Drainage District. The Irrigation District was willing to enter into a joint use agreement with the Drainage District. Exhibits were created that outlined the location and widths of the joint use agreement and the location and widths of the proposed drainage easement. This information was distributed to the surveyor for his use. **No update.**		
FC 16303 ~ Railroad Sketches	L&G	100%
Task is complete – See progress report dated 06-10-2015		
FC 16304 ~ Traffic Signal Agreement Sketches	L&G	0%
No Update		
FC 16305 ~ Estimate	L&G	0%
No update		
FC 16308 ~ Specifications and General Notes	L&G	0%
No update		

TASK #7 - FC 600 – Right-of-Way Acquisition Services – Compensable Utilities		
FC 60000 ~ Right of Way Administration Acquisition	L&G	25%
Project presence has been established at 900 S. Stewart Road in Mission, Texas 78572 @ L&G Engineering-Transportation Consulting Engineers Right of Way Office. The office is open during normal County and State work hours with available personnel to answer questions about the project. One staff member is a current commissioned notary. Project files have been created and are maintained in the office. Personnel are available on a daily basis for project meetings and determined by the County. Initial property owner list has been developed. Have negotiated title commitments and title insurance with a local, reputable title company who is available to begin work when needed.		
FC 60001 ~ Title Services	L&G	0%
No update		
FC 60002 – Appraisal Services	L&G	0%
No update		
FC 60003 ~ Appraisal Review	L&G	0%
No update		
FC 60004 ~ Parcel Negotiations	L&G	0%
No update		
FC 60005 ~ Closing Services	L&G	0%
No update		
FC 60030 ~ Appraisal Services / SUB	L&G	0%
No update		
FC 60040 – Appraisal Review / SUB	L&G	0%
No update		
FC 60101 ~ Preliminary Design Consultations	L&G	10%
L&G Right of Way staff and Project Manger have met as an introduction to this project. Discussions included what was expected of ROW Department. Tasks include analysis of possible compensable utilities.		
FC 60102 ~ Field Observations and Verifications	L&G	10%
Project site visits have been conducted by L&G Right of Way Staff to familiarize with the project and current conditions.		

FC 60103 ~ Exchange of Information with Utility Providers	L&G	0%
No update		
FC 60104 ~ Confirmation of Property Interests	L&G	10%
Preliminary survey drawing s have been reviewed and property owners have been identified.		
FC 60105 ~ Develop and Execute Release of Easements	L&G	0%
No update		
FC 60106 ~ Coordination and Development of Joint Use Agreements	L&G	10%
L&G Right of Way Staff attended L&G team meeting that discussed history of communications between interest holders and L&G as well as options to be explored.		
FC 60107 ~ Utility Meetings Throughout Project Development	L&G	10%
L&G Right of Way Staff met with various team members to gather information.		

Should you have any questions regarding this submittal or would like clarification on any aspect of the project, please do not hesitate to call me at (956) 585-1909.

Sincerely,

P.E.

for Armando Sandoval, P.E.
Project Manager
L&G Engineering

L &G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956)565-9813 Fax (956)565-9018

INVOICE#: 11325189
INVOICE DATE: 6/30/2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
12:20 AM / PM
BY: Rosa Arce

BILL TO:
Hidalgo County Drainage District#1
902 N. Doolittle
Edinburg, TX 78542

JOB:130106
La Joya Watershed Imp
WA#6A P.O #626941

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
Engineering services for the month of June 2015.						
FC 102 - Feasibility Studies						
10201-Preliminary Design Values	1,575.64	1,575.64		1,575.64	100.0	-
10202-Preliminary Route Location on Uncontrolld Mapping	1,575.64	1,575.64		1,575.64	100.0	-
10203-Uncontrolled Mapping	1,575.64	1,575.64		1,575.64	100.0	-
10204-Preliminary Hydrologic Map	1,575.64	1,575.64		1,575.64	100.0	-
10205-Preliminary ROW Requirements	1,575.64	1,575.64		1,575.64	100.0	-
10206-Preliminary Cost Estimates	1,575.64	1,575.64		1,575.64	100.0	-
10207-Preliminary Environmental Analysis	1,575.64	1,575.64		1,575.64	100.0	-
10208-Proj. Fact Sheet w/Est. Local Cost vs. Total Proj. Cost	1,575.64	1,575.64		1,575.64	100.0	-
10209-Meetings, Coord. & Support for Project Dvlpment	1,575.64	1,575.64		1,575.64	100.0	-
FC 110 - Route and Design Studies						
11004-Preliminary Cost Estimates	5,627.30	5,627.30		5,627.30	100.0	-
11005-Design Schematic	8,103.29	8,103.29		8,103.29	100.0	-
11006-Preliminary ROW Requirements	7,503.05	7,503.05		7,503.05	100.0	-
FC 130 - Right-of-Way Data						
13008-Coordination and Management of Right-of-Way Data	6,330.75		3,481.91	3,481.91	55.0	2,848.84
13020-ROW Map / SUB	11,200.00		2,240.00	2,240.00	20.0	8,960.00
FC 150 - Field Surveying						
15030-Horizontal and Vertical Ties	12,784.00		2,403.00	2,403.00	18.8	10,381.00
15040-Determine Changes in Topography	30,257.00		26,884.00	26,884.00	88.9	3,373.00
15060-Final Reports	3,364.00		1,682.00	1,682.00	50.0	1,682.00
15070-Project Management Oversight	1,246.00		623.00	623.00	50.0	623.00
FC 161 - Drainage						
16101-Hydrologic Map	7,228.00	3,614.00		3,614.00	50.0	3,614.00
16102-Hydraulic Drainage Study - Culverts	5,352.16	2,676.08		2,676.08	50.0	2,676.08
16103-Hydraulic Drainage Study - Channels	5,352.16	2,676.08		2,676.08	50.0	2,676.08
16104-Hydraulic Drianage Study - Irrigation Canals / Siphons	6,602.72	4,952.04		4,952.04	75.0	1,650.68
16105-Layout, Struc. Dsgn and Detail. Drainage Features-Culverts	6,602.72	3,301.36		3,301.36	50.0	3,301.36
16106-Layout, Struc. Dsgn and Detail. Drainage Features-Storm Se	6,602.72	3,301.36		3,301.36	50.0	3,301.36
16107-Layout, Struc. Dsgn and Detail. Drainage Features-Outfall	6,602.72	3,301.36		3,301.36	50.0	3,301.36
16108-Layout, Struc. Dsgn and Detail. Drainage Features-Summary	6,602.72	4,952.04		4,952.04	75.0	1,650.68
16109-Layout, Struc. Dsgn and Detail. Drainage Features-Storm Wa	6,602.72	3,301.36		3,301.36	50.0	3,301.36
16111-Storm Water Pollution Prevention Plan (SW3P)	7,228.00	3,614.00		3,614.00	50.0	3,614.00

L &G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956)565-9813 Fax (956)565-9018

INVOICE#: 11325189
INVOICE DATE: 6/30/2015

BILL TO:
Hidalgo County Drainage District#1
902 N. Doolittle
Edinburg, TX 78542

JOB:130106
La Joya Watershed Imp
WA#6A P.O #626941

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
FC 163 - Miscellaneous Roadway						
16306-Special Utility Details (Irrigation Lines)	4,301.76	3,226.32		3,226.32	75.0	1,075.44
16307-Miscellaneous Structures	4,301.76	3,226.32		3,226.32	75.0	1,075.44
16301-Foundation Studies	4,301.76			0.00	0.0	4,301.76
16302-Utility Agreements and Exhibits	4,301.76	3,226.32		3,226.32	75.0	1,075.44
16303-Railroad Sketches	4,301.76	4,301.76		4,301.76	100.0	-
16304-Traffic Signal Agreement Sketches	4,301.76			0.00	0.0	4,301.76
16305-Estimate	4,301.76			0.00	0.0	4,301.76
16308-Specifications and General Notes	4,301.76			0.00	0.0	4,301.76
FC 600 - Right-of-Way Acquisition Services						
60000-ROW Acquisition Administration	23,800.00		5,950.00	5,950.00	25.0	17,850.00
60001-Title Services Fees	2,400.00			0.00	0.0	2,400.00
60002-Appraisal Services Fees	3,000.00			0.00	0.0	3,000.00
60003-Appraisal Services Review Fees	1,400.00			0.00	0.0	1,400.00
60004-Parcel Negotiations	14,000.00			0.00	0.0	14,000.00
60005-Closing Sevices Fees	800.00			0.00	0.0	800.00
60030-Appraisal Services Fees / SUB	8,000.00			0.00	0.0	8,000.00
60040-Appraisal Review Fees / SUB	1,800.00			0.00	0.0	1,800.00
Compensable Utilities						
60101-Preliminary Design Consultations	5,877.20		587.72	587.72	10.0	5,289.48
60102-Field Observations and Verifications	5,877.20		587.72	587.72	10.0	5,289.48
60103-Exchange of Information with Utility Providers	14,630.48			0.00	0.0	14,630.48
60104-Confirmation of Property Interests	14,630.48		1,463.05	1,463.05	10.0	13,167.43
60105-Develop and execute release of Easements	14,630.48			0.00	0.0	14,630.48
60106-Coordination and Development of Joint Use Agreements	6,552.44		655.24	655.24	10.0	5,897.20
60107-Utility meetings throughout project development	5,314.50		531.45	531.45	10.0	4,783.05
TOTALS:	322,499.65	85,084.80	47,089.09	132,173.89	41.0	190,325.76

ORIGINAL CONTRACT SUM	$	322,499.65
CHANGE BY CHANGE ORDER	$	0.00
CONTRACT SUM TO DATE	$	322,499.65
TOTAL COMPLETED TO DATE	$	132,173.89
LESS PREVIOUS INVOICES	$	85,084.80
CURRENT PAYMENT DUE	$	47,089.09

PROJECT MANAGER'S SIGNATURE

R. O. W. SURVEYING SERVICES, L.L.C.

June 30, 2015

Jacinto Garza, President/CEO
L & G Engineering
Attn: Armando Sandoval, P.E.
2100 W. Expressway 83
Mercedes, Texas 78570

RE: Invoice #R15-056
La Joya Watershed Project South-Work Authorization #12
Limits: TxDOT Outfall to IBWC Levee

Dear Mr. Garza:

Attached for your approval is our invoice for services rendered for the month of June, 2015. Additional attachments have a progress report and project Schedule C.

Thank you for your business. Should you have any questions or require additional information, please do not hesitate to give me a call at (956) 451-2670.

Sincerely,

Julio Cerda, P.E.
President/CEO

Progress Report #1 as of 06/30/15:

FC130 (ROW MAP) Lump sum per Parcel

- ***A. Phase I-ROW Map, Parcel Description, Metes & Bounds Description, & Title Reports (4 Parcels)***
  a) 2 total parcels. Continued research and boundary resolution for proposed Right of Way. Met with L&G Engineers to verify alignment. Office staff continue to prepare for final deliverable.

FC150 Field Surveying (Control Hz :& Vt)

Phase I

- ***A. Primary Project Control***
  a) Primary Control and has been set at beginning and end of project limits.

- ***B. Secondary Project Control***
  a) No Activities
  b) No Activities
  c) No Activities

- ***C. Setting Benchmarks***
  a) No Activities

Phase II

- ***A. Topographic & Cross Sections Every 100'***
  Topography complete and attached.

- ***B. Locate Visible Utilities***
  Gas liners and visible utilities have been tied to survey

- ***C. Utilities***
  No Activities

- ***D. Proposed Centerline***
  No Activities

- ***E. Profile and Cross Section Intersecting Streets***
  Chihuahua and Military Topography complete

Progress Report #1 as of 06/30/15 (continuation):

- ***F. Irrigation Crossings***
  No Activities

- ***G. Existing Strom Drain***
  No Activities

- ***H. Cross Culverts, Driveway Culverts, Inverts***
  No Activities

- ***I. Outfalls***
  No Activities

- ***J. Driveways and Turnouts***
  No Activities

- ***K. Pot Holing 6 (2 per Gas Line)***
  No Activities

Phase III

- ***A. CADD file (2D &3D) for limits of Project***
  No Activities

- ***B. Final Report and Deliverables***
  No Activities

Project Management & Oversight

- ***A. Meeting & Coordination with Engineers***
  No Activities

- ***B. QC/QA Survey***
  No Activities

R. O. W. Surveying Services, L.L.C.

INVOICE

900 S. Stewart Road, Suite 13
Mission, TX 78572
TBPLS Reg. # 10193886
956-424-3335

INVOICE NUMBER : R15-056

Date: June 30, 2015

BILL TO:
Jacinto Garza, P.E.
L & G Engineering
Attn: Armando Sandoval, P.E.
2100 W. Expressway 83
Mercedes, Texas 78570

RE: Invoice #R15-056
La Joya Watershed Project South--WA#12
Limits: TxDOT Outfall to IBWC Levee

	Contract Amount	Invoice to Date	Paid to Date	Current Amount Due	Contract Balance	AMOUNT
FC 130 (ROW MAP) Lump Sum per Parcel						
A. Phase I -- ROW Map, Parcel Description, Metes & Bounds Description, & Title Reports (Approx. 4 Parcels @ $2,850/parcel)	$11,200.00	$2,240.00	$0.00	$2,240.00	$8,960.00	20.00%
Phase I - FC 150 Field Surveying (Control Hz &: Vt)						
A. Primary Project Control						
a. Establish Primary Control	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
B. Secondary Project Control						
a. Set additional secondary control points as needed	$1,857.00	$557.00	$0.00	$557.00	$1,300.00	29.99%
b. Horizontal values established with RTK or VRS	$2,146.00	$644.00	$0.00	$644.00	$1,502.00	30.01%
c. Vertical values established with digital level	$4,006.00	$1,202.00	$0.00	$1,202.00	$2,804.00	30.00%
C. Setting Benchmarks						
a. Setting Benchmarks @ 1,000'(ft.) intervals	$4,775.00	$0.00	$0.00	$0.00	$4,775.00	0.00%
Phase II - DTM Topography, Cross Sections, Pot Holing						
A. Topographic & Cross Sections Every 100'	$8,530.00	$7,251.00	$0.00	$7,251.00	$1,279.00	85.01%
B. Locate Visible Utilities	$2,020.00	$1,717.00	$0.00	$1,717.00	$303.00	85.00%
C. Utilities	$2,020.00	$1,717.00	$0.00	$1,717.00	$303.00	85.00%
D. Proposed Centerline	$2,020.00	$1,717.00	$0.00	$1,717.00	$303.00	85.00%
E. Profile and Cross Section Intersecting Streets	$2,777.00	$2,360.00	$0.00	$2,360.00	$417.00	84.98%
F. Irrigation Crossings	$1,446.00	$1,229.00	$0.00	$1,229.00	$217.00	84.99%
G. Existing Strom Drain	$1,446.00	$1,229.00	$0.00	$1,229.00	$217.00	84.99%
H. Cross Culverts, Driveway Culverts, Inverts	$702.00	$597.00	$0.00	$597.00	$105.00	85.04%
I. Outfalls	$1,528.00	$1,299.00	$0.00	$1,299.00	$229.00	85.01%
J. Driveways and Turnouts	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
K. Pot Holing 6 (2 per Gas Line)	$7,768.00	$7,768.00	$0.00	$7,768.00	$0.00	100.00%
Phase III - Final Report & Deliverables						
A. CADD file (2D & 3D) for limits of Project	$1,968.00	$984.00	$0.00	$984.00	$984.00	50.00%
B. Final Report and Deliverables	$1,396.00	$698.00	$0.00	$698.00	$698.00	50.00%
Project Management & Oversight						
A. Meeting & Coordination w/Engineers	$248.00	$124.00	$0.00	$124.00	$124.00	50.00%
B. QC/QA Survey	$998.00	$499.00	$0.00	$499.00	$499.00	50.00%
TOTAL	$58,851.00	$33,832.00	$0.00	$0.00	$25,019.00	57.4876%
			TOTAL DUE:	**$33,832.00**		

DIRECT ALL INQUIRIES TO:
JULIO CERDA, P.E.
(956)451-2670
email: julio@southtexasig.com

MAKE ALL CHECKS PAYABLE TO:
R. O. W. Surveying Services, L.L.C.
Attn: JULIO CERDA, P.E.
900 S. Stewart Road, Suite #13
Mission, TX 78572

THANK YOU FOR YOUR BUSINESS!

L&G Engineering
Transportation Consulting Engineers

2100 W. Expressway 83
Mercedes, TX 78570
Phone: (956) 565-9813
Fax: (956) 565-9018
Toll Free: (888) 565-9813

900 S. Stewart Rd., Ste. 10
Mission, TX 78572
Phone: (956) 585-1909
Fax: (956) 585-1927
Toll Free: (866) 585-1909

Firm No. F-4105

Letter of Transmittal

Mr. Raul E. Sesin, P.E. – Drainage District Manager
Attn: Ms. Lora Briones – Chief Financial Manager
Hidalgo County Drainage District #1
902 N. Doolittle Rd.
Edinburg, Texas 78542

DATE: July 1, 2015

REF.: Work Authorization #6A on La Joya Watershed Improvement Project
P.O. #626941
Invoice (11325189)

L&G PROJECT NO.: 130106

TRANSMITTED:

☒	For Your Use	☐	Please comment	☐	Approved as Noted
☐	As Requested	☐	Reply ASAP	☐	As Noted Below

VIA:

☐	US Mail	☐	Courier	☒	Hand Carry
☐	E-Mail	☐	Lonestar Overnight	☐	Pick up

COPIES	DESCRIPTION
1	Invoice # 11325189

REMARKS:
Attached is our invoice and progress report for the month of June.

If you have any questions or comments, please feel free to contact me or Mr. Damien B. Tijerina, P.E. at 956-585-1909.

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
10:35 AM / PM
BY:

_____
Received By

If enclosures are not as stated, please notify us.

L & G Engineering Electronic Data & CAD Disclaimer

By opening the attached files, the user agrees that data provided by this electronic file is for information purposes only and should be used at one's own risk. L & G Engineering, makes no representations, written or verbal, that the information contained in these CAD files are complete or accurate or should be relied upon for construction except to the extent that they are labeled, dimensioned or otherwise noted and reflect exactly what is on the approved and sealed preliminary or final drawings. Any conflict between the information reflected on the sealed plan sheets and that provided via this electronic data file shall be resolved in favor of the sealed plan sheets. Any reproduction of these sheets without the appropriate preliminary stamp, or professional engineering seal and signature, and the express written approval of L & G Engineering, is a violation of the Professional Engineering Practice Act.

6/30/2015

HCDD#1

La Joya Watershed Improvement Project (WA#6)
Task 3,4,&7

L & G Engineering
Highway / Civil
Structural / Bridge
Environmental
Construction Material Testing

900 S. Stewart Rd. Sta 5
Mission, TX. 78572
Phone : (956) 585-1909
Fax : (956) 585-1927

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Invoice/ Backup

Date Received: 7/1/2015

Engineer/Firm Name: L&G Eng.

Project Name/Number: Pharr McAllen & S. Flood Water Ch. WA NO. 2

Invoice No.: 11325196

Purchase Order No.: 626939

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos Date:

Total # of Pages Submitted: 9

Attachments: CD

Forwarded to: Jose N. Saldivar Date:

Forwarded to: Lora Briones Date:

Additional Comments:

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

L&G Consulting Engineers, Inc.

July 1, 2015

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle
Edinburg, Texas 78542

RE: Work Authorization #2 on Pharr McAllen Drain & South Flood Water Channel Watershed Improvement Project
Job # 150302
P.O. # 626939

Dear Mr. Sesin,

Attached for your review and approval is our invoice for the services rendered to date on the subject referenced project.

The following is attached:

- L&G's Invoice #11325196
- CD w/ Electronic Files of Data for:
  - Task 1, 2, 3, 5, 5a & 6

TASK		% COMPL
Pharr-McAllen Drain & South Flood Water Channel Watershed Improvement Project		
Task 1 ~ Coordination with Hidalgo Co. Irrigation District #2 on Existing Drainage Facilities & Ownership	L&G	40.0%
Update – L&G has provided coordination in gathering all existing data in the project area associated with Hid. Co. Irrigation District #2 (and verified with City of Pharr) for the project area in Las Milpas. L&G has generated exhibits of the project location and existing system map (showing Pharr, HCDD #1 and HCID #2 facilities). These maps were used to establish basis for field study (Task 2 & 3).		
Task 2 ~ Gather Information Regarding Existing Hydraulic Structures within South Floodwater Channel Watershed	L&G	60.0%
Update – L&G has provided field and office surveys for investigation of the existing structures and entrance/exit conditions of hydraulic culverts in the area of Las Milpas and the South Floodwater Channel. Google Earth file (.kmz) with description notes and information is being created. Google Earth points file, pictures of structures and structure types (including generalized flowline estimates) provided (scans of field book also provided for reference). Also reviewed City of Pharr Internal Drainage Database (GIS) for structure types, structure information and inlet/outlet data (connectivity to outfall network and ultimately to South Floodwater Channel).		

Task 3 ~ Field Reconnaissance for Identification and Logging of Existing Conditions Along South Floodwater Channel	L&G	60.0%
Update – L&G has provided office investigation and generalized field survey of basic cross sections for establishment of existing models. L&G has also field verified current channel conditions for use in proposed model. Word document noting general dimensions of channels at locations of structures provided as well as scans of field book for reference.		
Task 4 ~ Overall Drainage Area Map (Based on CSE Analysis/Model/Report)	L&G	0.0%
Task Not Started		
Task 5 ~ Coordination & Support to Hydraulic Engineer for South Pharr/Las Milpas – S. Floodwater Channel Study	L&G	40.0%
Update - L&G has held multiple informal conference calls with CSE discussing progress and plans for the South Floodwater Channel Study (major conference call held 6-22-15 for verification of needed field data and progress). L&G has provided QA/QC of HEC-HMS and 2D HEC-RAS files provided (need incorporation of structures noted in Task 2).		
Task 5a ~ (SUB): CSE ~ South Pharr/Las Milpas – S. Floodwater Channel Study	CSE	39.9%
Update - See progress report from CSE dated June 25, 2015 (see attached)		
Task 6 ~ Meetings & Coordination with County, HCDD#1, HCID#2, City of McAllen, City of Pharr	L&G	40.0%
Update – L&G has held meetings with City of Pharr, Hidalgo County Pct. 2, Hidalgo County Drainage District and Hidalgo County Irrigation District (major meeting with most parties held 6-4-2015). In addition, many informal coordination meetings have been held with multiple parties to discuss project. L&G has coordinated with City of Pharr to get City of Pharr Internal Drainage Network Database (GIS) and has coordinated with HCDD #1 to request Jackson Drain H&H and South Fork Plans & H&H data.		
Direct Expenses	L&G	0.0%
Task Not Started		

Should you have any questions regarding this submittal or would like clarification on any aspect of the project, please do not hesitate to call me at (956) 585-1909.

Sincerely,

David Saenz, P.E., C.F.M.
Project Manager
L&G Engineering

L &G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956)565-9813 Fax (956)565-9018

INVOICE#: 11325196
INVOICE DATE: 6/30/2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
12:20 AM PM
BY: Rosa Arc

BILL TO:
Hidalgo County Drainage District#1
902 N. Doolittle
Edinburg, TX 78542

JOB:150302
Pharr McAllen Drain & South Flood Water Channel Watershed Imp. Project
WA#2 - PO#626939

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
Engineering services for the month of June 2015.						
FC 161 - HYDROLOGY						
16107-Task 1-Coordination with TxDOT-County-City to	17,443.20	0.00	6,971.06	6,971.06	40.0	10,472.14
16101-Task 2-Gater/Verify Information Regarding Exhisting	56,492.08	0.00	33,918.30	33,918.30	60.0	22,573.78
16102-Task 3-Field Reconnaissance for Identification and I	46,225.28	0.00	27,732.05	27,732.05	60.0	18,493.23
16103-Task 4-Overall Drainage Area Map (Based on S&B & CSI	24,420.74	0.00	0.00	0.00	0.0	24,420.74
16106-Task 5-Coordination & Support to Hydraulic Engineer	12,235.32	0.00	4,890.42	4,890.42	40.0	7,344.90
16140-Task 5a-South Pharr/Las Milpas-S. Floodwater Channe	92,266.16	0.00	36,774.74	36,774.74	39.9	55,491.42
16105-Task 6-Meetings & Coordination with County	16,353.00	0.00	6,547.42	6,547.42	40.0	9,805.58
	265,435.78	0.00	116,833.99	116,833.99		148,601.79
Direct Expenses	4,500.00	0.00	0.00	0.00	0.0	4,500.00
	4,500.00	0.00	0.00	0.00		4,500.00
TOTALS:	269,935.78	0.00	116,833.99	116,833.99	43.3	153,101.79

PROJECT MANAGER'S SIGNATURE

ORIGINAL CONTRACT SUM	$	269,935.78
CHANGE BY CHANGE ORDER	$	0.00
CONTRACT SUM TO DATE	$	269,935.78
TOTAL COMPLETED TO DATE	$	116,833.99
LESS PREVIOUS INVOICES	$	0.00
CURRENT PAYMENT DUE	$	116,833.99

L&G Consulting Engineers, Inc
2100 W. Expressway 83
Mercedes, Texas 78570
(956) 565-9813

Project Workhour Report
Pharr McAllen Drain & South Flood Water Channel Warshed Improvement Project WA#2
Reference:Inv#11325196
Date: 06/30/2015
P.O.#626939

	Hrs		Rate	Total
Senior Project Manager	52.00	X	218.04	$11,338.08
Senior Engineer	98.00	X	180.66	$17,704.68
Project Engineer	196.00	X	133.94	$26,252.24
Senior Engineer Tech	257.00	X	93.45	$24,016.65
Admin/Clerical	12.00	X	62.3	$747.60

Grand Total of Hours		$ 80,059.25
(Difference due to rounding hours)		$ -

Invoice Summary

Man Hours					$ 80,059.25
Sub Contract					$ 36,774.74
(See Attached Sub Invoice for Man Hour Breakdown)					
	Current				
Direct Expenses	Units		Rate		
20 ft. Long by 3 ft. Tall Exhibits (60sq.ft.)@5.00/sq.ft (15 total Prints)	0	X	300.00	$ -	
					$ -
			(Difference due to rounding)		$ -
Total Per Invoice Submitted					**$ 116,833.99**

DAS

South Pharr/Las Milpas-South Floodwater Channel Study
WA No. 10
Monthly Progress Report No. #1 – June 2015

Period of Coverage:	June 2015
Date of Submittal:	June 25, 2015
Submitted To:	David Saenz, P.E.
Prepared By:	Civil Systems Engineering Inc.

The purpose of this study is to assist L&G and HCDD1 to evaluate the existing drainage systems conditions and alternative improvement plans to provide outfall and drainage relief to existing storm drainage systems within the South Pharr/Las Milpas area.

Specific Tasks

1. Coordinate meetings L&G, HCDD1, and City of Pharr.
2. Gather information on the existing hydraulic structures, including size, type, and flow line (upstream & downstream) elevations of structures from previous projects.
3. Obtain and review previous study reports.
4. Field visits.
5. LiDAR data processing and recondition.
6. Drainage area delineations using GeoHMS.
7. Drainage and hydrologic parameters estimation.
8. Unit hydrograph generation for subbasins.
9. HEC-HMS model development and modeling analysis for multiple frequencies.
10. Update drainage area delineation, parameters and HEC-HMS modeling for City of Pharr laterals and project specific analyses.
11. South Floodwater Channel HEC-RAS development using HEC-GeoRAS.
12. Integration of LiDAR data and channel cross section survey data.
13. Update South Floodwater Channel HEC-RAS model for surveyed cross-sections and structures
14. 2D-mesh generation for 2D-unsteady overbank areas and laterals.
15. South Floodwater Channel 1D/2D unsteady HEC-RAS model development.
16. Create HEC-RAS models for City of Pharr existing laterals.
17. Existing conditions HEC-RAS modeling analysis to identify system constraints, identify flood problem areas, and improvement opportunities.
18. Analyze City of Pharr proposed lateral configurations.
19. Alternative analysis to optimize alternative improvements to relieve existing flooding problems and provide outfall needs – channel improvement, detention basin, and underground box.
20. Report preparation.

21. Presentation

Progress of Project

1. Coordinate meetings L&G, HCDD1, City of Pharr, and IBWC – coordination and meeting with L&G, HCDD1, and City of Pharr.

2. Gather information on the existing hydraulic structures, including size, type, and flow line (upstream & downstream) elevations of structures from previous projects

3. Obtain and review previous study reports – reviewed studies, models, data related to this project (MapMod, IBTC/SH365, S&G)

4. Field visits – visited project site.

5. LiDAR data processing and recondition – Performed LiDAR data recondition based on site visit and aerial photographs.

6. Drainage area delineations using GeoHMS – performed drainage delineation for the watershed based on LiDAR data for the entire south floodwater channel watershed and modify watershed delineations from Map Mod project with the updated watershed basin information.

7. Drainage and hydrologic parameters estimation – reviewed and updated hydrologic and drainage parameters based on revised drainage delineations.

8. User defined hydrographs.

9. HEC-HMS model development and modeling analysis for multiple frequencies – preliminary HHM modeling analysis.

10. Update drainage area delineation, parameters and HEC-HMS modeling for City of Pharr/Las Milpas for existing lateral drainage ditches

11. South Floodwater Channel HEC-RAS development using HEC-GeoRAS – developed HEC-RAS 1D model with consideration of 2D mesh integration.

12. Integration of LiDAR data and channel cross section survey data.

13. Update South Floodwater Channel HEC-RAS model for surveyed cross-sections and structures – verified existing hydraulic structures within the existing RAS model.

14. 2D-mesh generation for 2D-unsteady overbank areas and laterals – generate 2D mesh for

2D modeling analysis.

15. South Floodwater Channel 1D/2D unsteady HEC-RAS model development.

16. Create HEC-RAS models for City of Pharr/La Milpas area existing laterals.

17. Existing conditions HEC-RAS modeling analysis to identify system constraints, identify flood problem areas, and improvement opportunities.

18. Analyze City of Pharr proposed lateral configuration.

19. Alternative analysis to optimize alternative improvements to relieve existing flooding problems and provide outfall needs – channel improvement, detention basin, and underground box.

20. Report preparation.

CSE Civil Systems Engineering, Inc.

1202 Lake Pointe Parkway
Sugar Land, Texas77478
(713) 782-3811

INVOICE

Engineering Services
South Pharr/Las Milpas -South Floodwater Channel Study _WA No. 10

L&G Engineering
2100 W. Expressway 83
Mercedes, Texas 78570
Attention: Mr. David Saenz, P.E.

CSE Invoice Number: LG201508
CSE Project Number: LG201503
Invoice Period: 5/13/2015 Through 6/25/2015
Invoice Date: June 25, 2015

Contract Amount	Contract Amount Remaining
$92,266.16	$55,491.42

Employee Classfication	Rate	Previous		This Period		To Date	
		Hr	Total	Hr	Total	Hr	Total
Project Manager	$205.80			42.0	$8,643.60	42.0	$8,643.60
Project Engineer	$178.30			143.0	$25,496.90	143.0	$25,496.90
GIS Specialist	$164.64			16.0	$2,634.24	16.0	$2,634.24
Subtotal			**$0.00**		**$36,774.74**		**$36,774.74**

Deren Li, Ph.D., P.E., D.WRE
Project Manager

TOTAL FEE EARNED:	$36,774.74
LESS PREVIOUSLY INVOICED:	$0.00
TOTAL AMOUNT DUE THIS INVOICE:	**$36,774.74**

DAS

L&G Engineering
Transportation Consulting Engineers

2100 W. Expressway 83
Mercedes, TX 78570
Phone: (956) 565-9813
Fax: (956) 565-9018
Toll Free: (888) 565-9813

900 S. Stewart Rd., Ste. 10
Mission, TX 78572
Phone: (956) 585-1909
Fax: (956) 585-1927
Toll Free: (866) 585-1909

Firm No. F-4105

Letter of Transmittal

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle Rd.
Edinburg, Texas 78542

DATE: July 1, 2015

Project: Progress Report & Invoice Package for Various Work Authorizations
La Joya Watershed Improvement Project
Pharr McAllen Drain & South Floodwater Channel Watershed Improvement Project

L&G PROJECT NO.:

TRANSMITTED:

☒	For Your Use	☐	Please comment	☐	Approved as Noted
☐	As Requested	☐	Reply ASAP	☐	As Noted Below

VIA:

☐	US Mail	☐	Courier	☒	Hand Carry
☐	E-Mail	☐	Lonestar Overnight	☐	Pick up

COPIES	DESCRIPTION
1	Progress Report and Invoice Package (including CD w/Electronic Files) for the following Project:
	• Work Authorization #4 on La Joya Watershed Improvement Project
	○ P.O. #625396, Invoice #11325198
	• Work Authorization #1 on Pharr McAllen Drain & South Floodwater Channel
	○ P.O. #626860, Invoice #11325195
	• Work Authorization #2 on Pharr McAllen Drain & South Floodwater Channel
	○ P.O. #626939, Invoice #11325196

REMARKS:

If you have any questions or comments, please feel free to contact me, Mr. David Saenz, P.E. at (956) 585-1909.

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1

JUL 01 2015

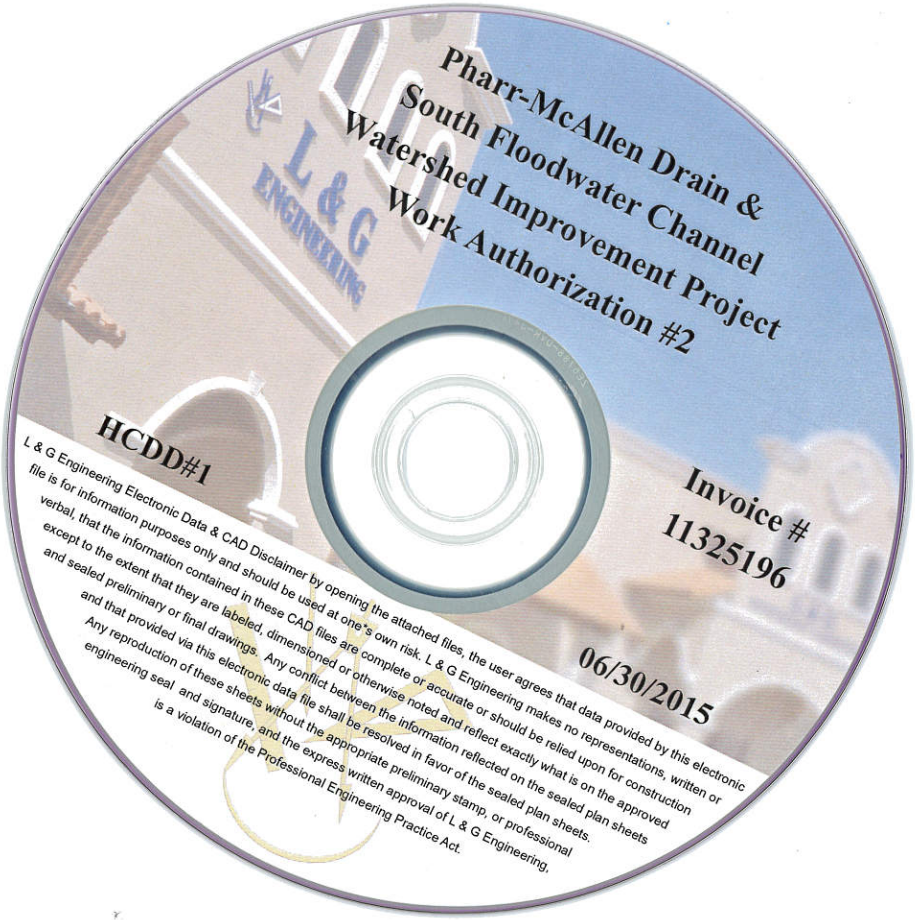
10:35 AM / PM

BY:

Thank you,

Signed: _____

If enclosures are not as stated, please notify us.


Pharr-McAllen Drain &
South Floodwater Channel
Watershed Improvement Project
Work Authorization #2
L & G
ENGINEERING
HCDD#1
Invoice #
11325196
06/30/2015
L & G Engineering Electronic Data & CAD Disclaimer by opening the attached files, the user agrees that data provided by this electronic file is for information purposes only and should be used at one's own risk. L & G Engineering makes no representations, written or verbal, that the information contained in these CAD files are complete or accurate or should be relied upon for construction except to the extent that they are labeled, dimensioned or otherwise noted and reflect exactly what is on the approved and sealed preliminary or final drawings. Any conflict between the information reflected on the sealed plan sheets and that provided via this electronic data file shall be resolved in favor of the sealed plan sheets.
Any reproduction of these sheets without the appropriate preliminary stamp, or professional engineering seal and signature, and the express written approval of L & G Engineering, is a violation of the Professional Engineering Practice Act.

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Invoice/ Backup

Date Received: 7/1/2015

Engineer/Firm Name: L&G Eng.

Project Name/Number: Pharr McAllen & S. Flood Water Ch. WA NO. 1

Invoice No.: 11325195

Purchase Order No.: 626860

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos _____ Date: _____

Total # of Pages Submitted: 8

Attachments: CD

Forwarded to: Jose N. Saldivar _____ Date: _____

Forwarded to: Lora Briones _____ Date: _____

Additional Comments: _____

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

L&G Consulting Engineers, Inc.

July 1, 2015

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle
Edinburg, Texas 78542

RE: Work Authorization #1 on Pharr McAllen Drain & South Flood Water Channel Watershed Improvement Project
Job # 150301
P.O. # 626860

Dear Mr. Sesin,

Attached for your review and approval is our invoice for the services rendered during June 2015 on the subject referenced project.

The following is attached:

- L&G's Invoice #11325195
- CD w/ Electronic Files of Data for:
  - CSE – Monthly Progress Report and Invoice (LG201509) – June 25, 2015
  - Task 1, 2, 3, 4, 5, 5a, 6 & Direct Expenses

TASK		% COMPL
Pharr-McAllen Drain & South Flood Water Channel Watershed Improvement Project		
Task 1 ~ Coordination with TxDOT-County-City to Accommodate Local Drainage Needs & Corres. Participation (McAllen & Pharr)	L&G	75.0%
Update – L&G has continued coordination in gathering all existing data in the project area. L&G has continued review of S&B Report & H&H Analysis for a portion of this system. L&G has also researched other master drainage plans/flood protection plans in the general area (1980 HCDD #1 Water Disposal Plan & 1997 TCB Flood Protection Plan). L&G has coordinated with City of Pharr for Internal Drainage Network GIS database for verification of system.		
Task 2 ~ Gather/Verify Information Regarding Existing Hydraulic Structures (Size, type, flow line elevations, etc)	L&G	100.0%
Update – L&G has finalized field and office surveys for investigation of the existing structures and entrance/exit conditions of hydraulic culverts (verification of results worked on this period) including QA/QC. Google Earth file (.kmz) with description notes and information has been created and verified. All data incorporated into draft report Pharr McAllen Drain Watershed Study (See Task 5A). This task is complete.		

Task 3 ~ Field Reconnaissance for Identification and Logging of Existing Conditions Along Project Alignment	L&G	100.0%
Update – L&G has finalized all field reconnaissance including survey of general cross sections and generation of preliminary DTM for verification of LiDAR information and usage on project H&H modeling (and including QA/QC). All data incorporated into draft report Pharr McAllen Drain Watershed Study (See Task 5A). This task is complete.		
Task 4 ~ Overall Drainage Area Map (Based on S&B & CSE Analysis/Model/Report)	L&G	75.0%
Update – L&G has updated an exhibit of the preliminary overall watershed map (based on S&B H&H report and CSE review/concurrence) and included incorporation of proposed improvements referenced from the Pharr McAllen Drain analysis report (improvements at choke from City of Pharr, Irrigation Canal and Ridge Road). In addition, preliminary construction cost estimates have been generated for discussion with Client and project stakeholders.		
Task 5 ~ Coordination & Support to Hydraulic Engineer for Pharr-McAllen Drain Watershed Study	L&G	98.2%
Update - L&G has coordinated with CSE in development of the Existing Condition HEC-HMS & HEC-RAS Models. Existing & Proposed models have been QC/QA'd by L&G. Various channel upgrades and proposed alternatives have been vetted by L&G & CSE to determine the most advantageous options (3 main alternatives). Draft Report Pharr McAllen Drain Watershed Study QA/QC'd by L&G.		
Task 5a ~ (SUB): CSE ~ Pharr-McAllen Drain Watershed Study	CSE	98.7%
Update – See progress report from CSE dated June 25, 2015 (see attached)		
Task 6 ~ Meetings & Coordination with County, HCDD#1, HCID#2, City of McAllen, City of Pharr	L&G	75.0%
Update – L&G has held a major project report review meeting with CSE (6-25-2015) in anticipation of final presentation and deliverable to County. Meeting with all affected parties to be held early next period. In addition, many informal coordination meetings have been held with multiple parties to discuss project.		
Direct Expenses	L&G	66.7%
Update – Direct Expenses is intended to cover all printed documents internal or otherwise completed at various intervals of the project and billed out as a percentage complete basis of the overall project. Under this function, L&G has produced various exhibits as part of the working process and has provided these prints to Hidalgo County Precinct No. 2, City of Pharr and HCDD #1.		

Should you have any questions regarding this submittal or would like clarification on any aspect of the project, please do not hesitate to call me at (956) 585-1909.

Sincerely,

David Saenz, P.E., C.F.M.
Project Manager – L&G Engineering

L &G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956)565-9813 Fax (956)565-9018

INVOICE#: 11325195
INVOICE DATE: 6/30/2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
12:20 AM / PM
BY: Rosa Ana

BILL TO:
Hidalgo County Drainage District#1
902 N. Doolittle
Edinburg, TX 78542

JOB:150301
Pharr McAllen Drain & South Flood
Water Channel Watershed Imp. Project
WA#1 - PO#626860

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
Engineering services for the month of June 2015.						
FC 161 - HYDROLOGY						
16107-Task 1-Coordination with TxDOT-County-City to	17,443.20	8,721.61	4,360.80	13,082.41	75.0	4,360.79
16101-Task 2-Gaterh/Verify Information Regarding Exhistin	44,941.98	33,694.03	11,247.95	44,941.98	100.0	-
16102-Task 3-Field Reconnaissance for Identification and I	37,254.34	27,959.50	9,294.84	37,254.34	100.0	-
16103-Task 4-Overall Drainage Area Map (Based on S&B & CSI	24,420.74	6,111.42	12,201.07	18,312.49	75.0	6,108.25
16106-Task 5-Coordination & Support to Hydraulic Engineer	11,874.00	9,251.26	2,404.70	11,655.96	98.2	218.04
16140-Task 5a-(SUB): CSE~Pharr-McAllen Drain Water Study	74,487.92	57,747.48	15,740.44	73,487.92	98.7	1,000.00
16105-Task 6-Meetings & Coordination with County	16,353.00	8,201.42	4,068.00	12,269.42	75.0	4,083.58
	226,775.18	151,686.72	59,317.80	211,004.52		15,770.66
Direct Expenses	4,500.00	1,500.00	1,500.00	3,000.00	66.7	1,500.00
	4,500.00	1,500.00	1,500.00	3,000.00		1,500.00
TOTALS:	231,275.18	153,186.72	60,817.80	214,004.52	92.5	17,270.66

PROJECT MANAGER'S SIGNATURE

ORIGINAL CONTRACT SUM	$	231,275.18
CHANGE BY CHANGE ORDER	$	0.00
CONTRACT SUM TO DATE	$	231,275.18
TOTAL COMPLETED TO DATE	$	214,004.52
LESS PREVIOUS INVOICES	$	153,186.72
CURRENT PAYMENT DUE	$	60,817.80

L&G Consulting Engineers, Inc
2100 W. Expressway 83
Mercedes, Texas 78570
(956) 565-9813

Project Workhour Report
Pharr McAllen Drain & South Flood Water Channel Warshed Improvement Project WA#1
Reference:Inv#11325195
Date: 06/30/2015
P.O.#626860

	Hrs		Rate	Total
Senior Project Manager	48.00	X	218.04	$10,465.92
Senior Engineer	62.00	X	180.66	$11,200.92
Project Engineer	78.00	X	133.94	$10,447.32
Senior Engineer Tech	120.00	X	93.45	$11,214.00
Admin/Clerical	4.00	X	62.3	$249.20

Grand Total of Hours		$ 43,577.36
(Difference due to rounding hours)		$ -

Invoice Summary

Man Hours					$ 43,577.36
Sub Contract					$ 15,740.44
(See Attached Sub Invoice for Man Hour Breakdown)					
Direct Expenses	Current Units		Rate		
20 ft. Long by 3 ft. Tall Exhibits (60sq.ft.)@5.00/sq.ft (15 total Prints)	5	X	300.00	$ 1,500.00	
					$ 1,500.00
(Difference due to rounding)					$ -
Total Per Invoice Submitted					**$ 60,817.80**

Pharr-McAllen Drain Watershed Study
Monthly Progress Report No. #2 – June 2015

Period of Coverage:	June 2015
Date of Submittal:	June 25, 2015
Submitted To:	David Saenz, P.E.
Prepared By:	Civil Systems Engineering Inc.

The purpose of this study is to assist L&G and HCDD1 to evaluate the existing drainage systems conditions and alternative improvement plans to provide outfall and drainage relief to existing storm drainage systems upstream of Pharr Lateral Drain.

Specific Tasks

1. Coordinate meetings L&G, HCDD1, City of Pharr, and IBWC.
2. Gather information on the existing hydraulic structures, including size, type, and flow line (upstream & downstream) elevations of structures from previous projects.
3. Obtain and review previous study reports.
4. Field visits.
5. LiDAR data processing and recondition.
6. Drainage area delineations using GeoHMS.
7. Drainage and hydrologic parameters estimation.
8. Unit hydrograph generation for subbasins.
9. HEC-HMS model development and modeling analysis for multiple frequencies.
10. Integration of LiDAR data and channel cross section survey data.
11. HEC-RAS geometry data development using HEC-GeoRAS.
12. Update existing (S&B) RAS model.
13. 2D-mesh generation for 2D-unsteady overbank areas and laterals.
14. 1D/2D unsteady HEC-RAS model development.
15. Existing conditions HEC-RAS modeling analysis to identify system constraints, identify flood problem areas, and improvement opportunities.
16. Alternative analysis to optimize alternative improvements to relieve existing flooding problems and provide outfall needs – channel improvement, detention basin, and underground box.
17. Report preparation.
18. Presentation

Progress of Project

1. Coordinate meetings L&G, HCDD1, City of Pharr, and IBWC – coordination and meeting with L&G, HCDD1, and City of Pharr.

2. Gather information on the existing hydraulic structures, including size, type, and flow line (upstream & downstream) elevations of structures from previous projects – complete.

3. Obtain and review previous study reports – complete.

4. Field visits – complete.

5. LiDAR data processing and recondition – complete.

6. Drainage area delineations using GeoHMS – complete.

7. Drainage and hydrologic parameters estimation – complete.

8. Unit hydrograph generation for subbasins – complete.

9. HEC-HMS model development and modeling analysis for multiple frequencies – complete.

10. Integration of LiDAR data and channel cross section survey data – complete.

11. HEC-RAS geometry data development using HEC-GeoRAS – complete.

12. Update existing (S&B) RAS model – complete.

13. 2D-mesh generation for 2D-unsteady overbank areas and laterals – complete.

14. 1D/2D unsteady HEC-RAS model development – complete.

15. Existing conditions HEC-RAS modeling analysis to identify system constraints, identify flood problem areas, and improvement opportunities – performed existing condition 1D/2D RAS modeling analysis to identify system constraints and opportunities – complete.

16. Alternative analysis to optimize alternative improvements to relieve existing flooding problems and provide outfall needs – channel improvement, and underground box – performed alternative analysis to lower upstream water surface elevations along Pharr Lateral and recommended preferred alternative - compete

17. Report preparation – completed draft report.

18. Presentation.

Civil Systems Engineering, Inc.

1202 Lake Pointe Parkway
Sugar Land, Texas77478
(713) 782-3811

INVOICE

Engineering Services
Pharr_McAllen Drain Watershed Study

L&G Engineering
2100 W. Expressway 83
Mercedes, Texas 78570
Attention: Mr. David Saenz, P.E.

CSE Invoice Number: LG201509
CSE Project Number: LG201502
Invoice Period: 5/26/2015 Through 6/25/2015
Invoice Date: June 25, 2015

Contract Amount	Contract Amount Remaining
$74,487.92	**$1,000.00**

Employee Classfication	Rate	Previous		This Period		To Date	
		Hr	Total	Hr	Total	Hr	Total
Project Manager	$178.36	121.0	$21,581.56	31	$5,584.45	152	$27,166.01
Project Engineer	$164.64	213.0	$35,068.32	51	$8,436.15	264	$43,504.47
GIS Specialist	$137.20	8.0	$1,097.60	2	$219.83	10	$1,317.43
Expenses					$1,500.00		$1,500.00
Subtotal			**$57,747.48**		**$15,740.44**		**$73,487.92**

Deren Li, Ph.D., P.E., D.WRE
Project Manager

TOTAL FEE EARNED:	$73,487.92
LESS PREVIOUSLY INVOICED:	$57,747.48
TOTAL AMOUNT DUE THIS INVOICE:	**$15,740.44**

L&G Engineering
Transportation Consulting Engineers

2100 W. Expressway 83
Mercedes, TX 78570
Phone: (956) 565-9813
Fax: (956) 565-9018
Toll Free: (888) 565-9813

900 S. Stewart Rd., Ste. 10
Mission, TX 78572
Phone: (956) 585-1909
Fax: (956) 585-1927
Toll Free: (866) 585-1909

Firm No. F-4105

Letter of Transmittal

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle Rd.
Edinburg, Texas 78542

DATE: July 1, 2015

Project: Progress Report & Invoice Package for Various Work Authorizations
La Joya Watershed Improvement Project
Pharr McAllen Drain & South Floodwater Channel Watershed Improvement Project

L&G PROJECT NO.:

TRANSMITTED:

☒	For Your Use	☐	Please comment	☐	Approved as Noted
☐	As Requested	☐	Reply ASAP	☐	As Noted Below

VIA:

☐	US Mail	☐	Courier	☒	Hand Carry
☐	E-Mail	☐	Lonestar Overnight	☐	Pick up

COPIES	DESCRIPTION
1	Progress Report and Invoice Package (including CD w/Electronic Files) for the following Project:
	• Work Authorization #4 on La Joya Watershed Improvement Project
	○ P.O. #625396, Invoice #11325198
	• Work Authorization #1 on Pharr McAllen Drain & South Floodwater Channel
	○ P.O. #626860, Invoice #11325195
	• Work Authorization #2 on Pharr McAllen Drain & South Floodwater Channel
	○ P.O. #626939, Invoice #11325196

REMARKS:

If you have any questions or comments, please feel free to contact me, Mr. David Saenz, P.E. at (956) 585-1909.

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
10:35 AM / PM
BY:

Thank you,

Signed: _____

If enclosures are not as stated, please notify us.

Pharr-McAllen Drain &
South Floodwater Channel
Watershed Improvement Project
Work Authorization #1
L & G
ENGINEERING
Invoice #
11325195
HCDD#1
06/30/2015
& G Engineering Electronic Data & CAD Disclaimer by opening the attached files, the user agrees that data provided by this electronic
file is for information purposes only and should be used at one"s own risk. L & G Engineering makes no representations, written or
verbal, that the information contained in these CAD files are complete or accurate or should be relied upon for construction
except to the extent that they are labeled, dimensioned or otherwise noted and reflect exactly what is on the approved
and sealed preliminary or final drawings. Any conflict between the information reflected on the sealed plan sheets
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Any reproduction of these sheets without the appropriate preliminary stamp, or professional
engineering seal and signature, and the express written approval of L & G Engineering,
is a violation of the Professional Engineering Practice Act.

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Invoice/ Backup

Date Received: 7/15/2015

Engineer/Firm Name: S&B Infrastructure

Project Name/Number: Raymondville Drain Outfall WA No. 2

Invoice No.: 11325197

Purchase Order No.:

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos NDC Date: 7-15-15

Total # of Pages Submitted: 5

Attachments: USB

Forwarded to: Jose N. Saldivar Date: 07/15/15

Forwarded to: Lora Briones Lora Briones Date: 7/16/2015

Additional Comments:

AJ # 30516
DO 7/21/15

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

Raymondville Drain Project, Project for Flood Control
Lower Rio Grande Basin, (Hidalgo & Willacy Counties), Texas
Water Resources Development Act (WRDA) 1986, Title IV, Section 401, As Amended by WRDA 2007

S&B INFRASTRUCTURE, LTD.
Engineering ✪ Management ✪ Technology

INVOICE TRANSMITTAL

S&BI Invoice U9444.103&812-08a

15 July 2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 15 2015
2:00 AM PM
BY: Rosa Luo

To: **Lora Briones, HCDD1 Financial Officer**
Claudette Guerrero, HCDD1 Accountant
Josè "Noe" Saldivar, PE, HCDD1 Engineer

From: Sharlotte L. Teague, PE, S&BI Senior Project Manager

Dear Lora, Claudette, and Noe,

Transmitted herewith is above-referenced S&BI invoice. Under this invoice, we are respectfully requesting payment as follows:

Work Performed Under: S&BI Work Authorization No. 17

Performance Period: thru June 30, 2015

Work Tasks Performed:

For this invoice, we are primarily requesting compensation for **geotechnical** work (see *"Expanded Progress Report"* attached to invoice; tasks performed are outlined as follows:

For the period of June 1 thru June 30, 2015, S&BI coordinated with L&G, and:

a. L&G has completed the field investigation / drilling and began laboratory testing of 5 additional Bridge/Structural borings this period (B-BRG-62, B-BRG-64, B-BRG-69, B-BRG-118, and B-BRG-119); 73 Bridge / Structural borings to-date.

b. L&G has completed the drilling and laboratory testing of 19 additional Channel borings this period (B-CH-28 thru B-CH-43, B-CH-45, B-CH-47, and B-CH-48); 19 Channel borings to-date.

c. Boring Logs were created for all borings completed to-date (BRG - TxDOT Wincore format; CH – gINT format).

d. Continued development of Gradation Curves (D50~D90 for Scour) at Bridge and Channel locations, Evaluation of Sulfate Content for Structure Locations (structure specific), and Deep Foundation Analysis for Bridge Abutments (36 locations investigated to-date).

e. Updates were made to the overall geotechnical exhibit / schematic.

Electronic back-up has been provided in the attached USB, and is in the form of pdfs.

Also, a hard-copy of L&G's invoice has been provided for your files in support of the request for this payment.

Respectfully Submitted By:

Sharlotte Lynne Teague, PE

Attachments: **S&BI Invoice U9444.103&812-08a with Expanded Line-Item Progress Report**
Sub-Provider Invoice (L&G 11325197 thru 6-30-2015) $81,226.96
USB (Electronic Copies of Technical Back-up as listed above and Sub-provider Invoice)

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 15 2015
1:10 AM PM
BY: ldc

L & G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956) 565-9813 Fax (956) 565-9018

INVOICE #: 11325197
INVOICE DATE: 06/30/15

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 15 2015
2:00 AM/PM
BY: Rosa

BILL TO: 09
S&B Infrastructure Ltd
Attn: Infrastructure A/P
P.O. Box 266245
Houston, TX 77207-6245

JOB: 140202
Raymondville Drain Outfall WA2
Willacy County PO#U9444-Z0023
S&B Project No. U9444.813

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
Engineering services for the month of June 2015.						
33001-Geotech Testin	799,881.31	316,719.32	58,637.33	375,356.65	46.9	424,524.66
33002-Geotech Analys	610,954.80	121,898.46	22,589.62	144,488.08	23.6	466,466.72
33003-Geotech OOE	4,390.00				0.0	4,390.00
TOTALS:	1,415,226.11	438,617.78	81,226.95	519,844.73	36.7	895,381.38

PROJECT MANAGER'S SIGNATURE

ORIGINAL CONTRACT SUM	$	1,415,226.11
CHANGE BY CHANGE ORDER	$	0.00
CONTRACT SUM TO DATE	$	1,415,226.11
TOTAL COMPLETED TO DATE	$	519,844.73
LESS PREVIOUS INVOICES	$	438,617.78
CURRENT PAYMENT DUE	$	81,226.95

81,226.95
X 1.10 SLOT
89,349.645

S&B Infrastructure, Ltd.

INVOICE

July 15, 2015

Hidalgo County Drainage District No. 1
Attention: Lora Briones, Financial Officer
902 N. Doolittle
Edinburg, Texas 78542

Project Description:
Raymondville Drain
Work Authorization No. 16 *"Hidalgo County - Planning, Design, Preliminary Engineering, PS&E"*
Work Authorization No. 17 *"Hidalgo and Willacy Counties - Planning, Design, Preliminary Engineering"*

S&B Invoice No.: U9444.812-08a
Invoice Period: June 1, 2015 through June 30, 2015

	QTY	UNIT	UNIT PRICE	PERCENT COMPLETE	INVOICED TO DATE	PREVIOUSLY INVOICED	AMOUNT THIS INVOICE
Hidalgo County -Planning, Design and PS&E	1	LS	$3,007,286 PO #623918-14	41%	$ 1,221,502.00	$ 1,221,502.00	
Hidalgo & Willacy Counties -Planning, Design, Preliminary Engineering, and PS&E	1	LS	$5,599,008 PO# 626525	25%	$ 1,411,989.00	$ 1,322,639.00	$ 89,350.00
						PAYMENT IS REQUESTED IN THE AMOUNT OF:	$ 89,350.00

07/16/15

I hereby certify that this invoice is true and correct, and that all services indicated have been provided.

S & B INFRASTRUCTURE, LTD.

Sharlotte L. Teague, PE
Senior Project Manager

IN ACCORDANCE WITH OUR CONTRACT,
PLEASE REMIT **BY FED EX**: **$ 89,350.00**

FED EX ACCOUNT NO. 2887-7404-8
S&B INFRASTRUCTURE, LTD.
ATTN: MIKE MANTHOS PHONE: 713.845.5401
3535 Sage Road
Houston, Texas 77056

Attachments:
PROGRESS REPORT NO. 8a

Raymondville Drain, Project for Flood Control
Hidalgo County Drainage District No. 1 / S&B Infrastructure, Ltd.
Work Authorization No. 16 / Work Authorization No. 17

Expanded Description	Estimated Line Item Budget	% Complete	Expanded Progress Report U9444.103&812-08a *Thru June 30, 2015* Invoice To-Date Amount	Previously Invoiced	Amount Due This Invoice
Work Authorization No. 16:					
1 GCM	$265,616	85%	$ 225,774	$ 225,774	$ -
2 Engineering / Design (HC)	$834,861	47%	$ 391,893	$ 391,893	$ -
3 Geotechnical (HC)	$423,909	48%	$ 204,674	$ 204,674	$ -
4 Design Survey (HC)	$241,451	85%	$ 205,234	$ 205,234	$ -
5 ROW Survey (HC)	$309,349	37%	$ 115,509	$ 115,509	$ -
6 ROW Acquis Administration (HC)	$782,100	0%	$ 3,420	$ 3,420	$ -
7 Prelim ROW / Utilities (HC)	$150,000	50%	$ 75,000	$ 75,000	$ -
SUB-TOTAL (WA 16):	$3,007,286	41%	$ 1,221,503	$ 1,221,503	$ -
Work Authorization No. 17:					
1 GCM	$703,663	28%	$ 198,378	$ 198,378	$ -
2 Engineering / Design (HC)	$653,667	25%	$ 163,417	$ 163,417	$ -
3 Prelim Compensable Utilities (HC)	$227,008	50%	$ 113,504	$ 113,504	$ -
4 H&H Design (WC)	$930,776	20%	$ 186,155	$ 186,155	$ -
5 Engineering - Final Schematic (WC)	$893,524	20%	$ 178,705	$ 178,705	$ -
6 Prelim ROW / Design Survey (WC)	$354,932	0%	$ -	$ -	$ -
7 Prelim ROW Acquis Admin (WC)	$270,500	0%	$ -	$ -	$ -
8 Geotechnical (WC)	$1,564,938	37%	$ 571,830	$ 482,480	$ 89,350
SUB-TOTAL (WA 17):	$5,599,008	25%	$ 1,411,989	$ 1,322,639	$ 89,350

S&BI Invoice
Electronic Back-up
Inv. U944.103&812-08A

Copy made By RoseA.

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Invoice/ Backup

Date Received: 7/6/2015

Engineer/Firm Name: L&G Eng

Project Name/Number: Rural Drainage Dev. Pct. 3 FM676 WA No. 1

Invoice No.: 11325174

Purchase Order No.: 622895

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos _____ Date: _____

Total # of Pages Submitted: 475

Attachments: 2-CD & Feasibility Report & 3 Plans

Forwarded to: Jose N. Saldivar _____ Date: _____

Forwarded to: Lora Briones _____ Date: _____

Additional Comments: With Final Waiver & Lien Release

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

L&G Consulting Engineers, Inc.

July 1, 2015

Mr. Raul Sesin, P.E., C.F.M. – Executive Director
Attn: Ms. Lora Briones – Chief Financial Officer
Hidalgo County Drainage District #1
902 N. Doolittle
Edinburg, Texas 78542

RE: Work Authorization #1 on Rural Drainage Development Pct #3 - FM676
P.O. #622895
Invoice #11325174

Dear Mr. Sesin,

Attached for your review and approval is our FINAL invoice for the services rendered during the month of June 2015 on the subject referenced project. L&G met with Mr. Raul Sesin ,HCDD #1, and discussed Outfalls options with emphasis on Outfall #2 (Recommended Outfall). The attachments below include the final completed packet of the study done by L&G.

The following is attached:

- L & G's Invoice #11325174
- CD with Recommended with Outfall #2, Optional Outfall #2B, and Hydrologic Map
- Feasibility Report
- Hydrologic Map
- Recommended Outfall Schematic
- Final Waiver and Lien Release

TASK		% COMPL
Task 1(FC 10201) ~ Coordinate w/ TxDOT - County - Alton to Accommodate Local Drainage Needs & Corresponding Participation	L&G	100.0%
L&G met internally and will meet with the City of Alton (City Manager and Assistant City Manager) to present draft final report and obtain comments. L&G will meet with HCDD#1 to present draft final report and obtained comments. L&G has completed field visits used in an effort to identify and log existing drainage features and view area of concerns especially after recent rain events experienced. L&G presented final draft to TxDOT, Hidalgo County and City of Alton.		
Task 2 (FC 16108) ~ Gather Information Regarding Existing Drainage Features, Facilities, & Watersheds	L&G	100.0%

2100 W. Expressway 83 • Mercedes, TX 78570 • Office (956) 565-9813 • Fax (956) 565-9018
900 S. Stewart Rd., Ste. 9 • Mission, TX 78572 • Office (956) 585-1909 • Fax (956) 585-1927

L&G performed field visits to the project area to review and note existing drainage features that are not shown in the GIS database, and to identify drainage facility not identified in studies or reports obtained. L&G met City of Alton to further determine areas of drainage concern, which have been including in the report. L&G has created a map of the general area depicting contours, flow patterns, low areas and other potential obstacles affecting drainage.		
Task 3 (FC 16107) ~ Hydrologic Mapping & Outfall Capacity Analysis	L&G	100.0%
L&G has compiled a pre-final the general hydrologic map showing drainages areas that contribute water to the FM676 project and surrounding area. Several potential outfall locations have also been established by L&G primarily based off of minimal impacts to residences. The map is being supplemented with drainage areas (Sub-Basins) that are contributing to the flooding experienced within the project area. Recommendations obtained from several studies done for this area in the late 1990's coincide with L&G's preliminary outfalls and continue to be studied further. Additionally, preliminary hydrologic analysis has been conducted within the study area to help determine feasibility of proposed outfalls. L&G has performed preliminary runoff calculations for each drainage area in efforts to provide a conceptual sizing of facility(s) that will be needed. This map was presented to HCDD#1 for comments. L&G presented and explained the various options.		
Task 4 (FC 16109) ~ Meet w/ County - HCDD#1 - TxDOT - Alton and Examine Existing Hydrologic Studies	L&G	100.0%
L&G has obtained available drainages studies done in the late 1990's for this general area. L&G has utilized and referenced the "Master Drainage Plan, City of Alton, Texas" (1998) and HCDD#1 Report: "Flood Protection Plan for Hidalgo County, Texas" (1997) These studies have been referenced in the report.		
Task 5 (FC 13009) ~ Identification of All Affected Property Owners on Proposed Facilities	L&G	100.0%
L&G has included exhibits as part of the feasibility report that provides ownership information obtained from Hidalgo County Appraisal District to identify any and all existing property ownership within the project limits. Additionally, L&G approximate acreage affected to the affected property owners for each of the proposed outfall locations. Included in the affected property owner identifications are estimated values in dollars of them proposed impacts to each parcel.		
Task 6 (FC 12007) – Coordination with Landowners due to Proposed Outfalls Facilities Impacting their Properties (Limited Public Involvement)	L&G	100.0%
Updated – L&G has determined recommended Outfall #2 (aka Option Outfall #6) which impacts two different owners including HCDD#1 and SIVAD Enterprises Inc as per Hidalgo Appraisal District data base. L&G has presented this proposal to Hidalgo County Drainage Manager and obtained concurrence on concept. (See attached Schematic for Outfall)		
Task 7 (FC 16401) - Coordination w/TxDOT & FHWA on Logistics for Utilizing Federal Earmark Monies.	L&G	100.0%

L&G identification of $500,738 of federal funds available for drainage improvements for FM 676 (from SH 107 to Taylor Rd) has being referenced in the report but is awaiting further information from TxDOT on possible uses of this money. L&G did not receive direction from TxDOT after several requests.		
Task 8 (FC 10202) ~ Feasibility Report and Recommendations	L&G	100.0%
Updated - L&G has completed compiling the information for the feasibility report to include Introduction, Assessment of Existing Storm Drain System, Proposed Outfall locations, Hydrologic Mapping Outfalls, Impacts of Drainage Outfalls, Funding Analysis and Conclusion and Recommendations. L&G has prepared the final submittal and met with Raul Sesin to presented recommended Outfall 2 (aka Option Outfall #6). In addition, an alternate Outfall 2B (aka Option Outfall #5) was briefly discussed. The report and the other options considered were discussed as well.		
L&G Direct Expenses	L&G	100.0%
L&G has produced a copy of the final 20ft X 3ft (Approx) Hydrologic Maps as a function of the contract total as well as approx 100 ~ 8.5X11 and 50 ~ 11X17 sheets (Approx).		

Should you have any questions regarding this submittal or would like clarification on any aspect of the project, please do not hesitate to call me at (956) 585 - 1909.

Sincerely,

Ricardo Gallaga, P.E.
Project Manager
L&G Engineering

L &G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956)565-9813 Fax (956)565-9018

INVOICE#: 11325174
INVOICE DATE: 6/19/2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 02 2015
12:00 AM / PM
BY: Rosa Arie

BILL TO:
Hidalgo County Drainage District#1
902 N. Doolittle
Edinburg, TX 78542

JOB:130401
FM 676 Outfall Analysis and Eval.
WA#1
P.O.#622895

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
Engineering services for this billing period.						
FC 102 - FEASABILITY STUDIES						
Task 1 - 10201 - Coord. w/TxDOT - County - Alton Local Drainage	13,405.68	13,405.68		13,405.68	100.0	-
Task 8 - 10202 - Feasibility Report and Recommendations	5,809.62	5,527.69	281.93	5,809.62	100.0	-
	19,215.30	18,933.37	281.93	19,215.30		-
FC 120 - PUBLIC INVOLVEMENT						
Task 6 - 12007 - Coord. W/Landowners due to Prop. Outfall Fac.	6,411.40	5,128.50	1,282.90	6,411.40	100.0	-
	6,411.40	5,128.50	1,282.90	6,411.40		-
FC 130 - RIGHT-OF-WAY DATA						
Task 5 - 13009 - ID. Of all affected Prop. Owners on Proposed Fac	9,110.28	9,110.28		9,110.28	100.0	-
	9,110.28	9,110.28	-	9,110.28		-
FC 161 - HYDROLOGY						
Task 3 - 16107 - Hydro. Map & Outfall Cap. Analysis	25,975.00	25,975.00		25,975.00	100.0	-
Task 2 - 16108 - Gather Info on existing Drainage features	4,080.08	4,080.08		4,080.08	100.0	-
Task 4 - 16109 - Meet w/County - HCDD#1 - TxDOT - Alton Ext Hydro	3,091.68	3,091.68		3,091.68	100.0	-
	33,146.76	33,146.76	-	33,146.76		-
FC 164 - COORDINATION						
Task 7 - 16401 - Coordination w/TxDOT & FHWA on Log. For Utilizin	5,271.03	5,271.03		5,271.03	100.0	-
	5,271.03	5,271.03	-	5,271.03		-
Direct Expenses	1,900.00	1,375.00	525.00	1,900.00	100.0	-
	1,900.00	1,375.00	525.00	1,900.00		-
TOTALS:	75,054.77	72,964.94	2,089.83	75,054.77	100.0	-

PROJECT MANAGER'S SIGNATURE

ORIGINAL CONTRACT SUM	$	75,054.77
CHANGE BY CHANGE ORDER	$	0.00
CONTRACT SUM TO DATE	$	75,054.77
TOTAL COMPLETED TO DATE	$	75,054.77
LESS PREVIOUS INVOICES	$	72,964.94
CURRENT PAYMENT DUE	$	2,089.83

L&G Consulting Engineers, Inc
2100 W. Expressway 83
Mercedes, Texas 78570
(956) 565-9813

Project Workhour Report
FM 676 Outfall Analysis and Evaluation WA#1
Reference:Inv#11325174
Date: 6/19/2015
P.O.#622895

	Hrs		Rate	Total
Senior Project Manager	3.00	X	215.40	$646.20
Senior Engineer	4.00	X	167.89	$671.56
Design Engineer	1.00	X	114.04	$114.04
Senior Engineer Tech	0.00	X	79.19	$0.00
CADD Operator/GIS Analyst	2.00	X	66.52	$133.04
Admin/Clerical	0.00	X	57.02	$0.00

Grand Total of Hours $ 1,564.84

(Difference due to rounding hours) $ 0.01

Invoice Summary

Man Hours					$	1,564.83
Sub Contract					$	-
(See Attached Sub Invoice for Man Hour Breakdown)						
Direct Expenses	Current Units		Rate			
20 ft. Long by 3 ft. Tall Hydro Map (60sq. Ft) @$5.00/sq. ft	1	X	300.00	$ 300.00		
8.5 X 11 Copies (i.e. Corr. w/Landowners) - (250 units)	150	X	1.00	$ 150.00		
11 x 17 Copies (i.e. various Exhibits) - (100 units)	50	X	1.50	$ 75.00		
					$	525.00
			(Difference due to rounding)		$	-

Total Per Invoice Submitted **$ 2,089.83**

L&G CONSULTING ENGINEERS INC
2100 W. Expressway 83
Mercedes, TX 78570
956-565-9813 fax 956-565-9018

FINAL WAIVER AND LIEN RELEASE

DATE:	06/19/2015
PROJECT:	FM 676 Outfall Analysis and Evaluation PO#622895
OWNER:	Hidalgo County Drainage District #1
FINAL PAYMENT:	$ 2,089.83

UPON RECEIPT OF THIS PAYMENT, Owner does hereby certify and acknowledge that Engineer has been fully paid for all work and labor done by Owner and for all materials and services supplied by Engineer on the above project and that this payment, which includes all retainage released to the Engineer, represents the FINAL AND COMPLETE payment for work and/or labor done and all materials and services supplied on the above described project.

The undersigned hereby further certifies: There are no known mechanics, materialmen's, or laborer's liens or claims or any other liens or claims, legal or equitable, contractual, statutory, or constitutional, outstanding or known to exist as of the date referenced above and if any should arise in the future, the undersigned agrees to indemnify and hold the Owner and Contractor harmless from any and all such liens or claims, including attorney's fees and expenses; all due and payable bills with respect to the real property referenced above have been paid to date or are included in the amount requested in the current application and will be paid from this payment, and there is no known basis for the filing of any mechanics', materialman's, or laborer's lien or claim, or any other lien or claim, legal or equitable, contractual, statutory, or constitutional, on the real property referenced above. Engineer certifies that all waivers and releases from all Engineers, laborers, and material men for work done and materials furnished have been obtained in such form as to constitute an effective waiver and release of all such liens under the Laws of the State of Texas.

ENGINEER SWEARS THAT, WITH RECEIPT OF THE PAYMENT ASSOCIATED WITH THIS LIEN RELEASE, ALL OUTSTANDING BILLS ASSOCIATED WITH THIS LIEN RELEASE WILL BE PAID AT THIS TIME. FURTHER, ENGINEER ACKNOWLEDGES THAT ALL FUNDS RECEIVED, TO THE APPROPRIATE AMOUNT, ARE RECEIVED IN TRUST FOR ALL ENGINEERS/SUPPLIERS THAT ARE OWED FUNDS BY HIM ON THIS PROJECT. ENGINEER AGREES TO INDEMNIFY ANY PARTY RELYING UPON THIS AFFIDAVIT FOR ANY LOSS OR EXPENSE RESULTING FROM FALSE OR INCORRECT STATEMENTS IN THIS AFFIDAVIT.

UPON RECEIPT OF THIS PAYMENT, Engineer hereby releases in full all claims and liens Engineer has heretofore filed, if any, on such property for such work and/or material. Engineer hereby waives all rights, claims and liens on this project forever for such work done and all materials supplied by Engineer.

L&G CONSULTING ENGINEERS, INC

Marisela G. Marin
Signature

6/19/2015
Date

Printed Name/Title Marisela G. Marin Secretary/Treasurer

STATE OF TEXAS

KNOW ALL MEN BY THESE PRESENTS:

COUNTY OF HIDLAGO

Before me, the undersigned authority, on this day personally appeared Marisela G. Marin, the Secretary/Treasurer (title) of L&G Consulting Engineers, Inc., known to me to be the person and officer whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes therein expressed and in the capacity therein stated.

Marie C. Bustamante

MARIE C. BUSTAMANTE
Notary Public, State of Texas
My Commission Expires
April 14, 2017

NOTARY PUBLIC in and for
THE STATE OF TEXAS

Printed Name: Marie C. Bustamante

My Commission Expires: April 14, 2017

L&G Engineering
Transportation Consulting Engineers

2100 W. Expressway 83
Mercedes, TX 78570
Phone: (956) 565-9813
Fax: (956) 565-9018
Toll Free: (888) 565-9813

900 S. Stewart Rd., Ste. 10
Mission, TX 78572
Phone: (956) 585-1909
Fax: (956) 585-1927
Toll Free: (866) 585-1909

Firm No. F-4105

Letter of Transmittal

Mr. Raul Sesin, P.E., C.F.M. – Drainage District Manager
Hidalgo County Drainage District
902 N. Doolittle Rd.
Edinburg, Texas 78541

DATE: July 1, 2015

REF.: Work Authorization #1 on FM 676 Outfall Analysis and Evaluation Project
P.O. #622895
Invoice #11325174

L&G PROJECT NO.: 130401

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☒ Hand Carry
☐ E-Mail	☐ Lonestar Overnight	☐ Pick up

COPIES	DESCRIPTION
1	Progress Report and Invoice Package
	• L & G's Invoice #11325174
	• FM 676 – CD w/Recom'd Outfall#2, Alternate Outfall #2B, Hydrologic Map, Feasibility Report
	• Feasibility Report w/CD (included in booklet)
	• Outfall #2 Schematic, Alternate Outfall#2B Schematic, and Hydrologic Map
	• Final Waiver and Lien Release

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 02 2015
12:00 AM / PM
BY: Rosa

REMARKS: Mr. Sesin,

Attached for your review and approval is our FINAL invoice for the services rendered during the month of June 2015 on the subject referenced project. L&G met HCDD #1 and discussed Outfalls options with emphasis on Outfall #2 (Recommended Outfall). The attachments include the final completed packet of the study done by L&G. If you have any questions or comments, please feel free to contact me, Mr. Ricardo Gallaga, P.E. at 956 585-1909.

Thank you,

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 02 2015
10:00 AM / PM
BY:

Signed: _____

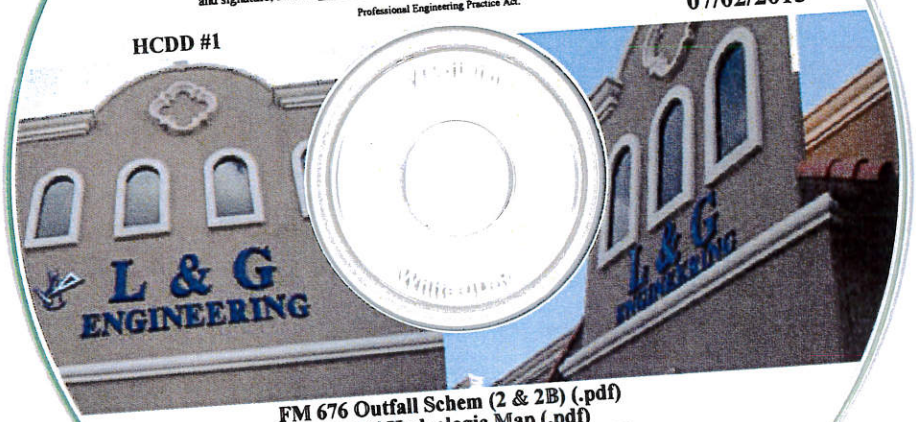
If enclosures are not as stated, please notify us.

L & G Engineering Electronic Data & CAD Disclaimer

By opening the attached files, the user agrees that data provided by this electronic file is for information purposes only and should be used at one's own risk. L & G Engineering, makes no representations, written or verbal, that the information contained in these CAD files are complete or accurate or should be relied upon for construction except to the extent that they are labeled, dimensioned or otherwise noted and reflect exactly what is on the approved and sealed preliminary or final drawings. Any conflict between the information reflected on the sealed plan sheets and that provided via this electronic data file shall be resolved in favor of the sealed plan sheets. Any reproduction of these sheets without the appropriate preliminary stamp, or professional engineering seal and signature, and the express written approval of L & G Engineering, is a violation of the Professional Engineering Practice Act.

07/02/2015

HCDD #1



FM 676 Outfall Schem (2 & 2B) (.pdf)
FM 676 Hydrologic Map (.pdf)
FM 676 Outfall Feasibility Report (.pdf)

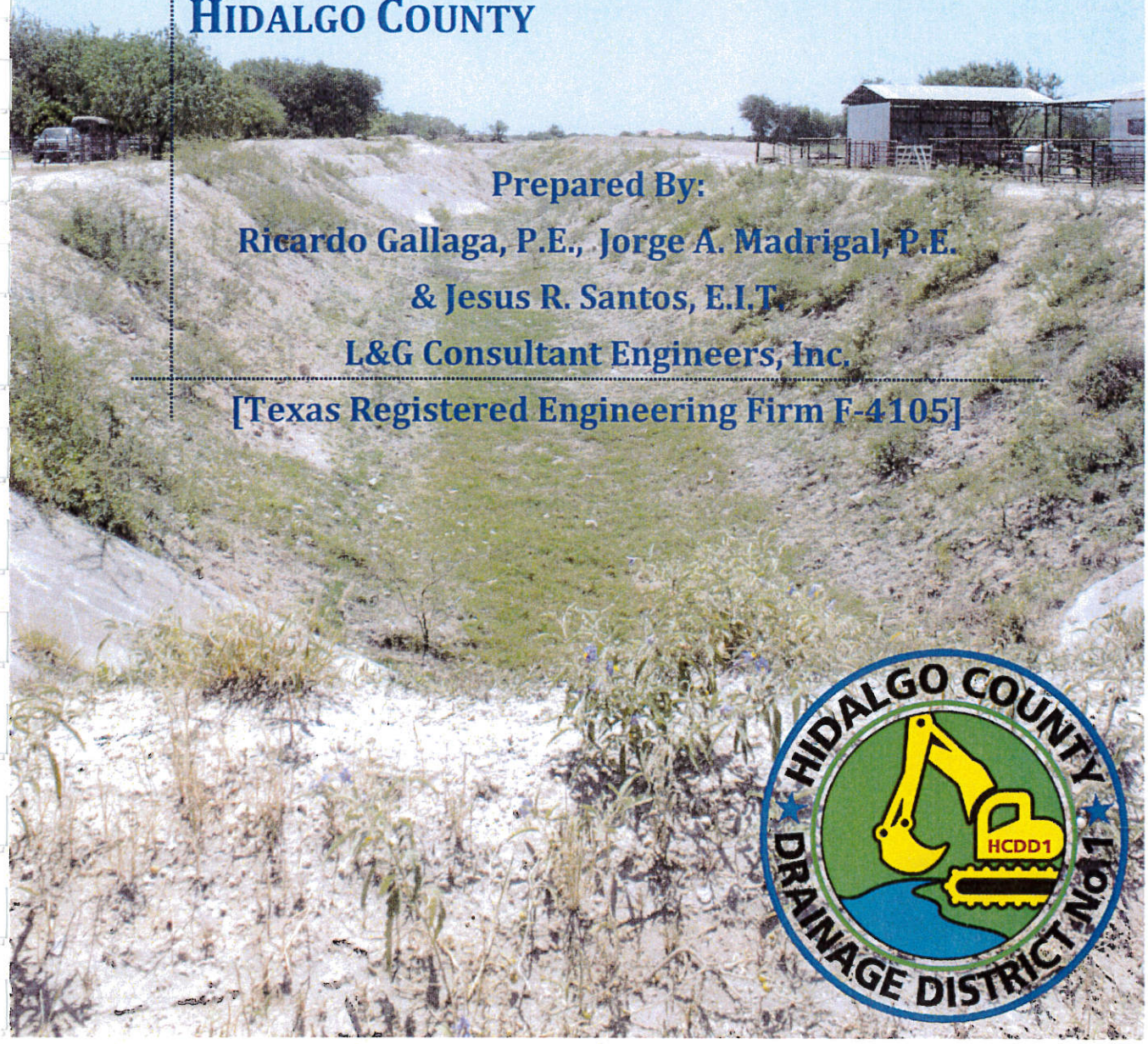
L&G Engineering
Highway / Civil
Structural / Bridge
Environmental
Firm No. : F-4105

2109 W. Expressway 83
Mercedes, TX. 78570
Phone : (956) 565-9913
Fax : (956) 565-9916

900 S. Stewart Rd., Ste. 10
Mission, TX. 78572
Phone : (956) 565-1909
Fax : (956) 565-1927

DRAINAGE OUTFALL FEASIBILITY REPORT

FM 676—DRAINAGE OUTFALL PROJECT FROM SH 107 – EAST TO TAYLOR RD. HIDALGO COUNTY



Prepared By:

Ricardo Gallaga, P.E., Jorge A. Madrigal, P.E.

& Jesus R. Santos, E.I.T.

L&G Consultant Engineers, Inc.

[Texas Registered Engineering Firm F-4105]

HIDALGO COUNTY DRAINAGE DISTRICT NO. 1

HCDD1

L&G Engineering

Transportation Consulting Engineers

HYDROLOGIC & HYDRAULIC STUDY

FOR

FM 676 (Mile 5)
HIDALGO COUNTY (TEXAS)

Limits: From SH 107 to East of Taylor Road

7/1/15

Ricardo S. Gallaga, P.E., 67612
Project Engineer

Prepared for:

Prepared by:

L&G Engineering
Transportation Consulting Engineers
2100 W. Expressway 83
Mercedes, TX 78570
Phone: (956) 565-9813
Fax: (956) 565-9018
Toll Free: (888) 565-9813

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Mission, TX 78572
Phone: (956) 585-1909
Fax: (956) 585-1927
Toll Free: (866) 585-1909

Texas Registered Engineering Firm No. F-4105

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SECTION I:	INTRODUCTION
SECTION II:	ASSESSMENT OF EXISTING STORM DRAINAGE SYSTEM
SECTION III:	OUTFALL OPTION LOCATIONS
SECTION IV:	HYDROLOGIC MAPPING AND OUTFALL CAPACITY ANALYSIS
SECTION V:	IMPACTS OF DRAINAGE OUTFALLS
SECTION VI:	FUNDING ANALYSIS
SECTION VII:	CONCLUSION AND RECOMMENDATIONS
APPENDIX A:	REFERENCE—"MASTER DRAINAGE PLAN, CITY OF ALTON, TEXAS"
APPENDIX B:	REFERENCE—"FLOOD PROTECTION PLAN FOR HIDALGO COUNTY, TEXAS"
APPENDIX C:	GEOPAK DRAINAGE ANALYSIS REPORT FOR OUTFALL #2
APPENDIX D:	HEC-RAS ANALYSIS REPORT FOR OUTFALL #2

L&G Engineering
Transportation Consulting Engineers

SECTION I - INTRODUCTION

L&G Engineering
Transportation Consulting Engineers

INTRODUCTION

The Hidalgo County Drainage District No. 1 (HCDD#1) has contracted L&G Engineering (L&G) to provide recommendations for drainage improvements in the vicinity of Alton, Texas. Specifically, the HCDD#1 has asked L&G to provide analysis and evaluation of multiple outfall drainage options in the City of Alton along FM 676, within the limits of SH 107 on the west to Taylor Road on the east. (See Location Map on succeeding page)

The general scope of work is as follows:

- **Assessment of Existing Storm Drainage System**—L&G Engineering will hold various meetings with TxDOT, Hidalgo County, and the City of Alton to ascertain local drainage patterns, current drainage issues, and community drainage needs. Additionally, L&G will conduct extensive outreach with all parties involved to document and establish all existing drainage facilities and features that exist within the delineated watershed.

- **Hydrologic Mapping and Outfall Capacity Analysis**—L&G Engineering will develop a Hydrologic Map for the project limits analyzing the watersheds, sub-basins & drainage areas contributing to the proposed outfalls options. Subsequently, L&G will provide a preliminary hydraulic analysis for each drainage area or sub-basin and provide preliminary discharges for 25 yr and 100 yr frequencies. Determination of proposed outfall structure and recommend approximate sizing for each may be determined if requested.

- **Impacts of Drainage Outfalls**—L&G Engineering will research and identify all affected property owners on each of the proposed outfall alignments utilizing the latest appraisal district file information from Hidalgo County Appraisal District. In addition, L&G will document any easements affecting the parcels, if determined to be necessary in identifying impacts to property owners. Subsequently, L&G will coordinate numerous meetings with affected land owners on this project. L&G will ensure that the alignment of the proposed outfalls are presented and explained to the affected land owner prior to finalizing the proposed alignments.

- **Funding Analysis**—L&G Engineering will research and identify a plan of action for utilizing the appropriated federal monies earmarked for this drainage outfall project.

MISSION/MCALLEN LATERAL
TAYLOR ROAD
FM 494 (SHARY ROAD)
FM 676 (5 MILE LINE)
SH 107 (CONWAY RD)
CLASSCOCK ROAD
STEWART ROAD
BRYAN ROAD
HIDALGO WEST MAIN DRAIN III
6 MILE LINE
MAYBERRY & 6 MILE BASIN
ATION DRAIN

SECTION II - ASSESSMENT OF EXISTING STORM DRAINAGE SYSTEM

L&G Engineering
Transportation Consulting Engineers

ASSESSMENT OF EXISTING STORM DRAINAGE SYSTEM

The City of Alton is located in a relatively flat area of Hidalgo County that falls primarily from west to east. The heavily developed area of Alton is currently along the north and south side of FM 676 (Mile 5). Scattered residential and commercial development exists throughout the remainder of the drainage area. FM 676 follows a slight rise in the ground surface. The terrain north of the road falls generally to the north and east. The portion of the study area south of FM 676 falls generally to the east and south.

The remainder, and major portion of the study area, is crossed by many manmade features such as irrigation canals and laterals, drainage ditches, and roads. There are also a number of natural and manmade depressions in the study area that currently store storm runoff. All of these features were taken into consideration when the existing contributing drainage area boundaries, illustrated on the Hydrologic Map, were defined.

There are three existing drain ditches that can be used as drainage outfalls in the vicinity of the study area. The Alton Drain begins one block west of SH 107 and just north of FM 676. This open ditch turns east and crosses beneath SH 107 towards Chicago Street. Before reaching Chicago the ditch turns northward and outfalls into the HCDD#1 West Main III (also known as L-00-00). Additionally, the Mayberry & 6 Mile Basin serves as an overflow retention pond for the Alton Drain. The HCDD#1 West Main III Drain runs parallel to FM 676 approximately 6000 feet to the north. The Mission-McAllen Lateral (also know as L-02-00) is an open drain ditch that runs north and south at the eastern end of the study area. This drain ditch is located approximately 1,200 feet north of FM 676 and approximately 1,300 ft east of Taylor Road.

Figure 1: Alton Drain at 6-Mile (facing south)

Figure 2: HCDD#1 West Main III at Mayberry Rd (facing west)

Figure 3: Mayberry & 6 Mile Basin

Figure 4: Mission-McAllen Lateral at FM 676 (facing north)

As part of our coordination efforts, L&G conducted a meeting with the City of Alton, TX evaluating the existing local drainage patterns, current drainage issues, and community drainage needs. A summary of the meeting can be reviewed on the following page.

L&G Engineering
Transportation Consultants

Meeting Summary Report

PROJECT: Outfall Feasibility Study—From SH 107 to Taylor Road	L&G JOB NO.: 130401
SUBJECT: Meeting with City of Alton City Manager and Assistant City Manager	
CLIENT: HCDD#1	
LOCATION: Alton City Hall	DATE: 07/10/13
ATTENDEES: Jorge Arcaute (City Manager), Steven Pena (Assistant City Manager), Velma Garcia (ENV/L&G), Jorge A. Madrigal (L&G)	

DISCUSSION: ***The following is our understanding of the subject matter covered in this meeting. If this differs with your understanding, please notify us.***

L&G began the meeting by thanking the City for taking time to meet with us. Additionally, the general scope of work was presented and the City was receptive of the concept of needing a drainage outfall in the area.

Present Preliminary Hydrologic Map and discuss:

- **Drainage issues**
  - The hydrologic map was presented showing drainage areas and flow.
  - The City mentioned that although they do not have an extensive drainage system in the area, the City has not experienced a lot of flooding because of the many natural basins located throughout the city. However, they do expect continued growth in the area so they are anticipating drainage needs in the near future.
  - The City provided L&G with a Flood Hazard Boundary Map (see attached).
  - Additionally, the City mentioned that they have annexed additional land on the southern boundary of the city (see attached City Limits Map)
- **Outfall Options Discussed**
  - L&G briefly discussed the three preliminary outfall options we are currently studying and the City did not have any problems with them. L&G mentioned that they would follow up with additional meetings as the outfall options are finalized.
  - The city mentioned that the large basin along Bryan Rd., a quarter mile south of Mile 5, is presently being filled-in by the City of McAllen, therefore, we should not study it as part of an outfall option.
  - The City also mentioned that the Bryan Road Basin, (on the northwest corner of Mile 5 and Bryan Rd.) where the tragic bus accident occurred some years back, is part of a larger basin that stretches northwest toward Mayberry. This area can be considered as part of a drainage outfall.

L&G concluded the meeting and mentioned that we are on a tight time schedule and will be following of with more information very shortly.

SECTION III - OUTFALL OPTION LOCATIONS

L&G Engineering
Transportation Consulting Engineers

parallel to FM 676) and a proposed channel 1200-feet long (going North away from FM 676) is required. It is anticipated that an additional ROW or drainage easement of approximately 20-feet wide and 1300-feet long is required on the north side of FM 676 eastward beyond the project limit to contain the storm sewer trunkline extension because the existing TxDOT ROW is only 40 feet outside the project limits east of Taylor Road compared to 80-foot ROW within the project limits west of Taylor Road. After 1300-feet, the flow conveyance is proposed to turn northward and daylight into a proposed open channel. The 1200-feet long open channel will have a 5- foot flat bottom and approximately 5-6 feet deep with 3:1 side slopes. This channel will require a ROW acquisition or drainage easement of approximately 70-feet wide and 200-feet long. It will outfall into the existing McAllen-Mission Lateral.

Other Outfall Options not Proposed

In locating the six proposed outfall options discussed above, several other outfalls were considered but were deemed not to be acceptable to use as an outfall for FM 676 storm water runoff. The following outfalls were considered but were not proposed:

- Existing Five Mile and Bryan Detention Basin was not proposed because of TxDOT's concern of the sensitivity of the site. This was the site where a tragic school bus accident occurred. This area is also designated as Zone A, an area inundated by the base (100- year) flood with no base flood elevations (BFEs) determined on the FEMA effective flood Insurance Rate Map (FIRM) for the City of Alton, Texas, Hidalgo County (FIRM Panel 481571 0005 A), dated June 8, 1982.

Figure 5: Five Mile and Bryan Basin (facing west)

- Existing retention basin located east of Bryan Road and approximately 1,350 feet South of FM 676. Because this is a retention basin and does not have any positive outflow, this was not used as an outfall. This area is also designated as Zone A on the

effective FIRM for the City of Alton. Additionally, after meeting with the City of Alton it was determined that this retention basin is being filled in by the City of McAllen.

- Two existing irrigation canals, which cross FM 676 within the project limits were not used because communications with United Irrigation District (UID) of Hidalgo County revealed that UID will not permit using these as outfalls for storm water.

- Existing Mexico Basin located north of FM 676 between Bryan and Stewart is currently being used as an outfall for collecting flows from a portion of FM 676 through an existing storm sewer system. Even the possibility of draining some amount of flow from the proposed roadway project that currently the system is taking was rejected by TxDOT since there is no positive outflow and homes surround this basin. Therefore, this outfall was not proposed and the existing storm sewer connection is proposed to be eliminated.

Figure 6: Mexico Basin (facing south)

- Proposed Lateral L-03-00, as proposed by the HCDD #1, located midway between Glasscock and Shary Road, was not used because it was not deemed feasible based on PBS&J's investigations contained in a Memorandum to TxDOT dated April 2007. A portion of their findings are described below:

The proposed Lateral L-03-00 is shown on a map, titled "Proposed Laterals for HCMDS and Drainage Area Map" for Hidalgo County Drainage District #1, prepared by Turner, Collie & Braden, Inc. This proposed lateral runs parallel and just west of an existing irrigation channel from south to north and connects to HCDD #1's lateral L-00-00, located approximately 6000 feet north of FM 676.

An attempt has been made to evaluate the option of draining the project flows from the end of the project westward to outfall into Lateral L-03-00. This lateral is proposed to be built by HCDD #1 and was included in the Hidalgo County Master Drainage Study. Because the roadway and the adjacent general terrain slopes from west to east PBS&J determined that any proposed storm sewer trunkline from that first inlet approximately 207 feet west of the end of the project at Taylor Road could not come back west and make grade to the proposed HCDD #1 Lateral L-03-00. Following are the calculations PBS&J performed to come to the above-mentioned conclusion:

The approximate distance from the first inlet to the proposed Lateral L-03-00 would be approximately 4000 feet. Using an 18" RCP at this inlet location, the proposed Flowline (FL) elevation of the 18" RCP would be 135.57 based on a gutter low point elevation of 137.82. The FL elevation of the proposed 6000-foot long Lateral L-03-00 at the outfall from LiDAR data is 128. Using minimum of 0.1% slope of the proposed Lateral L-03-00, the FL elevation of this lateral at FM 676 is 134. Hence, the slope of the storm sewer line would be approximately 0.04%, which is too flat to be constructed as per TxDOT Pharr district (minimum 0.15% acceptable). Therefore, this option was not utilized.

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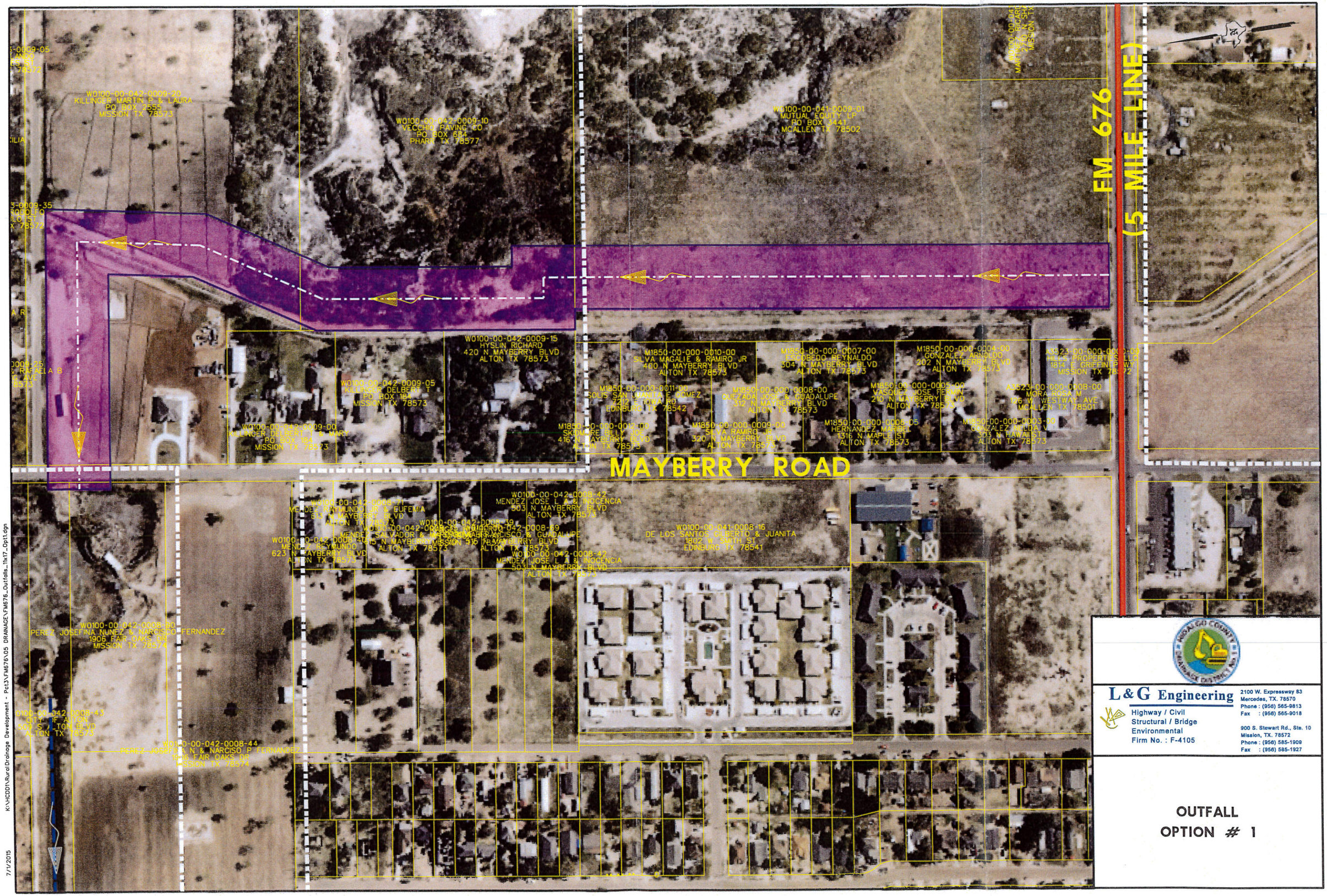

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Misalon, TX. 78572
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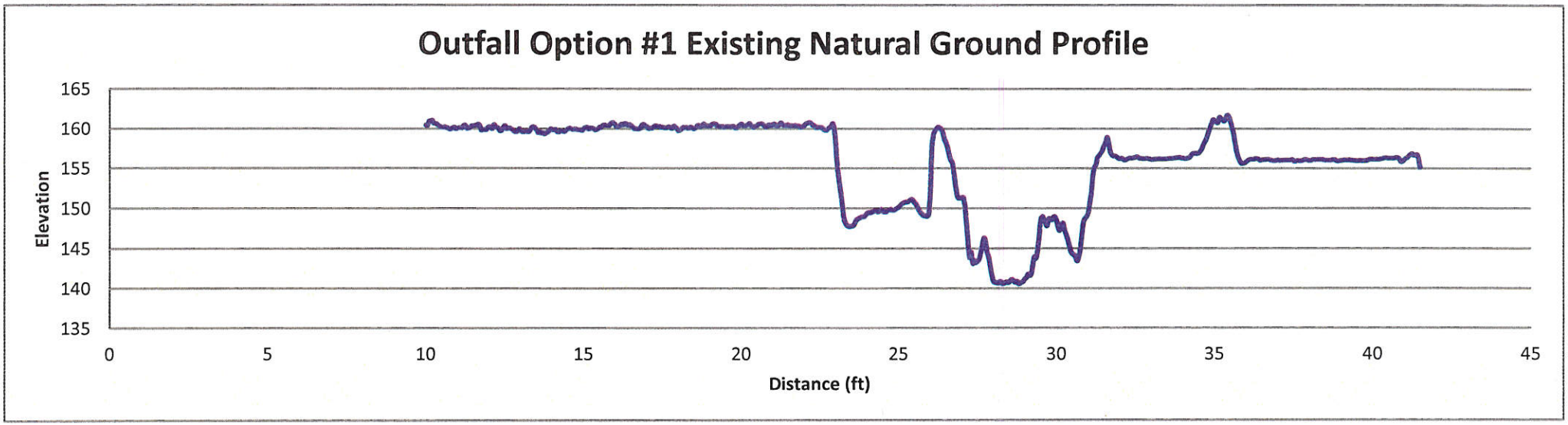
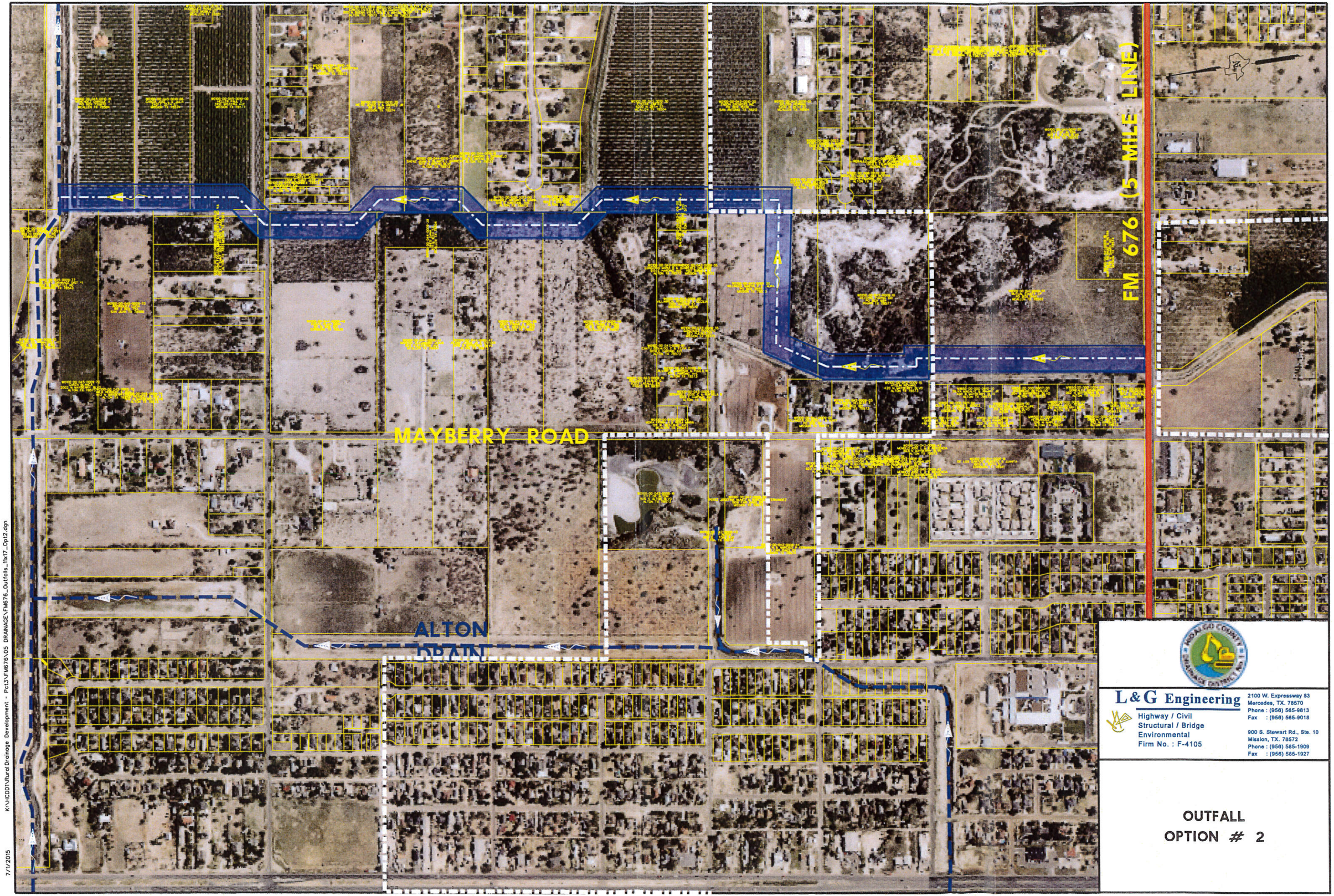
OUTFALL OPTION # 1

K:\HCDD1\Rural Drainage Development - Pct3\FM676\05 DRAINAGE\FM676_Outfalls_11x17_Opt1.dgn

7/1/2015


Outfall Option #1 Existing Natural Ground Profile
Elevation
165
160
155
150
145
140
135
0
5
10
15
20
25
30
35
40
45
Distance (ft)



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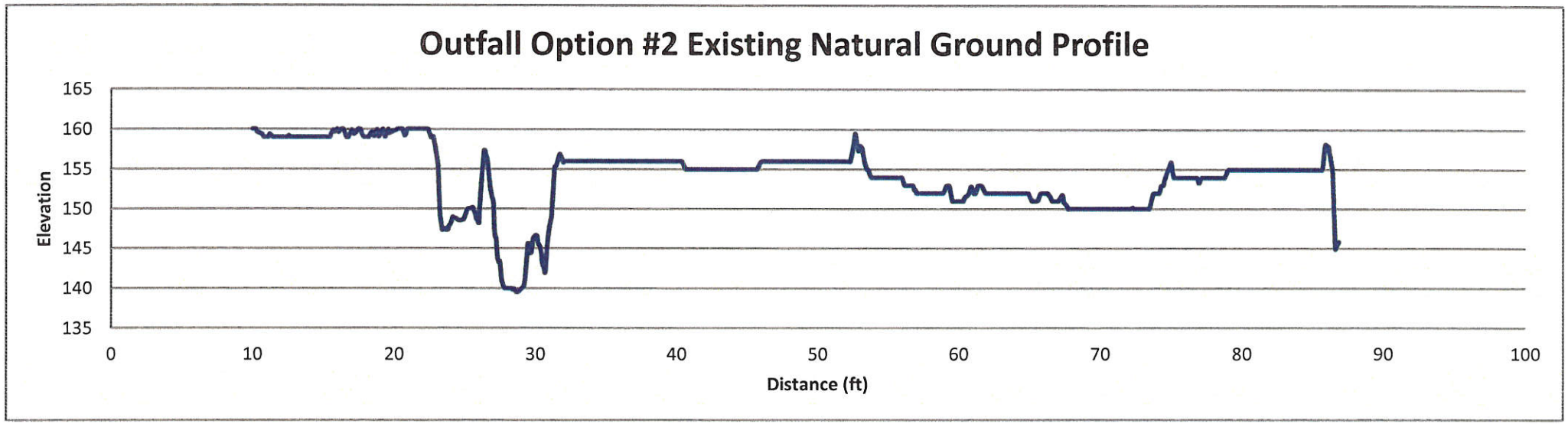
OUTFALL
OPTION # 2

7/1/2015 K:\HCDD\Rural Drainage Development - Pct3\FM676\05 DRAINAGE\FM676_Outfalls_11x17_Opt2.dgn


Outfall Option #2 Existing Natural Ground Profile
Elevation
165
160
155
150
145
140
135
0
10
20
30
40
50
60
70
80
90
100
Distance (ft)

BRYAN RD

FM 676 (5 MILE LINE)

MAYBERRY ROAD

ALTON DRAIN

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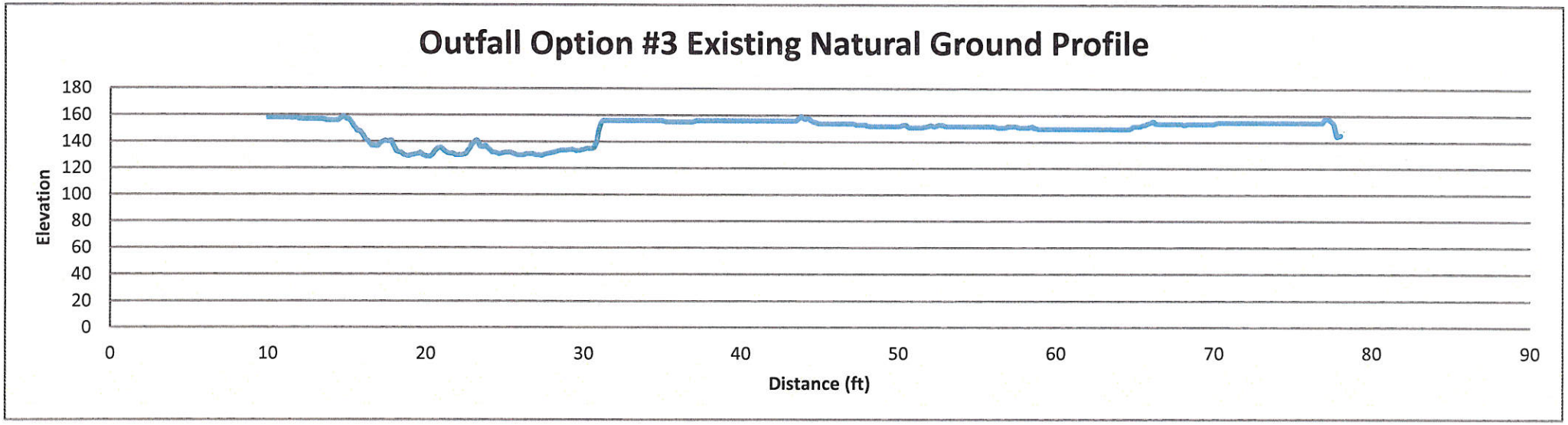
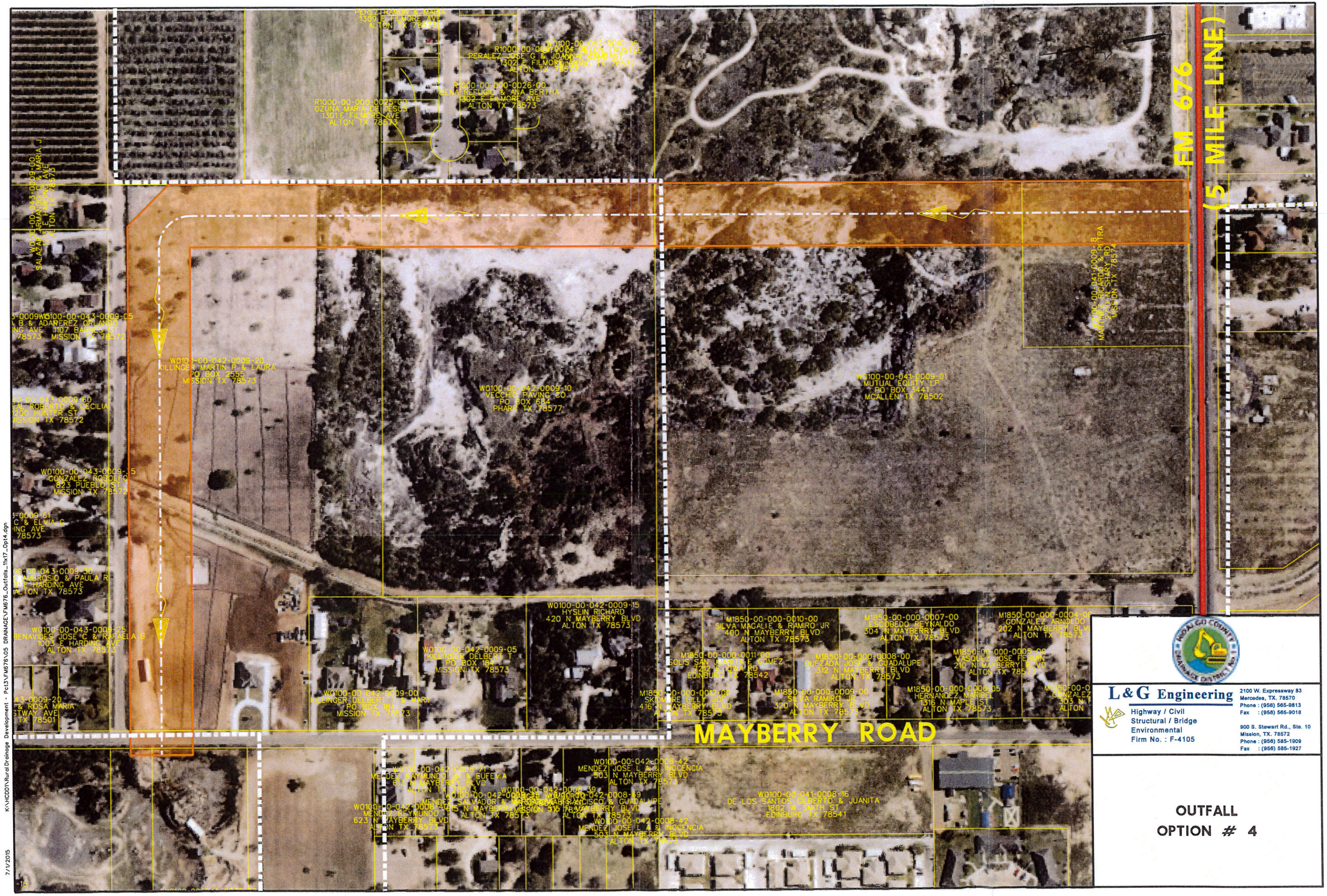
OUTFALL OPTION # 3


Outfall Option #3 Existing Natural Ground Profile
Elevation
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
Distance (ft)



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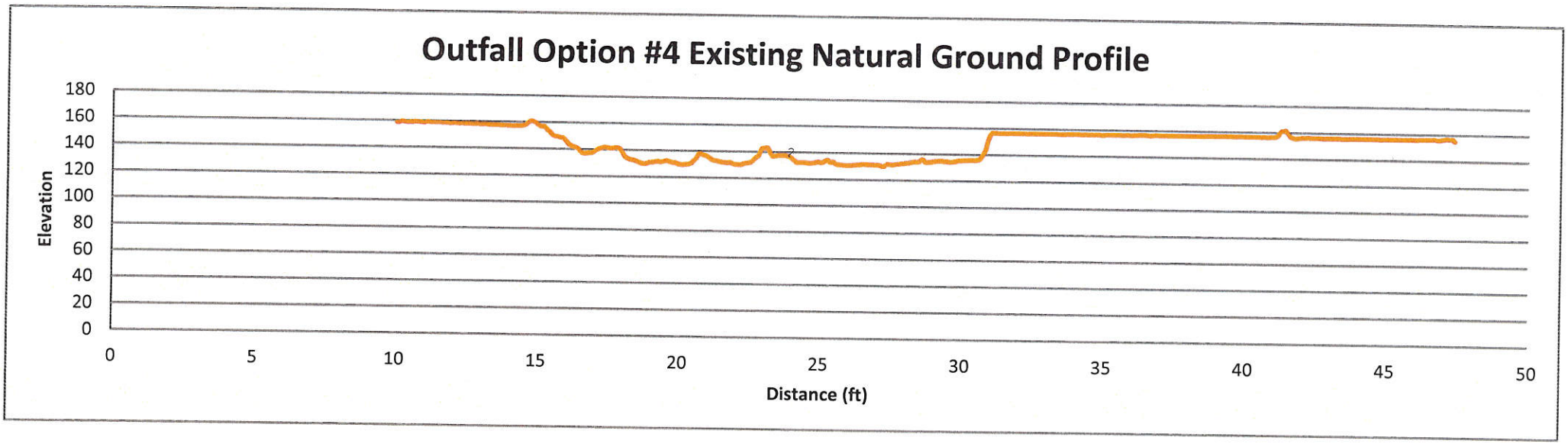
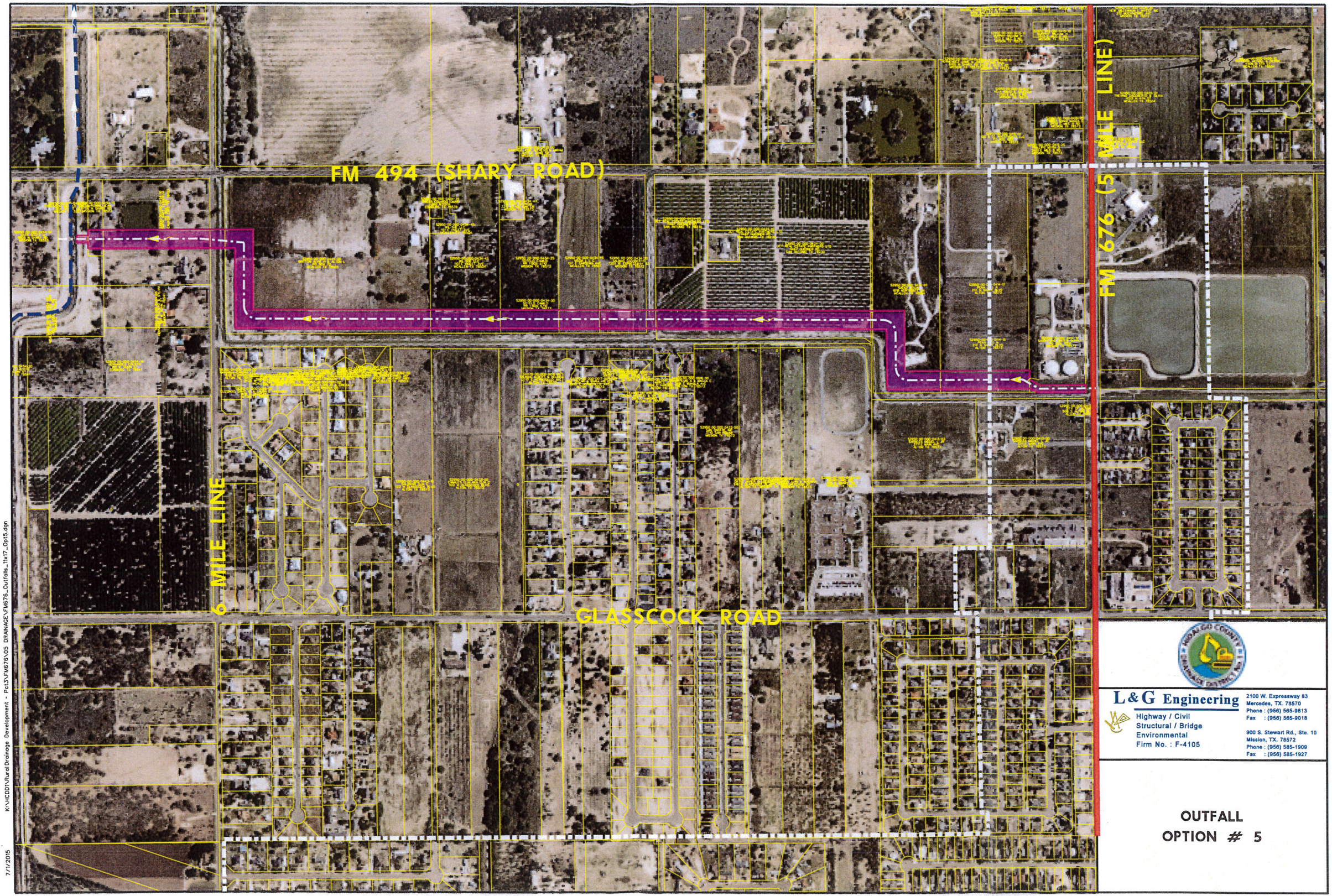
OUTFALL OPTION # 4


Outfall Option #4 Existing Natural Ground Profile
Elevation
180
160
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
45
50
Distance (ft)



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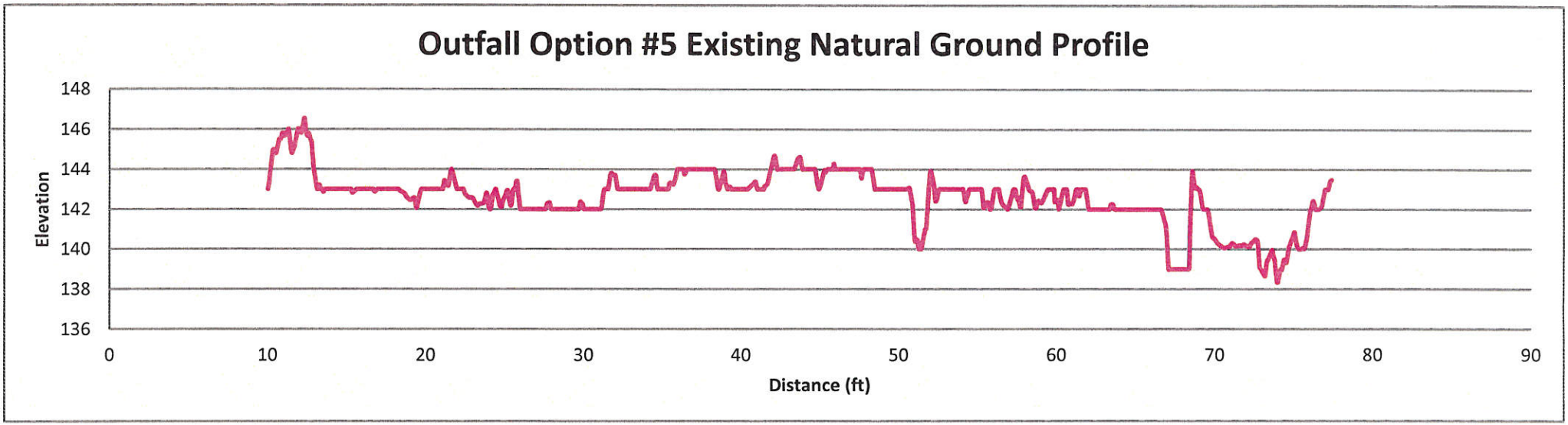
OUTFALL OPTION # 5


Outfall Option #5 Existing Natural Ground Profile
148
146
144
142
140
138
136
Elevation
0
10
20
30
40
50
60
70
80
90
Distance (ft)

S2950-00-000-0427-18
WOMACK SANDRA J
8300 N TAYLOR RD
MCALLEN TX 78504

TAYLOR ROAD

S2950-00-000-0417-15
TEXAS CITRUS DEVELOPMENT CORP
8301 N WARE RD
MCALLEN TX 78504

S2950-00-000-0417-05
TEXAS CITRUS DEVELOPMENT CORP
8301 N WARE RD
MCALLEN TX 78504

S2950-00-000-0417-00
SIVAD ENTERPRISE INC
8301 N WARE RD
MCALLEN TX 78504

S2950-00-000-0418-00
BANCO MERCANTIL DEL NORTE SA
100 E SAVANNAH AVE STE 540
INSTITUCION DE BANCA MUL GRUPO FINANCIERO BANORTE
MCALLEN TX 78503

S2950-00-000-0417-10
TWINBROOKE SOUTH CORPORATION
PO BOX 2888
MCALLEN TX 78502

S2950-00-000-0417-30
VALDEZ SYLVIA
8004 N TAYLOR RD
MCALLEN TX 78504

S2950-00-000-0418-40
LANE GLORIA I
720 BLUEBIRD AVE
MCALLEN TX 78504

S2950-00-000-0416-00
SHARYLAND ISD
1106 N SHARY RD
MISSION TX 78572

S2950-00-000-0417-22
RGV PARTNERS LLC
9200 N TAYLOR RD
MCALLEN TX 78504

S2950-00-000-0417-20
RGV PARTNERS LLC
9200 N TAYLOR RD
MCALLEN TX 78504

M4652-00-000-0001-00
LUEG FAMILY LTD
PO BOX 2888
MCALLEN TX 78502

S2950-00-000-0418-50
SOTELO CRUZ
4724 AUBURN AVE
MCALLEN TX 78504

S2950-00-000-0418-10
WILSON FAMILY REVOCABLE TRUST
5008 N MINNESOTA RD
MISSION TX 78574

P4405-00-000-0001-00
ORTEGA ROSA E
6904 N 7TH ST APT 2
MCALLEN TX 78504

S2950-00-000-0417-21
RGV PARTNERS LLC
9200 N TAYLOR RD
MCALLEN TX 78504

FM 676
(5 MILE LINE)

S2950-00-000-0406-60
HOLY COW ROY LLC
2728 E MILE 5 RD
MISSION TX 78573

S2950-00-000-0406-15
MOSS RAY B
6221 N TAYLOR RD
MISSION TX 78573

S2950-00-000-0406-02
STEINDEL DAVID
3501 LAS PALMAS
MCALLEN TX 78504

S2950-00-000-0406-26
HELMA T & JUAN JR
2 E MILE 5 RD
MISSION TX 78573

S2950-00-000-0406-23
CASAS FORTINO
2712 E MILE 5 RD
MISSION TX 78573

N0355-00-000-0001-00
GALLARDO ISABEL & MANANELLA

S2950-00-000-0407-27
KOLODZEJ DIANA
115 RIO GRANDE DR
MISSION TX 78572

S2950-00-000-0407-28
KOLODZEJ DIANA
115 RIO GRANDE DR
MISSION TX 78572

S2950-00-000-0407-26
HERNANDEZ JOSE FLOYD & MARTHA
4913 AUBURN AVE
MCALLEN TX 78504

M3928-00-000-0001-05
KOLODZEJ DIANA
115 RIO GRANDE DR
MISSION TX 78572

S2950-00-000-0407-15
HERNANDEZ DANIEL & HERMINIA
4813 AUBURN AVE
MCALLEN TX 78504

S2950-00-000-0407-35
M & L MANAGEMENT LLC
6351 W MILE 5 RD
MISSION TX 78573

S2950-00-000-0408-20
ALVAREZ JUAN A & BLANCA E
4709 AUBURN AVE
MCALLEN TX 78504

S2950-00-000-0407-00
RODRIGUEZ RAMIRO & MINDY L
7701 N TAYLOR RD
MCALLEN TX 78504

S2950-00-000-0407-60
EGUIA RIGOBERTO & BENITA
426 CHARLES CIR
ALAMO TX 78516

S2950-00-000-0408-21
BEST DONALD & JAMES
112 LEGEND RUN
BOERNE TX 78006

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7/1/2015

HIDALGO COUNTY DRAINAGE DISTRICT NO. 1

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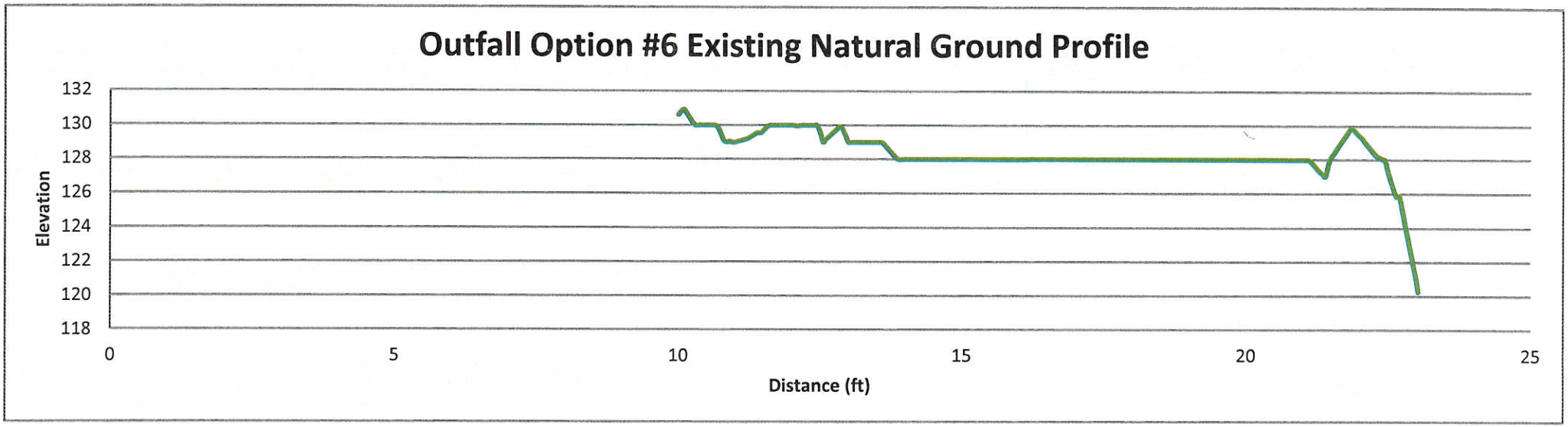
OUTFALL OPTION # 6


Outfall Option #6 Existing Natural Ground Profile
Elevation
132
130
128
126
124
122
120
118
0
5
10
15
20
25
Distance (ft)

SECTION IV - HYDROLOGIC MAPPING AND OUTFALL CAPACITY ANALYSIS

L&G Engineering
Transportation Consulting Engineers

HYDROLOGIC MAPPING AND OUTFALL CAPACITY ANALYSIS

A Hydrologic Map is being submitted along with this report. The Hydrologic Map utilized the latest GIS information to determine drainage areas for the existing FM 676 roadway configuration. Additionally, L&G Engineering (L&G) has delineated a Study Area where additional discharges will be investigated to help alleviate flooding problems.

A meeting was conducted with the City of Alton and they provided L&G with a Flood Hazard Boundary Map that outlines the 1% Flood Risk Zones that are present within the Study Area. (Please see attached, "City of Alton, Hidalgo County, Texas, Flood Hazard Boundary Map") This helps to delineate areas of potential flooding and identify best location of the proposed outfall options.

As can be seen on the attached hydrologic map, L&G has identified fifteen (15) drainage areas that will affect the delineated study area. Analysis of each area was conducted and results have been recorded on Table 1-- Summary of Computed Peak Discharges for Existing Conditions, shown on the following page. Also, a sketch of the drainage areas is provided.

The peak discharge for each drainage area was calculated for a 25-year and 100-year storm. Two methods of analysis were considered: for areas less than 200 acres, the Rational Method was used. For areas greater that and equal to 200 acres, the Unit Hydrograph Method was utilized.

Appendix C gives an approximate analysis report of the proposed storm sewer culvert section using GEOPAK Drainage. Appendix D gives an approximate analysis report of the proposed outfall ditch using HEC-RAS. Further investigation will be needed once proper topography and surveying is obtained.

CITY OF ALTON
Hidalgo County, Texas.
Flood Hazard Boundary Map.

Data Source: www.tnris.state.tx.us

N
W E
S

1 inch = 1,000 feet

CITY OF ALTON PLANNING DEPARTMENT
509 S. Alton Blvd.
Alton TX 78573
Ph: (956) 432-0760
Fax: (956) 432-0766
www.alton-tx.gov

Map Updated: May 25, 2010
Drawn By: Hernan Lugo, E.I.T, CFM

Legend

- Rivers and Streams

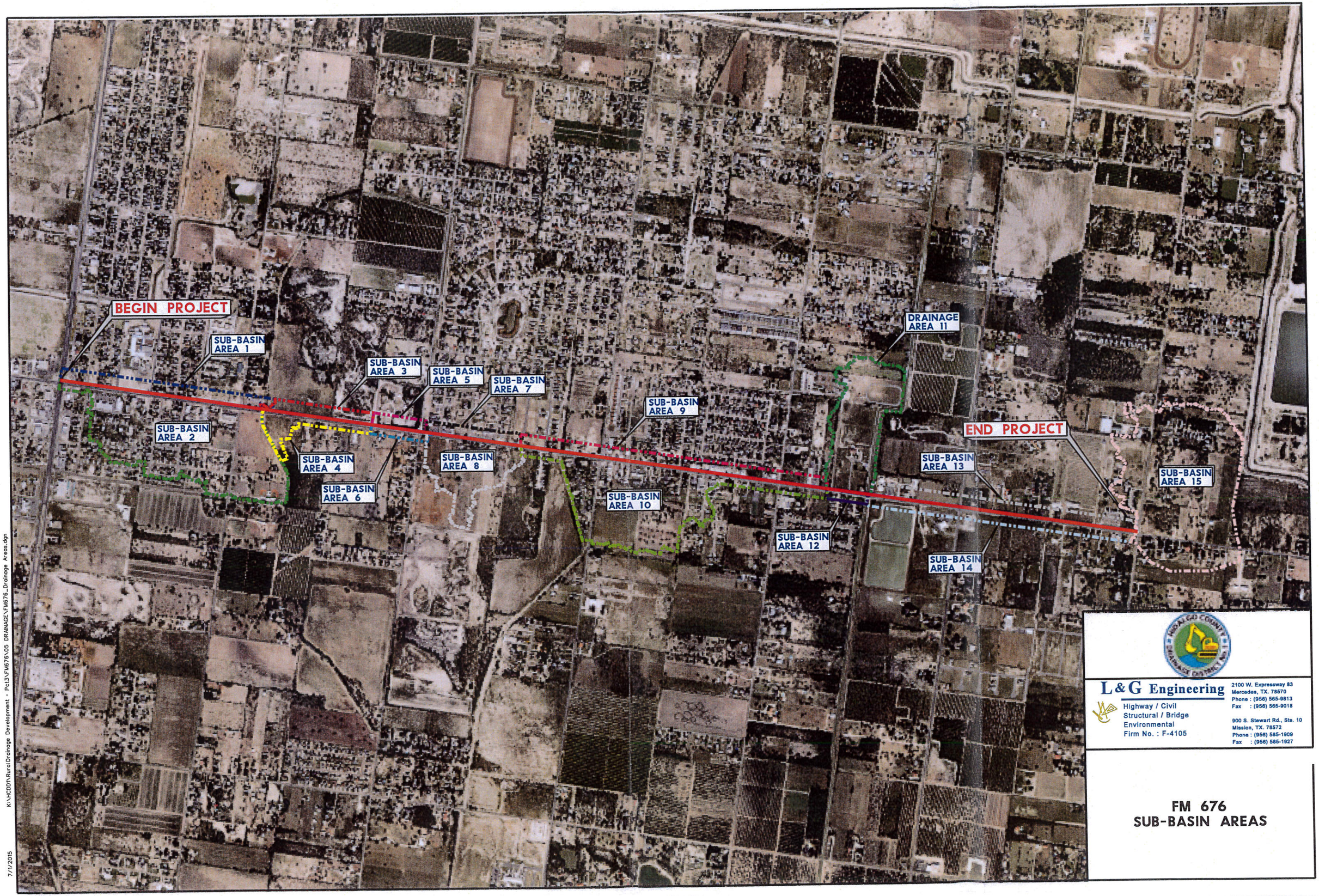
1-Percent Flood Risk Zones (FEMA)

thmp_prj.SDE.Statewide_Floodplain_Risk_Zones.D_ZONE

- A
- A1-A30
- AE
- AH
- ANI
- AO
- V
- V1-V30
- VE
- Alton_City_Limits

Table 1—Summary of Computed Peak Discharges for Existing Conditions

Area (Subbasin) No	Area (ac)	Channel Slope (ft/ft)	Flow Length (ft)	Discharge 25 yr (cfs)	Discharge 100 yr (cfs)
SB 1	12.3	0.0044	2900	**21.0**	**25.8**
SB 2	75.2	0.0044	4900	**36.1**	**49.81**
SB 3	6.0	0.0063	1700	**14.9**	**18.1**
SB 4	8.1	0.0063	1700	**4.7**	**6.4**
SB 5	3.2	0.0027	840	**16.3**	**19.8**
SB 6	2.7	0.0027	880	**1.4**	**1.9**
SB 7	5.3	0.0002	1400	**6.4**	**8.2**
SB 8	24.1	0.0002	1600	**11.2**	**15.4**
SB 9	16.8	0.0016	4500	**16.9**	**21.9**
SB 10	60.6	0.0016	3900	**44.9**	**59.4**
SB 11	33.3	0.0004	2100	**23.3**	**30.7**
SB 12	1.9	0.0004	620	**4.1**	**5.0**
SB 13	14.8	0.0018	3900	**15.7**	**20.1**
SB 14	15.1	0.0018	4000	**15.1**	**19.3**
SB 15	83.9	0.0788	1900	**77.4**	**100.9**



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FM 676
SUB-BASIN AREAS

7/1/2015

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HYDROLOGIC DATA

LIBERTY ROAD NRCS TIME OF CONCENTRATION COMPUTATIONS

Area	SHEET FLOW TRAVEL TIME					SHALLOW CONCENTRATED TRAVEL TIME					CHANNEL FLOW TRAVEL TIME									TIME OF CONCENTRATION	
	Reach (Lsh)	nol	P2 (Rain Depth)	Slope	Tsh	Reach (Lsc)	Paved Area (Input 1)	K	Slope	Tsc	Channel Depth	Channel Top	Channel Bottom	Side Slope : 1	Reach (Lch)	Mannings Coeff.	Hyd. Radius	Channel Slope	Tch	Total Tc	Total Tc
	(ft)	(Unitless)	(in)	(Unitless)	(hr)	(ft)	Unpaved Area (Input 2)	(Unitless)	(Unitless)	(hr)	(ft)	Width ft)	Width (ft)	(unitless)	(ft)	n (unitless)	R (ft)	(ft/ft)	(hr)	(hr)	(min)
DA-1	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	2899.58	0.03	0.49875544	0.004407	**0.39**	**0.40**	**23.77**
DA-2	300	0.13	3.2	0.0004	**1.74**	1920	2	16.13	0.0016	**0.82**	1	30	0	10	2636.98	0.03	0.49875544	0.004407	**0.35**	**2.91**	**174.37**
DA-3	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	1619.63	0.03	0.49875544	0.00625	**0.18**	**0.19**	**11.39**
DA-4	300	0.13	3.2	0.0003	**1.88**	105	2	16.13	0.0026	**0.04**	1	30	0	10	1334.2	0.03	0.49875544	0.00625	**0.15**	**2.07**	**124.05**
DA-5	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	805.89	0.03	0.49875544	0.002706	**0.14**	**0.15**	**8.73**
DA-6	300	0.13	3.2	0.0001	**3.43**	129	2	16.13	0.0129	**0.02**	1	30	0	10	451.66	0.03	0.49875544	0.002706	**0.08**	**3.53**	**211.85**
DA-7	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	1374.89	0.03	0.49875544	0.000222	**0.82**	**0.83**	**49.70**
DA-8	300	0.13	3.2	0.0014	**1.01**	306	2	16.13	0.0000	**0.92**	1	30	0	10	985.45	0.03	0.49875544	0.000222	**0.59**	**2.51**	**150.90**
DA-9	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	4502.85	0.03	0.49875544	0.001556	**1.02**	**1.02**	**61.37**
DA-10	300	0.13	3.2	0.0055	**0.59**	609	2	16.13	0.0039	**0.17**	1	30	0	10	2969.35	0.03	0.49875544	0.001556	**0.67**	**1.43**	**85.58**
DA-11	300	0.13	3.2	0.0063	**0.56**	1475	2	16.13	0.0014	**0.67**	1	30	0	10	306.32	0.03	0.49875544	0.0004713	**0.13**	**1.35**	**80.98**
DA-12	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	593.21	0.03	0.49875544	0.0004713	**0.24**	**0.25**	**15.04**
DA-13	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	3898.72	0.03	0.49875544	0.001832	**0.81**	**0.82**	**49.06**
DA-14	30	0.01	3.2	0.0200	**0.01**	0	2	16.13	0.0000	**0.00**	1	30	0	10	3942.39	0.03	0.49875544	0.001832	**0.82**	**0.83**	**49.61**
DA-15	300	0.13	3.2	0.0022	**0.85**	1445	2	16.13	0.0070	**0.30**	1	30	0	10	170.27	0.03	0.49875544	0.07875	**0.01**	**1.15**	**69.14**

SHEET FLOW TRAVEL TIME EQUATION:

$$t_{sh} = \frac{0.007(n_{ol}L_{sh})^{0.8}}{(P_2)^{0.5}S_{sh}^{0.4}}$$

Where:

t_{sh} = sheet flow travel time (hr.)
n_{ol} = overland flow roughness coefficient
L_{sh} = sheet flow length (ft) (300 ft. maximum)
P_2 = 2-year, 24-h rainfall depth (in.) (provided in the TxDOT 5-1301-01-1)
S_{sh} = sheet flow slope (ft/ft)

CHANNEL FLOW TRAVEL TIME EQUATION:

$$t_{ch} = L_{ch} \Big/ \left((3600 \frac{1.49}{n} R^{\frac{2}{3}} S_{ch}^{\frac{1}{2}}) \right)$$

Where:

t_{ch} = channel flow time (hr.)
L_{ch} = channel flow length (ft)
S_{ch} = channel flow slope (ft/ft)
n = Manning's roughness coefficient
R = channel hydraulic radius (ft), and is equal to $\frac{a}{P_w}$, where: a = cross sectional area (ft^2) and p_w = wetted perimeter (ft), consider the uniform flow velocity based on bank-full flow conditions. That is, the main channel is flowing full without flow in the over-banks. This assumption avoids the significant iteration associated with other methods that employ rainfall intensity or discharges (because rainfall intensity and discharge are dependent on time of concentration).

SHALLOW CONCENTRATED TRAVEL TIME EQUATION:

$$t_{sc} = \frac{L_{sc}}{3600KS_{sc}^{0.5}}$$

Where:

t_{sc} = shallow concentrated flow time (hr.)
L_{sc} = shallow concentrated flow length (ft)
K = 16.13 for unpaved surface, 20.32 for paved surface
S_{sc} = shallow concentrated flow slope (ft/ft)

TIME OF CONCENTRATION EQUATION:

$$t_c = t_{sh} + t_{sc} + t_{ch}$$

Where:

t_{sh} = sheet flow travel time
t_{sc} = shallow concentrated flow travel time
t_{ch} = channel flow travel time

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 1					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 1	535788.00	12.30	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.30	160736.40
DA 1		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 1		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA:	535788 SQFT	12.30 AC	WEIGHTED RUNOFF COEFFICIENT (C):	0.30

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

***** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)**

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	0.4	1.26	3.15
20	5	0.4	1.66	4.15
10	10	0.4	1.92	4.80
4	25	0.4	2.28	5.70
2	50	0.4	2.58	6.45
1	100	0.4	2.8	7.00

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	11.62
20	5	15.31
10	10	17.71
4	25	21.03
2	50	23.80
1	100	25.83

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

TIME OF CONC, tc
(MIN)
24
24
24
24
24
24

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 2					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 2	87120.00	2.00	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Low	0.04	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.28	24393.60
DA 2	3145032.00	72.20	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - High	0.08	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.30	943509.60
DA 2	43560.00	1.00	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - High	0.08	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.30	13068.00
TOTAL AREA:	3275712 SQFT	75.20 AC		WEIGHTED RUNOFF COEFFICIENT (C):	0.30	

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes
Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$				

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	2.91	2.291	0.79
20	5	2.91	3.091	1.06
10	10	2.91	3.591	1.23
4	25	2.91	4.664	1.60
2	50	2.91	5.582	1.92
1	100	2.91	6.437	2.21

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c
t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
174.6
174.6
174.6
174.6
174.6
174.6

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)
C = runoff coefficient
I = average rainfall intensity (in./hr. or mm/hr.)
A = drainage area (ac or ha)
Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	17.73
20	5	23.92
10	10	27.79
4	25	36.09
2	50	43.20
1	100	49.81

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 3					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 3	230868.00	5.30	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Low	0.04	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.26	60025.68
DA 3	30492.00	0.70	Relief	Relief (Cr) - Extreme	0.28	
			Soil Infiltration	Soil Infiltration (Ci) - Extreme	0.12	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.54	16465.68
DA 3		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
TOTAL AREA:	261360 SQFT	6.00 AC		WEIGHTED RUNOFF COEFFICIENT (C):	0.29	

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	0.19	0.966	5.08
20	5	0.19	1.156	6.08
10	10	0.19	1.332	7.01
4	25	0.19	1.608	8.46
2	50	0.19	1.908	10.04
1	100	0.19	1.96	10.32

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c
t_c = drainage area time of concentration (hr.)

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)
C = runoff coefficient
I = average rainfall intensity (in./hr. or mm/hr.)
A = drainage area (ac or ha)
Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	8.93
20	5	10.68
10	10	12.31
4	25	14.86
2	50	17.63
1	100	18.11

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

TIME OF CONC, tc
(MIN)
11.4
11.4
11.4
11.4
11.4
11.4

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 4					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 4	352836.00	8.10	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.28	98794.08
DA 4		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 4		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA:	352836 SQFT	8.10 AC	WEIGHTED RUNOFF COEFFICIENT (C):	0.28

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined, large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	2.07	2.207	1.07
20	5	2.07	3.007	1.45
10	10	2.07	3.507	1.69
4	25	2.07	4.328	2.09
2	50	2.07	5.414	2.62
1	100	2.07	5.849	2.83

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c
t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
124.2
124.2
124.2
124.2
124.2
124.2

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)
C = runoff coefficient
I = average rainfall intensity (in./hr. or mm/hr.)
A = drainage area (ac or ha)
Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	2.42
20	5	3.29
10	10	3.84
4	25	4.74
2	50	5.93
1	100	6.41

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 5					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 5	4356.00	0.10	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Extreme	0.12	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.36	1568.16
DA 5	135036.00	3.10	Relief	Relief (Cr) - Extreme	0.28	
			Soil Infiltration	Soil Infiltration (Ci) - Extreme	0.12	
			Vegetal Cover	Vegetal Cover (Cv) - High	0.08	
			Surface Storage	Surface Storage (Cs) - Low	0.04	
				TOTAL:	0.52	70218.72
DA 5		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
TOTAL AREA:	139392 SQFT	3.20 AC		WEIGHTED RUNOFF COEFFICIENT (C):	0.52	

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	0.15	0.91	6.07
20	5	0.15	1.06	7.07
10	10	0.15	1.22	8.13
4	25	0.15	1.48	9.87
2	50	0.15	1.78	11.87
1	100	0.15	1.8	12.00

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c
t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
9
9
9
9
9
9

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)
C = runoff coefficient
I = average rainfall intensity (in./hr. or mm/hr.)
A = drainage area (ac or ha)
Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	10.00
20	5	11.65
10	10	13.40
4	25	16.26
2	50	19.56
1	100	19.78

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 6					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 6	21780.00	0.50	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - High	0.08	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.32	6969.60
DA 6	95832.00	2.20	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Extreme	0.12	
			Vegetal Cover	Vegetal Cover (Cv) - High	0.08	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.38	36416.16
DA 6		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA:	117612 SQFT	2.70 AC	WEIGHTED RUNOFF COEFFICIENT (C):	0.37

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes
Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v - C_s$				

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

***** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)**

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	3.53	2.353	0.67
20	5	3.53	3.188333333	0.90
10	10	3.53	3.723666667	1.05
4	25	3.53	4.841333333	1.37
2	50	3.53	5.670666667	1.61
1	100	3.53	6.676666667	1.89

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c
t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
211.8
211.8
211.8
211.8
211.8
211.8

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)
C = runoff coefficient
I = average rainfall intensity (in./hr. or mm/hr.)
A = drainage area (ac or ha)
Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	0.66
20	5	0.90
10	10	1.05
4	25	1.37
2	50	1.60
1	100	1.88

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 7					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 7	230868.00	5.30	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - High	0.08	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.32	73877.76
DA 7		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 7		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA: 230868 SQFT, 5.30 AC

WEIGHTED RUNOFF COEFFICIENT (C): 0.32

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

***** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)**

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	0.83	1.664	2.00
20	5	0.83	2.23	2.69
10	10	0.83	2.629	3.17
4	25	0.83	3.128	3.77
2	50	0.83	3.56	4.29
1	100	0.83	3.992	4.81

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
49.8
49.8
49.8
49.8
49.8
49.8

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	3.40
20	5	4.56
10	10	5.37
4	25	6.39
2	50	7.27
1	100	8.16

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily, very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 8					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 8	1049796.00	24.10	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Low	0.04	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.26	272946.96
DA 8		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 8		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA: 1049796 SQFT, 24.10 AC

WEIGHTED RUNOFF COEFFICIENT (C): 0.26

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	2.51	2.251	0.90
20	5	2.51	3.051	1.22
10	10	2.51	3.551	1.41
4	25	2.51	4.504	1.79
2	50	2.51	5.502	2.19
1	100	2.51	6.157	2.45

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
150.6
150.6
150.6
150.6
150.6
150.6

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	5.62
20	5	7.62
10	10	8.86
4	25	11.24
2	50	13.74
1	100	15.37

119 19.83333

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 9					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 9	731808.00	16.80	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.30	219542.40
DA 9		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 9		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA:	731808 SQFT	16.80 AC	WEIGHTED RUNOFF COEFFICIENT (C):	0.30

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

***** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)**

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	1.02	1.808	1.77
20	5	1.02	2.412	2.36
10	10	1.02	2.863	2.81
4	25	1.02	3.418	3.35
2	50	1.02	3.93	3.85
1	100	1.02	4.428	4.34

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
61.2
61.2
61.2
61.2
61.2
61.2

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	8.93
20	5	11.92
10	10	14.15
4	25	16.89
2	50	19.42
1	100	21.88

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 10					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 10	2639736.00	60.60	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.28	739126.08
DA 10		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 10		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA: 2639736 SQFT 60.60 AC

WEIGHTED RUNOFF COEFFICIENT (C): 0.28

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	1.43	1.972	1.38
20	5	1.43	2.658	1.86
10	10	1.43	3.1295	2.19
4	25	1.43	3.787	2.65
2	50	1.43	4.545	3.18
1	100	1.43	5.002	3.50

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
85.8
85.8
85.8
85.8
85.8
85.8

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	23.40
20	5	31.54
10	10	37.13
4	25	44.94
2	50	53.93
1	100	59.35

119 19.83333

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal: well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined, large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 11					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 11	1193544.00	27.40	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Low	0.04	
			Vegetal Cover	Vegetal Cover (Cv) - Low	0.04	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.24	286450.56
DA 11	257004.00	5.90	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Extreme	0.12	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - Normal	0.06	
				TOTAL:	0.32	82241.28
DA 11		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA:	1450548 SQFT	33.30 AC	WEIGHTED RUNOFF COEFFICIENT (C):	0.25

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	1.35	1.94	1.44
20	5	1.35	2.61	1.93
10	10	1.35	3.0775	2.28
4	25	1.35	3.715	2.75
2	50	1.35	4.425	3.28
1	100	1.35	4.89	3.62

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	12.16
20	5	16.36
10	10	19.29
4	25	23.29
2	50	27.74
1	100	30.66

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined, large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

TIME OF CONC, tc
(MIN)
81
81
81
81
81
81

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 12					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 12	82764.00	1.90	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - High	0.08	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.30	24829.20
DA 12		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 12		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA:	82764 SQFT	1.90 AC	WEIGHTED RUNOFF COEFFICIENT (C):	0.30

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

***** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)**

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	0.25	1.05	4.20
20	5	0.25	1.3	5.20
10	10	0.25	1.5	6.00
4	25	0.25	1.8	7.20
2	50	0.25	2.1	8.40
1	100	0.25	2.2	8.80

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	2.39
20	5	2.96
10	10	3.42
4	25	4.10
2	50	4.79
1	100	5.02

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily, very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

TIME OF CONC, tc
(MIN)
15
15
15
15
15
15

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 13					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 13	644688.00	14.80	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.28	180512.64
DA 13		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 13		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA:	644688 SQFT	14.80 AC	WEIGHTED RUNOFF COEFFICIENT (C):	0.28

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes
Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$				

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

***** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)**

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	0.82	1.656	2.02
20	5	0.82	2.22	2.71
10	10	0.82	2.616	3.19
4	25	0.82	3.112	3.80
2	50	0.82	3.54	4.32
1	100	0.82	3.968	4.84

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c
t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
49.2
49.2
49.2
49.2
49.2
49.2

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)
C = runoff coefficient
I = average rainfall intensity (in./hr. or mm/hr.)
A = drainage area (ac or ha)
Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	8.37
20	5	11.22
10	10	13.22
4	25	15.73
2	50	17.89
1	100	20.05

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 14					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 14	622908.00	14.30	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Low	0.04	
			Surface Storage	Surface Storage (Cs) - High	0.08	
				TOTAL:	0.26	161956.08
DA 14	34848.00	0.80	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Extreme	0.12	
			Vegetal Cover	Vegetal Cover (Cv) - Extreme	0.12	
			Surface Storage	Surface Storage (Cs) - Low	0.04	
				TOTAL:	0.36	12545.28
DA 14		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
TOTAL AREA:	657756 SQFT	15.10 AC		WEIGHTED RUNOFF COEFFICIENT (C):	0.27	

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily; very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined, large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v - C_s$

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

***** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)**

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	0.83	1.664	2.00
20	5	0.83	2.23	2.69
10	10	0.83	2.629	3.17
4	25	0.83	3.128	3.77
2	50	0.83	3.56	4.29
1	100	0.83	3.992	4.81

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
49.8
49.8
49.8
49.8
49.8
49.8

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

A = drainage area (ac or ha)

Z = conversion factor, 1 for English, 360 for metric

AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	8.03
20	5	10.76
10	10	12.69
4	25	15.10
2	50	17.18
1	100	19.27

119 19.83333

RATIONAL METHOD FOR RURAL WATERSHEDS (TXDOT HYDRAULIC MANUAL) (2011)

DRAINAGE AREA ID:	DA 15					
RUNOFF COEFFICIENT (RURAL):			◉ Minimum Coeff Range	○ Average Coeff Range	○ Maximum Coeff Range	
DRAINAGE AREA ID	AREA, SQFT	AREA, AC	WATERSHED CHARACTERSITIC	DRAINAGE AREA TYPE	RUNOFF COEFF, C	COEFF, C x AREA
DA 15	3654684.00	83.90	Relief	Relief (Cr) - Low	0.08	
			Soil Infiltration	Soil Infiltration (Ci) - Normal	0.06	
			Vegetal Cover	Vegetal Cover (Cv) - Normal	0.06	
			Surface Storage	Surface Storage (Cs) - Extreme	0.10	
				TOTAL:	0.30	1096405.20
DA 15		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00
DA 15		0.00	Relief	Relief (Cr) - N/A	0.00	
			Soil Infiltration	Soil Infiltration (Ci) - N/A	0.00	
			Vegetal Cover	Vegetal Cover (Cv) - N/A	0.00	
			Surface Storage	Surface Storage (Cs) - N/A	0.00	
				TOTAL:	0.00	0.00

TOTAL AREA: 3654684 SQFT, 83.90 AC

WEIGHTED RUNOFF COEFFICIENT (C): 0.30

AVERAGE RAINFALL INTENSITY: $I = \frac{P_d}{t_c}$

*** Values of Pd are found in the Atlas of Depth-Duration Frequency (DDF) of Precipitation Annual Maxima for Texas (TxDOT 5-1301-01-1)

Table 4-11: Runoff Coefficients for Rural Watersheds

Watershed characteristic	Extreme	High	Normal	Low
Relief - C_r	0.28-0.35 Steep, rugged terrain with average slopes above 30%	0.20-0.28 Hilly, with average slopes of 10-30%	0.14-0.20 Rolling, with average slopes of 5-10%	0.08-0.14 Relatively flat land, with average slopes of 0-5%
Soil infiltration - C_i	0.12-0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08-0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity or poorly drained	0.06-0.08 Normal; well drained light or medium textured soils, sandy loams	0.04-0.06 Deep sand or other soil that takes up water readily, very light, well-drained soils
Vegetal cover - C_v	0.12-0.16 No effective plant cover, bare or very sparse cover	0.08-0.12 Poor to fair; clean cultivation, crops or poor natural cover, less than 20% of drainage area has good cover	0.06-0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04-0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent cover
Surface Storage - C_s	0.10-0.12 Negligible; surface depressions few and shallow, drainageways steep and small, no marshes	0.08-0.10 Well-defined system of small drainageways, no ponds or marshes	0.06-0.08 Normal; considerable surface depression, e.g., storage lakes and ponds and marshes	0.04-0.06 Much surface storage, drainage system not sharply defined; large floodplain storage, large number of ponds or marshes

Table 4-11 note: The total runoff coefficient based on the 4 runoff components is $C = C_r + C_i + C_v + C_s$

AEP DESIGN STORM	STORM FREQUENCY	TIME OF CONC, tc	DEPTH OF RAINFALL, (Pd)	RAINFALL INTENSITY, I
(%)	(YR)	(HR)	(IN)	(IN/HR)
50	2	1.15	1.86	1.62
20	5	1.15	2.49	2.17
10	10	1.15	2.9475	2.56
4	25	1.15	3.535	3.07
2	50	1.15	4.125	3.59
1	100	1.15	4.61	4.01

P_d = Depth of rainfall (in. or mm) for AEP design storm of duration t_c

t_c = drainage area time of concentration (hr.)

TIME OF CONC, tc
(MIN)
69
69
69
69
69
69

FLOW RUNOFF: $Q = \frac{CIA}{Z}$

Q = maximum rate of runoff (cfs or m^3/sec.)

C = runoff coefficient

I = average rainfall intensity (in./hr. or mm/hr.)

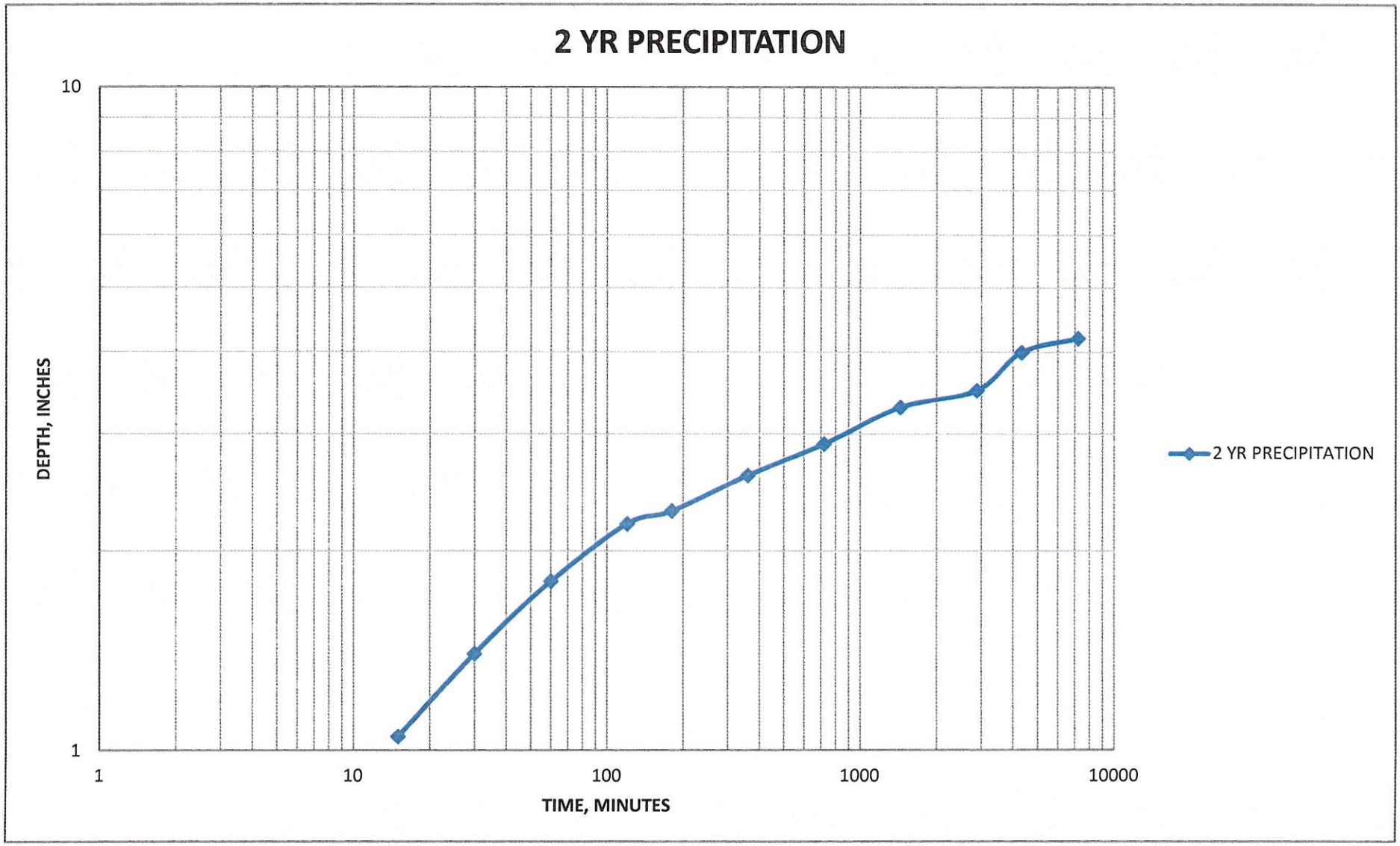
A = drainage area (ac or ha)

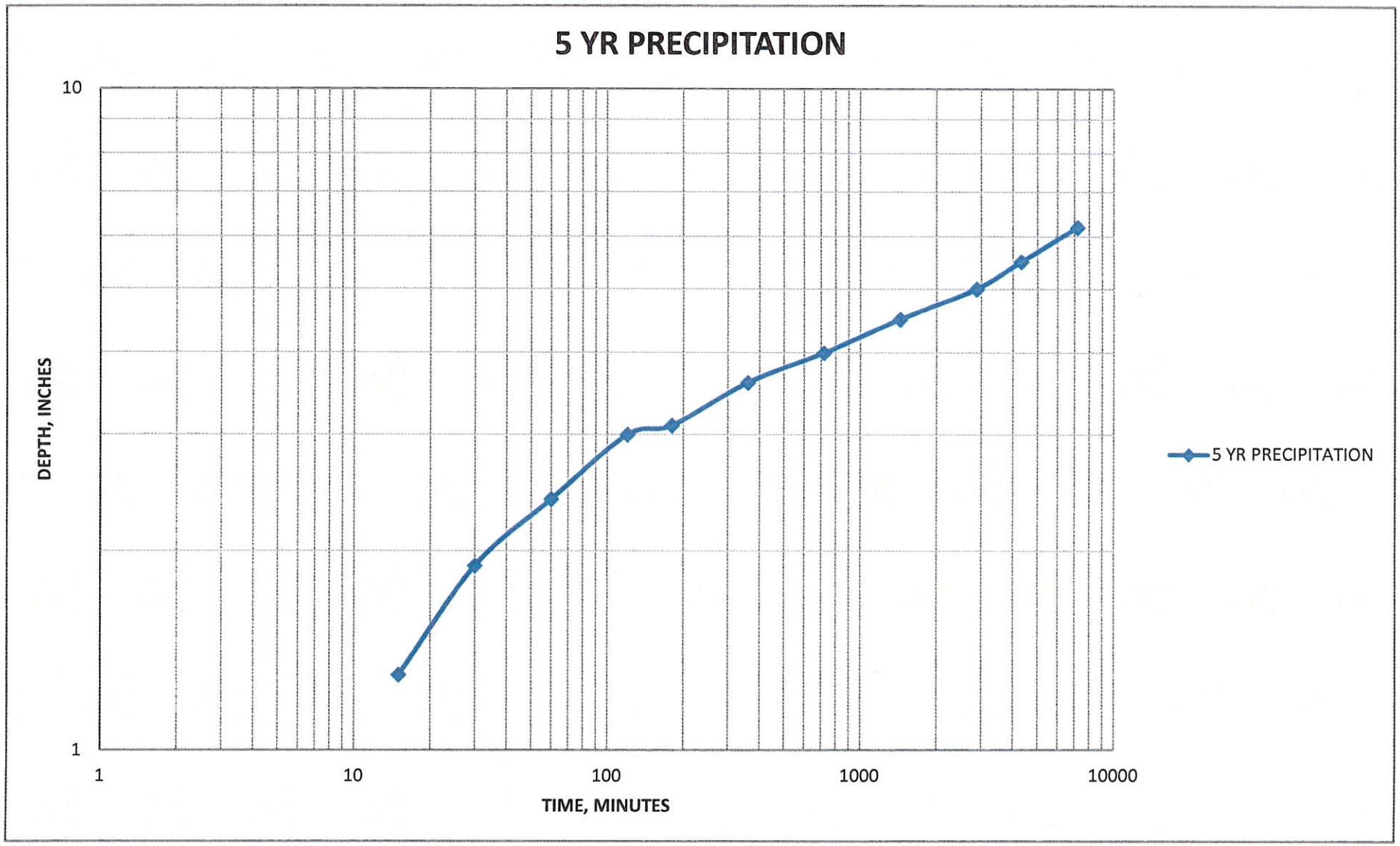
Z = conversion factor, 1 for English, 360 for metric

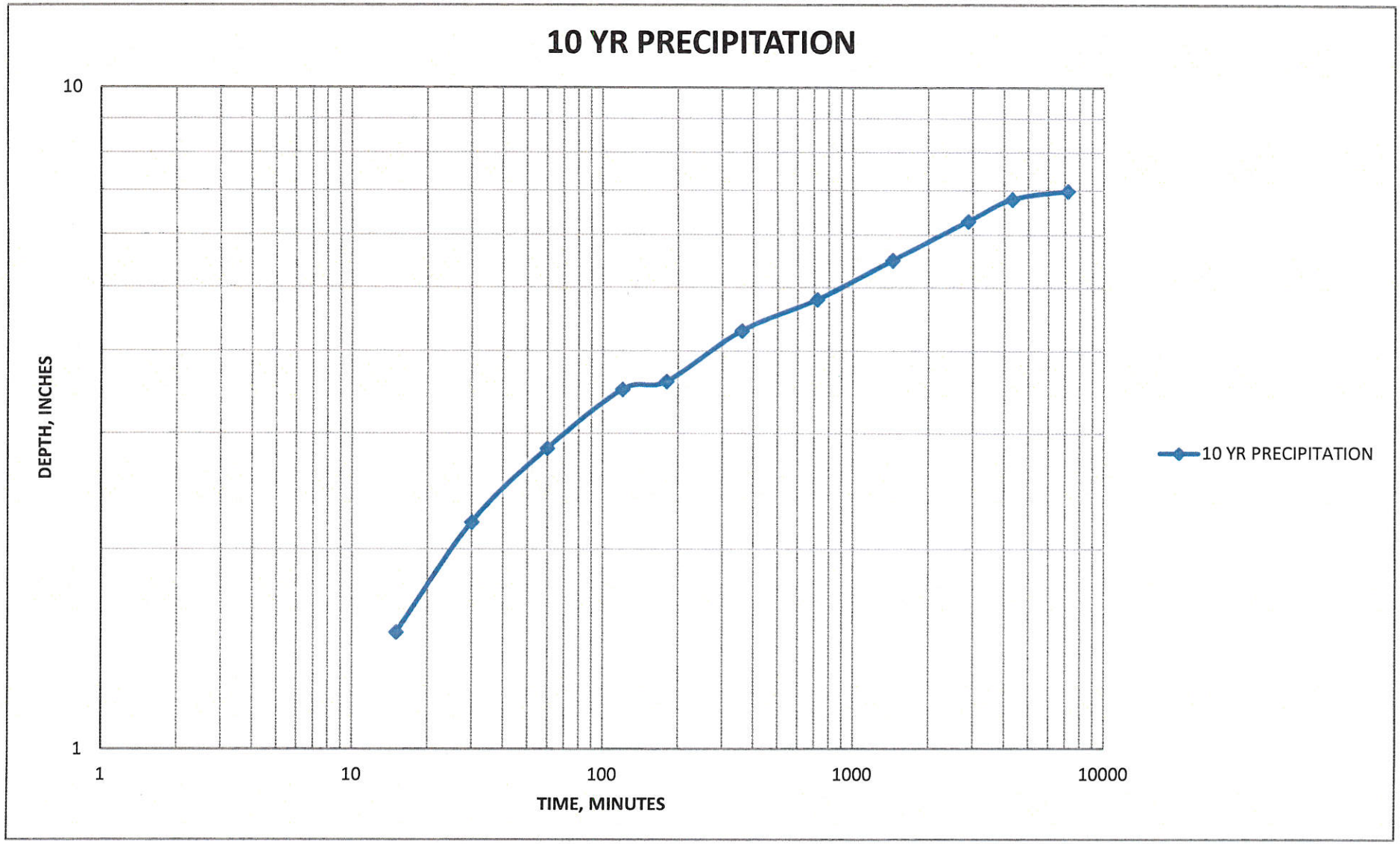
AEP DESIGN STORM	STORM FREQUENCY	FLOW RUNOFF, Q
(%)	(YR)	(CFS)
50	2	40.71
20	5	54.50
10	10	64.51
4	25	77.37
2	50	90.28
1	100	100.90

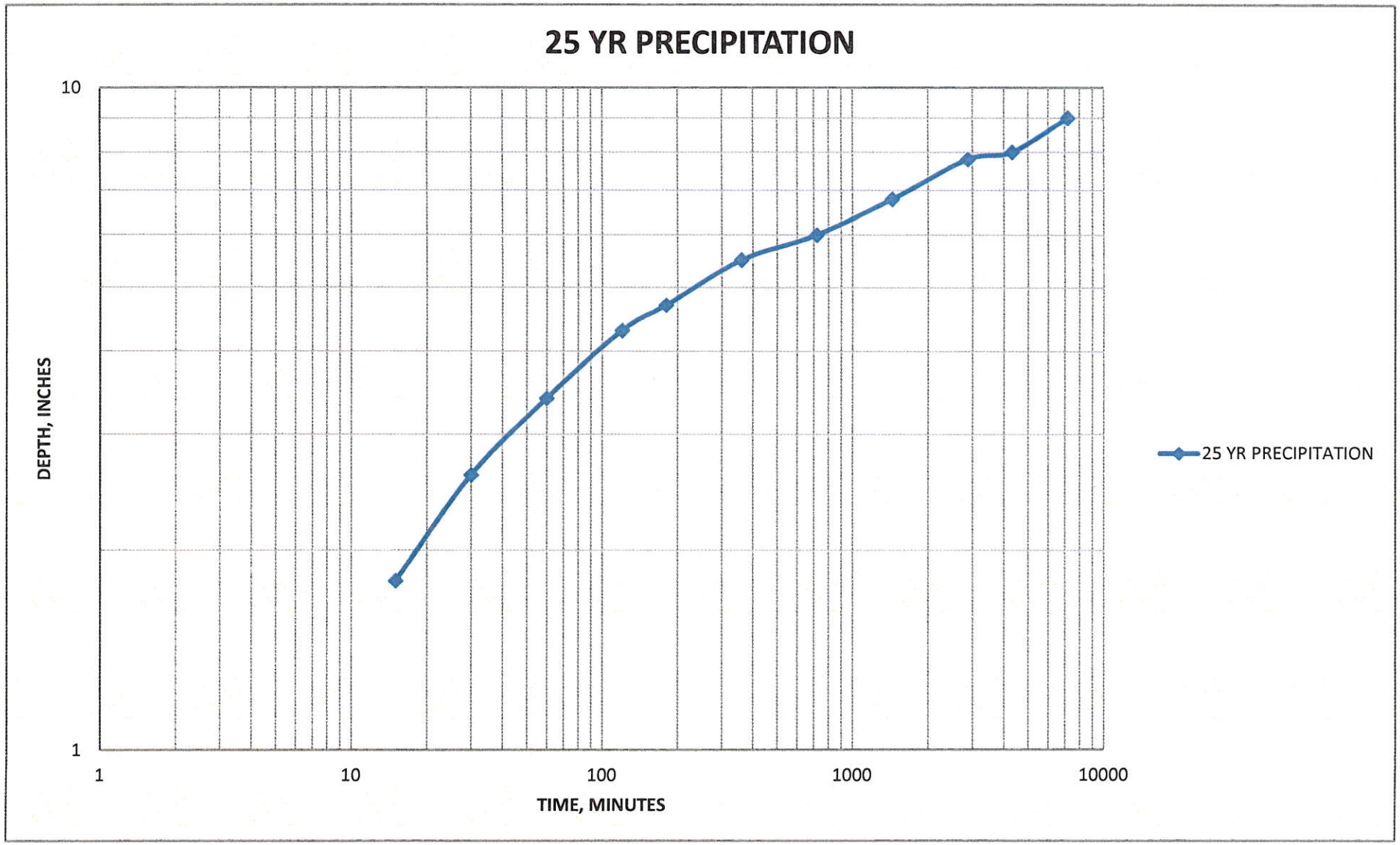
119 19.83333

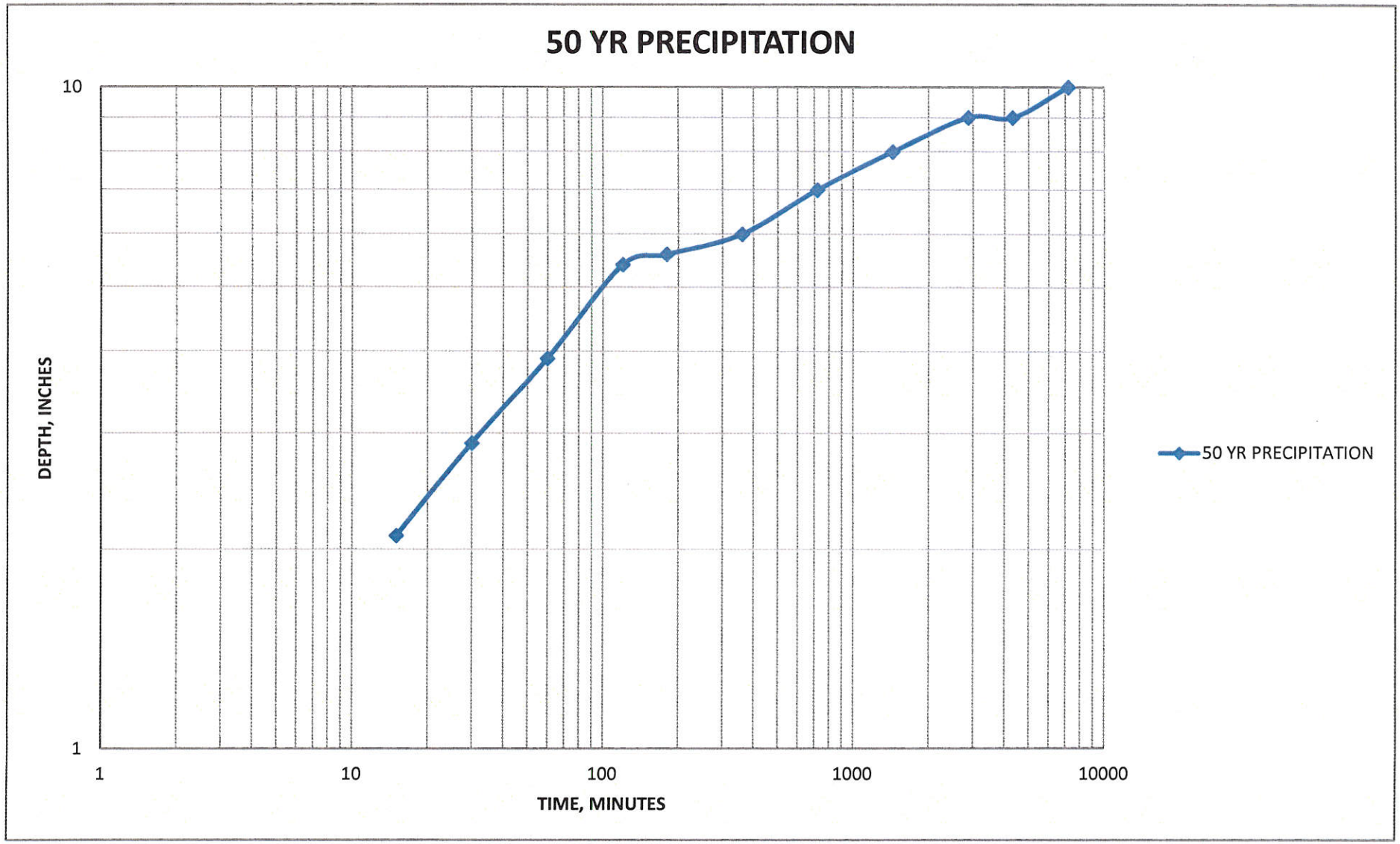
RUNOFF COEFFICIENTS FOR RURAL WATERSHEDS			
WATERSHED CHARACTERISTIC	RUNOFF COEFFICIENT (MIN)	RUNOFF COEFFICIENT (AVG)	RUNOFF COEFFICIENT (MAX)
Relief (Cr) - N/A	0.00	0.00	0.00
Relief (Cr) - Extreme	0.28	0.32	0.35
Relief (Cr) - High	0.20	0.24	0.28
Relief (Cr) - Normal	0.14	0.17	0.20
Relief (Cr) - Low	0.08	0.11	0.14
Soil Infiltration (Ci) - N/A	0.00	0.00	0.00
Soil Infiltration (Ci) - Extreme	0.12	0.14	0.16
Soil Infiltration (Ci) - High	0.08	0.10	0.12
Soil Infiltration (Ci) - Normal	0.06	0.07	0.08
Soil Infiltration (Ci) - Low	0.04	0.05	0.06
Vegetal Cover (Cv) - N/A	0.00	0.00	0.00
Vegetal Cover (Cv) - Extreme	0.12	0.14	0.16
Vegetal Cover (Cv) - High	0.08	0.10	0.12
Vegetal Cover (Cv) - Normal	0.06	0.07	0.08
Vegetal Cover (Cv) - Low	0.04	0.05	0.06
Surface Storage (Cs) - N/A	0.00	0.00	0.00
Surface Storage (Cs) - Extreme	0.10	0.11	0.12
Surface Storage (Cs) - High	0.08	0.09	0.10
Surface Storage (Cs) - Normal	0.06	0.07	0.08
Surface Storage (Cs) - Low	0.04	0.05	0.06

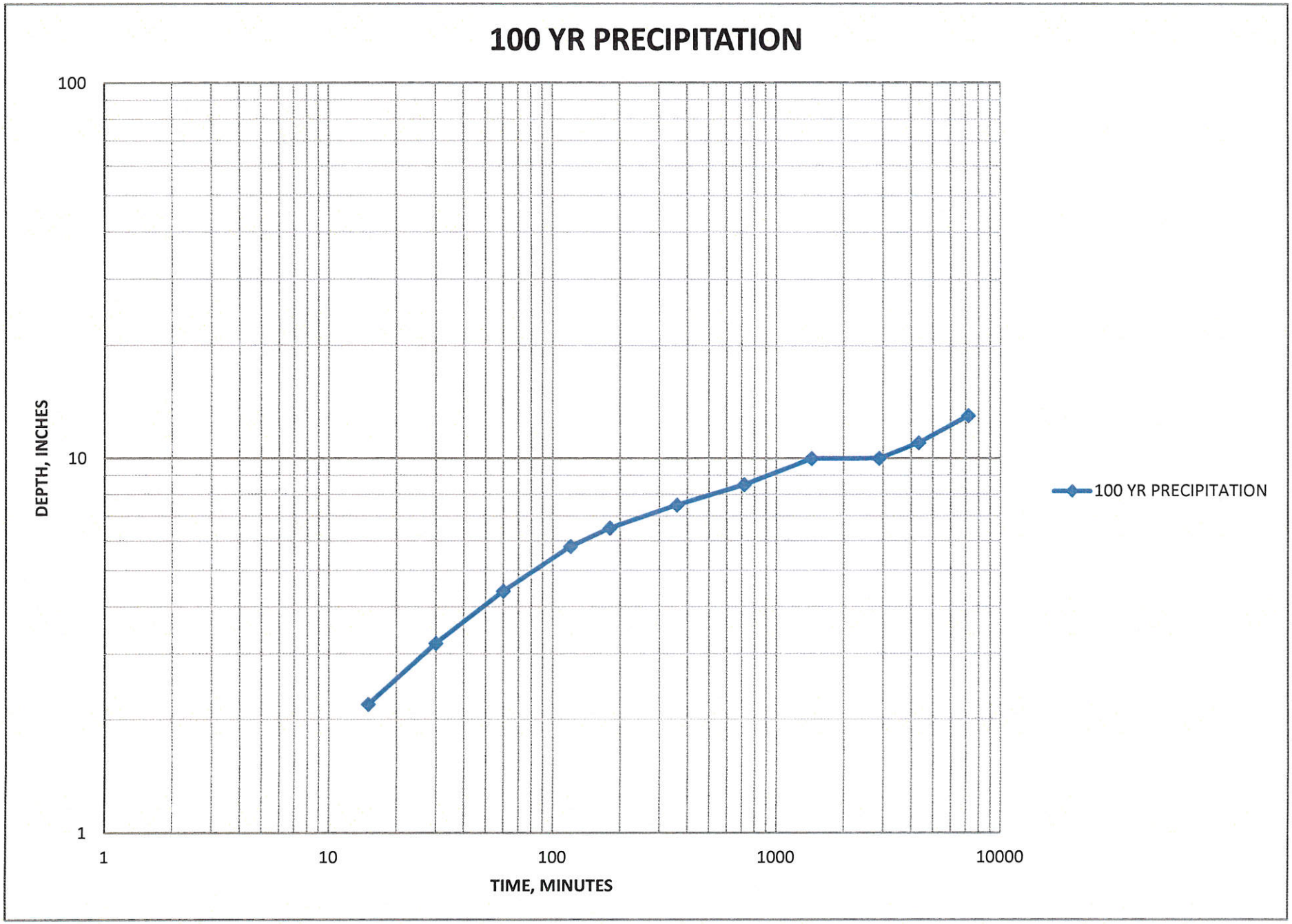

2 YR PRECIPITATION
10
1
DEPTH, INCHES
1
10
100
1000
10000
TIME, MINUTES
2 YR PRECIPITATION


5 YR PRECIPITATION
10
1
DEPTH, INCHES
1
10
100
1000
10000
TIME, MINUTES
5 YR PRECIPITATION


10 YR PRECIPITATION
10
1
DEPTH, INCHES
1
10
100
1000
10000
TIME, MINUTES
10 YR PRECIPITATION


25 YR PRECIPITATION
10
1
DEPTH, INCHES
1
10
100
1000
10000
TIME, MINUTES
25 YR PRECIPITATION


50 YR PRECIPITATION
10
1
DEPTH, INCHES
1
10
100
1000
10000
TIME, MINUTES
50 YR PRECIPITATION


100 YR PRECIPITATION
100
10
1
DEPTH, INCHES
1
10
100
1000
10000
TIME, MINUTES
100 YR PRECIPITATION

HYDROLOGIC SOIL GROUPS				
SOIL GROUP	DESCRIPTION	SOIL TYPE	RANGE OF LOSS RATES	
			(IN/HR)	(MM/HR)
A	Low runoff potential due to high infiltration rates even when saturated	Deep sand, deep loess, aggregated silts	0.30-0.45	7.6-11.4
B	Moderately low runoff potential due to moderate infiltration rates when saturated	Shallow loess, sandy loam	0.15-0.30	3.8-7.6
C	Moderately high runoff potential due to slow infiltration rates; Soils in which a layer near the surface impedes the downward movement of water or soils with moderately fine to fine texture	Clay loams, shallow sandy loam, soils low in organic content, and soils usually high in clay	0.05-0.15	1.3-3.8
D	High runoff potential due to very slow infiltration rates	Soils that swell significantly when wet, heavy plastic, clays, and certain saline soils	0.00-0.05	1.3

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA1)

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	4.6	37.1%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	2.6	21.2%
31	Hidalgo-Urban land complex, 0 to 1 percent slopes	B	5.1	41.7%
Totals for Area of Interest			**12.3**	**100.0%**

Description

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

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

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

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

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

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

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

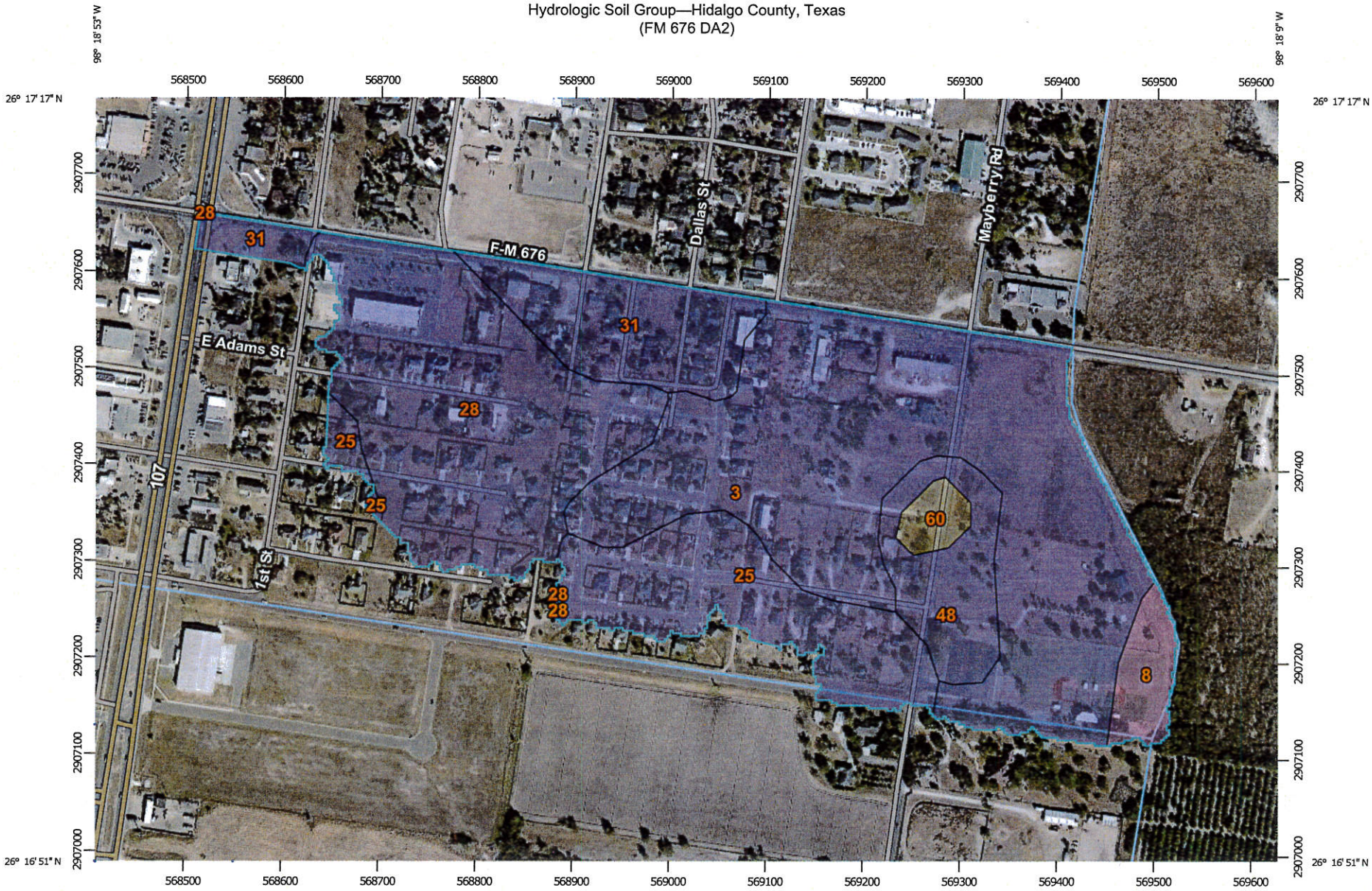
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA2)



Map Scale: 1:5,570 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	31.3	41.6%
8	Comitas loamy fine sand, 0 to 3 percent slopes	A	2.0	2.6%
25	Hidalgo fine sandy loam, 0 to 1 percent slopes	B	10.0	13.3%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	18.6	24.8%
31	Hidalgo-Urban land complex, 0 to 1 percent slopes	B	7.7	10.2%
48	Racombes sandy clay loam	B	4.6	6.1%
60	Rio clay loam	C/D	1.0	1.4%
Totals for Area of Interest			**75.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA3)

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	5.0	83.5%
46	Pits, caliche	D	0.7	11.3%
48	Racombes sandy clay loam	B	0.3	5.1%
51	Randado-Cuevitas complex, 0 to 3 percent slopes	D	0.0	0.0%
Totals for Area of Interest			**5.9**	**100.0%**

Description

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

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

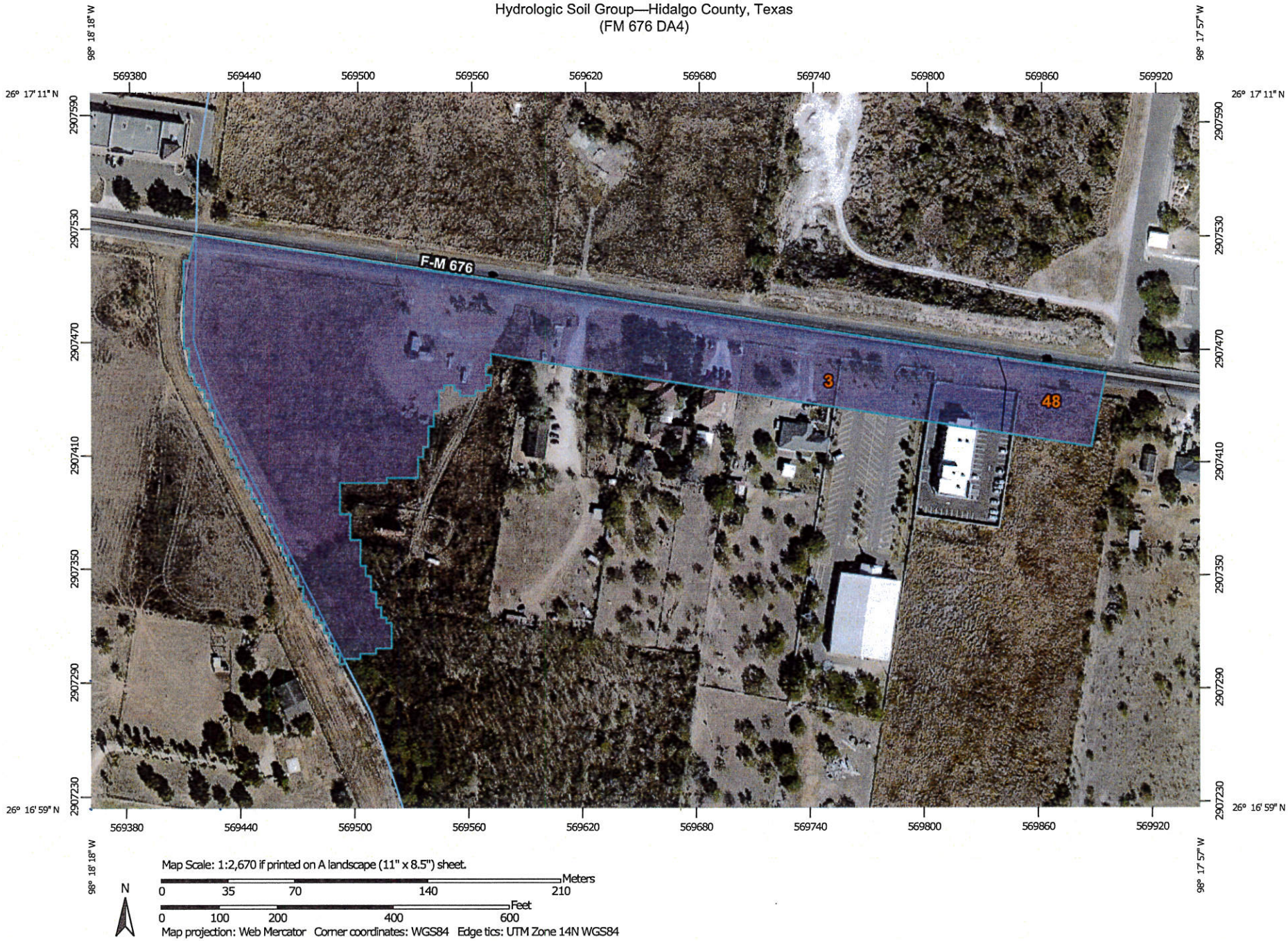
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA4)



MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	7.6	93.8%
48	Racombes sandy clay loam	B	0.5	6.2%
Totals for Area of Interest			**8.1**	**100.0%**

Description

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

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

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

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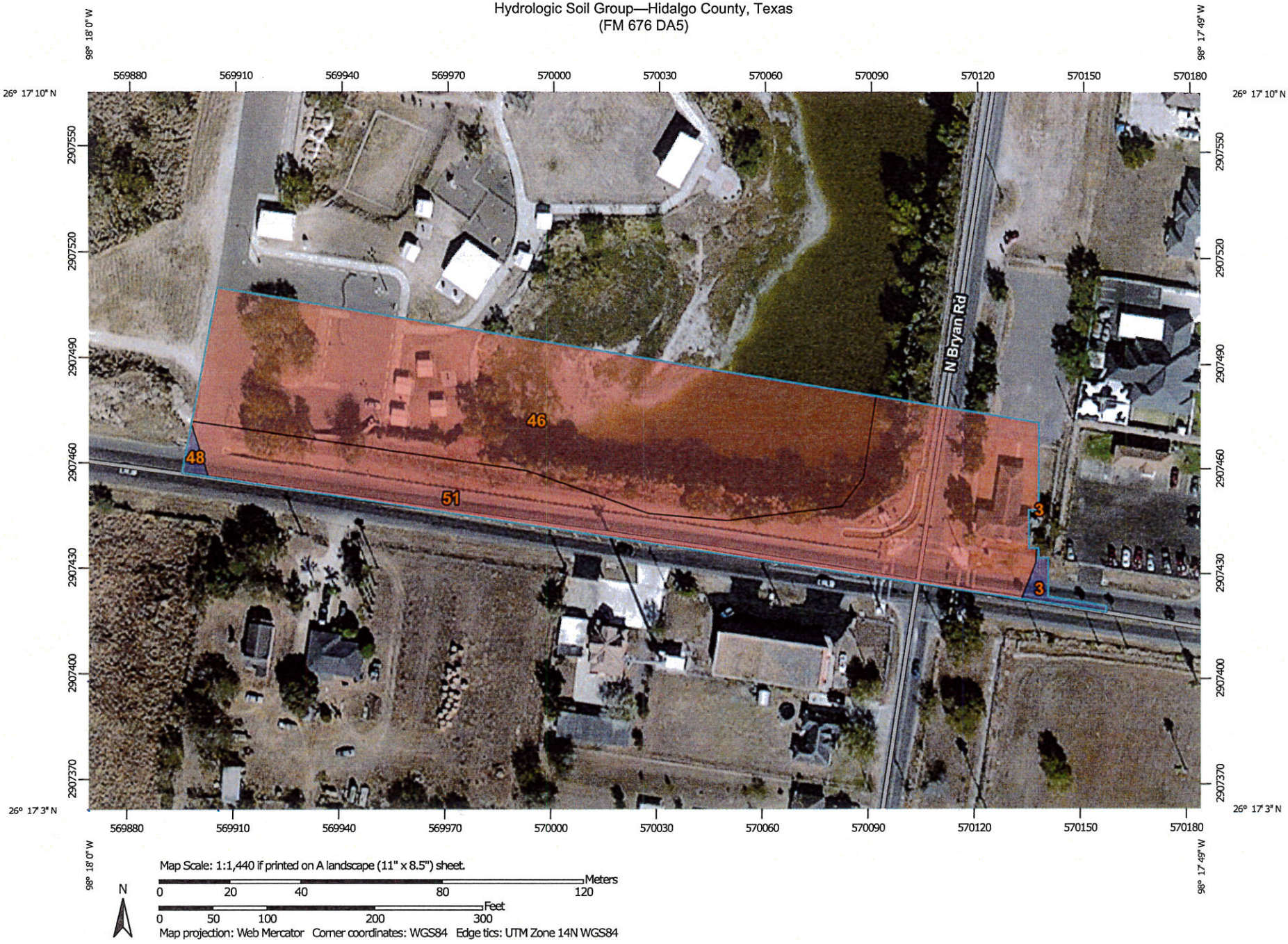
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA5)



Map Scale: 1:1,440 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	0.0	0.8%
46	Pits, caliche	D	1.8	58.4%
48	Racombes sandy clay loam	B	0.0	0.4%
51	Randado-Cuevitas complex, 0 to 3 percent slopes	D	1.3	40.4%
Totals for Area of Interest			**3.1**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA6)

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	0.3	9.8%
48	Racombes sandy clay loam	B	0.2	6.1%
51	Randado-Cuevitas complex, 0 to 3 percent slopes	D	2.2	84.2%
Totals for Area of Interest			2.6	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA7)

Map Scale: 1:2,330 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	5.3	100.0%
Totals for Area of Interest			5.3	100.0%

Description

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

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

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

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

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

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

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

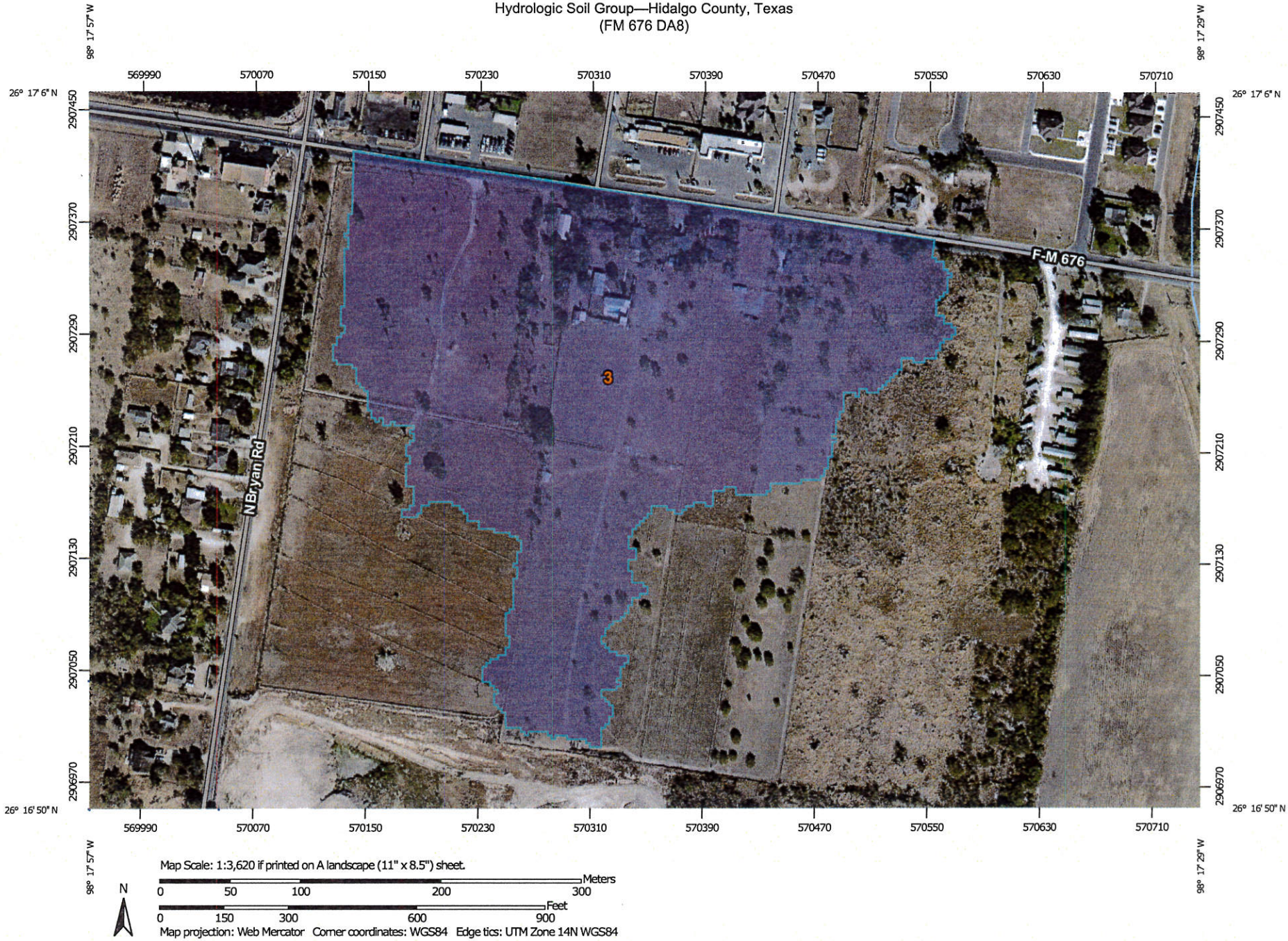
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA8)



MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	24.1	100.0%
Totals for Area of Interest			24.1	100.0%

Description

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

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

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

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

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

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

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

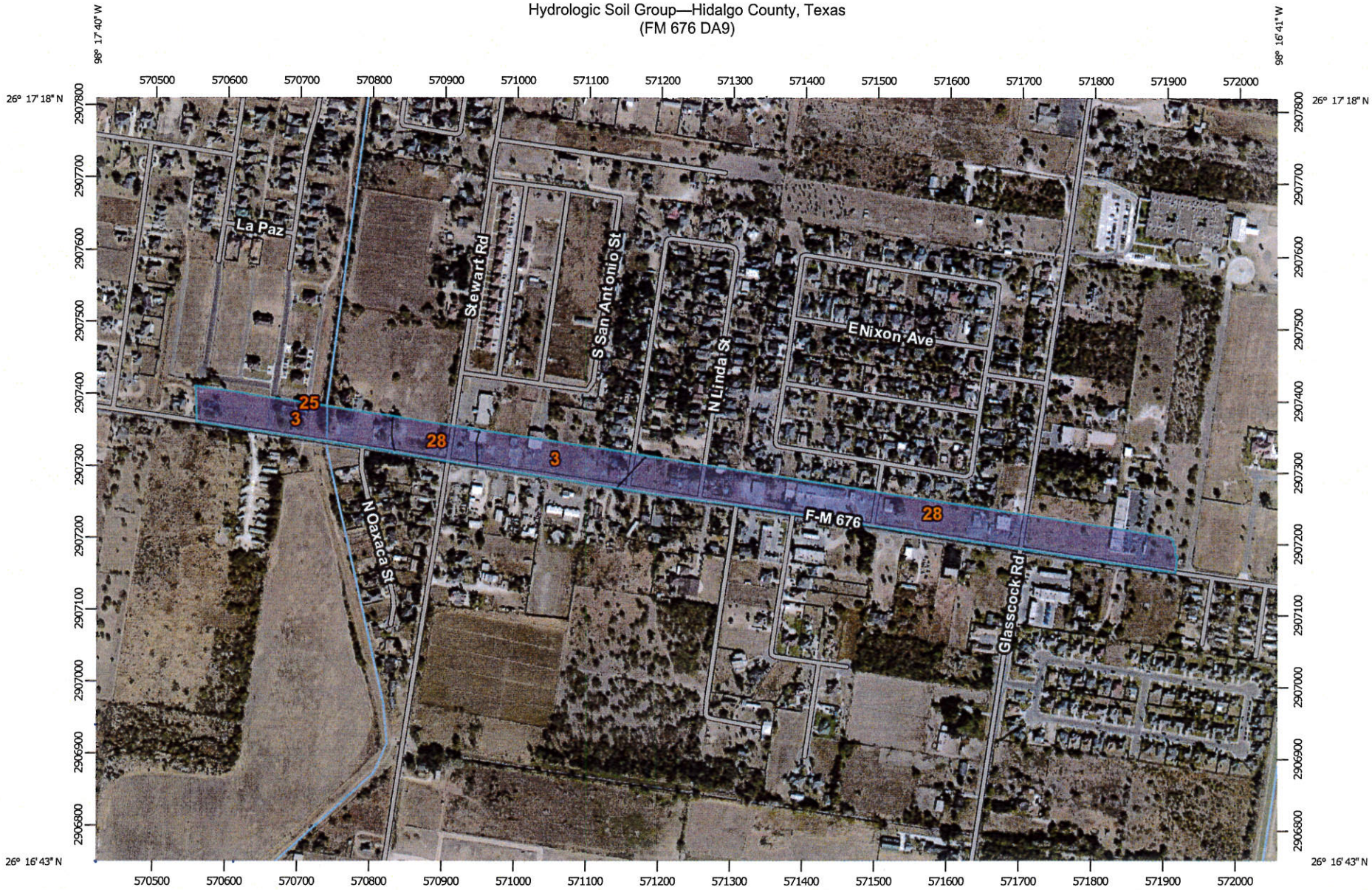
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA9)



MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

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

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

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	6.1	36.2%
25	Hidalgo fine sandy loam, 0 to 1 percent slopes	B	0.0	0.0%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	10.7	63.8%
Totals for Area of Interest			**16.8**	**100.0%**

Description

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

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

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

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

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

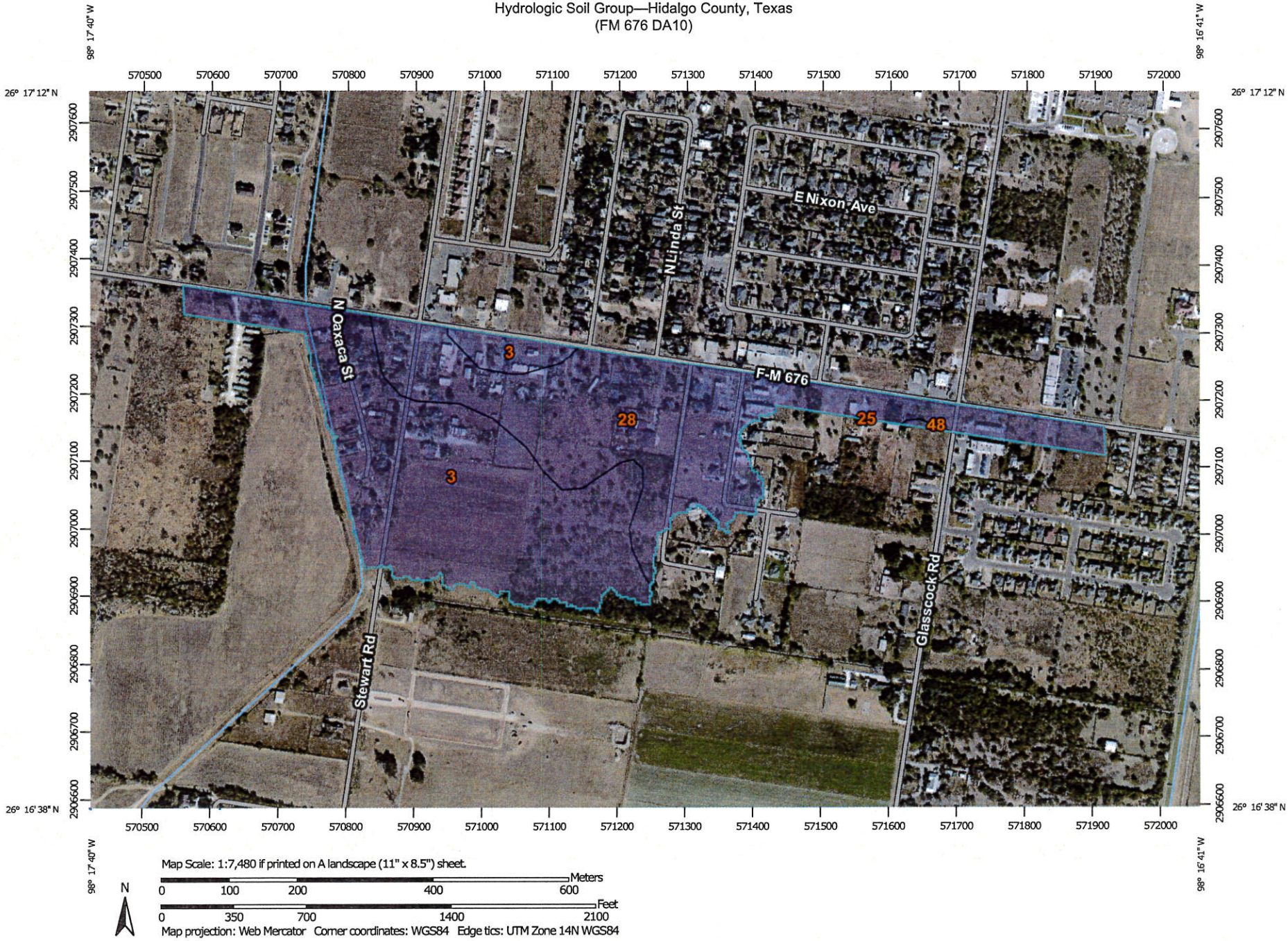
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA10)



USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	32.4	53.4%
25	Hidalgo fine sandy loam, 0 to 1 percent slopes	B	0.0	0.0%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	28.1	46.4%
48	Racombes sandy clay loam	B	0.1	0.2%
Totals for Area of Interest			**60.6**	**100.0%**

Description

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

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

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

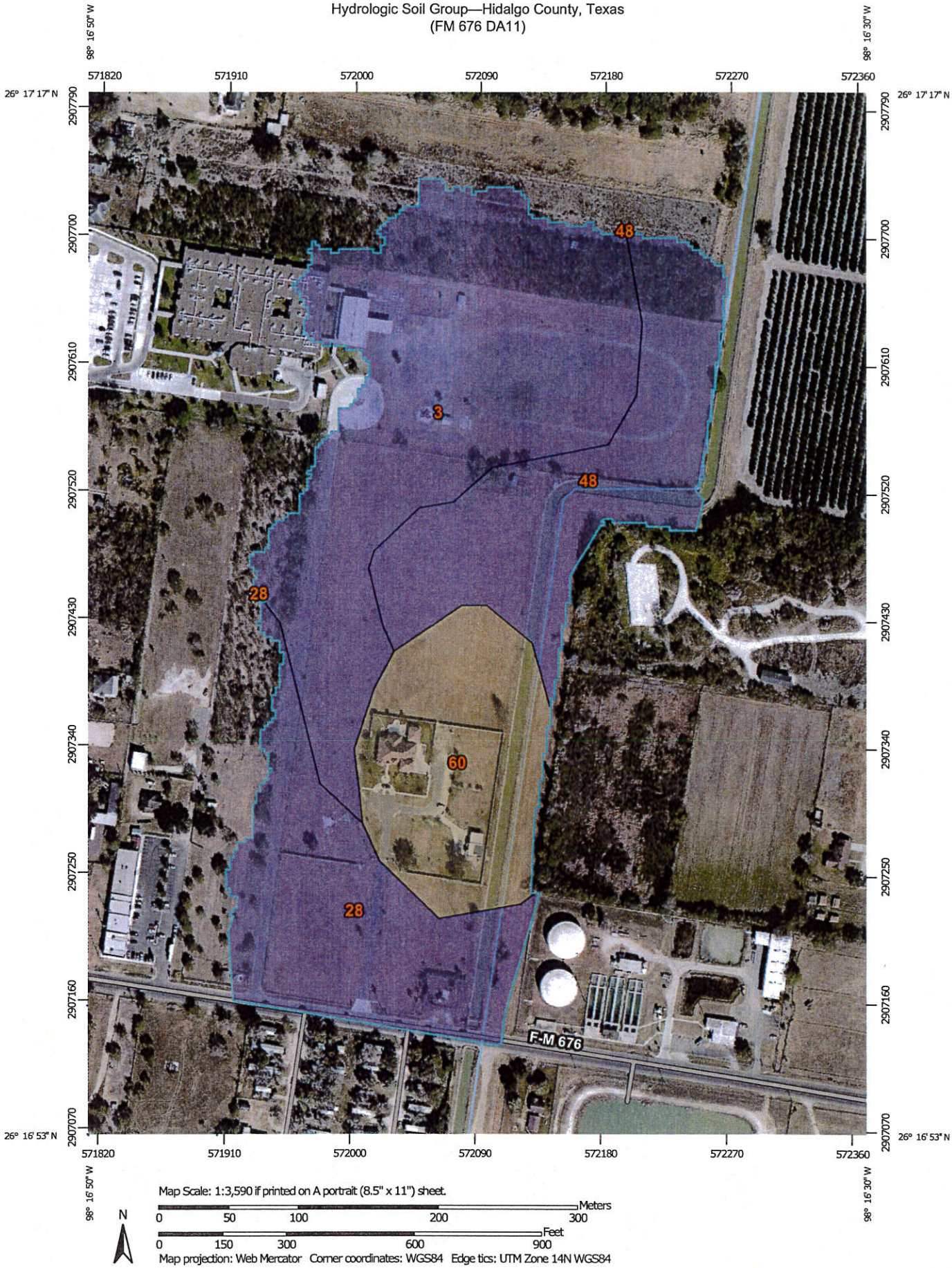
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA11)



MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	13.5	40.6%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	6.8	20.5%
48	Racombes sandy clay loam	B	7.1	21.2%
60	Rio clay loam	C/D	5.9	17.7%
Totals for Area of Interest			**33.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA12)

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	1.9	100.0%
Totals for Area of Interest			**1.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA13)

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	5.7	38.6%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	9.1	61.4%
Totals for Area of Interest			**14.8**	**100.0%**

Description

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

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

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

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

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

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

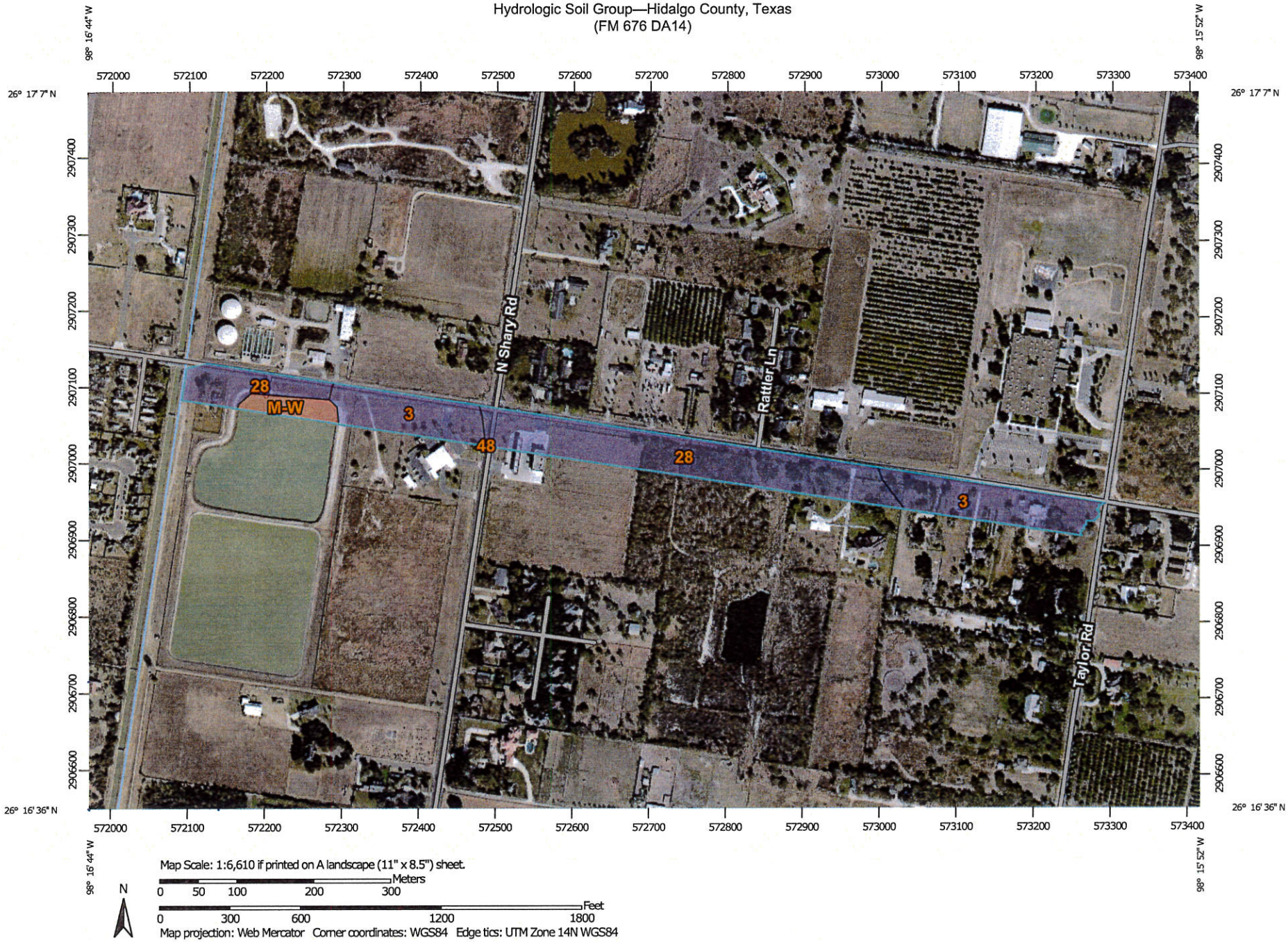
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA14)



MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Dec 10, 2010—Jan 25, 2011

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	5.8	38.5%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	8.5	56.3%
48	Racombes sandy clay loam	B	0.0	0.0%
M-W	Miscellaneous water	D	0.8	5.2%
Totals for Area of Interest			**15.1**	**100.0%**

Description

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

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

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

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

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

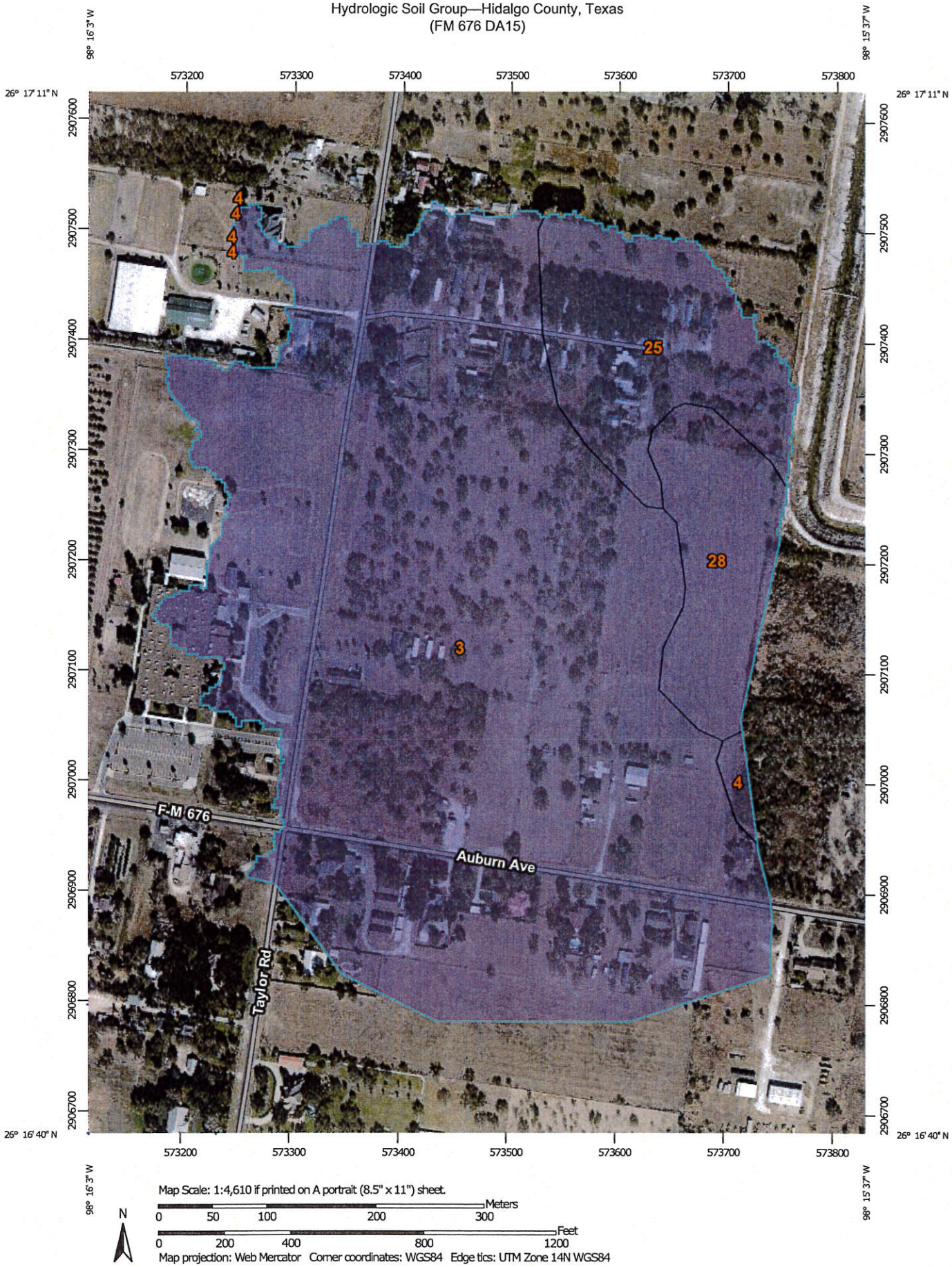
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—Hidalgo County, Texas
(FM 676 DA15)



Map Scale: 1:4,610 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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Coordinate System: Web Mercator (EPSG:3857)

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Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Hidalgo County, Texas (TX215)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Brennan fine sandy loam, 0 to 1 percent slopes	B	67.8	80.8%
4	Brennan fine sandy loam, 0 to 3 percent slopes	B	0.5	0.6%
25	Hidalgo fine sandy loam, 0 to 1 percent slopes	B	9.4	11.2%
28	Hidalgo sandy clay loam, 0 to 1 percent slopes	B	6.2	7.4%
Totals for Area of Interest			**83.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hidalgo County, Texas

3—Brennan fine sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t8bl
Elevation: 70 to 600 feet
Mean annual precipitation: 19 to 24 inches
Mean annual air temperature: 72 to 74 degrees F
Frost-free period: 295 to 330 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Brennan and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brennan

Setting

Landform: Sand sheets
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands and/or calcareous loamy alluvium

Typical profile

A - 0 to 12 inches: fine sandy loam
Bt - 12 to 26 inches: sandy clay loam
Bk - 26 to 40 inches: sandy clay loam
BCk - 40 to 80 inches: sandy 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: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to slightly saline (1.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: Sandy loam 20-30" pz (R083EY702TX)

Minor Components

Delmita
Percent of map unit: 5 percent

Mcallen
Percent of map unit: 5 percent

Ramadero
Percent of map unit: 3 percent

Zapata
Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

4—Brennan fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2t8bn
Elevation: 70 to 600 feet
Mean annual precipitation: 17 to 24 inches
Mean annual air temperature: 72 to 74 degrees F
Frost-free period: 295 to 330 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Brennan and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brennan

Setting

Landform: Sand sheets
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands and/or calcareous loamy alluvium

Typical profile

A - 0 to 10 inches: fine sandy loam
Btk - 10 to 35 inches: sandy clay loam
Bk - 35 to 50 inches: sandy clay loam
BCk - 50 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to slightly saline (1.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: Sandy loam 20-30" pz (R083EY702TX)

Minor Components

Copita
Percent of map unit: 10 percent

Hebbronville
Percent of map unit: 3 percent

Tela
Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

8—Comitas loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2sxvh
Elevation: 30 to 750 feet
Mean annual precipitation: 19 to 25 inches
Mean annual air temperature: 70 to 74 degrees F
Frost-free period: 270 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Comitas and similar soils: 83 percent
Minor components: 17 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Comitas

Setting

Landform: Sand sheets
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands over alluvium and/or eolian deposits

Typical profile

A - 0 to 31 inches: loamy fine sand
Bt - 31 to 59 inches: fine sandy loam
Btk - 59 to 80 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A

Ecological site: Loamy sand 25-30" pz (R083EY705TX)

Minor Components

Sarita

Percent of map unit: 4 percent
Landform: Dunes on sand sheets
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy 20-28" pz (R083EY706TX)

Nueces

Percent of map unit: 4 percent
Landform: Sand sheets
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Sandy 20-28" pz (R083EY706TX)

Brennan

Percent of map unit: 3 percent
Landform: Sand sheets
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy loam 20-30" pz (R083EY702TX)

Falfurrias

Percent of map unit: 3 percent
Landform: Dunes on sand sheets
Landform position (two-dimensional): Summit, shoulder, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex, linear
Ecological site: Sand hills 20-28" pz (R083EY707TX)

Delmita

Percent of map unit: 3 percent
Landform: Sand sheets
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy sand 25-30" pz (R083EY705TX)

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

25—Hidalgo fine sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2sxvn
Elevation: 20 to 500 feet
Mean annual precipitation: 20 to 27 inches
Mean annual air temperature: 72 to 74 degrees F
Frost-free period: 300 to 365 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hidalgo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hidalgo

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

Ap - 0 to 17 inches: fine sandy loam
Bk1 - 17 to 28 inches: sandy clay loam
Bk2 - 28 to 38 inches: clay loam
Ck - 38 to 80 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: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: B
Ecological site: Gray sandy loam 20-25" pz (R083DY501TX)

Minor Components

Willacy
Percent of map unit: 10 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy loam 25-35" pz (R083DY519TX)

Brennan
Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy loam 20-30" pz (R083EY702TX)

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

28—Hidalgo sandy clay loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2sxvl
Elevation: 20 to 500 feet
Mean annual precipitation: 20 to 27 inches
Mean annual air temperature: 72 to 74 degrees F
Frost-free period: 300 to 365 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Hidalgo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hidalgo

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

Ap - 0 to 17 inches: sandy clay loam
Bk1 - 17 to 28 inches: sandy clay loam
Bk2 - 28 to 38 inches: clay loam
Ck - 38 to 80 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: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 2c

Hydrologic Soil Group: B
Ecological site: Gray sandy loam 20-25" pz (R083DY501TX)

Minor Components

Raymondville
Percent of map unit: 7 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clay loam 20-25" pz (R083DY493TX)

Racombes
Percent of map unit: 6 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clay loam 20-25" pz (R083DY493TX)

Willacy
Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy loam 25-35" pz (R083DY519TX)

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

30—Hidalgo sandy clay loam, saline, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: dbl8
Elevation: 50 to 300 feet
Mean annual precipitation: 18 to 22 inches
Mean annual air temperature: 72 to 73 degrees F
Frost-free period: 320 to 340 days
Farmland classification: Not prime farmland

Map Unit Composition

Hidalgo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hidalgo

Setting

Landform: Delta plains
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Calcareous loamy alluvium

Typical profile

H1 - 0 to 17 inches: sandy clay loam
H2 - 17 to 28 inches: sandy clay loam
H3 - 28 to 80 inches: sandy 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: About 30 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 20.0
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: Gray sandy loam 20-25" pz (R083DY501TX)

Minor Components

Unnamed

Percent of map unit: 15 percent

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

31—Hidalgo-Urban land complex, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t12b
Elevation: 20 to 500 feet
Mean annual precipitation: 20 to 27 inches
Mean annual air temperature: 72 to 74 degrees F
Frost-free period: 300 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Hidalgo and similar soils: 65 percent
Urban land: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hidalgo

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

Ap - 0 to 17 inches: sandy clay loam
Bk1 - 17 to 28 inches: sandy clay loam
Bk2 - 28 to 38 inches: clay loam
Ck - 38 to 80 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: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: B
Ecological site: Gray sandy loam 20-25" pz (R083DY501TX)

Description of Urban Land

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Human-transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8e
Hydrologic Soil Group: D

Minor Components

Racombes

Percent of map unit: 4 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clay loam 20-25" pz (R083DY493TX)

Raymondville

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clay loam 20-25" pz (R083DY493TX)

Willacy

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy loam 25-35" pz (R083DY519TX)

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

45—Pits, borrow

Map Unit Setting

National map unit symbol: dbls
Elevation: 50 to 850 feet
Mean annual precipitation: 20 to 41 inches
Mean annual air temperature: 64 to 73 degrees F
Frost-free period: 225 to 325 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Typical profile

H1 - 0 to 80 inches: variable

Properties and qualities

Slope: 1 to 30 percent
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (0.57 to 19.98 in/hr)
Frequency of flooding: Occasional

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Other vegetative classification: ON SITE INVESTIGATION IS NEEDED (000XY999TX)

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

46—Pits, caliche

Map Unit Setting

National map unit symbol: dblt
Elevation: 20 to 8,750 feet
Mean annual precipitation: 9 to 56 inches
Mean annual air temperature: 54 to 73 degrees F
Frost-free period: 180 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Typical profile

H1 - 0 to 80 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

48—Racombes sandy clay loam

Map Unit Setting

National map unit symbol: dblw
Elevation: 20 to 400 feet
Mean annual precipitation: 23 to 30 inches
Mean annual air temperature: 70 to 73 degrees F
Frost-free period: 280 to 350 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Racombes and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Racombes

Setting

Landform: Delta plains
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Calcareous loamy alluvium

Typical profile

H1 - 0 to 13 inches: sandy clay loam
H2 - 13 to 49 inches: sandy clay loam
H3 - 49 to 72 inches: sandy clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately 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: About 42 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to slightly saline (1.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 6.0
Available water storage in profile: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: Clay loam 20-25" pz (R083DY493TX)

Minor Components

Unnamed

Percent of map unit: 15 percent
Ecological site: Clay loam 20-25" pz (R083DY493TX)

Rio

Percent of map unit: 5 percent
Landform: Depressions

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

51—Randado-Cuevitas complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: dbm0
Elevation: 80 to 800 feet
Mean annual precipitation: 18 to 28 inches
Mean annual air temperature: 70 to 73 degrees F
Frost-free period: 250 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition

Randado and similar soils: 55 percent
Cuevitas and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Randado

Setting

Landform: Interfluves, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy alluvium

Typical profile

H1 - 0 to 9 inches: fine sandy loam
H2 - 9 to 16 inches: sandy clay loam
H3 - 16 to 20 inches: cemented material
H4 - 20 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 8 to 20 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Shallow sandy loam 20-30" pz (R083CY487TX)

Description of Cuevitas

Setting

Landform: Interfluves, ridges
Landform position (two-dimensional): Summit, shoulder
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy alluvium

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 12 inches: cemented material
H3 - 12 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 8 to 14 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water storage in profile: Very low (about 0.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Shallow sandy loam 20-30" pz (R083CY487TX)

Minor Components

Unnamed

Percent of map unit: 20 percent

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

60—Rio clay loam

Map Unit Setting

National map unit symbol: dbmb
Elevation: 10 to 500 feet
Mean annual precipitation: 18 to 34 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 310 to 350 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Rio and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rio

Setting

Landform: Closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey alluvium

Typical profile

H1 - 0 to 12 inches: clay loam
H2 - 12 to 38 inches: clay
H3 - 38 to 63 inches: clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly 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 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: Clay loam 20-25" pz (R083DY493TX)

Minor Components

Tiocano
Percent of map unit: 8 percent
Landform: Depressions

Unnamed
Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

M-W—Miscellaneous water

Map Unit Composition

Water, miscellaneous: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

Hidalgo County, Texas

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Data Source Information

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 11, Sep 30, 2014

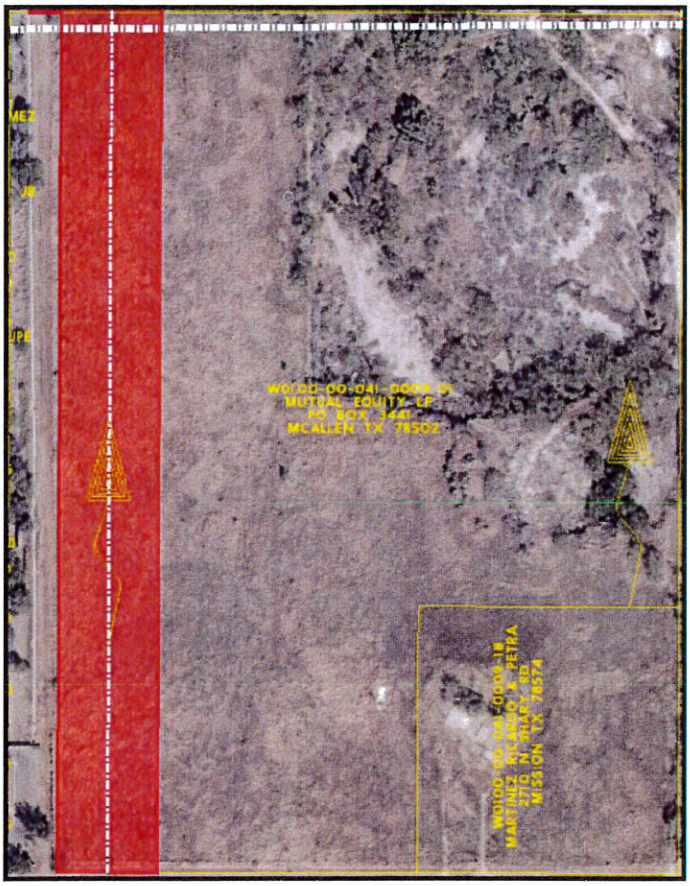
SECTION V - IMPACTS OF DRAINAGE OUTFALLS

L&G Engineering
Transportation Consulting Engineers

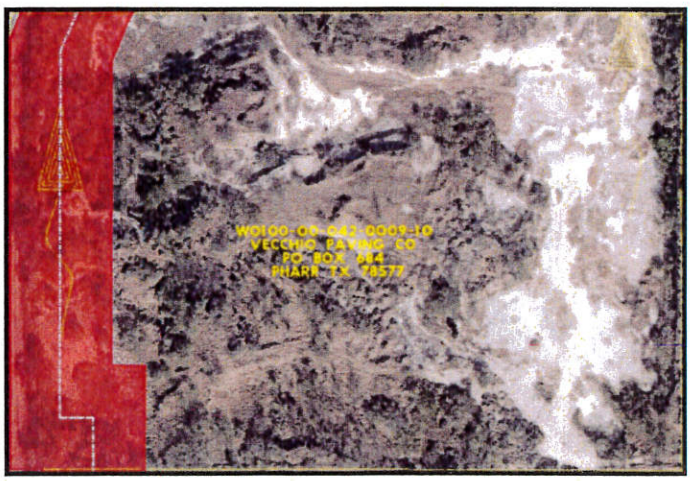
IMPACTS OF DRAINAGE OUTFALLS

L&G Engineering has researched and identified all affected property owners on each of the proposed outfall options alignments utilizing the latest appraisal district file information from Hidalgo County Appraisal District. Additionally, the approximate land affected is based on a preliminary 150 ft of ROW width. Note the affected property owners as follows:

Outfall Option #1 (showing impacts from FM 676 to the North)



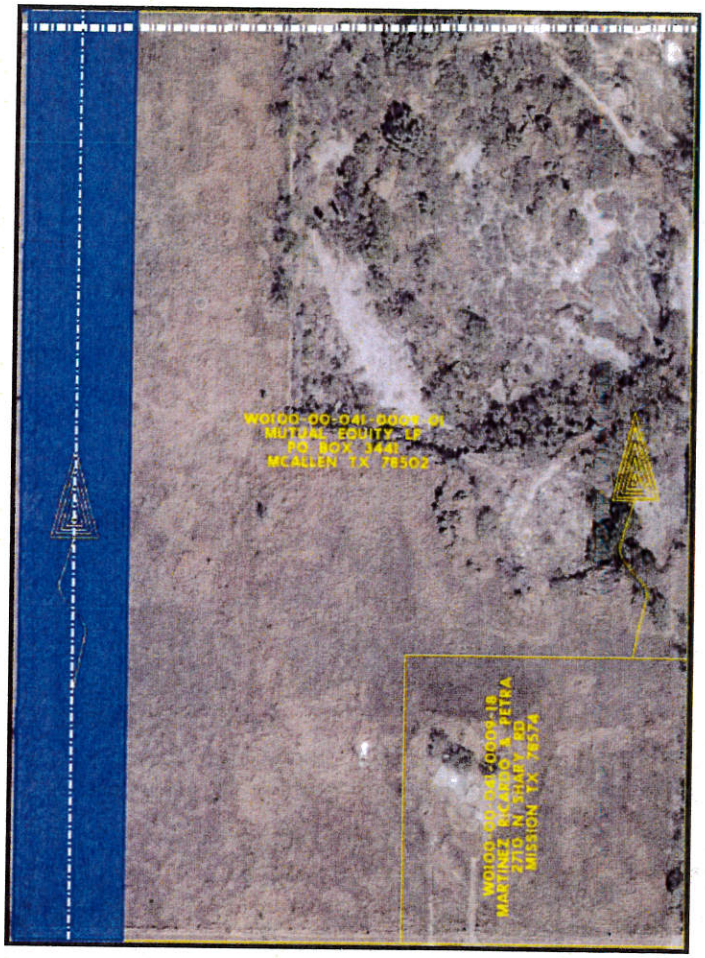
Parcel ID: W0100-00-041-0009-01
Owner: Mutual Equity LP
PO BOX 3441
McAllen, TX 78502
Approx. Land Affected: 4.44 AC



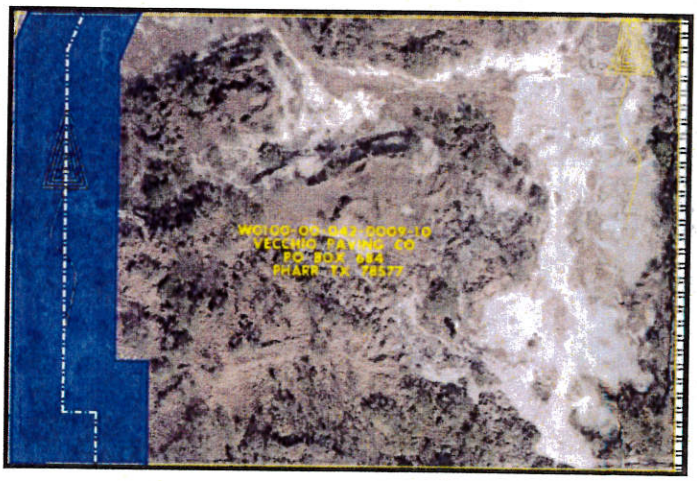
Parcel ID: W0100-00-042-0009-10
Owner: Vecchio Paving Co
PO BOX 684
Pharr, TX 78577
Approx. Land Affected: 2.45 AC

Parcel ID: W0100-00-042-0009-20
Owner: Killinger Martin P & Laura
PO BOX 2555
Mission, TX 78573
Approx. Land Affected: 3.75 AC

Outfall Option #2



Parcel ID: W0100-00-041-0009-01
Owner: Mutual Equity LP
PO BOX 3441
McAllen, TX 78502
Approx. Land Affected: 4.44 AC

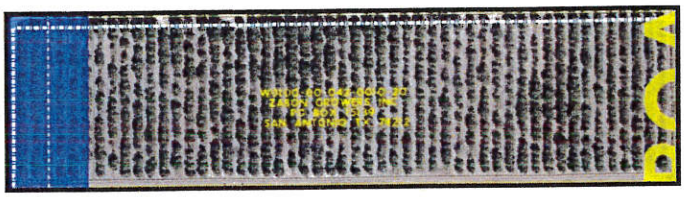


Parcel ID: W0100-00-042-0009-10
Owner: Vecchio Paving Co
PO BOX 684
Pharr, TX 78577
Approx. Land Affected: 2.45 AC

Outfall Option #2 (continued)

Parcel ID: W0100-00-042-0009-20
Owner: Killinger Martin P & Laura
PO BOX 2555
Mission, TX 78573
Approx. Land Affected: 3.61 AC

Parcel ID: W0100-00-042-0010-01
Owner: Skloss Herman
5200 N. 26th ST
McAllen, TX 78504
Approx. Land Affected: 0.60 AC



Parcel ID: W0100-00-042-0010-20
Owner: Zabon Growers Inc.
PO BOX 15139
San Antonio, TX 78212
Approx. Land Affected: 1.13 AC

Parcel ID: W0100-00-043-0010-30
Owner: Eyecue Limited
5200 N. 26th ST
McAllen, TX 78504
Approx. Land Affected: 2.51 AC

Outfall Option #2 (continued)

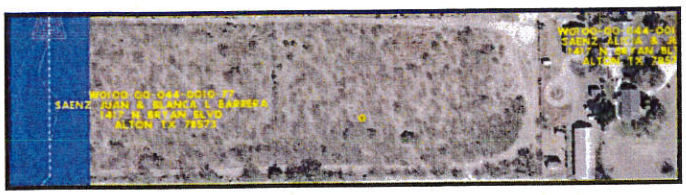
Parcel ID: W0100-00-043-0009-40
Owner: Mora Frank & Rosa
Approx. Land Affected: 1.07 AC

Parcel ID: W0100-00-043-0009-55
Owner: Mora Frank & Rosa
126 W. Westway Ave.
McAllen, TX 78501
Approx. Land Affected: 1.13 AC

Parcel ID: W0100-00-044-0009-39
Owner: Wied Dana
5111 N. 10th ST
McAllen, TX 78504
Approx. Land Affected: 0.50 AC

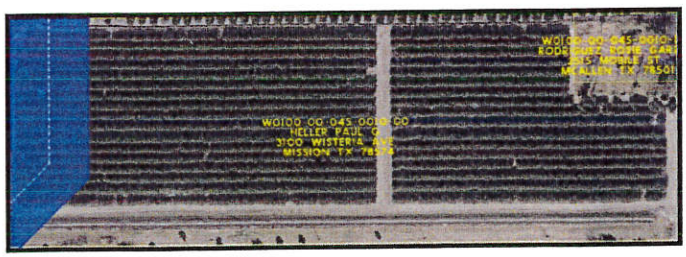
Outfall Option #2 (continued)

Parcel ID: W0100-00-044-0010-18
Owner: Cardenas Alejandro & Consuelo
1313 N. Bryan Blvd.
Alton, TX 78573
Approx. Land Affected: 0.50 AC



Parcel ID: W0100-00-044-0010-77
Owner: Saenz Juan & Blanca
1417 N. Bryan Blvd.
Alton, TX 78573
Approx. Land Affected: 1.13 AC

Parcel ID: W0100-00-044-0009-40
Owner: Garza Vilma Nidia
RR 2 BOX 11 A
Mission, TX 78574
Approx. Land Affected: 2.08 AC

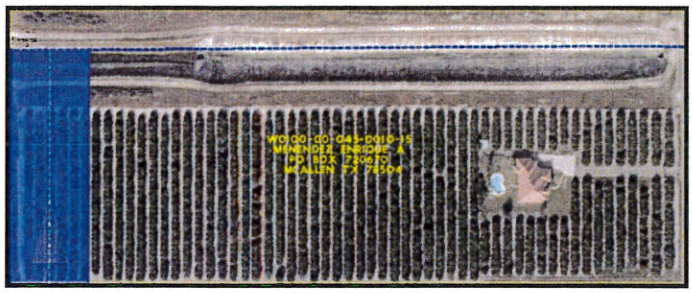


Parcel ID: W0100-00-045-0010-00
Owner: Heller Paul G
3100 Wisteria Ave.
Mission, TX 78574
Approx. Land Affected: 1.33 AC

Parcel ID: Q0800-00-000-0002-00
Owner: Salinas Rigoberto & Sonia
1215 E. Jude
Mission, TX 78573
Approx. Land Affected: 0.14 AC

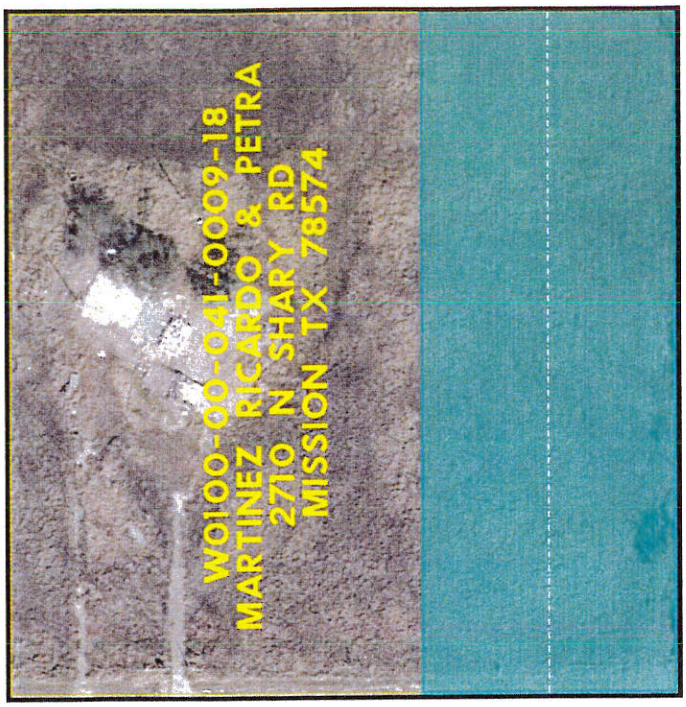
Parcel ID: W0100-00-045-0010-05
Owner: Garcia Jose L & Julia
2401 E. 35th ST.
Mission, TX 78574
Approx. Land Affected: 1.13 AC

Outfall Option #2 (continued)



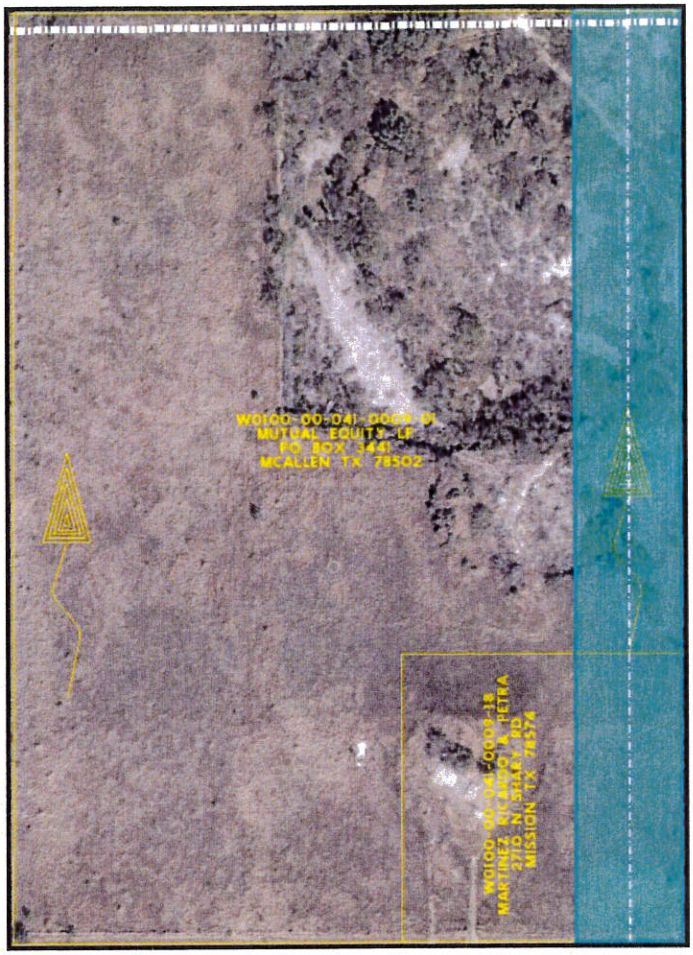
Parcel ID: WO100-00-045-0010-15
Owner: Menendez Enrique A
PO BOX 720670
McAllen, TX 78504
Approx. Land Affected: 1.53 AC

Outfall Option #3



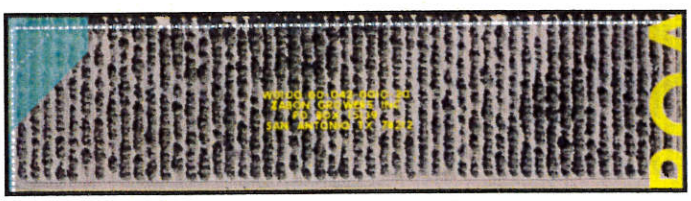
Parcel ID: W0100-00-041-0009-18
Owner: Martinez Ricardo & Petra
2710 N. Shary RD.
Mission, TX 78574
Approx. Land Affected: 1.37 AC

Outfall Option #3 (continued)



Parcel ID: W0100-00-041-0009-01
Owner: Mutual Equity LP
PO BOX 3441
McAllen, TX 78502
Approx. Land Affected: 3.06 AC

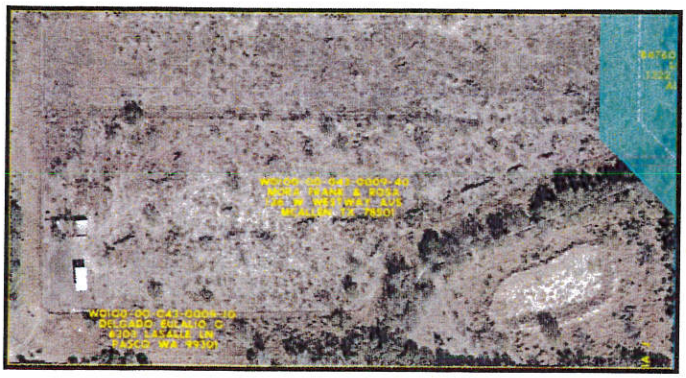
Parcel ID: W0100-00-042-0009-20
Owner: Killinger Martin P & Laura
PO BOX 2555
Mission, TX 78573
Approx. Land Affected: 1.95 AC



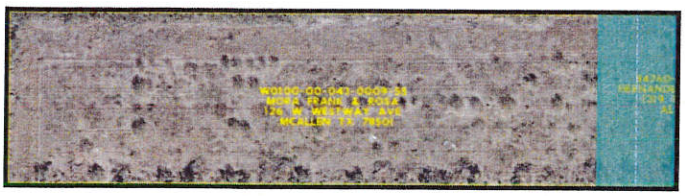
Parcel ID: W0100-00-042-0010-20
Owner: Zabon Growers Inc
PO BOX 15139
San Antonio, TX 78212
Approx. Land Affected: 0.48 AC

Outfall Option #3 (continued)

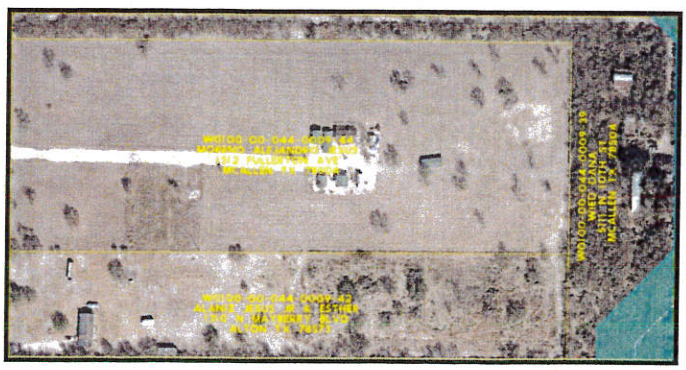
Parcel ID: W0100-00-043-0010-30
Owner: Eyecue Limited
5200 N. 26th ST
McAllen, TX 78504
Approx. Land Affected: 2.51 AC



Parcel ID: W0100-00-043-0009-40
Owner: Mora Frank & Rosa
126 W. Westway Ave.
McAllen, TX 78501
Approx. Land Affected: 1.07 AC



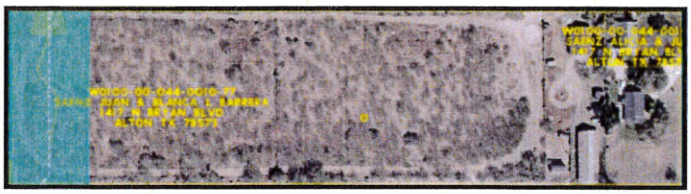
Parcel ID: W0100-00-043-0009-55
Owner: Mora Frank & Rosa
126 W. Westway Ave.
McAllen, TX 78501
Approx. Land Affected: 1.13 AC



Parcel ID: W0100-00-044-0009-39
Owner: Wied Dana
5111 N. 10th ST
McAllen, TX 78504
Approx. Land Affected: 0.05 AC

Outfall Option #3 (continued)

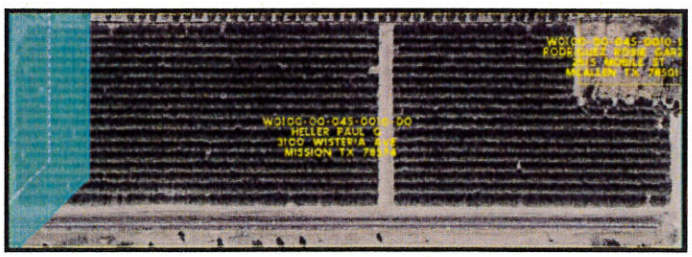
Parcel ID: W0100-00-044-0010-18
Owner: Cardenas Alejandro & Consuelo
1313 N. Bryan Blvd.
Alton, TX 78573
Approx. Land Affected: 0.23 AC



Parcel ID: W0100-00-044-0010-77
Owner: Saenz Juan & Blanca
1417 N. Bryan Blvd.
Alton, TX 78573
Approx. Land Affected: 1.13 AC

Parcel ID: W0100-00-044-0010-35
Owner: Nieto Jesus H & Andres Jr
RR 2 BOX 11 A
Mission, TX 78572
Approx. Land Affected: 1.13 AC

Parcel ID: W0100-00-044-0009-40
Owner: Garza Vilma Nidia
RR 19 BOX 814
Edinburg, TX 78539
Approx. Land Affected: 2.08 AC

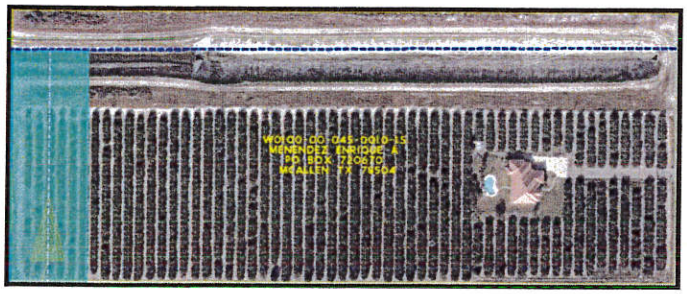


Parcel ID: W0100-00-045-0010-00
Owner: Heller Paul G
3100 Wisteria Ave.
Mission, TX 78574
Approx. Land Affected: 1.33 AC

Outfall Option #3 (continued)

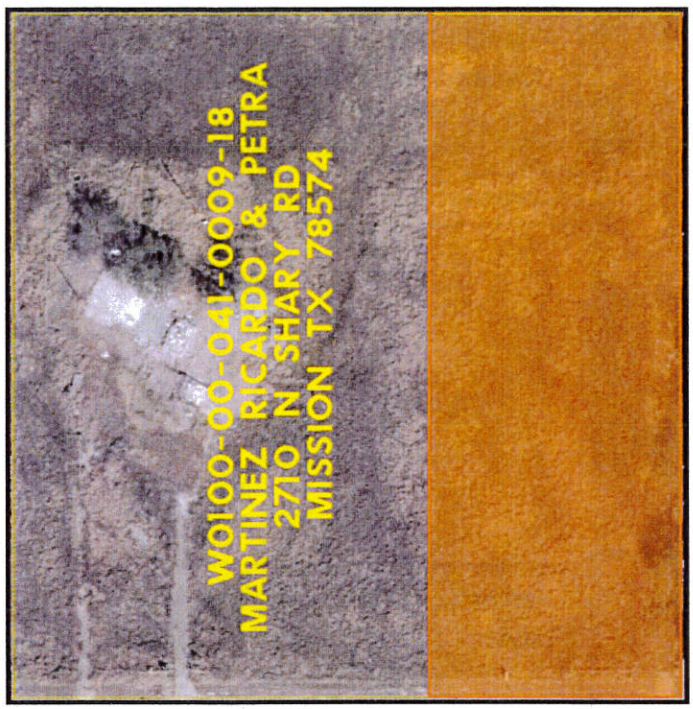
Parcel ID: Q0800-00-000-0002-00
Owner: Salinas Rigoberto & Sonya
1215 E. Jude
Mission, TX 78573
Approx. Land Affected: 0.14 AC

Parcel ID: W0100-00-045-0010-05
Owner: Garcia Jose L & Julia
2401 E. 35th ST.
Mission, TX 78574
Approx. Land Affected: 1.13 AC

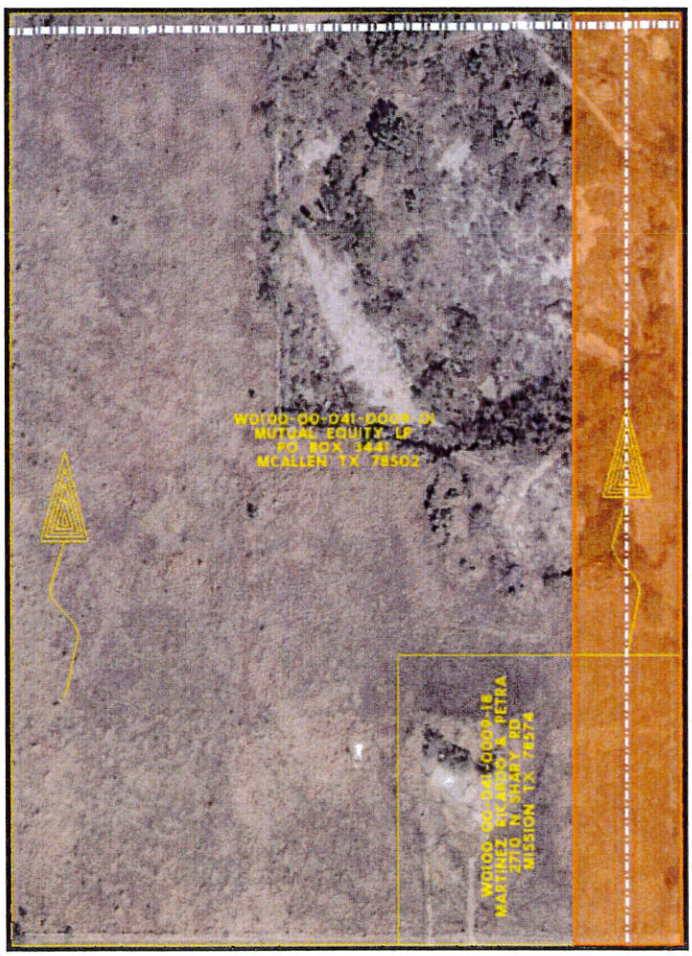


Parcel ID: W0100-00-045-0010-15
Owner: Menendez Enrique A
PO BOX 720670
McAllen, TX 78504
Approx. Land Affected: 1.53 AC

Outfall Option #4

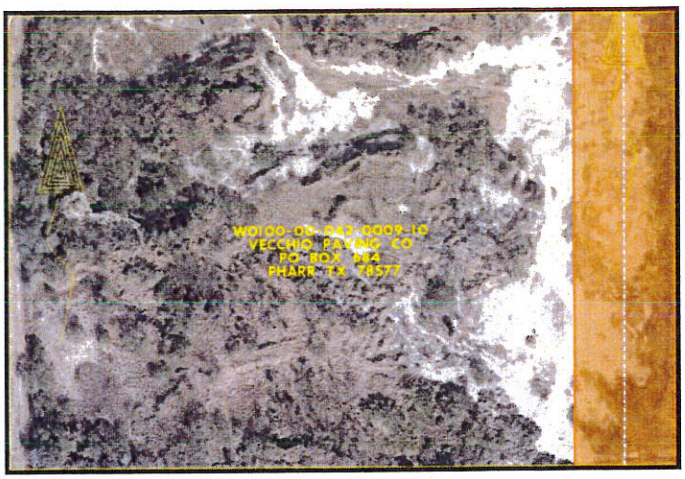


Parcel ID: W0100-00-041-0009-18
Owner: Martinez Ricardo & Petra
2710 N. Shary RD.
Mission, TX 78574
Approx. Land Affected: 1.37 AC



Parcel ID: W0100-00-041-0009-01
Owner: Mutual Equity LP
PO BOX 3441
McAllen, TX 78502
Approx. Land Affected: 3.06 AC

Outfall Option #4 (continued)



Parcel ID: W0100-00-042-0009-10
Owner: Vecchio Paving Co
PO BOX 684
Pharr, TX 78577
Approx. Land Affected: 2.27 AC

Parcel ID: W0100-00-042-0009-20
Owner: Killinger Martin P & Laura
PO BOX 2555
Mission, TX 78573
Approx. Land Affected: 5.95 AC

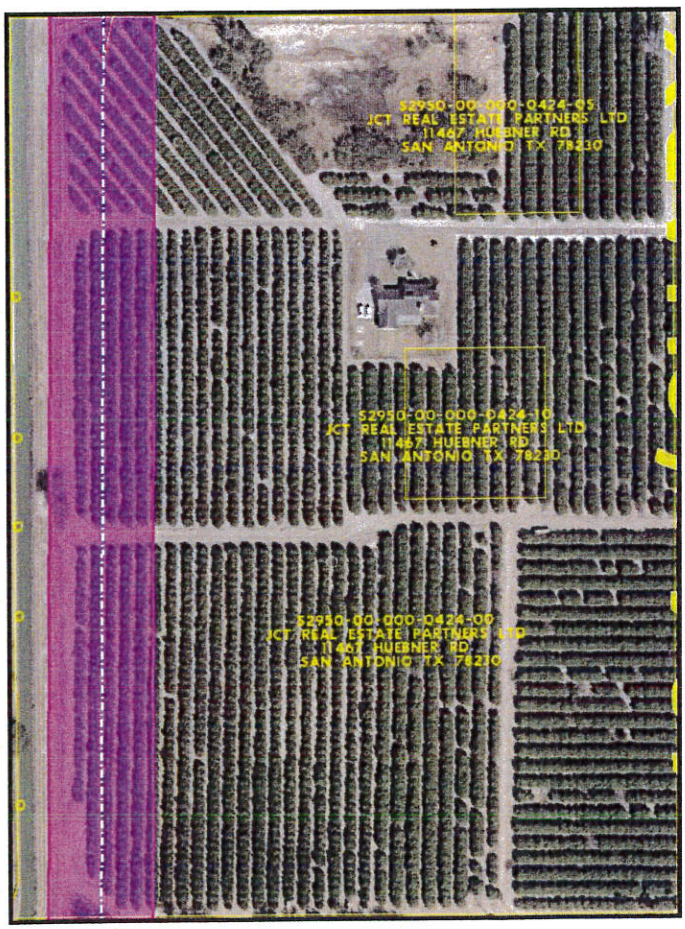
Outfall Option #5

Parcel ID: S2950-00-000-0414-10
Owner: Sharyland Water Supply
PO BOX 1868
Mission, TX 78573
Approx. Land Affected: 1.14 AC

Outfall Option #5 (continued)

Parcel ID: S2950-00-000-0414-15
Owner: Pena Joel N
217 N. Shary Blvd.
Alton, TX 78573
Approx. Land Affected: 1.86 AC

Parcel ID: S2950-00-000-0414-01
Owner: Saenz Jesus
1818 Northgate Ln. Apt. B
McAllen, TX 78504
Approx. Land Affected: 3.75 AC



Parcel ID: S2950-00-000-0424-00
Owner: JCT Real Estate Partners Ltd.
11467 Huebner RD.
San Antonio, TX 78230
Approx. Land Affected: 4.43 AC

Outfall Option #5 (continued)

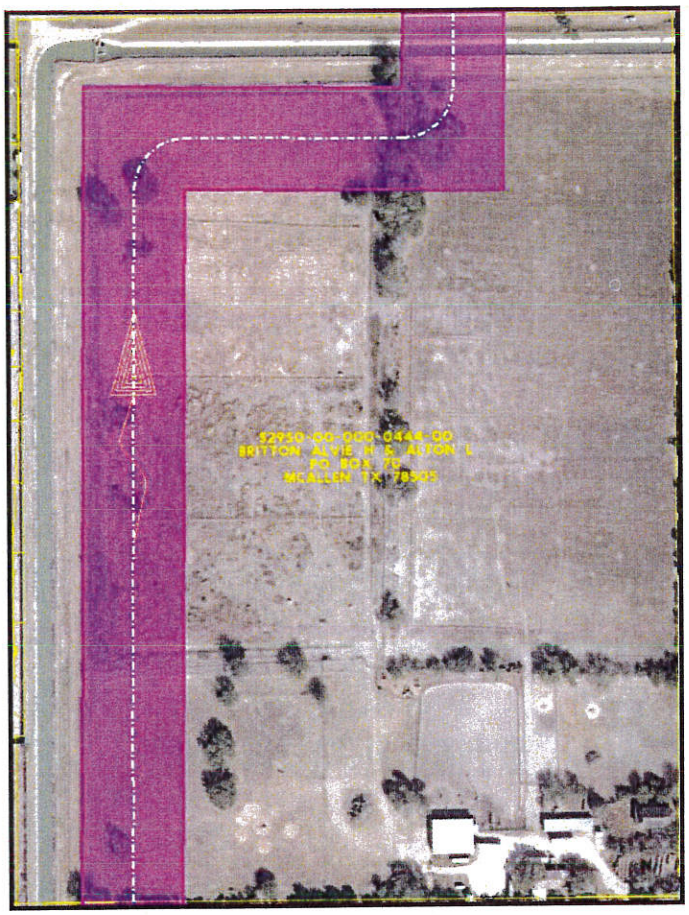
Parcel ID: S2950-00-000-0434-20
Owner: Salinas Dagoberto
7207 W. Expressway 83
Mission, TX 78572
Approx. Land Affected: 0.90 AC

Parcel ID: S2950-00-000-0434-46
Owner: MSGM LLC
137 E. Gardenia Ave.
McAllen, TX 78501
Approx. Land Affected: 0.83 AC

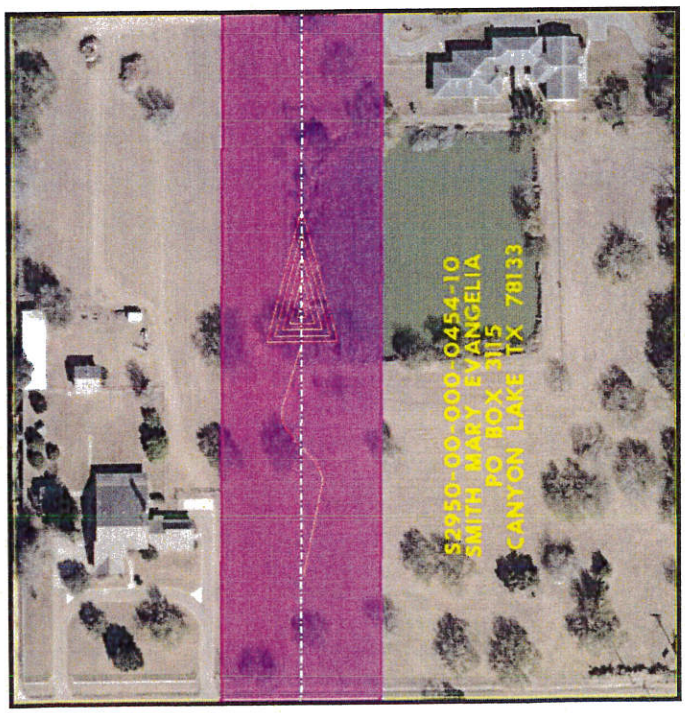
Parcel ID: S2950-00-000-0434-30
Owner: Sotelo Camilo
RR 1 BOX 5710
Mission, TX 78573
Approx. Land Affected: 1.20 AC

Parcel ID: S2950-00-000-0434-41
Owner: Wil-She LLC
1101 E. Violet Ave.
McAllen, TX 78504
Approx. Land Affected: 1.50 AC

Outfall Option #5 (continued)



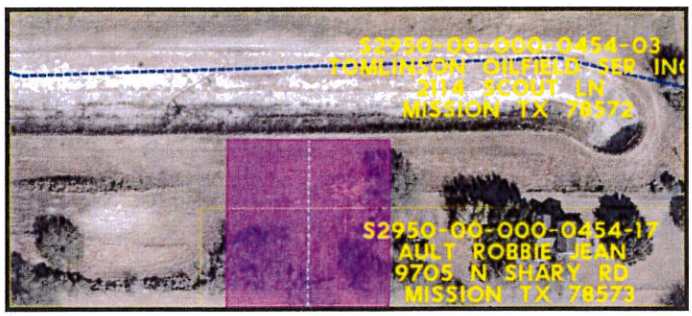
Parcel ID: S2950-00-000-0444-00
Owner: Britton Alvie H & Alton L
PO BOX 70
McAllen, TX 78505
Approx. Land Affected: 6.09 AC



Parcel ID: S2950-00-000-0454-10
Owner: Smith Mary Evangelia
PO BOX 3115
Canyon Lake, TX 78133
Approx. Land Affected: 2.19 AC

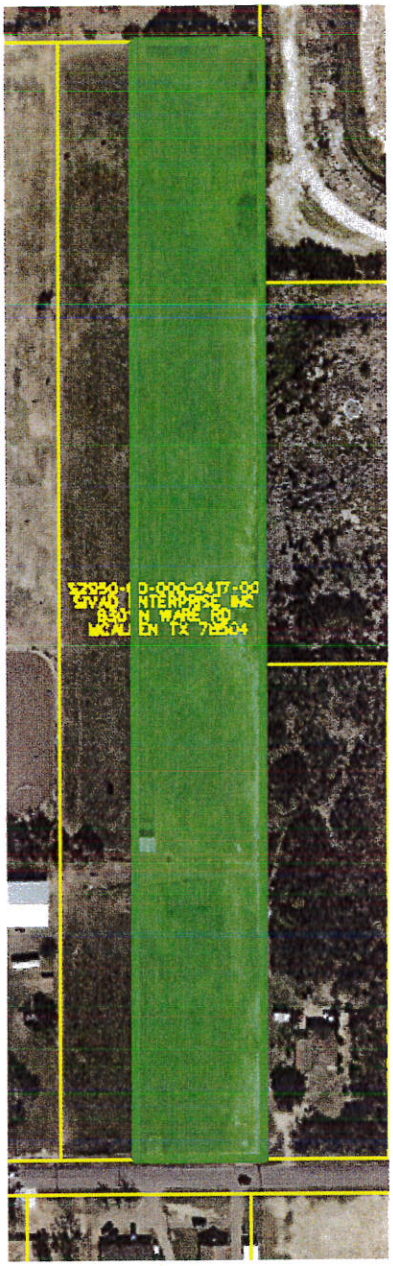
Outfall Option #5 (continued)

Parcel ID: S2950-00-000-0454-17
Owner: Ault Robbie Jean
9705 N. Shary Rd.
Mission, TX 78573
Approx. Land Affected: 0.30 AC

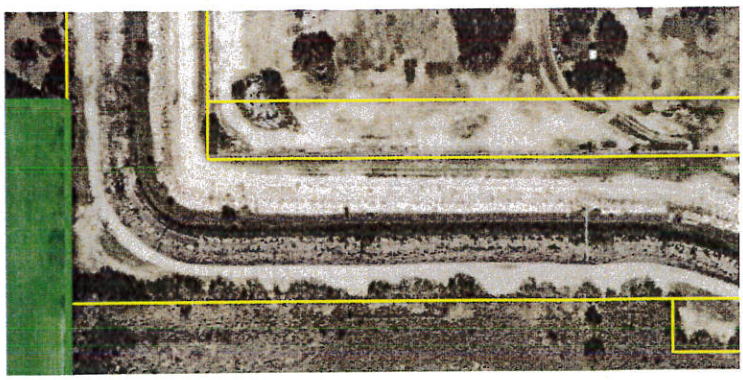


Parcel ID: S2950-00-000-0454-03
Owner: Tomlinson Oilfield Ser Inc
2114 Scout Ln.
Mission, TX 78572
Approx. Land Affected: 0.25 AC

Outfall Option #6



Parcel ID: S2950-00-000-0417-00
Owner: Sivad Enterprise Inc
8301 N. Ware Rd.
McAllen, TX 78504
Approx. Land Affected: 4.48 AC



Parcel ID: S2950-00-000-0418-04
Owner: HCDD #1
Approx. Land Affected: Outfall

Additionally, the following table provides a preliminary cost estimate for the aforementioned Proposed Outfall Options. (Land Cost Only)

Table 2 -- Preliminary Cost Estimate of Proposed Impacts

Proposed Outfall	Orchard Impact (No.)	Orchard Impact ($)	Land Affected (Ac)	Land Affected ($)	Total Impact ($)
Option 1	0	*$0.00*	10.64	*$319,200.00*	**$319,200.00**
Option 2	879	*$109,875.00*	28.21	*$846,300.00*	**$956,175.00**
Option 3	819	*$102,375.00*	23.04	*$691,200.00*	**$793,575.00**
Option 4	0	*$0.00*	12.65	*$379,500.00*	**$379,500.00**
Option 5	540	*$67,500.00*	23.61	*$708,300.00*	**$775,800.00**
Option 6	0	*$0.00*	4.48	*$134,400.00*	**$134,400.00**

Note: Average Land Cost is $30,000/Ac and $125/tree

L&G Engineering will follow up with the affected property owners to determine their support and/or concurrence with the drainage outfall options.

SECTION VI - FUNDING ANALYSIS

L&G Engineering
Transportation Consulting Engineers

FUNDING ANALYSIS

On the latest Hidalgo County Metropolitan Organization, Metropolitan Transportation Plan Project Data (MTP), dated March 20 2015, there are funds identified for drainage improvements associated with the FM 676 (Mile 5) roadway project. The limits of this project are along FM 676 from SH 107 east to Taylor Road.

As can be seen on the attached MTP, $500,738 of earmarked Federal monies is available for this project in fiscal year 2015. However, while investigating the Statewide Transportation Improvement Program (TIP), the funding is broken down into an 80/20 share between the Federal Government and a Local Entity, in this case the County of Hidalgo. (Please find TIP attached)

L&G Engineering (L&G) has contacted the Texas Department of Transportation (TxDOT) to help clarify why this 80/20 share is proposed for this on-system transportation project. Additionally, L&G initiated discussions with TxDOT to determine the requirements of this earmark to see if these funds could be used to pay for the cost of land, compensable utilities, land acquisition and construction. The purpose of these discussions was to determine the best use of these funds from the City of Alton's and Hidalgo County's perspective. L&G plan was to develop a plan of action to utilize these Federal funds to construct the drainage ditch. Several requests for clarification of use for these funds were not answered by TxDOT. In recommending the preferred outfall, this outfall would benefit FM 676 Roadway Construction Project and a couple of Colonias adjacent or near the highway; however, the earmark would more than likely be used for actual construction of this outfall.

HIDALGO COUNTY METROPOLITAN PLANNING ORGANIZATION METROPOLITAN TRANSPORTATION PLAN PROJECT DATA

Line Numbers	System Sort	Roadway	From	To	MTP#	CSJ #	Project Length (mi)	Proposed Project Data: Type of Improvement	Proposed Project Data: Jurisdiction	Total Project Cost: Construction Cost 2013 dollars	Total Project Cost: Letting Year Construction dollars	Total Project Cost: ROW cost (12% 2011 const cost)	Total Project Cost: Preliminary Engineering (4.9% 2011 const cost)	Total Project Cost: CE Cost (<$2 M 7.5%, $2-$10 M 5%, >$10 M 4.5%, of 2011 const cost)	Total Project Cost: Contingencies (<$2M 7%, $2-$25 M 6.5%, $25-$50 M 9%, >$50M 7% of	Total Project Cost: Total Project Cost	Total Project Cost: Year of Expenditure Dollars (YOE)	Funding Categories: Cat 1 Funding	Cat 3 - TMF	Cat 7 Funding (CE & Contingencies)	Cat 9 Funding	Cat 11 Funding	Cat 12 Funding	CBI - Eligible	Earmark Funding	Other Funds (Local, Bond, etc)	TRENDS - Innovative Financing	TOTAL
REHABILITATION & PREVENTIVE MAINTENANCE																											
	LS	LUMP SUM						Maintenance / Rehabilitation	Various								$ 295,161,902										$ 295.16
BRIDGE																											
	LS	Lump Sum						Bridge Replacement	Various								$ 4,296,855										$ 4.30
SAFETY																											
	LS	Lump Sum						Safety Improvements	Various								$ 45,937,229										$ 45.94
DISTRICT DISCRETIONARY																											
	LS	Lump Sum						District Discretionary	Various								$ 22,797,701										$ 22.80
MOBILITY																											
			FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015	FY 2015		
82	Off	Mile 1 East **PE**	Bus 83	Mile 8 North	HC-269	0921-02-254	7	Reconstruct & widen to urban 2 lanes & shoulders	Mercedes	$ 6,000,000	$ 6,000,000	$ 720,000	$ 294,000	$ 300,000	$ 390,000	$ 8,076,000	$ 650,000								$ 0.65		$ 0.65
218a	On	US 83/US 281 Interchange - **PE**	@ US 83 / US 281 Interchange		HC-287a	0039-17-175		Improvements at US 83/US 281 interchange	TxDOT	$ 4,987,619	$ 4,987,619	$ -	$ 250,000	$ 249,381	$ -	$ 5,849,600	$ 250,000							0.25			$ 0.25
214	Off	Liberty Blvd (Phase I-II) - **PE**	US 83	FM 2221	HC-284	0921-02-194	6.2	Widen to 4 lanes with dedicated left turn lane & Construct 2 lanes with shoulders	County	$ 16,000,000	$ 16,000,000	$ 2,331,755	$ 784,000	$ 720,000	$ 1,040,000	$ 21,867,755	$ 784,000								$ 0.55	$ 0.23	$ 0.78
40	On	FM 676 (Mile 5 N) - **PE**	SH 364 (La Homa Rd)	SH 107 (Conway)	HC-117b	1064-01-028 1064-01-027	2.39	Widen to 4 Lane Divided	Alton / County	$ 8,652,800	$ 8,652,800	$ 1,038,336	$ 423,987	$ 432,640	$ 562,432	$ 11,646,669	$ 423,987									$ 0.42	$ 0.42
223	Off	Dicker Road - **PE**	Spur 115 (23rd St)	FM 2061 (Jackson Rd)	HC-291	0921-02-312	2.56	Widen to 4 lane with continuous left turn	County	$ 12,700,000	$ 12,700,000	$ -	$ 1,270,000	$ 571,500	$ 825,500	$ 16,154,400	$ 1,270,000									$ 1.27	$ 1.27
70	On	FM 1925 - **PE**	FM 907 (Alamo Rd)	FM 493 (La Blanca)	HC-12	1803-02-901	4.1	Widen to 4 Lane Divided	County	$ 14,226,519	$ 14,226,519	$ 1,900,000	$ 697,099	$ 640,193	$ 924,724	$ 19,270,580	$ 697,099									$ 0.70	$ 0.70
224	On	FM 494 - **PE**	FM 676 (Mile 5)	SH 107	HC-292a	0864-01-068	2	Widen to 4 lane	County	$ 8,000,000	$ 8,000,000	$ 500,000	$ 392,000	$ 400,000	$ 520,000	$ 10,308,000	$ 392,000									$ 0.39	$ 0.39
224	On	FM 494 - **PE**	FM 1924 (Mile 3)	FM 676 (Mile 5)	HC-292b	0864-01-069	2	Widen to 4 lane	County	$ 8,000,000	$ 8,000,000	$ 500,000	$ 392,000	$ 400,000	$ 520,000	$ 10,308,000	$ 392,000									$ 0.39	$ 0.39
216	Off	Mile 3 N (Phase I) - **PE**	East Goodwin Road	Tom Gill Road	HC-286a	0921-02-321	3.8	Widen to 4 Lane Divided - Curb & Gutter Section	County	$ 8,453,684	$ 8,453,684	$ 1,186,754	$ 414,231	$ 422,684	$ 549,489	$ 11,550,970	$ 414,231									$ 0.41	$ 0.41
216	Off	Mile 3 N (Phase II) - **PE**	Tom Gill Road	FM 2221	HC-286b	0921-02-332	2.5	New location 2 lane rural roadway	County	$ 4,100,000	$ 4,100,000	$ 996,342	$ 200,900	$ 205,000	$ 266,500	$ 6,022,942	$ 200,900									$ 0.20	$ 0.20
229	On	SH 68 **PE**	US 83	US 281 @ FM 2812	HC-295a	3629-01-001	10	Construct new 4 lane divided rural highway facility	TxDOT	$ 55,000,000	$ 55,000,000	$ 23,500,000	$ 6,500,000	$ 2,475,000	$ 3,850,000	$ 94,735,000	$ 6,500,000									$ 6.50	$ 6.50
229	On	SH 68 **ROW**	US 83	FM 1925	HC-295b	3629-01-001	10	Construct new 4 lane divided rural highway facility	TxDOT	$ 55,000,000	$ 55,000,000	$ 23,500,000	$ 6,500,000	$ 2,475,000	$ 3,850,000	$ 94,735,000	$ 10,000,000									$ 10.00	$ 10.00
237	On	Nolana - **PE & ROW**	FM 1426 (Raul Longoria)	FM 88	HC-152	0921-02-169	10	Reconstruct & Widen to 2 lanes with shoulders	Various	$ 16,000,000	$ 16,000,000	$ 2,573,503	$ 784,000	$ 720,000	$ 1,040,000	$ 22,109,503	$ 2,000,000								$ 2.00		$ 2.00
238	Off	Thomas Road - **PE & ROW**	FM 2061	FM 2557 (Stewart Road)	HC-304	0921-02-302	3.6	Construct 4 lane urban roadway	County	$ 11,600,000	$ 11,600,000	$ 1,392,000	$ 568,400	$ 522,000	$ 754,000	$ 15,555,600	$ 1,960,400								$ 0.69	$ 1.27	$ 1.96
74	Off	Mile 6 W Rd - **PE & ROW**	Mile 9 N	SH 107	HC-148b	0921-02-168	7.5	ROW & PE for Widen to 4 Lane	Weslaco	$ 16,762,500	$ 16,762,500	$ 1,718,637	$ 821,363	$ 754,313	$ 1,089,563	$ 22,185,651	$ 2,540,000								$ 2.54		$ 2.54
27	Off	Owassa - **PE & ROW**	Jackson Rd	US 281	HC-106	0921-02-296	1.21	Widen to 4 Lane Divided	Pharr	$ 5,673,187	$ 6,136,119	$ 377,936	$ 300,670	$ 306,806	$ 398,848	$ 7,900,818	$ 678,606			$ 0.38						$ 0.30		$ 0.68
25	Off	SH 364 (La Homa) - **ROW**	FM 495	FM 1924 (Mile 3 N)	HC-48a	2966-01-009	2	Right of Way for Widen to 4 Lane Urban Divided	Palmview	$ 7,750,000	$ 7,750,000	$ 2,930,494	$ 379,750	$ -	$ 503,750	$ 12,044,494	$ 2,930,494			$ 2.93								$ 2.93
52	On	FM 1925 (Monte Cristo rd) - **ROW**	Kenyon	FM 907 (Alamo Rd)	HC-10	1803-02-028	0.95	Widen to 4 Lane Divided	Edinburg / County	$ 3,700,000	$ 3,700,000	$ 790,000	$ 181,300	$ -	$ 240,500	$ 5,141,200	$ 790,000			$ 0.79								$ 0.79
220	Off	N Alamo Road Extension - **ROW**	FM 1925 0.5m North		HC-289	0921-02-311	0.5	Road Realignment	Edinburg / County	$ 650,000	$ 650,000	$ 200,000	$ 31,850	$ 48,750	$ 45,500	$ 1,016,400	$ 200,000			$ 0.20								$ 0.20
234	Off	Edinburg Hike & Bike Trail	Intersection Jackson Rd / Chapin Rd	Intersection Jackson Rd / Canton Rd	HC-300	0921-02-316	3.3	Construction of Hike & Bike Trail along Jackson Rd	Edinburg	$ 1,747,853	$ 1,747,853	$ -	$ -	$ 262,178	$ -	$ 2,010,031	$ 2,010,031				$ 0.96					$ 1.05		$ 2.01
235	On	FM 676 (Mile 5)	SH 107 east to Taylor Road		HC-301	1064-01-034	3	Drainage improvements	TxDOT	$ 500,738	$ 500,738	$ 150,000	$ 24,536	$ 37,555	$ 32,548	$ 776,423	$ 500,738								$ 0.50			$ 0.50
219	Off	Pharr/Reynosa Int'l Bridge (NB Phase II)	At Pharr/Reynosa Int'l Bridge - Northbound Lanes Improvements Phase II		HC-288	0921-02-289		Addition of 2 commercial northbound entrance lanes, booths and canopies	Pharr	$ 2,645,473	$ 2,645,473	$ -	$ -	$ 118,770	$ 154,400	$ 2,918,643	$ 2,918,643						$ 2.92				$ 2.92
216	Off	US 83 Interchange @ Bicentennial	SH 336	SP 115	HC-285	0039-17-180	0.1	Interchange improvements at Main Street & Bicentennial	McAllen	$ 30,000,000	$ 30,000,000	$ -	$ 2,000,000	$ 1,350,000	$ 2,700,000	$ 37,910,000	$ 32,000,000					$ 32.00					$ 32.00
205c	On	US 83 La Joya Relief Route	0.85 M East of FM 886 (El Faro Rd)	0.04 Mi West of FM 1427	HC-60ca	0039-02-040	6.458	New location 4-lane divided highway	TxDOT	$ 42,858,590	$ 42,858,590	$ 17,000,000	$ 1,600,000	$ 2,000,000	$ 2,000,000	$ 68,366,590	$ 63,458,590		$ 45.13				$ 18.33				$ 63.46
205c	On	US 83 La Joya Relief Route	0.04 Mi West of FM 1427	0.28 Mi West of Showers Rd	HC-60cb	0039-17-131	1.742	New location 4-lane divided highway	TxDOT	$ 12,141,410	$ 12,141,410	$ 6,500,000	$ 600,000	$ 800,000	$ 800,000	$ 21,931,910	$ 20,041,410		$ 15.11				$ 4.94				$ 20.04
245	Off	IBTC (Phase I) - **PE**	Interchange to SH 365 to I-2	Valley View Interchange to FM 493	RMA-3	0921-02-142		4 lane controlled access facility with 2 lane connector	HCRMA	$ -	$ -	$ 40,163,746	$ 16,724,991	$ -	$ -	$ 56,888,737	$ 16,724,991								$ 16.72		$ 16.72
245	Off	IBTC (Phase I) - **ROW**	Interchange to SH 365 to I-2	Valley View Interchange to FM 493	RMA-3	0921-02-142		4 lane controlled access facility with 2 lane connector	HCRMA	$ -	$ -	$ 40,163,746	$ 16,724,991	$ -	$ -	$ 56,888,737	$ 40,163,746								$ 40.16		$ 40.16
203a	On	SH 365 (Phase I) **PE**	US 281 Military Highway	FM 396 (Anzalduas Highway)	RMA-1aa	3627-01-001	12.5	A toll improvement being a 4 lane controlled access facility	HCRMA	$ 137,405,566	$ 137,405,566	$ 51,596,891	$ 10,860,670	$ 5,385,907	$ -	$ 223,213,321	$ 10,860,670								$ 10.86		$ 10.86
203a	On	SH 365 (Phase I) **ROW**	US 281 Military Highway	FM 396 (Anzalduas Highway)	RMA-1aa	3627-01-001	12.5	A toll improvement being a 4 lane controlled access facility	HCRMA	$ 137,405,566	$ 137,405,566	$ 51,596,891	$ 10,860,670	$ 5,385,907	$ -	$ 223,213,321	$ 51,596,891								$ 51.60		$ 51.60
203b	On	SH 365 (Phase II) **PE**	FM 396 (Anzalduas Highway)	FM 1016 (Conway Rd)	RMA-1b	3627-01-002		Toll improvement being a 4 lane controlled access facility	HCRMA	$ 37,620,524	$ 37,620,524	$ 5,406,143	$ 3,215,286	$ 1,380,765	$ -	$ 48,393,480	$ 3,215,286								$ 3.22		$ 3.22
203b	On	SH 365 (Phase II) **ROW**	FM 396 (Anzalduas Highway)	FM 1016 (Conway Rd)	RMA-1b	3627-01-002		Toll improvement being a 4 lane controlled access facility	HCRMA	$ 37,620,524	$ 37,620,524	$ 5,406,143	$ 3,215,286	$ 1,380,765	$ -	$ 48,393,480	$ 5,406,143								$ 5.41		$ 5.41
221	On	US 281 Military Highway - **PE**	0.45 Mi E of Spur 600	FM 2557 (Stewart Road)	RMA-1ab	0220-01-023	0.94	Widening to 4 lane divided with overpass at San Juan Rd	HCRMA	$ 14,594,604	$ 14,594,604	$ 2,529,228	$ 616,079	$ 774,041		$ 20,600,023	$ 616,079								$ 0.62		$ 0.62

STATEWIDE TRANSPORTATION IMPROVEMENT PROGRAM
Hidalgo County MPO FY 2015-2018 TIP
Pharr District Projects
FY 2015

DISTRICT	COUNTY	CSJ	HWY	PHASE	CITY	PROJECT SPONSOR	YOE COST
PHARR	HIDALGO	0921-02-337	BSIF CONNECTOR	C/E	HCRMA	HCRMA	$3,324,707

LIMITS FROM: SP 29/VETERANS DRIVE AT THE BSIF
LIMITS TO: US 281
PROJECT DESCRIPTION: NON-TOLL IMPROVEMENT BEING A LOCAL COLLECTOR
REMARKS: E = CONSTRUCTION ENGINEERING
P7:

REVISION DATE: 11_2014
MPO PROJ NUMBER: RMA-2
FUNDING CAT(S): 3 - LOCAL
PROJECT HISTORY:

ADDED

TOTAL PROJECT COST INFORMATION

PRELIM ENG:	4.22%	$117,348	COST OF APPROVED PHASES:
ROW PURCHASE:		$481,758	
CONST COST:		$2,779,924	
CONST ENG:	5.30%	$147,436	$3,324,707
CONTING:		$0	
IND COSTS:	14.29%	$397,347	
BND FINANCING:		$0	
TOTAL PROJECT COST:		$3,923,814	

AUTHORIZED FUNDING BY CATEGORY/SHARE

	FEDERAL	STATE	LOCAL	LC	TOTAL
CAT 3 - LOCAL				$3,324,707	$3,324,707
TOTALS	$0	$0	$0	$3,324,707	$3,324,707

PHARR	HIDALGO	1064-01-034	FM 676 (MILE 5)	C	TXDOT	TXDOT	$500,738

LIMITS FROM: SH 107 EAST TO TAYLOR RD
LIMITS TO:
PROJECT DESCRIPTION: DRAINAGE IMPROVEMENTS
REMARKS:
P7:

REVISION DATE: 9_2014
MPO PROJ NUMBER: HC-301
FUNDING CAT(S): 10 - EARMARK
PROJECT HISTORY: CE = 100% TXDOT

TOTAL PROJECT COST INFORMATION

PRELIM ENG:	4.90%	$24,536	COST OF APPROVED PHASES:
ROW PURCHASE:		$150,000	
CONST COST:		$500,738	
CONST ENG:	7.50%	$37,555	$500,738
CONTING:	6.50%	$32,548	
IND COSTS:	6.20%	$31,046	
BND FINANCING:		$0	
TOTAL PROJECT COST:		$776,423	

AUTHORIZED FUNDING BY CATEGORY/SHARE

	FEDERAL	STATE	LOCAL	LC	TOTAL
CAT 10 - EARMARK	$400,590		$100,148		$500,738
TOTALS	$400,590	$0	$100,148	$0	$500,738

PHARR	HIDALGO	0921-02-168	MILE 6 W	E/R	WESLACO	COUNTY	$2,540,000

LIMITS FROM: MILE 9 N
LIMITS TO: SH 107
PROJECT DESCRIPTION: WIDEN TO 4 LANE
REMARKS: EARMARK = $2,540,000 FOR ROW AND PE
P7: E=PRELIMINARY ENGINEERING

REVISION DATE: 11_2014
MPO PROJ NUMBER: HC-148b
FUNDING CAT(S): 10 - EARMARK
PROJECT HISTORY:

ADDED

TOTAL PROJECT COST INFORMATION

PRELIM ENG:	4.90%	$821,363	COST OF APPROVED PHASES:
ROW PURCHASE:		$1,718,637	
CONST COST:		$16,762,500	
CONST ENG:	4.50%	$754,313	$2,540,000
CONTING:	6.50%	$1,089,563	
IND COSTS:	6.20%	$1,039,275	
BND FINANCING:		$0	
TOTAL PROJECT COST:		$22,185,651	

AUTHORIZED FUNDING BY CATEGORY/SHARE

	FEDERAL	STATE	LOCAL	LC	TOTAL
CAT 10 - EARMARK	$2,032,000		$508,000		$2,540,000
TOTALS	$2,032,000	$0	$508,000	$0	$2,540,000

PHASE: C = CONSTRUCTION, E = ENGINEERING, R = ROW, T = TRANSFER
* FUNDING NOT FIXED

SECTION VII – CONCLUSIONS AND RECOMMENDATIONS

L&G Engineering
Transportation Consulting Engineers

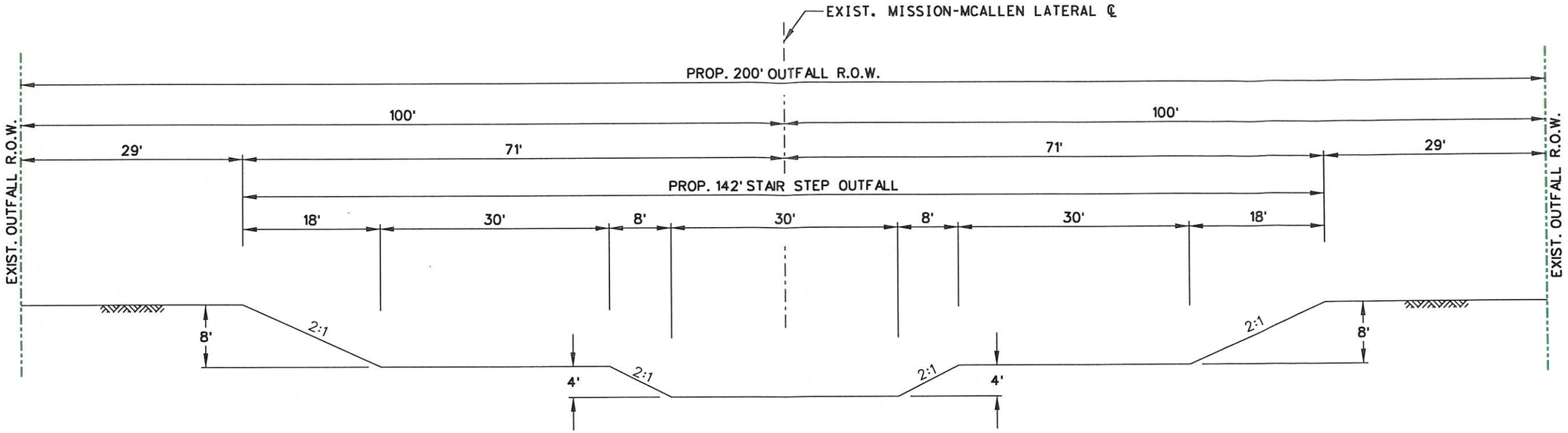
CONCLUSIONS AND RECOMMENDATIONS

In studying the drainage areas and patterns along FM 676 within the limits between SH 107 and Taylor Road several outfalls were developed, studied, and analyzed. Based on the preceding research and calculations, L&G Engineering recommends two proposed outfalls.

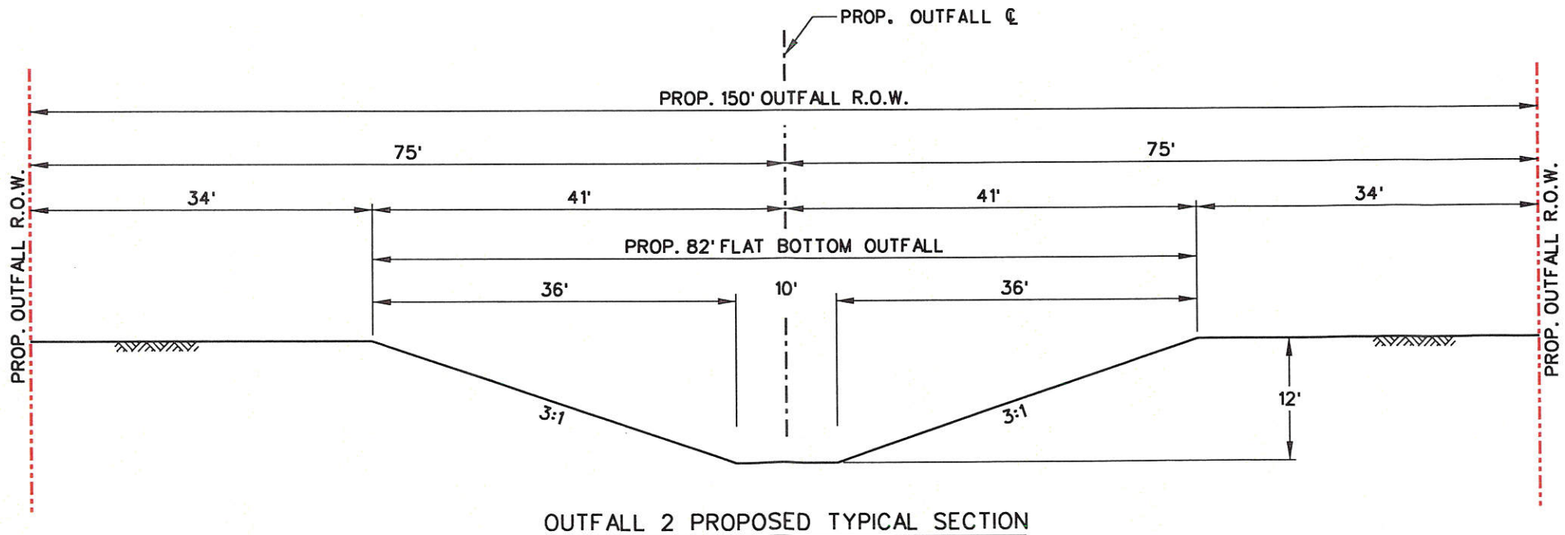
Outfall #1 (No previous Option) would utilized a storm drainage system designed and sized to tie in the FM 676 TxDOT Project currently under development between the limits of La Homa Road and SH 107. The TxDOT system would require the system to include the storm runoff of approximately 40 cfs (5yr storm frequency) to be introduced as an added Q. City of Alton, Hidalgo County and L&G are coordinating with TxDOT to make sure the TxDOT proposed system includes the Q base introduction of the 40 cfs. Outfall #1 would drain Drainage Area #1 which encompasses an area beginning at SH 107 to approximately 2500'east of SH 107(see Hydrologic Map). The cost for the proposed Outfall #1 will be part of the construction cost for FM 676 once the project is designed and developed.

Outfall #2 (Option 6) is the most feasible outfall of the options studied that will provide drainage for future improvements to FM 676 and the further development of the City of Alton in eastern part of the study area. Different storm event frequencies were used to determined the appropriate size of outfall cross-section and capacity restrictor; however, the ultimate storm event frequencies of 25 year and 100 year storms were the approved storm events formally being submitted. The recommended Proposed Outfall #2 has a ditch cross-section that is capable of handling a 100 year storm event; however a 60"RCP restrictor is being introduced downstream where Outfall #2 connects to HCDD#1 West Main III ditch. The proposed restrictor will maintain a release of a 25 year storm event to avoid overwhelming the HCDD#1 main ditch. Without the restrictor, the ditch can conservatively handle a 100-yr storm or greater storm event. A cost estimate for the proposed Outfall #2 has been developed and attached in the following pages.

An alternate Outfall, Outfall #2B, which is not being recommended due to cost, can help alleviate drainage concerns in the western portion of the study area. This alternate will provide possible drainage relief to the Mayberry & 6 Mile Basin as well as the Mexico Basin. Localized flooding and detention areas can be minimized or possibly eliminated by this outfall. The cost of construction cost of property improvements and the higher number of property owners were the deciding factor for selecting Outfall #2 as the recommended one. A cost estimate for the proposed Outfall #2B has been developed and attached in the following pages.



MISSION-MCALLEN LATERAL EXISTING TYPICAL SECTION



OUTFALL 2 PROPOSED TYPICAL SECTION

FROM: STA. 180+67.21 TO: STA. 181+60.09 (CULVERT)
FROM: STA. 181+60.09 TO: STA. 192+24.46
FROM: STA. 192+24.46 TO: STA. 194+53.55 (CULVERT)

L&G Engineering
Highway / Civil
Structural / Bridge
Environmental
Firm No. : F-4105

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Mercedes, TX. 78570
Phone : (956) 565-9813
Fax : (956) 565-9018

900 S. Stewart Rd., Ste. 10
Mission, TX. 78572
Phone : (956) 585-1909
Fax : (956) 585-1927

FM 676
OUTFALL 2 TYPICAL SECTIONS
STA. 180+67.21 TO STA. 194+53.55

SCALE:
1"= 15'

DN:		FED. RD. DIV. NO.	STATE	PROJECT NO.				SHEET NO.
CK DN:								
DW:		STATE DIST. NO	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	HIGHWAY NO.	
CK DW:								
TR:								FM 676
CK TR:								

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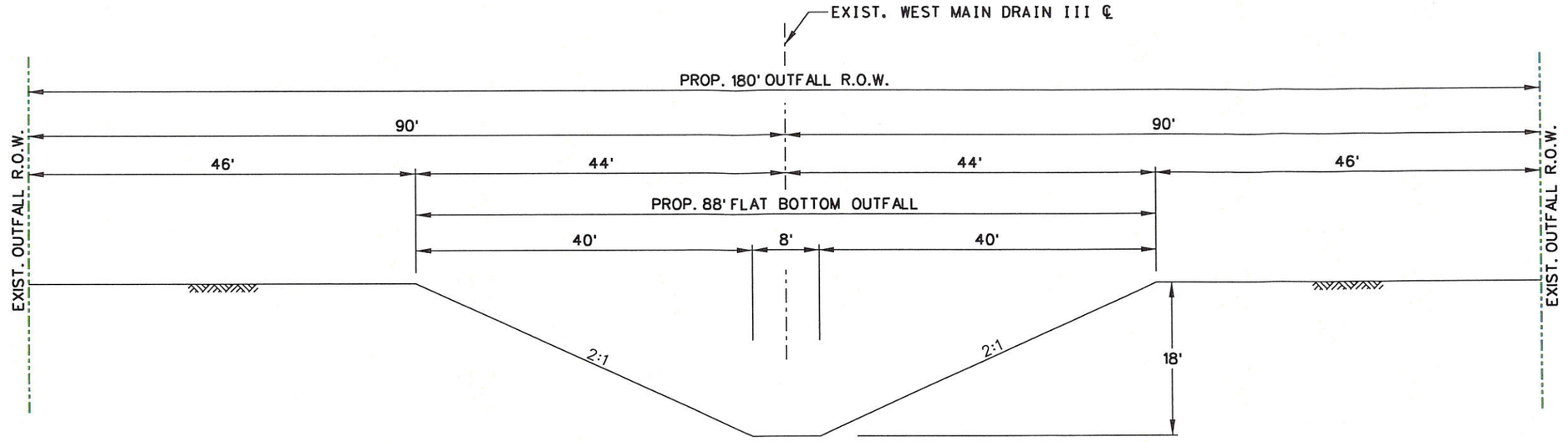
OUTFALL #2 COST ESTIMATE

	Land Cost	
Proposed Outfall	Prop. ROW [Acres]	Total ROW [$30,000/acre]
Outfall #2	4.48	*$134,400.00*

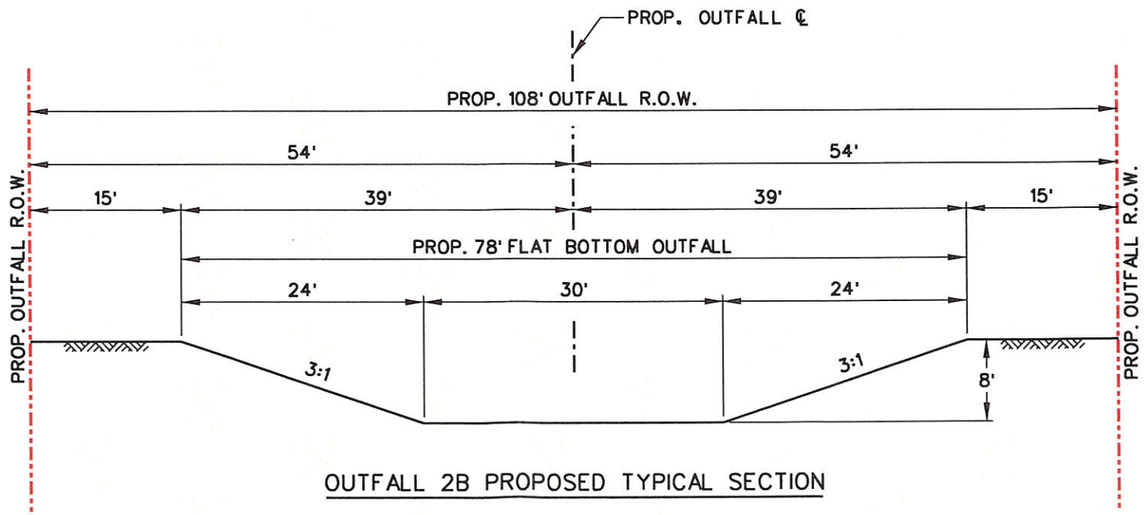
	Item #100 Prep ROW			Item #110 Excavation	
Proposed Outfall	Channel [STA]	Culvert [STA]	Total Prep ROW [$1,500/STA]	Channel [CY]	Total Excavation [$9.00/CY]
Outfall #2	10.64	29.71	*$60,531.00*	21761.07	*$195,849.63*

	Item #464 RCP (CL III) (24 IN)		Item #464 RCP (CL III) (60 IN)		Item #465 Junction Box W/ Grates	
Proposed Outfall	RCP [LF]	Total RCP [$52.55/LF]	RCP [LF]	Total RCP [$200.00/LF]	J. B. w/ Grates [Each]	Total J. B. w/ Grates [$5000.00/Each]
Outfall #2	51	*$2,680.05*	2,761	*$552,200.00*	7	*$35,000.00*

ROW (Land Cost)	*$134,400.00*
Item #100 Prep ROW	*$60,531.00*
Item #110 Excavation	*$195,849.63*
Item #464 RCP (CL III) (24 IN)	*$2,680.05*
Item #464 RCP (CL III) (60 IN)	*$552,200.00*
Item #465 Junction Boxes w/ Grates	*$35,000.00*
Grand Total	***$980,660.68***



WEST MAIN DRAIN EXISTING TYPICAL SECTION



OUTFALL 2B PROPOSED TYPICAL SECTION

FROM: STA. 79+04.74 TO: STA. 74+91.72 (CULVERT)
FROM: STA. 74+91.72 TO: STA. 50+41.35
FROM: STA. 50+41.35 TO: STA. 48+97.01 (CULVERT)
FROM: STA. 48+97.01 TO: STA. 21+11.63
FROM: STA. 21+11.63 TO: STA. 18+36.46 (CULVERT)
FROM: STA. 18+36.46 TO: STA. 12+20.90
FROM: STA. 12+20.90 TO: STA. 10+91.18 (CULVERT)

L&G Engineering
Highway / Civil
Structural / Bridge
Environmental
Firm No. : F-4105

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900 S. Stewart Rd., Ste. 10
Mission, TX. 78572
Phone : (956) 585-1909
Fax : (956) 585-1927

FM 676
ALTERNATE OUTFALL 2B
TYPICAL SECTIONS
STA. 79+04.74 TO STA. 10+91.18

SCALE:
1"= 15'

DN:		FED. RD. DIV. NO.	STATE	PROJECT NO.			SHEET NO.
CK DN:							
DW:		STATE DIST. NO	COUNTY	CONTROL NO.	SECTION NO.	JOB NO.	HIGHWAY NO.
CK DW:							FM 676
TR:							
CK TR:							

7/1/2015 K:\HCDD1\Rural Drainage Development - Pct3\VFM676\01 GENERAL\04 Typical Sections\FM 676_OUTFALL_TYP.dgn

OUTFALL #2B COST ESTIMATE

	Land Cost		Orchards Impacted		Total ROW (Land & Trees)
Proposed Outfall	Prop. ROW [Acres]	Land Cost [$30,000/acre]	Orchards [Each]	Orchards Cost [$125/tree]	Total ROW
Outfall #2B	16.42	*$492,600.00*	540.00	*$67,500.00*	*$560,100.00*

	Item #100 Prep ROW			Item #110 Excavation	
Proposed Outfall	Channel [STA]	Culvert [STA]	Total Prep ROW [$1,500/STA]	Channel [CY]	Total Excavation [$9.00/CY]
Outfall #2B	58.55	9.58	*$102,195.00*	96048.74	*$864,438.66*

	Item #464 RCP (CL III) (60 IN)		Item #465 Junction Box W/ Grates	
Proposed Outfall	RCP [LF]	Total RCP [$200.00/LF]	J. B. w/ Grates [Each]	Total J. B. w/ Grates [$5000.00/Each]
Outfall #2B	958	*$191,600.00*	1	*$5,000.00*

ROW (Land & Trees Cost)	*$560,100.00*
Item #100 Prep ROW	*$102,195.00*
Item #110 Excavation	*$864,438.66*
Item #464 RCP (CL III) (60 IN)	*$191,600.00*
Item #465 Junction Boxes w/ Grates	*$5,000.00*
Grand Total	***$1,723,333.66***

APPENDIX A

L&G Engineering
Transportation Consulting Engineers

RECEIVED
FEB 19 1998
& PROJECTS

MASTER DRAINAGE PLAN

City of Alton, Texas

1998

Submitted January 1998
by

Perez/Freese and Nichols, L.L.C.

PEREZ / FREESE - NICHOLS, L.L.C.
3233 N. McColl Rd., McAllen Texas 78501
956/631-4482 Fax 956/682-1545

STATE OF TEXAS
T. ANTHONY REID
33686
REGISTERED
PROFESSIONAL ENGINEER
1/26/98

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Appendix C- Texas Water Development Board Review Comments for the City of Alton Flood Protection Planning Contract- Contract No. 96-483-158 on the Final Draft Report

Texas Water Development Board Review Comments for the City of Alton Flood Protection Planning Contract - Contract No. 96-483-158 on the Final Report

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Master Drainage Plan
City of Alton, Texas

1.0 Introduction

1.1 Basic Philosophy

Upstream areas of urbanizing watersheds contribute to downstream stormwater runoff problems simply because of the cumulative effects. In many cases, land development in upstream areas has occurred with little thought of the consequences to downstream areas.

Many entities of local government are autonomous units primarily concerned with land use and stormwater runoff within their own boundaries. There are exceptions where municipalities receive water or sanitary sewer services from outside areas. Sometimes conflicts have arisen among adjoining communities, particularly over land use issues and its effect on the management of stormwater runoff.

The basic philosophy on the need for watershed management within urban areas has, over the past several decades, changed dramatically. Nationwide experience with the effects of inadequate past practices indicates that stormwater has not always been well managed. This experience has led to a major redirection in the way many communities perceive urban drainage and attempt to deal with it effectively.

The City of Alton recognized the importance of addressing stormwater management and contracted with Perez/Freese and Nichols, L.L.C., in March 1996 to perform a **Master Drainage Study** and prepare a master plan for the management of stormwater for the City of Alton and its

surrounding extraterritorial areas. The study is funded in part through the Texas Water Development Board Flood Protection Planning Study, contract No. 96-483-158.

The basic scope of work is as follows:

Task I. Base Mapping: *Objective:* To develop a digital planimetric and topographic base map from existing mapping available from TNRCC Information Section within the study area at 1" = 400' scale.

Task II. Drainage Policy and Criteria Development: *Objective:* To review current drainage guidelines for the City of Alton and Hidalgo Drainage District No. 1 that will facilitate and establish fundamental drainage policies for the City of Alton. Drainage Criteria, Ordinances, and Drainage Design Procedures will be written and proposed to support the drainage policies.

Task III. Existing Storm Sewer Assessment: *Objective:* To evaluate and determine the capacity of the existing storm sewer systems, detention pounds, open channels, and storm sewers within the Study Area.

Task IV. Master Plan Development: *Objective:* To develop a master drainage plan that will implement adopted drainage policies and criteria. The Master Plan will correctly identify drainage system deficiencies and to provide a document that will lead to an orderly development of the City of Alton and its extraterritorial jurisdiction. The plan will also provide a working document for developers and engineers, including recommended drainage easement widths and methods for determining pipe, channel or detention structure sizes.

Stormwater is a difficult resource to manage primarily because drainage systems are constantly in a state of flux. Even a natural drainage system is not static: streams meander, banks erode, lakes are filled by sediment. Urbanization compounds this problem because it increases the rate and quantity of runoff, and urban runoff is often polluted with chemicals and litter that is carried into the rivers and lakes. It is important to keep in mind that all development increases the stormwater runoff and contirbutes to the problems.

The combination of increased runoff, erosion and excess sediment, and pollution at times threatens public safety and properties and in turn damages the habitat of plants and animals dependent on the streams.

A generally accepted concept is that property within a city should contribute to the remedy of the problem caused by increased stormwater runoff. Two important principles underlie this stormwater management concept:

- First, that all real property within a city will be benefited by the installation of an adequate storm drainage system;
- Second, that the cost of installing an adequate drainage system should therefore be assessed against the real property in a city.

These principles are not easy for property owners to understand at first glance, but they are the keys to an effective stormwater management effort. A property owner may not have a problem immediately on his property, but he contributes a proportionate share to problems downstream. A unified and safe drainage system is the benefit of the basin as a whole. Each property individual

should contribute to the improvements necessary to solve the problem.

The problems that exist today will not go away, and the longer they are put off the more costly they will become to solve. Through advance planning, there will be fewer facilities and they will be larger and more strategically placed to minimize long-term maintenance costs, and they can be multi-purpose in use (for open space and recreation as well as for drainage).

Recognition that stormwater management includes much more than just flood control is important. Keeping streets open to emergency vehicle traffic, maintaining ponds and open channels so they do not become health and safety hazards, and promoting the use of drainage facilities for recreational purposes all contribute to enhancing and maintaining the quality of life for the entire community.

1.2 Statement of the Problem

The City of Alton (like many other cities) has reached a point of "problem convergence" related to management of stormwater runoff from the watershed. A number of factors and conditions have come together to pose a major challenge to the City. The growth and development of the community are manifested in a long-term, often subtle, and pervasive change in the City's drainage systems. Symptoms of the changes are evident in drainage system failures, localized flooding and escalating costs of control. Unfortunately, there is no single cause or simple cure for the problems of stormwater management.

What are the factors which combine to make urban stormwater management a major challenge in Alton? They are a diverse group of problems, circumstances, and conditions. When considered separately, they do not fully indicate the seriousness of the situation. The seriousness

is apparent, however, when they are considered together. The four most prominent factors in the present problems are changes in hydrology, resource conflicts, surrounding jurisdictions, and economics.

Changes in Hydrology: As the City has grown, impervious surfaces such as rooftops and pavement have covered over soils which were relatively pervious. An increasing proportion of the precipitation which previously filtered through the soil to the groundwater has been repelled. Instead, it is diverted by roofs and parking lots to channels and culverts, and carried to receiving streams in the hydraulically most efficient manner, i.e., as quickly as possible in the smallest facility considered being adequate.

Although Alton has some natural and manmade stormwater detention or retention facilities on developed sites, these systems are not coordinated to mitigate major storms. The overall impact of urban development will result in large increases in runoff from smaller, more frequent storms which may not be effectively controlled by on-site detention systems designed for more severe events. The change in hydrology is a basic condition which must be recognized.

Resource Conflicts: Urban levels of development are rarely achieved without conflicts in the use of resources, especially when stormwaters impede potential uses of the land. Unfortunately, land development in the Lower Rio Grande Valley area has not typically been achieved by solving the drainage problems. More often the symptoms (like flooding) have merely been moved to another location.

Urban runoff is a unique product of development. The quantity and quality of stormwater runoff in Alton may pose major problems for the community in general. As new growth occurs in

the area, resolution of short-term resource conflicts related to drainage control should be made with a better vision of long-term needs and impacts. The alternative consequence is that economic and social costs will continue to mount in the form of repetitive stormwater management problems.

Surrounding Jurisdictions: Stormwater runoff does not recognize established jurisdiction lines and close coordination with the surrounding communities (McAllen, Mission, and Palmhurst) is essential for a successful master plan. The concept of a stormwater management in a watershed is not new. A coordinated effort can assist with the management of land within a watershed to enhance the well-being and quality of life of municipalities within the watershed. Once a decision is reached to consider a coordinated watershed program, public meetings can be convened to help promote the need for comprehensive stormwater management planning and subsequent implementation. Ultimately, a regional stormwater management entity may be needed, as it is difficult for individual units of local government to act on a watershed basis outside of their borders. Hence, a regional entity is frequently needed to implement a comprehensive stormwater management plan.

Economics: The problems cited above, which are primarily physical, are compounded by economic factors which make solutions more difficult to achieve. Texas cities are in a period of a serious revenue shortfall in which programs of long-standing are being closely scrutinized, trimmed, and sometimes eliminated. This overriding revenue shortfall problem further exaggerates what has always been a major obstacle to effective stormwater control: the lack of stable and adequate local financing upon which long-range programs can be based.

Lurking behind the immediate economic problems of local governments is an even more

imposing potential problem. Existing physical improvements of all types in the United States, both public and private, are collectively growing old and wearing out. Many will have to be rebuilt or they will fall apart within our lifetimes.

Regardless of what level of government will be responsible for rebuilding public systems, it will meet intense competition for limited capital resources to finance the reconstruction. Private industry faces many similar reinvestment needs, and many other costs of government are also rapidly rising.

The demand for financing to rebuild large public and private systems will likely keep the cost of money, in terms of interest rates, high throughout the next two decades. Even if federal policies change regarding growth of the money supply and interest rates decline somewhat, it is likely that prices will inflate again. Inflation in the construction industry has historically been higher than average price inflation, driving the costs of public capital improvement projects up rapidly. This economic "Catch-22" may be the most serious of all the problems that Alton's drainage program must face.

Summation: The previously discussed factors create potentially serious situations as each drainage problem is compounded by the effect induced by changes in the other factors. This situation indicates the need to consider a comprehensive, balanced, and consolidated stormwater management program.

2.0 Assessment of the Existing Storm Drainage System

2.1 Study Area

The limits of the study area are illustrated on Sheet A-1 through 3-B in Section 8 of this report. The study area extends from FM 107 on the north to Three Mile North on the south and from Sharyland Road on the east to Moore Field Road on the west. The current city limits of Alton and the city limits and the extraterritorial jurisdiction boundaries of the adjacent cities are also shown.

Stormwater runoff does not recognize jurisdiction lines, and close coordination with the surrounding communities is essential for a successful master plan. During the development of the Master Plan efforts have been made to keep the Cities of McAllen, Mission, and Palmhurst, as well as the Hidalgo County Drainage District No. 1, informed about the progress and preliminary results of the study. Continued coordination is recommended as the plan is implemented.

2.2 Contributing Drainage Areas

The City of Alton is located in a relatively flat area of Hidalgo County that falls primarily from west to east. The heavily developed area of Alton is currently along either side of FM 676. Scattered residential and commercial development exists throughout the remainder of the study area. FM 676 follows a slight rise in the ground surface. The terrain north of the road falls generally to the north and east. The portion of the study area south of FM 676 falls generally to the east and south. The extreme western section of the study area is separated from the remainder by the Main Canal and the Hidalgo County Drainage District No. 1 ditch. Runoff from this western area has not been included in the sizing of the proposed drainage control facilities east of these two structures presented in this study since these two facilities should intercept runoff from this western region.

Storm runoff does enter the study area from the area north of FM 107. This outside runoff has been considered in the planning of the proposed drainage control facilities. The drainage control facilities within this northern portion of the study area should be sized to limit the rate of inflow into the Hidalgo County Drainage District No. 1 ditch to the same flow rate as under existing conditions. Making this assumption should eliminate any effects on the City of Alton from this area. To achieve this condition, close coordination will be required with the appropriate governmental entities and irrigation districts as this portion of Hidalgo County is developed.

The remainder, and major portion of the study area, is crossed by many manmade features such as irrigation canals and laterals, drainage ditches and roads. There are also number of natural and manmade depressions in the study area that currently store storm runoff. All of these features were taken into consideration when the existing contributing drainage area boundaries, illustrated on Plate 1, were defined. The identification reference assigned to each contributing drainage area is also included on the plate. The physical characteristics of each contributing drainage area as determined from the available topographic maps are summarized in Table 2.1.

Table 2.1

Summary of Computed Peak Discharges for Existing Conditions
10-year, 24-hour Storm

					Discharge		Hidalgo County Drainage Dist No. 1	
Area No	Area (ac)	∑ Area (ac)	Channel Slope (ft/ft)	Flow Length (ft)	Developed CN=69(cfs)	Undeveloped CN=(cfs)	Urban (cfs)	Rural (cfs)
N1	194.51	194.51	0.001324	4,012	96.93	50.72	74	42
N2	198.28	198.28	0.000721	4,464	71.70	37.40	76	44
N3	396.18	396.18	0.00105	8,114	111.40	61.42	132	76
N4	713.66	713.66	0.00131	9,064	209.42	112.14	210	122
N5	257.43	257.43	0.002367	4,850	142.78	75.47	92	54
N6	164.18	164.18	0.001864	4,549	86.45	45.50	66	38
N7	97.06	97.06	0.00039	3,021	35.14	18.32	44	25.5
N8	976.32	976.32	0.00157	5,938	404.98	214.19	260	157
W1	237.97	237.97	0.00244	4,102	148.93	78.35	90	50
NE1	244.25	244.25	0.00085	4,697	90.79	48.81	92	52
NE2	365.83	365.83	0.00254	4,416	222.04	115.93	124	72
E1	159.68	159.68	0.00165	2,479	116.89	61.42	64	37.2
E2	129.76	129.76	0.00069	2,033	76.44	40.51	52.2	32.8
E3	540.88	540.88	0.00173	6,407	222.91	117.92	170	98
SE1	180.72	180.72	0.00237	3,932	114.42	60.09	72	39
SE2	579.97	579.97	0.00144	6,556	215.18	115.60	180	105
SE3	123.33	123.33	0.001365	4155	60.97	31.95	51	29.6

Continued Table 2.1

					Discharge		Hidalgo County Drainage Dist No. 1	
Area No	Area (ac)	∑E Area (ac)	Channel Slope (ft/ft)	Flow Length (ft)	Developed CN=69 (cfs)	Undeveloped CN=58 (cfs)	Urban (cfs)	Rural (cfs)
S1	661.00	661.00	0.001795	7520	245.26	131.76	202	117
S2	128.15	128.15	0.001978	2887	91.61	48.54	54	31.5
S3	427.07	427.07	0.001404	5577	176.26	93.37	140	80.5
S4	552.17	552.17	0.001586	8828	178.33	92.32	175	100
S5	279.37	279.37	0.002126	4915	147.27	77.53	100	58
S6	288.93	288.93	0.002919	3553	211.25	111.00	104	58.4
S7	362.62	362.62	0.004780	3538	321.73	198.97	122	70

2.3 Storm Runoff Computations

Based on the proposed City of Alton Drainage Design Manual, stormwater discharges produced by watersheds 200 acres or larger shall be computed using a unit hydrograph method. There are two acceptable unit hydrograph methods for drainage system design in the City of Alton: Snyder's Unit Hydrograph Method and the Soil Conservation Service Unit Hydrograph Method. Each contributing watershed was modeled using the SCS Synthetic Unit Hydrograph method as contained in the ***Watershed Modeling*** (1) procedures in the Eagle Point computer software package. Hydrologic elements were used to compute runoff hydrographs at selected design points. The

hydraulic models were used to determine storage-discharge relationships to route flood hydrographs in the hydrologic models. By definition, a unit hydrograph is a plot of discharge versus time for a storm producing one inch of rainfall over the entire drainage basin. The curvilinear shape was used to compute the SCS unit hydrograph, and values were selected for the shape factor and the runoff curve number. The unit hydrographs were computed using a standard shape factor of 484, a constant undeveloped runoff curve number = 58, and a constant developed runoff curve number = 69. These values are included in the Eagle Point ***Watershed Modeling*** Manual. Development of Runoff curve numbers is discussed in the Soil Conservation Service, Section 4 Hydrology, (2).

2.4 Rainfall Intensity

The point rainfall intensities to be used in the design of all stormwater drain facilities within the Alton area are specified in Section 4 of the Drainage Design Manual. The constants to be used in the rainfall intensity equation $I = b/(t_c + d)^e$ (from the TexDOT Drainage Manual (3) are summarized in Table 2.2 below. The t_c is the time of concentration in minutes required for the runoff to flow from the most hydraulically remote point in the watershed to the facility being designed.

Table 2.2

Rainfall Intensity Equation Constants

2 Year			5 Year			10 Year			25 Year			50 Year			100 Year		
e	b	d	e	b	d	e	b	d	e	b	d	e	b	d	e	b	d
.831	74	9.6	.795	80	9.2	.778	87	9.2	.771	98	9.2	.749	99	9.2	.749	103	9.6

2.5 Rainfall Data

Rainfall depths for storms are applied to the unit hydrograph to determine the resulting peak stormwater discharges produced by those storms. Rainfall data for the 5-, 10-, 25-, 50-, and 100-year frequency storms were derived from intensity-duration-frequency curves from the proposed **Drainage Design** Manual. A listing of the rainfall intensities used in the hydrologic models is presented in Table 2.3.

2.6 Precipitation Losses

Interception, depression storage and infiltration within each contributing drainage area are combined and handled as precipitation losses in the hydrologic models. Initial and hourly rainfall loss rates vary with storm frequency and soil type. Typically, storms with a lower return interval (i.e., more frequent storms) will have higher initial and hourly loss rates. Clay soils typically have lower loss rates than sandy soils due to the lower permeability of clay soils. The initial and hourly loss rates used in this project included in the SCS curve number for the soil type.

Table 2.3

Rainfall Intensity-Duration Frequency

	[5 min]	[15min]	[30 min]	[60 min]	[6 hr]	[24hr]
[2 yr]	7.97	5.17	3.48	2.18	0.54	0.17
[5 yr]	9.71	6.35	4.33	2.76	0.73	0.25
[10 yr]	11.04	7.29	5.01	3.22	0.88	0.3
[25 yr]	12.67	8.4	5.79	3.74	1.03	0.36
[50 yr]	13.57	9.1	6.34	4.14	1.18	0.42
[100yr]	14.16	9.63	6.77	4.46	1.3	0.47

2.7 Lag Time

The lag time is the time interval between the center of the rainfall duration and the peak discharge. For the SCS unit hydrographs, the lag time is equal to 0.6 times the time of concentration.

2.8 Hydrograph Routing

The Muskingum routing method, which is described in most standard hydrology and open channel textbooks, was used to route runoff hydrographs between design points. Linsey Kohler and Paulhus in Hydrology for Engineers (4) have expressed the storage in a reach of a stream as:

$$S = b/a\ [xI^{m/n} + (1 - x)O],$$

where a and n are constants from the mean stage-discharge relation for the reach, $q=ag^n$, and b and m are constant in the mean stage-storage relation for the reach, $S=bg^m$. The constant x expresses the relative importance of inflow and outflow in determining storage. For a simple reservoir, $x = 0$ (inflow has no effect). If inflow and outflow have an equal effect on stage, x would be 0.5. For most streams, x is between 0 and 0.3, with a mean value near 0.2. A value of 0.25 was used in these studies.

In the Muskingum method, m/n is assumed equal to 1 and b/a is assumed to be a constant k.

$$S=K[xI+(1-x)O]$$

The constant K, known as the *storage constant,* is the ratio of storage to discharge and has the dimension of time. It is approximately equal to the travel time through the reach and, in the absence of better data, is sometimes estimated in this way. Sufficient historical data does not exist

for the Alton area to compute a *K*. The *K* value has been approximated by dividing the travel distance by flow velocity of three feet per second.

2.9 Contributing Drainage Area Computed Peak Flows

The computed peak flows for existing conditions for the 10-year frequency storm for both undeveloped and developed watershed conditions are summarized in Table 2.1. The computed peak flow values using the SCS Synthetic Unit Hydrograph method are compared to those obtained from the Hidalgo County Drainage District No. 1 runoff curve for small tracts of farmland and grass land and the runoff curve for city drainage. The computed values generally agree with those from the Hidalgo County Drainage District No. 1. Where there is a difference, the SCS computed values are larger and, therefore, more conservative for preliminary master drainage planning purposes.

3.0 Methods of Stormwater Management

3.1 Legal Considerations

The Flood Control and Insurance Act (Article 8280-13 of the Revised Civil Statutes of the State of Texas) authorizes Texas cities to develop stormwater management controls. The act provides for the development of a flood plain management program and the adoption and enforcement of permanent land use and control measures to aid in the implementation of the program.

The legal authority of the City to carry out a comprehensive program of stormwater management, and legal procedures for implementation of various funding methods must be carefully examined as the program strategy evolves. It is recommended that the City Attorney be consulted to provide a legal opinion on integrating the stormwater management program into the City process, especially as it relates to control of private drainage systems and the timing of program elements in light of financing implementation steps.

3.2 Structural Alternatives

Structural applications to control floodwater from a watershed may be divided into two fundamentally different approaches. The two approaches are:

- conveyance oriented approach
- storage oriented approach

Conveyance Oriented Approach: The conveyance concept, briefly stated, is the transmission of a given quantity of water within the confined limits of conduit or channel banks to minimize and/or eliminate damage and disruption through the area to be protected. This technique

is the more traditional stormwater management approach, and the system components consist of pipes, culverts, bridges, improved channels, and levees.

Conveyance describes the capacity of a conduit or channel section to transport stormwater runoff. The transmission capability of an improved conduit or channel varies with numerous factors such as the slope of the channel bed, channel width and depth, and smoothness of the channel walls and bottom. It is also necessary to understand that channel improvements must be sized to convey the selected storm frequency. The system that carries flooding for one storm will often be inadequate to carry the runoff from a larger frequency storm within the conduit or channel banks

An improved channel can greatly increase the conveyance capability provided by a typical natural channel. Depending upon conveyance needs, the improvements can include cleaning the clogged natural channel of vegetative growth, channel straightening which eliminates meandering and improves the slope, developing a new channel section to increase the flow area and maximize smoothness, or a combination of one or more of these. Compared to a typical natural channel, an improved straightened earth or grass lined channel having equal cross-sectional area can convey approximately 40 percent more water, and a concrete lined channel can convey more than three times the flow of a natural channel.

Because of the increased conveyance capability of the improved channel, stormwater can be rapidly and efficiently removed from a given area. Since the improved channel is more efficient in conveying water, it provides the benefit of minimizing the required channel area. Increasing channel efficiencies can also affect the overall watershed hydrology (i.e., hydrograph timing to create a peak on peak).

Within existing developments, the improved channel is very adaptable in controlling and removing stormwaters while requiring the minimum loss of right-of-way. In new developing areas, with proper planning, the improved channel can be combined with aesthetic amenities to provide efficient conveyance while minimizing the hard appearance that may be projected, for example, by a stark concrete lined channel.

Without question, the aesthetic quality of a natural tree-lined meandering creek or stream is very attractive and it becomes a desirable location for development. Alton is not unique in regard to development adjacent to many of the swales meandering through the area. However, implementing stormwater control measures in some streams can possibly destroy or certainly diminish the natural aesthetic qualities with channel improvements, depending upon the conveyance requirements.

The advantages gained, from the increased conveyance capability of the improved channel, may be accompanied by loss of aesthetic quality. Another disadvantage sometimes associated with the improved channel is the possible increase in erosion due to higher velocities. There is also a potential for downstream flooding if the improved channel abruptly ends and allows water to stack up in an area of reduced channel conveyance.

Possible channel improvements and their respective advantages and disadvantages are summarized in Table 3.1. These typical improvements are basic and do not reflect the numerous variations to provide floodwater control within defined parameters or the myriad of aesthetic treatments to retain the natural look.

Table 3.1

Typical Channel Improvements

Type	Nature	Advantage	Disadvantage
Channel Clean Out	Selective removal of trees & under-brush to minimize clogging	Maintains maximum natural setting while improving conveyance	Destroys some Vegetation
Channel Straightening	Improved alignment by eliminating excessive mean-dering and increa-sing channel slope	Retains selected natural setting & improves the conveyance capability	Reduces aesthetic quality of natural swales depending upon extent of straigh-tening
Channel Enlargement	Complete modifi-cation of natural channel by straightening & widening	Provides significant increase in conveyance	Reduces aesthetic quality
Channel Lining	Maximum channel modification by providing lining (nor-mally concrete) to reduce right-of-way requirements	Provides maximum conveyance & minimizes land loss	Can project a hard appearance unless supple-mented with amenities

Storage Oriented Approach: This method of stormwater management provides for the control by means of storing water and releasing it at a predetermined rate which can be adequately conveyed by the downstream system. Traditionally, this method has been utilized on large streams and river systems to control major flooding and is an important function of many of the large dams existing on streams and rivers throughout Texas and the United States. In urban areas, detention is being used to limit discharges from developed properties to that of the pre-developed conditions. This is a requirement of Hidalgo County Drainage District No. 1.

The general application of this methodology for watershed management on smaller areas has seen increased use in recent years. Applications of this method are now employed to areas as small as two acres and can even be applied to individual lots. The only requirement to affect this concept, whether large or small, is provision of a storage area for stormwater collection. This storage can be done on roof tops, parking areas, small ponds, or large areas requiring detailed evaluation of the storage area and overflow spillway.

The storage concept may be divided into retention or detention facilities. The retention storage method assumes the continual retainage of a given quantity of water that may be used for aesthetic, recreational or domestic purposes. The retention system, however, has the capacity to retain additional volumes of water for a short duration to reduce the maximum floodwater flow rate. The stored stormwater is released downstream as rapidly as the receiving channels, creeks, or system will allow, consistent with a stormwater management program.

The detention storage method is similar to the retention system except no provision is made for continuous storage of water. Rather, the stored floodwaters are completely released in a time period consistent with a flow rate that will minimize or eliminate downstream flooding. Detention storage has as its major function the control of stormwaters, yet this requirement may be utilized on an infrequent basis. As a result, the detention storage area can very effectively provide multiple uses for such functions as park areas, playgrounds, or athletic fields.

The primary function of the retention/detention concept is elimination or reduction of downstream flooding by storing and controlling the released water. The prime advantage of this concept is the use of smaller conveyance systems downstream. Depending upon the available storage capacity, it may be possible for the natural creek or stream to convey the released waters and not cause flooding. This approach not only can reduce the capital cost for larger downstream facilities, but maximizes preservation of the aesthetic qualities of the natural stream area.

Multiple use of the storage area is also an advantage. New planning concepts generally encourage open space, parks, and other recreation areas within a development. The retention/detention areas are ideal locations for development of water-related aesthetic or recreational facilities, or can be used for maintained green belts, parks, or athletic fields, depending upon the storage area size.

An advantage associated with the retention/detention concept that has recently received considerable attention is the attenuation of stream pollutants. Inherent in the storage concept is rapid reduction of water velocity which allows the precipitation of water-conveyed sediments and other pollutants such as heavy metals, pesticides, and phosphorous, and thereby significantly reduces

downstream pollution. Because urban stormwater has been observed as a major contributor to pollution of surface waters, the storage concept can be a very effective quality control facility. The periodic disposal of collected pollutants is another factor that should be considered in the planning of this type of facility.

Depending upon the upstream drainage area and the desired reduction of peak discharge, the loss of developable land can become significant. For this reason the application of the storage concept is generally restricted to new development that can incorporate the required storage area into desirable open space, park, or recreational areas. In existing developments, the open space requirements are generally prohibitive and the storage concept becomes difficult to apply.

The basic premise of the retention/detention concept is containment and storage of large inflow rates and the gradual release of smaller outflow rates to the downstream area. Due to this differential between inflow and outflow rates, extended period of time is needed to release the stored volume of water. If the downstream conveyance system is inadequate and the peak flow reduction provided by the retention/detention system is limited, it is possible to extend a reduced flood stage problem over a longer period of time as opposed to the natural condition of higher stages of flooding for a shorter period of time. It is important in selection and design of retention/detention facilities to give adequate consideration to the downstream conveyance capabilities.

Construction of retention/detention facilities requires open land areas primarily in the upper regions of a watershed. In the case of Alton, this is also true where a drainage course exits the study area or where a drainage course enters the Hidalgo Drainage District No. 1 facilities. Desirable sites will be those where existing depressions or abandoned caliche pits already exist, and the length of

dam construction will be minimal and sufficient capacity exists. Since the study area is relatively flat, it may be necessary to excavate a storage area with a controlled overflow from the stream. The stored water would later be released downstream through a conduit with a flap gates as the water surface of the stream declines. Lack of property containing sufficient capacity within the watershed management program area may make this concept only viable in select areas without excavation.

A comparison of the two structural methods of watershed management, conveyance systems and retention/detention systems, is provided in Table 3.2. The conveyance and storage concepts are the current state-of-the art structural methods for stormwater management control. Either approach can be employed individually, but the best results will generally be achieved through a combination of the two concepts. The integrated system of improvements should consider each drainage basin as a whole to provide effective stormwater management control.

Federal Programs: Federal support for urban runoff control has been minimal, and limited primarily to program planning and research. The Section 208 program under the 1972 Clean Water Act (Public Law 92-500) invested heavily in evaluations of water quality programs resulting from urban runoff (3). The Soil Conservation Service (SCS) has historically gives technical assistance to local governments to control soil loss and provide water resource management in urban and rural areas. The types of controls the SCS has promoted reduce erosion/sediment, flow, and flooding problems. These controls often have another benefit, stormwater pollution control (8). The federal government has otherwise steered clear of urban runoff.

Table 3.2

Comparison of Conveyance and Storage Features

Conveyance	
Advantages	**Disadvantages**
1. Removes stormwater runoff rapidly and efficiently.	1. Reduces aesthetic quality, e.g., concrete lined channel.
2. Minimizes land loss by improved conveyance of stormwater.	2. Possible increase in erosion due to increased velocities.
3. Lowers maintenance cost compared to storage concept.	3. Possible increase in downstream flooding.
4. Can be applied to new or existing development.	
5. Generally the more accepted design analysis.	

Storage	
Advantages	Disadvantages
1. Reduces downstream flow therefore, smaller downstream conveyance system required.	1. Increased land loss.
2. Reduces downstream flow, allowing utilization of natural streams with minimum improvements while retaining aesthetic quality	2. Extends runoff period, bu at reduced peak.
3. Can be applied to new development limiting runoff to no more than natural conditions.	3. Generally restricted to new development.
4. Improves water quality by decreasing pollution through precipitation.	4. Collected sediment must be periodically removed which increases maintenance costs.
5. Has potential multipurpose application, e.g., recreation or aesthetic value.	
6. Can make use of existing depressions and abandoned caliche pits.	

Texas Legislation Related to Floodwater Management: Municipal floodwater management controls are authorized by Article 8280-13 of the Revised Civil Statutes of the State of Texas, commonly known as the "Flood Control and Insurance Act." The primary purpose of this Act is the "promotion of public interest by providing appropriate protection against the perils of flood losses and encouraging sound land use by minimizing exposure of property to flood losses." Subsection (5) of Section 5 provides for the development of a flood plain management program and the adoption and enforcement of permanent land use and control measures to aid in the implementation of the program.

Home Rule Authority: Any assessment of the legal considerations and requirements involved in providing an appropriate stormwater management program should include both the program functions and the financing options to properly balance the needs of the community with the authority and resources available to the City. A home rule city has a good deal of flexiblilty in organizing and financing municipal programs to meet the community's needs. The analysis of finance options addresses several innovative financing methods many of which have not previously been widely used. These include establishing drainage as a utility and using impact or capital recovery fees.

The State of Texas has not specifically authorized cities to use the full range of possible drainage financing methods. It is fortunate that a home rule city has some latitude in using a variety of financing concepts. Home rule cities look to state law for limitations upon their powers, not for specific grants of power. Thus, home rule authority enables the City Council to enact funding methods which respond to the City's drainage needs without specific authorization at the state level.

However, restrictive court definitions of local taxing powers in Texas could impose limits on a city's flexibility.

From a practical standpoint, the program and financing strategy proposed for stormwater management must reflect the needs and attitudes in the local community and must be attractive to promote orderly growth. The options identified throughout this report have been developed in a manner that is intended to be consistent with reasonable public policies. The public will better understand drainage issues and the rationale underlying the strategies if the alternatives are clearly in tune with City policies on economic development, neighborhood revitalization, and environmental protection. Existing policies should not, however, foreclose opportunities to introduce new financing concepts or adjust existing policies.

3.3 Nonstructual Alternatives

Governmental Controls: Local governmental or administrative controls are means of providing control to sensitive areas such as the watershed and its flood plain. Such controls significantly broaden the scope of watershed management beyond the normal structural controls. Governmental controls take two forms: regulatory and non-regulatory.

Zoning and subdivision regulations are effective regulatory control tools in stormwater management. New approaches to the control and management of land allow flexibility in the operation of flood plain land use controls.

The detailed specifications commonly found in zoning ordinances are generally inadequate when applied uniformly over an entire flood plain zone. The natural functions of the flood plain vary from site to site (1) due to local conditions, (2) how the site interacts with the surrounding natural

features, (3) which conditions have a direct impact upon the site, and (4) whether the site is relatively pristine or is in the process of adjusting to surrounding disturbances.

An approach, that of controlling the impact of uses, represents a shift from zoning control of uses. Because of the shift in focus, this approach has caused some major changes in the operation of flood plain land use controls. This change can be characterized by a movement away from detailed specifications concerning construction techniques or site requirements and a movement toward performance criteria for land use.

One of the most commonly used methods of establishing performance type controls is the development of a series of policy guidelines that outline the community's expectations on the function of the land. The ensuing regulations are individualized, with each case being judged on its own merits as to how well it satisfies the policy guidelines. An alternate to this method is the use of performance standards. Using this type method, the community sets a specific measurable level at which the key functions of a development will meet these standards.

Subdivision control regulations are effective tools in watershed management. Unlike zoning ordinances which apply only within the city limits, subdivision control in Texas extends to areas within a city's extraterritorial jurisdiction (ETJ).

An effective method used in the establishment of a stormwater management program is the incorporation of runoff, erosion, water quality, and sedimentation controls into the City's subdivision ordinance performance specifications and design standards. This system allows for uniform application of a stormwater management program throughout the watershed, minimizing the possibility of inter-ordinance conflicts.

Non-regulatory controls take several forms. Annexation of areas which could potentially affect the flooding characteristics of the community is a viable method of increasing the effectiveness of stormwater regulatory controls. As discussed in the previous section, the subdivision ordinance and its platting requirements are essentially the only formal control the City has in regulating development in the ETJ. By annexing land, the City can use additional regulatory tools including the zoning ordinance, building code and the site plan review process.

Direct ownership through a fee simple purchase is one of the most effective means of preserving flood plains as open space areas, parks, existing caliche pits, or nature reserves within the City's corporate limits. Because of the direct expenditure of funds, there are fiscal limitations to this approach. However, some grant and loan programs are available to local governments through various public and private agencies for preservation and open space development within the City's corporate limits.

Purchase and/or dedication of flood easements is another option available for the control of flood hazard areas. This technique is usually implemented along drainageways requiring regular maintenance and inspection so as to maximize accessibility.

The development of governmental policies that limit or discourage the extension of public services (i.e., roads, utilities, parks, etc.) into a flood prone areas are effective tools in the promotion of stormwater management. By not authorizing the extension of services to nonconforming developments, the City in conjunction with private utility companies, can encourage flood conscious design.

Municipal Drainage Regulations: The Alton's Zoning Ordinance, Subdivision Regulations, and Building Code are the primary instruments used in the reduction of flood hazards within the city and its extraterritorial jurisdiction.

Drainage regulations to be developed for Alton should be designed to provide a stable foundation for a stormwater management program and provide effective measures for the prevention of flood damage to development. The regulations should outline concise performance standards for development outside of the flood hazard areas. Outlining at least a minimum level of performance for runoff will mitigate the long-term impact of development throughout the watersheds.

4.0 Stormwater Management Costs

Once the scope of stormwater management activities has been defined, it is necessary to estimate the annual cost for programs to achieve the stated program goals. Estimating the total costs (i.e., revenue requirements) of a comprehensive stormwater management program is the first step in preparation of a financing plan. Costs for each specific function performed as part of the program (e.g., capital improvements, operations and maintenance) must be estimated.

For initial studies, such as this one intended to present various management practices, order-of-magnitude estimates are sufficient to obtain a concept of the total cost of such a program. For implementation, more detailed analyses-- preferably in the context of a specific master stormwater development plan--are warranted.

Recently published literature provides a range of estimates of costs for stormwater management. In most cities, basic annual watershed administration, engineering, and reactive maintenance cost $30 to $50 per acre. Comprehensive management, including drainage master plans, preventive maintenance, and major capital improvements will cost several thousand dollars per acre.

This section presents representative data on the cost of each aspect of stormwater management: administration; planning, design, and engineering; regulation and enforcement; operations and maintenance; and capital improvements.

4.1 Administration

Administrative costs for watershed management are difficult to estimate. In situations where

no separate drainage division exists, estimating administrative costs from historical records will involve, for example, determining the percentage of time devoted to stormwater management by various personnel in Public Work, Planning, Code Enforcement, and other departments.

In most cases, the assumption that administrative expenses will be a certain percentage of total capital costs is a reasonable approach. The formation of a stormwater management utility will significantly increase administrative costs, however, because of the costs of developing and administering a billing system. Therefore, the percentage of total costs for administration most likely will be higher under a utility approach.

4.2 Planning, Design, and Engineering

Costs for planning, design, and engineering may be determined separately or may be included with other functions such as capital improvements, maintenance, and plan review (regulation). In cities where separate engineering divisions exist, estimates of the costs can be prepared by totaling the historical cost of personnel and adding an overhead percentage.

4.3 Regulation and Enforcement

Many jurisdictions charge fees based on actual cost of service for plan review, inspections, and other regulatory services. Therefore, compared to other costs, the costs for regulation and enforcement can be determined relatively easily and fairly accurately. However, to the extent these costs are financed by fees, they should not be added to the estimate of cost for function that will be financed by some other method.

4.4 Operation and Maintenance

The difficulties in estimating operations and maintenance (O&M) costs are similar to those in estimating costs for administration. To determine stormwater management costs, most public work's maintenance supervisors have to estimate the percentage of time that various people spend on stormwater maintenance as opposed to maintenance of other infrastructure. This division is difficult to do accurately.

Another approach is to estimate O&M costs as a percentage of total capital investment. This is relatively straightforward for recently built or proposed facilities; it is not as helpful for older facilities that need substantial maintenance. For recently built or proposed facilities, 3% to 5% of the base construction cost should be allocated for maintenance

A third approach, which presumes knowledge of the location and condition of all facilities, is to assign unit costs for maintenance to each facility that will be maintained. This approach is likely to be possible only in situations where inventories of facilities recently have been completed or where master plans recently have been prepared. Table 4.1 shows representative costs for mowing, debris removal, and other routine activities.

Table 4.1

Typical Maintenance Costs for Drainage Facilities

Activity	1997 Cost (dollars)
Grass-lined channel	
Mowing	130/acre/year/cycle
Cleaning	1.00/linear foot
Rock-lined channel	
Rock replacement	3.55/linear foot
Debris removal	1.00/linear foot
Concrete-lined channel	
Minor repair	2.25/linear foot
Debris removal	1.00/linear foot
Detention pond	
Mowing	38.75/acre/year/cycle
Cleaning	500 lump sum
Weed control	105/acre

4.5 Capital Improvements

Capital costs can be estimated for master drainage plans, capital improvement budgets, or other similar sources. One method for estimating is the use of tabulations for previous projects. These tabulations can be used as a guide, but no assurances can be drawn involving similar applications, especially if the severity of the conditions varies between the applications.

A second method is the use of old master drainage plans, capital improvement budgets, and engineering publications to supplement bid tabulations. However, these figures are only as accurate as the quantity of materials estimated.

A third method is the use of published equations for estimating construction costs. These equations may be useful in situations where a capital cost estimate of facilities is needed to estimate maintenance costs, and no other method is available. For example, if an estimate of maintenance costs is needed for an old facility for which no construction costs are available, these equations could be used to estimate current construction costs, and then calculate maintenance costs from that estimate. Also, these equations can be used for rough replacements costs of new facilities that have failed. This method should be utilized only when the first and second estimating methods cannot be used.

4.6 Summation

Establishing a concept for the stormwater management program is a critical first step in the preparation of a financing plan. Costs for each specific function performed as part of the program must be analyzed with respect to the program concept to determine total costs for comprehensive

stormwater management. Adequate funds for maintenance as well as capital improvements must be available for an effective watershed management program.

The Watershed Management Program must generate sufficient funds to provide for maintenance of existing and future stormwater structures, personnel costs, annual capital improvement projects and administrative expenses.

5.0 Financing Options

The lack of stable and adequate local financing is a major obstacle to implementation of comprehensive, long-range stormwater management programs. Traditional municipal financing methods have proven to be ill-suited to funding major improvements to drainage systems, their maintenance and operation, and regulation of private sector activities which impact the systems. This section addresses major recent changes in watershed management financing, and describes some of the alternative and innovative approaches which can be considered. It briefly summarizes a range of financing concepts and suggests criteria for evaluating various financing alternatives.

The range of financing option concepts available to the City of Alton includes those which are explicitly authorized by state legislation, those available under home rule authority, and methods which might require legislative authorization at the state level. Each of the options identified in this section has been used in one or more cities in the United States, though some have not been implemented in Texas. Their use in Alton could be subjected to legal challenge and judicial interpretation. Financing concepts used in other states cannot be assumed to be legal under Texas law, and methods held to be invalid in other applications should not necessarily be considered invalid for stormwater management.

Since both legislative and judicial actions may limit the application of the various methods of drainage financing, this list of options will require legal review by the City Attorney's Office. No legal evaluation was made during this analysis.

5.1 Summary of Financing Options

Traditionally, stormwater management has been financed using general fund revenues for annual operating expenses and a mix of revenue sources for capital improvements. The level of operational funding in most jurisdictions has only been sufficient to respond to the highest priority needs, and has not allowed comprehensive programs to be developed.

The range of financing option concepts presented herein is a contrast to the limited number of funding sources that have been used for stormwater management in the past. The options should be viewed as opportunities to broaden the base of support and balance financial participation in a stormwater management program, while also localizing costs when it is more appropriate than distributing them citywide

.

5.2 General Fund

The general fund of the City is the "base" of financing for municipal programs, with revenues from a number of sources including property taxes, excise and sales taxes, business licenses and taxes, utility taxes, and fees of several types. It supports wholly or partially those city functions which do not have other sources of funding such as service charges.

The City administration and Board of Alderman have discretionary control of the general fund through the budget process. Identified municipal responsibilities and political realities tend to define how most of these revenues are spent, however. It has historically been difficult for programs which focus on long-term, capital intensive, public facilities construction and maintenance to complete effectively in an annual municipal budget process.

There are few explicit limitations on the use of general fund revenues. They can be spent on both operational and capital expenses, although most often they are used for annual operating costs. Capital outlays which are sometimes paid from the general fund include equipment and land acquisition, but only rarely major construction.

General fund revenues are often relatively susceptible to economic conditions in the community. Sales tax and excise tax receipts drop during a bad economic slump. Property values may decline leading to reduced tax assessments. Property tax delinquencies tend to increase during periods of recession and high interest rates. At the same time demand for many municipal services (especially police and social services) increases.

Insofar as drainage is concerned, financing through the general fund tends to create an imbalance of costs in comparison to contribution to drainage problems, benefit or services received. The complexity of drainage problems makes it difficult to accurately define who pays a disproportionate amount or receives more in benefit than they may be paying. It is clear, however, that there is no measurable basis of equity inherent in general fund financing of stormwater management.

5.3 Drainage Utility Service Charges

This financing method has been instituted in a number of cities and counties (particularly in the western U.S.) as an alternative to general fund financing for annual operating expenses. These "user" charges are analogous to water and sanitary sewer service charges, but dedicated for stormwater management. This approach requires that an enterprise fund utility be established for

stormwater management.

The drainage utility is an innovative concept, but one which fits uniquely well with the program needs in most local stormwater management operations. The functions and costs for effectively managing drainage are similar to those needed to provide water supply and sanitary sewer programs. Since water and sewer have been financed through service charges for some time, it is not surprising that drainage utilities and service charges have been implemented in the same basic format.

The philosophy behind user charges for watershed management differs from those for water and sewer service in several ways. Unlike water supply, a measurable commodity is not delivered to the customer. The service provided is similar to sanitary sewers or solid waste disposal in that something is carried away and disposed of (i.e., stormwater) but quantified measurement is difficult and costly. The demand for the "service" is not comparable to the demand for water supply, since most properties drain onto downhill neighbors fairly effectively without any public system. A broader definition of benefit resulting from service is needed in the case of drainage than for other utilities. Finally, drainage programs are more oriented to solving or mitigating problems than are the other utility functions, which have focused on providing service to clients.

Unlike some of the other financing options, user charges can provide a true alternative to general fund financing for drainage, rather than just a supplement to it. The other options have a limited clientele group and will not generate sufficient revenue to fund all the necessary functions. User charges, on the other hand, spread the expense of the drainage program as broadly as possible throughout a community, resulting in a relatively low cost for each property owner.

Revenues derived from service charges can be used to pay for administration, planning, design, operations and maintenance, revenue bonds for new construction and replacement of old systems, support services, regulatory functions, and virtually anything else required in a drainage program. Rate structures are flexible mechanisms which enable a city to tailor the cost distribution to fit the local program and be consistent with other local policies. Finally, drainage utility revenues remain in the utility fund if not spent, rather than reverting for redistribution in the next year's budget, an important factor in long-term program stability.

5.4 Interfund Loans to Drainage Utility

The legislative action establishing an enterprise utility necessarily precedes the imposition of service charges and collection of revenues. An interfund loan from another municipal fund(s) may be desirable for interim financing of stormwater management functions until revenues are generated by the drainage utility. An interfund loan of this type is normally repaid from the utility service charge revenues.

5.5 General Obligation Bonding Repaid by Property Taxes

Capital improvements are often too expensive to finance from operating revenues, especially when an activity is funded from the general fund. General obligation bonding is a form of municipal borrowing in which the full credit of the city is pledged to service the bond debt. These bonds require voter approval, and usually involve an excess property tax levy. They have been used for many purposes in the past, though use of them for utility projects has diminished with greater

acceptance of revenue bonds.

Because they are backed by the full credit of the local government, general obligation bonds normally receive the most attractive (lowest) interest rates of any municipal borrowing instrument. They can be issued with varying maturities and other provisions which may affect their marketability and the interest rate they must pay.

5.6 Revenue Bonding Repaid by Service Charge Revenues

Enterprise funds, such as utilities, which have a source of financing separate from the general fund can borrow money for capital improvements through bonds to be paid off with service charge revenues. These bonds do not require a voted approval, but are usually subject to slightly higher interest rates than general obligation bonds because the full credit of the city is not pledged.

Revenue bonds do not authorize an increase in taxes, nor do they usually authorize a specific increase in utility service charges. If necessary to support the bonds, a rate increase is normally enacted separately. It is possible to use service charge revenues from throughout a service area to repay revenue bonds or to specify that only revenues from one area or even certain properties be used for the bond payments. In most cases, it is best to place few limitations within the bond ordinance which relate to revenue sources, while still being consistent with financing philosophies and local policies. This provides the bondholders with some assurance of payment, and may result in a lower interest rate.

Although typically the bonds are repaid from the regular service charge revenues, municipalities may also establish system development charges, hook up fees, and other financing

methods and earmark those funds for repayment of the revenue bonds. This reduces the revenue required from the standard service charge by the amount generated by the special fees and charges, and ensures that developing properties help pay for the project.

5.7 Utility Tax Revenues

Utility taxes and franchise taxes are levied on utilities operating with a municipality, including one or more of the following in most jurisdictions: telephone, electricity, natural gas, water, sewer, solid waste, fuel oil, cable television, and drainage. In recent years, cities have used utility tax revenues to construct various kinds of capital improvements, including drainage system improvements. In general, communities have a high level of discretionary control of utility taxes and their uses.

5.8 Tax Increment Financing

Tax increment financing can be used to provide funds for an infrastructure in areas where development is desired but funding for public facilities are not otherwise available when needed. In this approach, increases in tax revenues that are realized as a result of new development in a specified area are earmarked for financing public improvements or services in that area.

Usually administered by a public agency, a district is defined with a specified "base line" tax base of existing development. Improvements within the area are financed from the general fund or from bonds, then repaid from increasing tax revenues generated by the new development. The new development in effect pays its own way, using the community's normal tax program as the

mechanism for deriving revenues. The method does have the drawback of siphoning off all increases in revenues, even revenues attributable to increased value of existing development in the area, until the bonds are paid off.

5.9 State Funding

Community Development Block Grant Funds: These revenue sharing funds are intended for use in neighborhoods which have been targeted for improvement based on social-economic and physical condition criteria. The City has discretion in the use of the funds within broad guidelines. In Texas, CDBG funds are administered by the Texas Department of Commerce.

With pressures to balance the federal budget, the future of federal development funding is uncertain and the City should not depend on CDBG funds. In addition to the uncertainty surrounding revenue sharing funds, the program itself has substantially more applicants that funds available. Therefore, grants are generally awarded to those communities with highest priority needs, such as substandard housing, inadequate water and sewer systems, and a significant percentage of low/moderate income residents.

Texas Water Development Board Funding: The Texas Water Development Board (TWDB) administers state funds for financing flood control projects. TWDB funds are disbursed to eligible political entities, generally as loans. Using the state's excellent bond rating, TWDB sells Texas Water Development Bonds which are general obligations of the state and purchases the bonds of local political subdivisions.

Historically, use of the Texas Water Development Fund was reserved for "hardship" political

entities (political subdivisions unable to sell bonds in the open market or political subdivisions unable to sell bonds at a reasonable interest rate). However, passage of House Bill 2 by the 69th Legislature and approval by voters in November 1985 expanded the program to allow TWDB to make loans without a finding of hardship for the construction of a regional water treatment facility, flood control project, and facilities designed for conversion from the use of ground water to surface water.

TWDB may provide loans from flood control funds for the following flood-control related projects: (1) construction of stormwater retention basins, (2) enlargement of stream channels, (3) modification or reconstruction of bridges, (4) the acquisition of floodplain land for use as a public open space, (5) acquisition and removal of buildings located in a floodplain, (6) relocation of residents of buildings removed from a floodplain, and (7) development of flood plain management plans. To determine if a project is eligible for loan funds, several points are considered including the needs and benefits of the project to the area to be served, the availability of revenue for repayment of the loan, and whether the political subdivision can reasonably finance the project without State assistance (hardship).

5.10 Fees and Charges

Cities have developed a variety of special administrative fees and charges to cover expenses which are associated with permits and other services for individuals. In most cases an identifiable "client" is assessed the fee or special charge, which is often earmarked to support a specific function.

Plan Review and Inspection Fees: The City has specific design and construction standards which private drainage systems must meet. Development permits are issued only when the plans meet these standards, requiring that the staff check that plans. Field inspections are necessary to verify that the systems are installed as designed, since private drainage systems may have a direct impact on the function of public systems. Some cities attempt to make plan review and inspection financially self-sufficient through the fees, while others subsidized these functions partially out of general fund revenues to encourage development. The net effect of this type of fee is to have individuals with changes in land use bear some or all of the cost for improvement of public services impacted by their projects.

On-site Detention/Retention System Inspection Fees: The private drainage systems which are installed on private property are important components of the total drainage system. Public systems are often designed and operated on the assumption that the private systems will function properly. Experience has shown, however, that voluntary maintenance of private drainage systems is very lax. Annual inspections of private on-site facilities can identify needed maintenance before problems occur, but they are relatively expensive to carry out on a regular basis. These inspections can be billed to the property owner as a service charge if a drainage utility is established. It may be possible for the City to also levy such a charge without a utility, though an annual permit of some type may be needed.

Impact Fees: Impact fees are charges or assessments against new development to fund the cost of capital improvements or facility expansions necessitated by and attributable to the new development. As of June 1987, Texas cities are expressly authorized to assess impact fees for

drainage facilities provided that the fees are directly associated with actual impacts and earmarked to ensure they are used to mitigate those effects. Further, the costs of over sizing facilities constructed prior to adoption of an impact fee ordinance may be recouped through the fees.

Impact fees began as a response to the realization that construction and land development may have significant impacts on a neighborhood or even an entire community. Rapid growth fostered a concern not only for the environmental effects of growth, but the economic implications as well. Increased urban runoff and pollution, congested highways, and larger water and sewer facilities often translate into higher property taxes to upgrade municipal systems in response to problems. Impact fees are perceived as a mechanism to make growth pay it's own way by participating in the cost of new facilities at the front end of a project rather than indirectly through long-term enhancement of the tax base and increased local employment.

While the recently enacted state legislation limits the use of the impact fee concept, the statute validates a funding process that has already passed judicial scrutiny. The new law requires that, prior to adoption of an ordinance establishing impact fees, a City must conduct several studies to determine the real impact of new development on the infrastructure. These studies include land use assumptions, establishment of service areas, a capital improvements plan, and analyses relating the costs of improvements to individual "service units." The statute also prescribes a definitive adoption procedure and requirements for earmarking and accounting, refunds, and assessment and collection of the fees. Prohibitions on the use of fees include "repair, operation or maintenance of existing or new capital improvements" and "administrative and operating costs" of the City.

Impact fees are sometimes confused with the other types of special fees and charges cited in

this report. Care should be taken to differentiate between impact fees, which are associated specifically with the impact of a project, and the general needs for new facilities to serve the community.

Development Assessment Charges: As an alternative to requiring each new development to provide conveyance systems, on-site detention or retention to mitigate increases in peak runoff, the City could institute this type of charge as an option available to developers in some drainage basins. Detention capacity and conveyance systems would be satisfied by regional public facilities, which the developers would be "buying into" through the development assessment charge instead of building the on-site detention system. Such fees are then earmarked to pay for regional detention facilities.

This approach will probably be enthusiastically welcomed in communities where developers have experience with building their own on-site detention systems. Not only are the developers relieved of the cost of design and responsibility of building the on-site facility, but they gain more flexibility in the use of their property since an area need not be set aside for detention of stormwater.

Assessment fees are particularly useful when more than one type of drainage system would solve or mitigate a problem, but one approach would be privately financed while the other would be paid for from public funds. In some cases, the cities would prefer to have the type of system that would require public financing, yet do not want to forego the private investment which is justified. Assessment charges can offer the best of both options by allowing the most desirable system to be built while still ensuring private financial involvement.

System Development Charges (SDCs): These charges have been used by municipal utilities

for a number of years as a method of financing improvements. They have been known by several titles other than system development charges, e.g., utility expansion charges and extension and improvement charges. System development charges differ from other similar charges, such as general facility charges, in that they are associated with specific improvements are constructed as a means of balancing financial participation.

Communities must frequently install suitable water, sewer, and drainage systems in anticipation of growth. System development charges enable communities to meet the increasing demands on systems which accompany growth pressures. The SDC resembles the latecomer fee for developer extensions, which is explained below, in that the intent is to enable a community to achieve excess capacity improvements in advance of growth. At the same time, place an equitable portion of the cost on those properties which later develop and makes use of the extra capacity that was built into the system.

When revenue bonds (supported by drainage utility service charges) are used to finance drainage improvements, SDC's can ensure that all properties, adjacent to or within the watershed, equitably participate in the financing of the capital improvements. Major drainage improvements are normally sized with future development in mind and have a useful life at least two or three times as long as the bond maturity. One purpose of the SDC's concept is to ensure that the properties which develop after the bonds are sold also help to pay for the improvements, SDC's should be consistent with that amount paid by developed properties when the improvements were constructed.

The SDC provides a rational financing method which responds to the sensitive issue of who pays for over-sizing to accommodate future growth. Care must be taken, however not to place too

much confidence on future growth as a revenue source. If the growth slows or does not occur, the existing developed properties might have to pay a larger service charge in the future to cover the shortfall of SDC revenue. Unanticipated increases in service charges due to SDC shortfalls can erode a utility's credibility with the public, and should be avoided through conservative projections.

General Facilities Charges: General facilities charges are similar to the SDC concept, although they are more often used for overall improvement to a system, or for maintenance or replacement than for specific capital improvements. This method of financing is most often used when improvements which will benefit an entire service area are involved.

If a community has sufficient drainage utility service charge revenues that improvements made to the drainage system can be paid for directly out of revenues rather than through bonding, general facilities charges can be used to balance the financial participation. For example, if all improvements to the drainage systems are oversized for future conditions but the developed properties are not billed a service charge, the general facilities charge can be used to ensure that developing properties "buy into" the prior capital investment in the system. This type of financing works best when the newly developing properties must obtain a permit to hook up to the drainage system, similar to the case of water and sewer.

The general facilities charge is probably most appropriate when a simplified rate structure is used which lumps operating and capital expense into a uniform system of charges or an "equivalent residential unit" approach. In such cases, the costs of all elements of the drainage program are spread area-wide without a highly refined cost distribution formula.

The underlying philosophy of this approach is that the improvement serves everyone, or the

system is viewed as a fairly uniform whole rather than as a number of discrete parts. There is usually no need to break down a general facilities charge into component parts, whereas a system development charge is often associated specifically with revenue bonds for individual improvements, which suggests that much closer accounting practices are justified.

Other terminology is used in different areas of the country for financing concepts quite similar to general facilities charges. Water and sanitary sewer "hook up" fees are often intended to help finance general improvements to the systems rather than simply cover the expenses related directly to the hook up itself. Some cities include general facility charges in building permit fees, or other municipal approvals associated with development. Regardless of what they are called, general facilities charges for drainage provide an additional revenue source which may fill in gaps in a utility rate structure. The gaps are often intentional and reflect the City's financing policies (e.g., undeveloped properties do not help finance utility systems), or occur because of billing system limitations.

Latecomer's Fees: These charges are especially useful in developing areas or where major reconstruction or upgrading of a drainage system is needed, public funds are limited or not available, and a private development is contingent on the improvement. Through a developer extension agreement, the City can allow the developer to construct the improved and oversized drainage facility in conjunction with the project.

Developer extensions are common for water and sewer systems in new developments, but have not been widely used for drainage systems. The latecomer's fee is usually only used for over sizing costs, for example in the case of sanitary sewer interceptors or to ensure fire flow capacity to

other properties. This charge method may be applied to drainage systems as well.

Regardless of what these various fees and charges may be called, they typically have specified purposes, and are accounted for in a manner which allows the revenues to accumulate. Fees and charges dedicated for specific purposes can be carried forward, and reserves can accumulate if an enterprise utility fund is established for drainage which separates the revenues from the general fund.

Revenue which is not spent for several years may also require special accounting treatment in municipalities in some state. Usually, the money must be accounted for in the budget, even if it is not intended to be spent during that year. For water, sewer, and solid waste, a utility expansion fund is often the reserve account for these revenues in a municipal budget. Drainage utilities can use the same accounting technique to make dedicated reserves less susceptible to application to other needs, a protection which may be important in differentiating fees from taxes.

Utilities are allowed to retain surplus funds, both as a reserve to respond to emergencies and as a natural function of long-term rate structures which are predicated on differing rates of change in expenditures and revenues over time. This reduces the frequency at which the rate structure must be changed, contributing to stability. Similar accounting practices allow revenue accounts for fees and charges in a utility to accumulate. It is important to clearly identify reserved funds in the annual budget and to maintain a proper audit trail to ensure that an accurate picture is given of the enterprise's balance sheet, including fee accounts.

5.11 Special Assessments

Several methods of levying special assessments on benefited properties to pay for drainage improvements have been used around the country. In most cases, the projects have a demonstrable benefit to the properties included in the assessment area and the charges for each parcel are consistent with the relative benefit to each property. In Texas, special assessment options include drainage districts, which are special-purpose taxing districts with specific authority to deal with stormwater management (10), and special improvement districts, which are areas of the city where the majority of property owners have requested City Council to establish a district and collect assessments to fund levels of service and programs in excess of the existing levels (11).

5.12 Criteria for Evaluating Financing Options

Whenever an effort is made to develop a new drainage program and/or a new financing concept for a municipal function as complex as stormwater management, some basis must be established for judging the appropriateness of the various options. A financing strategy must provide a stable, adequate, and publicly acceptable source of funds which will support the entire program as efficiently and equitably as possible. Transition, growth, and future program requirements must be considered as well as immediate needs. Further, the financing strategy must be consistent with the community's perceptions and resources.

Based on experiences in cities which have implemented stormwater management programs, the following criteria were selected as qualitative measures of the financing options. It is unlikely that any single financing method will be judged best under this wide range of considerations, but the criteria should help identify the best mix of funding methods, and reconcile differences between

program and financing strategies. Some of the criteria may be viewed as more important than others. The order does not imply a priority, although public acceptance based on perceived equity is essential for political success of any new stormwater financing proposal. No single criteria should outweigh the others to the extent that an option is selected or rejected solely on one consideration.

Perceived Equity and Public Acceptance: Public acceptance of a financing strategy and the mix of financing methods it incorporates is essential for a drainage program to be successful. It must be recognized that some members of the community will not wish to pay anything, through any financing method, to fund drainage control. In most cases, a larger segment of the population will understand the need for an adequate stormwater management program, and the necessity of paying for it. To these citizens the critical issue is usually equity. It is important to note that perfect equity is probably not achievable either technically or economically, and that public opinion will be based on "perceived equity" and an appearance of basic fairness in financing.

The key is to finance stormwater management in an understandable manner. This is the strength of classifying financing techniques according to purposes for which the technique typically is used. It presents a logical association between what is done (functions) and how to pay for it (financing). To achieve perceived equity and public acceptance this logic must be communicated to the general public through various public information concepts.

Flexibility: A great deal of change could occur in stormwater management programs during the next decade. More effective regulation and maintenance of systems could be required. Water quality may become as important a concern in the overall management of the drainage systems as flow control. A financing strategy should be responsive to the growth needs of the program and to

the physical complexities of the drainage basins. It must provide a flexible approach which can grow incrementally with the program.

To gain this flexibility, a mix of financing methods is likely to be needed. Some methods may require authorizing legislative action at the state level, and the local government may have to substitute a second choice for funding some functions until such legislation is adopted. Care should be taken during the interim not to foreclose options which require legislative authorization. It is also possible that a financing strategy selected through this process will not fit the needs 10 or 20 years in the future, in which case the most flexible system might be the easiest to adjust to meet changing priorities.

Capacity: The financing methods should be carefully evaluated to determine if they can generate sufficient revenue now and in the future to meet program needs. The public's willingness to pay may have thresholds beyond which they will not support even the most equitable financing system for watershed management.

Perceived equity is a factor in the public's willingness to pay. Their willingness may increase with the strength of their perception of equity. However, emphasis on equity also carries with it a potential problem if the financing capacity of the most logical and equitable funding method is insufficient to accomplish the program.

Analysis of long-term financing capacity is important, and the equity criteria must be tempered with a degree of reasonableness. Inflation and other factors can render even the best estimates unreliable, which would suggest that the greatest emphasis be placed on short-term financing capacity (for not more than five to seven years).

Cost of Implementation: The bottom line to many of the criteria identified in this section is cost. A perfectly equitable financing method might be desirable and achievable except for the cost of development and maintenance. Compatibility with other programs and policies may be limited in a financing strategy to avoid the expense of an excessively complicated mix of financing methods, or to limit the complexity of needed rate structures.

The initial cost of implementation must be weighed against the financing capacity of the options and the program needs. A financing method which costs more to implement may be worth the added expense if the alternatives cannot generate sufficient revenue to fund the program. Another consideration is the source of revenue against which the implementation costs would be charged. One element of a financing strategy could be to delay the implementation of some financing methods until a drainage utility is formally established, making the subsequent implementation costs a utility expense rather than a general fund expense. The work might initially have to be funded from an interfund loan from another fund, but could be repaid later from utility revenues.

Finally, the cost of implementation must be weighed against the price of delay. Many segments of a drainage system may be in need of remedial repair or even replacement to prevent costly and dangerous failures. At least one year lead time is usually needed to prepare plans, designs, and bid documents to correct major drainage problems. Timely implementation may prove less costly in the long-run than the method with the lowest initial cost of implementation. Also, each month that a utility service charge concept is not in place, it means that the revenue is foregone.

Compatibility: Whenever possible, the financing methods for stormwater management

should be compatible with existing policies, practices, and systems. This simplifies implementation and acceptance among City staff, and minimizes costs. Special emphasis should be given to ensuring compatibility between policies pertaining to the water and sewer utilities and those of a drainage utility, if one is established.

In some cases, financing methods may necessitate substantial changes in existing practices or systems. For example, use of drainage utility service charges might require that the utility billing system be altered to incorporate the additional billing. An effort should also be made to anticipate opportunities to improve existing systems during a changeover in the drainage program. Development of a master billing file for a utility service charge could provide the mechanism for assembling a parcel-based data system which would have spinoff benefits for land use planning, economic development, and other municipal programs. The incremental cost of generating additional data for management information systems is minimized if it can be piggybacked with the base file work being done for drainage or other related purposes. The City should also consider compatibility with programs in neighboring jurisdictions and special-purpose agencies.

Upkeep Requirements: The financing methods may have differing needs in terms of upkeep. Some require virtually no file or record maintenance, whereas others demand constant updates. Fee systems can be set up in a variety of ways which imply different upkeep procedures. Systems which minimize upkeep costs are desirable, but this must be weighed against both the equity and flexibility considerations.

This criterion is especially important with regard to drainage utility service charges. The upkeep requirements can be controlled through proper design of the data systems and processes that

are used in the rate structure and for billing. The best reference, for evaluating the upkeep costs of drainage utility service charge financing options during the finance strategy phase, is the experience of the other cities which have implemented similar systems.

Balance: A financing strategy must be balanced in the terms of dependency placed on any single method of funding, the fit with the drainage program, and the resources of various sectors of the general public. A single source is likely to provide most of the money for annual operating expenses, i.e., either the general fund or a utility service charge. An effort should be made, however, to balance the dominant revenue source with complementary funds for special elements of the program. A municipality can control (to some degree) the balance the dominant revenue source with complementary funds for special elements of the program. A municipality can control (to some degree) the balance of revenue sources to ensure that the financing capacity is hedged against economic downturns and is responsive to economic improvements.

Drainage utility rate structures are relatively inelastic, and more stable than other utility rates that are based on consumption (e.g., water and electricity). Most drainage rates are based on how the use of property effects hydrology and/or water quality (with no charges assessed to unimproved property). These rates do not change in response to the economy. Delinquencies tend to increase during recessions, however, and a drainage utility is not totally immune from a revenue shortfall.

With so much emphasis placed on reconciling the financing strategy with the program strategy, that aspect of balance is usually well-assured initially. Care must be taken that the balance of the financing strategy remains consistent with the various stages in the development of the program, especially in light of the capacity of various financing methods. If the cumulative

willingness to pay of the citizens in a neighborhood is fully tapped during the first two years by application of a variety of fees and charges, another element of the financing strategy might later be rejected. Also, no segment of the community should feel that the entire drainage program is being carried solely on their backs.

Timing: This consideration is most important in terms of the time required for implementation, and whether it fits with the desired timing of the program development process. If possible, charges should be initiated during the rainy season, when residents' recognition of drainage problems is highest. Some financing methods are highly dependent on timing for success. For example, special assessment districts should be proposed when the problems are fresh in the residents' minds and not during drought times.

Geographical and Jurisdictional Considerations: Unique geographical conditions should be incorporated into the evaluation, especially when there are numerous drainage basins, as the case in Alton. Over the long-term, demand for drainage services may be similar, but some areas might require replacement of inadequate or failing systems years before others.

Possibly the most important jurisdictional consideration is the difference in service level and design standards between neighboring local governments which share responsibility for drainage basins. The financing options should be evaluated on their suitability for bridging technical differences to support mutually desirable solutions to problems. The priorities which each local jurisdiction place on achieving its standards should also be reconciled with the opportunities afforded by financing options.

5.13 Summation

Experience has shown that implementation of numerous service charges, fees, and taxes cause confusion and misunderstanding in payment and funding allocations. In addition to an administrative fee charge for drainage plans review, a general drainage facilities charge, a base charge for the entire City similar to a utility charge but based upon land use, should be considered to supplement the existing fee structure. This charge would be designed to generate the additional revenue needed for program operations and allow the burden for generating revenue to be distributed equitably among all the citizens of Alton.

The City of Alton needs to review the financing options and adopt a combination that should provide adequate funding for a stormwater management program.

6.0 Administrative and Managerial Considerations

Effective stormwater management involves establishing goals, specifying the scope and defining the functions of the stormwater management program to achieve the goals, and delineating. Responsibility for the functions or activities (i.e., organization) must be delineated. These aspects of management are important for both legal and administrative reasons.

A comprehensive program of stormwater management could be subjected to legal challenges. To counter a challenge, officials must be able to show that the program was created as the result of a careful master planning process and is based on rational, objective principles. City officials with a good understanding of the scope of their program are in a better position to document costs (revenue requirements), relate revenue sources to costs, and justify financing techniques.

6.1 Scope of the Stormwater Management Program

In Texas, state law authorizes municipal floodwater management. Within the constraints of the state requirements, local governments may establish their own goals. Local jurisdictions are allowed to determine who will have responsibility for administration of the programs.

The goals of the program can be quite broad. For example, the principal goal of the stormwater program could be to identify the existing and future flooding, sedimentation, and water quality problems within Alton and its extarterritorial jurisdiction and evaluate and implement appropriate measures to eliminate, reduce, or prevent these problems. Other program goals could include:

- Integration of the planning, design, and construction of public and private (on-site) stormwater management systems into a single watershed management plan.

- Mitigation of the adverse impact of stormwater flows within the studied watersheds.
- Coordination of City efforts through the stormwater management program to reduce duplication of effort.
- Periodic review and revision to the watershed management program to assure continuity with City policies, laws, regulations, and ordinances.

6.2 Stormwater Management Functions

Stormwater management typically involves these functions: administration; planning; design, and engineering; operations and maintenance; regulation and enforcement; and capital improvements. Water quality improvement and finance sometimes are included as separate activities.

The types of functions which will make up the stormwater program are a major consideration in molding the financing strategy. Defining the functions or activities of the stormwater management program allows the financing option to be evaluated in relation to various aspects of the long-range program. For example, a mix of different financing methods is often found to best for comprehensive programs that include planning, maintenance, construction and various other activities.

6.3 Options for Program Administration

The decision on how to organize these functions within the City of Alton should be made

after careful consideration of the strength and weaknesses of alternative approaches. No two communities resolve the organizational issues in exactly the same way. Stormwater management may be performed by:

- the Planning Department;
- the Public Works Department;
- a Department of Environmental Regulation;
- a separate Drainage Utility controlled by the municipal government;
- an independent Drainage District.

In some situations, responsibility for stormwater management is shared among departments. For example, Public Works may have responsibility for design and engineering, capital improvements, and operations and maintenance, with City Administrator or Finance responsible for billing, and Planning or Community Development responsible for regulation and enforcement. Decisions about the assignment of stormwater functions to specific departments should be made only after evaluation of the possible alternatives.

6.4 Evaluating Administrative Options

Evaluating the strengths and weaknesses of different administrative approaches to stormwater management is a difficult task for which there are no precise guidelines. Evaluation criteria necessarily will be qualitative; professional judgement will be the basis for most decisions.

Factors to be considered are presented in Table 6.1. The list is not inclusive. The most important aspect of the evaluation is that the options should be evaluated systematically.

Table 6.1

Criteria for Evaluating Administrative Approaches

1. Department currently exists.
2. Department has sufficient, competent staff to administer and manage a program.
3. Department has ability to integrate water quantity and water quality concerns.
4. Department has experience dealing with public and development community.
5. Department has engineering capabilities.
6. Department has regulatory experience.
7. Department has experience in contracting with other entities.
8. Department has experience with implementation of fee schedules for services.
9. Department has experience in managing capital improvements and maintenance programs.
10. Department has testing, sampling, and laboratory capabilities.
11. Department has experience in managing complex database such as a utility master accounts file.

Note: This list of criteria is not complete; others should be added and, if necessary, some removed, depending on the needs of the City of Alton.

In situations involving reorganization of ongoing responsibilities, bureaucratic infighting may occur. The possibility for this should be recognized, and all agency heads potentially affected should have opportunities to collaborate and present recommendations before final decisions are made.

6.5 Public or Private Maintenance of Drainage Facilities

There are strong arguments in favor of private maintenance, especially from the perspective of public works managers who have inadequate funding for existing maintenance activities. The main one is that private maintenance limits the direct public costs of stormwater management.

The American Public Works Association (APWA) suggests that maintenance activities are best carried out by the entities with the "greatest interest in the specific benefits associated with each maintenance operation" (2). With this approach, maintenance for aesthetic purposes would best be done by residents or users of the area near the particular facility. Maintenance for reasons of safety (e.g., to maintain the structural integrity of drainage facilities) is a public concern and should be carried out by a public agency. Maintenance responsibility often would differ with the type of facility.

APWA has identified factors to be considered in deciding whether drainage facilities are to be privately or publicly owned (Table 6.2). Nevertheless, APWA concludes that:

> "there appears to be a preference for and a trend towards public ownership. Generally, unless basins are maintained by public agencies, long-term

Table 6.2

Factors Affecting Decisions About Ownership of Stormwater Facilities

1. Type of development.
2. Size, location, and proposed use of development.
3. Potential impact of failure or malfunction of the drainage system
4. Possible multipurpose use of the facility.
5. Design life of the facility.
6. Runoff contributions from offsite areas.
7. Resources in funds, equipment, and personnel of the City.
8. Existing local ordinances and regulations.
9. Control of the facility as to safety and theft or vandalism.
10. Public ability and willingness to provide maintenance

adequate maintenance cannot be assured."

Cost is the biggest obstacle to providing public maintenance. It is clear that decisions by the City of Alton to maintain facilities in the private sector would greatly increase public expenditures for stormwater management.

6.6 Drainage District vs. Drainage Utility

Local government's ability to respond to drainage problems and needs has historically been limited by two major factors. First, the traditional structure of municipal government does not

provide an organizational focus for drainage activities. The second obstacle has been the lack of stable, adequate, and publicly acceptable financing methods.

Public work's strategies tried and proven in dealing with other municipal problems have not always adapted well to drainage applications. Cities have had to seek or develop creative new alternatives for meeting the stormwater challenge. Two such alternatives are described herein: drainage districts and drainage utilities are as follows:

1. Drainage districts are special-purpose local government agencies authorized to deal with watershed management. In Texas, they may levy valorem taxes and issue bonds; as of June 1987, they are also authorized to impose capital recovery fees. These special-purpose governments lack many of the essential general-purpose responsibilities of cities and counties which enable a comprehensive approach to urban runoff management, such as land-use control and police powers. Many special districts have been used successfully for drainage control in rural agricultural areas, but their track record in urban communities, especially those undergoing rapid growth, has been poor.

The creation of drainage districts as political subdivisions assures local control over water resources. However, the state does exercise substantial control over most districts through approval of plans for development projects and continuing supervision, primarily regarding financial matters, by the Texas Natural Resources Conservation Commission.

2. A Storm Drainage Utility is a special-purpose organization within the City government given the responsibility to provide for public needs in the area of stormwater management. In the same way that the Water and Wastewater and Electric Utilities are self-supporting, the Drainage

Utility charges fees for the operations and maintenance of facilities and for capital improvements.

Storm drainage utilities provide a variety of services including maintenance of detention ponds, repair and cleaning of catch basins and storm sewers, as well as monitoring storm water quality. The utility staff reviews new developments and subdivisions to ensure that they provide adequate drainage facilities and share in the cost of basin improvements. These functions, along with administration, budgeting, and answering questions from the public, are part of the operations of a storm drainage utility.

6.7 Summation

There are many options available to the City of Alton on how it can manage a stormwater management program. The City of Alton needs to review the administrative and managerial options and establish an organizational system which by definition could oversee the stormwater management program.

7.0 Suggested Drainage and Stormwater Management Policy

7.1 Purpose

A drainage and stormwater management policy to establish the general framework of the desired management program needs to be formally adopted by the City of Alton. The general purpose of the proposed City of Alton's drainage and stormwater management policy would be to protect and provide for the safety and welfare of the general public and to minimize and mitigate flood damage to private and public property within the community, and to establish methods of fiscal responsibility by developers. A suggested policy is summarized in the sections below. The objective of this suggested policy is to identify an outline of the key elements that can be used to establish a stormwater management policy for the City of Alton. The City of Alton should thoroughly review this suggested policy and then adopt one that meets its specific needs.

7.2 Suggestions for a Drainage and Stormwater Management Policies

It shall be the City of Alton's policy to:

- Incorporate natural floodways in areas of new development
- Establish management practices to be used for the drainage and control of stormwater runoff and flood waters, where it can be shown the use of natural floodways will not adequately protect life and property.

  The order of preference for structural techniques is as follows:

  a. Conveyance-oriented approaches

(1) Channel alterations

(a) Vegetative lined channels

(b) Stone or riprap lined channels

© Concrete lined channels

b. Storage-oriented approaches

(1) Regional storage facilities

(a) Detention

(b) Retention

(2) On-site storage facilities

(a) Detention

(b) Retention

- Initiate and continue coordination with the Cities of McAllen, Mission, and Palmhurst and the Hidalgo County Drainage District No. 1 to utilize non-structural approaches to maintain the natural floodways and the integration of the drainage and stormwater management program. Non-structural approaches include, but are not limited to, the following:

  a. Annexation

  b. Fee simple purchase of land for open space uses.

  c. Acquisition of floodway easements and right-of-way in flood hazard areas.

- Initiate and continue coordination with the Cities of McAllen, Mission, and

Palmhurst and the Hidalgo County Drainage District No. 1 on the use of structural approaches to manage the drainage and stormwater management improvements

7.3 Application of Drainage and Stormwater Management Policy

A City's policies for drainage and stormwater management govern the planning, design, construction and operation of storm drainage facilities within the City's jurisdiction. A drainage and stormwater management policy should based on the City of Alton's Code of Ordinances, the **Drainage Design Manual**, and this Report. Each should be considered effective on the date of acceptance by the Alton City Board of Alderman. The overall drainage and stormwater management policy should apply to any drainage and stormwater management system improvement not having plans released for construction as of the date of the City's approval of this manual.

7.4 Regional Stormwater Management

To limit the impact of development and corresponding storm runoff within the Hidalgo County Drainage District No. 1's (HCDD No.1) Main Ditch(s) watershed(s) and to provide flood control in that area, regional stormwater management must be implemented by the City of Alton in a coordinated effort with the Hidalgo County Drainage District No.1 and the surrounding communities. All inflows into the Hidalgo County System are limited in accordance with the rules and regulations of the HCDD No.1 and all latest permit requirements for discharge into such

county ditches must be adhered to.

7.5 Drainage System Classifications

Major Drainage Systems: Major drainage facilities should include natural or improved manmade channels, detention reservoirs (Natural or manmade), bridges or roadway culverts, overflow swales and street rights-of-way. In certain instances, an enclosed storm drain pipe system may be considered part of a major drainage facility if it drains a sump area. The design storm, as defined by the 100-year frequency flood, must be contained within the right-of-way or dedicated easement of all major drainage systems to provide for public safety and welfare.

Minor Drainage Systems: Minor drainage systems are intended to provide conveyance for more frequent occurring flooding and usually consist of streets, storm drain inlets, pipes, roadside ditches and driveway culverts. To enhance the quality of life and provide for public safety, minor drainage systems are required to provide conveyance for the 10-year frequency flood under fully developed watershed conditions.

7.6 Drainage and Stormwater Management Plans Submittals

A review process should be established by the City of Alton to provide control of all development activities related to drainage and stormwater runoff through natural or manmade facilities. As part of the review process, a preliminary drainage plan containing a conceptual layout of the proposed storm drainage system must be submitted as part of the preliminary platting process.

When land development is proposed contrary to those assumptions used in the development of the **Master Plan**, detailed analysis of the drainage and stormwater facilities for the development will be provided by the developer's engineer to determine the need to compensate for the additional runoff created above that for current conditions.

The developer requesting a change in land use should be required to compensate for the additional runoff in excess of that calculated for the existing conditions. Measures to be taken by the developer should be approved by the City Administrator or designated representative. Measures used to compensate for the additional runoff should be one or a combination of the following methods and procedures, in order of preference:

- Acquisition and dedication to the City of additional downstream flooding easements to include areas not previously flooded.
- Storm runoff conveyance by use if streets, improved channels, culverts, and storm sewers to convey the runoff to the main drainage systems or existing stormwater conveyance systems whose discharge points are in the location of the major drainage systems.
- On-site flow attenuation by the use of time of concentration extensions, ditch attenuation with culvert under sizing, balancing of runoff coefficients (C), or methods based upon sound engineering principals and approved by the City Administrator or designated representative.
- Stormwater detention structures.

A final drainage plan must be submitted at the time of the final plat application. The final drainage plan shall include the appropriate computation sheets as required in Section 2.8, "Drainage Design Computations" of the City of Alton **Drainage Design Manual.**

7.7 Floodplain Development

Development within and improvements to the 100-year floodplain should be consistent with the improvements shown in this Manual and shall abide with all requirements of the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program.

7.8 Drainage Structure Aesthetics

Hydraulic design in the urban environment requires an approach not encountered elsewhere because appearance must be an integral part of the design. In an effort to maintain the natural aesthetics of its existing floodplains, the City of Alton encourages preservation of the natural floodplains and detention areas as greenbelt areas, and in some areas, the City may require the floodplain be designated as a greenbelt area in addition to the developer providing drainage or flowage easements. When utilized, the design of drop structures and other hydraulic structures should blend with the natural surroundings as much as possible to maintain the aesthetics of the natural occurring area.

7.9 Drainage Design Computations

Computations to support all drainage designs should be submitted to the City Administrator or designated representative for review and approval as part of the final drainage plan and should be in the form of standard computation sheets as contained in the City of Alton **Drainage Design Manual**. Computer programs (other than spreadsheets) used to perform computations shall be limited to those referenced in that manual. All computations submitted should be certified by an engineer experienced in municipal stormwater drainage design and registered in the State of Texas in accordance with the requirements set forth by the Texas State Board of Registration for Professional Engineers and in accordance with the City of Alton Code of Ordinances. Stormwater runoff computations should be based upon conditions representing ultimate watershed development in accordance with the Code of Ordinances and the Alton Master Drainage Plan.

7.10 Construction of Drainage and Stormwater Management Facilities

Development activities associated with the construction of drainage facilities must minimize erosion caused during construction. The protection of trees and vegetation should be maximized during construction of development activities. Whenever possible, the replacement of trees destroyed by storm water management procedures is encouraged.

7.11 Maintenance of Drainage and Stormwater Management Facilities

The hydraulic integrity of major and minor drainage systems dedicated to and accepted by the City of Alton will be maintained by the City of Alton. The hydraulic integrity of drainage systems retained by the owner with approval of the City and not dedicated to the City of Alton should be maintained by the owner. That is, all vegetative growth and foreign debris should be removed from the private drainage facility periodically to insure proper conveyance of storm waters. The appearance of drainage ways and floodplains, excluding the area between the top of each channel bank, and overflow swales should be maintained by the adjacent property owners.

All drainage and stormwater management facilities constructed, installed or provided by the owner should, upon acceptance by the City, become the property of the City. The City should be responsible for the operation and maintenance of the accepted facilities.

The City should maintain all accepted public drainage facilities located within City-owned land, city right-of-ways, and City easements. The City may maintain other accepted public drainage facilities located within or adjacent to the City. Such public facilities include, but are not limited to, open drainage ways and piped drainage ways constructed expressly for use by the general public and as part of the City drainage facilities; bridges; roadside drainage ditches and gutters; flood control facilities, including detention and retention storage, dikes, overflow channels, pump stations, etc., that have been designed and constructed expressly for use by the general public.

Duly authorized inspectors of the City should have the right of entry on the land or premises where property owners are required to maintain drainage and stormwater management

facilities, for the purpose of inspection of the maintenance required. The City Administrator's office should inspect the premises of each such facility approved at least once per year. Where a noncompliance is found, the City should request in writing that the property owner comply. This notice should describe the measures required to be taken. If, within one month of the notice, the maintenance required is not accomplished, the City shall either:

- Cause the necessary restoration to be accomplished and assess the property owner for the City's actual cost, or
- Bring an action for a mandatory injunction to require the property owner to accomplish the necessary maintenance.

8.0 Discussion of Improvement Alternatives

The improvements described in this master plan represent, for the most part, only those major construction projects that will be required to manage the drainage and stormwater runoff for the assumed conditions in the future. The assumption is made that the more localized drainage improvements will be incorporated in the development of subdivisions following the criteria set forth in the proposed **Drainage Design Manual** and will discharge into these major construction projects. Within the developed area of the community, preliminary plans are included to relieve known, existing drainage problems. Interim solutions to correct these problems that are consistent with the long range master plan are suggested.

The described improvements are well planned based on the available data, but they should be considered as conceptional or preliminary. Although there is always interest in more detailed information in specific locations, the scope of the study does not permit detailed planning. The terrain in the study area is relatively flat and the only limited topographic information (five-foot contours) represents the principal constraint on detailed planning. The opinions of probable construction cost are realistic, but sufficiently conservative, and they are adequate for financial planning and the development of a concept for an improvement program that can be reasonably managed by the community.

8.1 Planning Criteria

The applicable design criteria for an open channel in the proposed **Drainage Design Manual** states that all improved channels shall be designed to carry the 10-year, based on the ultimate

watershed development, and shall have one foot of freeboard. The proposed **Drainage Design Manual** also states that the design shall assure that no flooding of buildings or other improvements will occur for the 100-year frequency peak flow. Drainage easements are required on all channels of sufficient width to contain the 100-year frequency peak flow. Improvements to channels and creeks, to include culverts and bridges, are to be designed for the 25-year frequency storm.

Since the terrain in the study area is relatively flat and there are no clearly defined creeks, the preliminary plans for major improvements have been sized to handle the 100-year frequency storm within the constructed channel with one-foot of freeboard. Although this approach is conservative, it is selected to meet the intent of the requirement that the design shall assure that no flooding of buildings or other improvements will occur for the 100-year frequency flow peak.

The improved grassed lined channels have been shaped with a minimum bottom width of 10 feet, three to one side slopes, and a minimum depth of four feet (three feet of flow depth and one foot of freeboard). The relatively flat side slopes of the shape are intended to provide a drainage path that is easily maintained with mowers. With additional planning for connecting routes and landscaping of the overbank easement, these major drainage improvements have the potential of being connected into a beneficial linear park system within the community.

Coordinating with and satisfying the criteria of the Hidalgo County Drainage District No. 1 is another key in the planning of the major improvements. The Hidalgo County Drainage District No. 1 facilities are sized to handle slightly less than a ten-year frequency storm (approximately a 9.5-year storm) under existing conditions. As urbanization of the drainage areas continue with its associated increase in the rate and quality of runoff, the rate of discharge for the

ten-year frequency storm to the Hidalgo County Drainage District No. 1 ditches must be kept at the same rate as existing conditions. To achieve this requirement, stormwater has to be stored in the study area and to be released at a slower rate. This detention of drainage and stormwater runoff can be achieved by a number of smaller detention ponds in the watershed or by a larger detention pond at the lower end of the watershed. In the **Master Plan** development, larger detention ponds at the lower end of the watershed have been assumed. These detention storage facilities would likely be planned, designed, constructed, and maintained by the City of Alton in conjunction with the major drainage channels improvements.

The Texas Natural Resource Conservation Commission regulations governing detention facilities have been reviewed for their applicability to the proposed detention facilities. The TNRCC typically requires any dam designed to impound floodwater that is six feet or greater in height to be permitted. Although some of the detention facilities proposed in this **Master Plan** will be higher than six feet, no permitting will be required as long as there is no permanent storage of water within the detention facilities. Therefore, since the proposed detention facilities are not planned to permanently store water, no TNRCC permits should be required. However, should the final design of a detention pond incorporate permanently ponded water to enhance the aesthetic quality of the detention facility (i.e., such as in a park), an application must be made to the TNRCC for a permit.

Channel improvement projects often fall under the jurisdiction of the Corps of Engineers 404 permit program. In most cases, the work will most likely fall under one of two nationwide permits: (1) Nationwide 26, and (2) Nationwide 3.

The Nationwide 26 permit is required for fill (improvements) within channel areas below the

headwaters of the waters of the United States. The point, at which a stream is below the headwaters, approaches a contributing drainage area on the order of 25 square miles. The permit allows up to ten acres below the normal high water mark upstream of the headwaters to be filled (modified). The normal high water mark is usually observed as the distinct point at which vegetation along the stream ends. If the improvements below the high water mark are less than one acre, no formal notification to the Corps is necessary.

The other permit that may cover a portion of the channel is the Nationwide 3 Permit. Under this permit, repairs are authorized for maintenance of existing channels. This permit could cover the connections to the existing Hidalgo County Drainage District No.1 ditches. Under this permit, repairs are authorized for the maintenance of existing channels.

8.2 Coordination with Surrounding Jurisdictions

The limit of the area over which the City of Alton has direct control is only a portion of the study area. The future limits of the City of Alton extend to Four Mile Road on the south, to Sharyland Road on the east, to Five Mile Road on the north, and to Moore Field Road on the west. The City of Palmhurst lies to the south, McAllen borders the city on the east and north, and Mission lies to the west. Fairly specific conceptual or preliminary improvements are defined within the limits of the City of Alton jurisdiction. Since improvements outside the limits of the City of Alton will be the responsibility of other jurisdictions, they have been developed in a more general manner to illustrate how the drainage and stormwater runoff can be managed in the entire

study area.

Four Mile Road acts as an effective drainage boundary between the Cities of Alton and Palmhurst. The **Master Plan** assumes that the detail planning drainage and stormwater management facilities for the area south of Four Mile Road will be the responsibility of the City of Palmhurst. A general concept of how this area can be served is illustrated.

The City of McAllen currently has planning underway for the area to the east of Alton. Facilities within the City of Alton of have been planned to limit the discharge from the ultimate 10-year frequency storm to the same level as from the existing 10-year frequency storm. The improved channels within the City of Alton are sized to handle the 100-year frequency storm within the channel. This approach needs to be coordinated with the City of McAllen to avoid a lack of congruency at the boundary between the two cities.

A narrow strip of McAllen exists between Six Mile Road and the Hidalgo County Drainage District No. 1 ditch to the north of the City of Alton. Since the discharge into this ditch of the 10-year frequency storm is to be limited to that from existing conditions, detention storage will be required in the northern portion of the City of Alton. To avoid the need for multiple smaller detention facilities, this area would appear to be an excellent candidate regional detention facilities that could be shared by the two communities. This approach has been utilized in the planning the drainage and stormwater improvements for this area base on the assumption that an agreement can be reached.

On the west side of Alton, the Main Canal and the Hidalgo County Drainage District No. 1

ditch stretches across the city between Inspiration Road and Los Ebanos Road. Drainage and stormwater runoff in the area to the west of this boundary can be collected in an improved channel and detained in ponds to meet the criteria of the Hidalgo County Drainage District No. 1 criteria. This concept has been incorporated in the specific master planning for the City of Alton; however, this area is also a potential candidate for coordination with the City of Mission.

8.3 Drainage and Stormwater Management Plans

Appendix A contains the drainage maps showing proposed drainage and stormwater management facilities. The existing facilities are shown on a separate map that has been furnished to the city. Generally, the maps of the proposed facilities provide the following information:

- Drainage areas contributing to the stormwater collection points and channels are identified by area designation
- Drainage channels are improved earth (grass-lined) channels and "Concrete Lined" for concrete lined channels. The bottom width, depth of the channel, channel slope and the 100-year frequency discharge are also provided.
- It is assumed that the proposed improved grass-lined channels have a roughness coefficient 0.027.
- Proposed culverts and inverted siphons are identified by size and number of barrels, and the 100-year frequency discharge is provided. It is assumed that all of the proposed culvert improvements are either reinforced concrete pipe or reinforced concrete box sections.

Hydrologic Design Considerations: The hydrologic considerations used in the determination of the design discharges are based on the criteria and methodologies as defined in the City of Alton proposed **Drainage Design Manual**, which is assumed to be adopted as part of the Subdivision and Land Development Regulations. Additional constraints are utilized in the evaluation of drainage areas due to the uncertainty of future drainage boundary locations.

Drainage area boundaries generally follow natural drainage divides. In cases where existing or future major roadways and existing and future irrigation canals interrupt the natural flow path, the drainage area boundary follows the roadway or irrigation canal: that is, flow is assumed to cross a major roadway or irrigation canal only at a location where closed pipe systems or drainage channels would likely cross the roadway or canal.

Hydraulic Design Considerations: The procedures for determining the required storm drain pipe and channel designs are outlined in the City of Alton proposed **Drainage Design Manual**. Additional constraints were imposed due to the unpredictability of future development (particularly street layouts) which allow flexibility for future storm drain designs in these areas. More specifically, hydraulic design considerations used to determine the required storm drain systems were based on the items listed below:

Open Channel Systems

- Proposed drainage channels generally follow the natural flow paths.
- Open channels were based on the 100-year frequency flow capacity. The depths for improved (grass-lined) channels were based on the 100-year frequency depth plus one foot.

- Culverts and inverted siphons in channels that cross major roadways and irrigation canals were designed to convey the 100-year frequency discharge from the upstream drainage area.
- Grass-lined drainage channels are unlined, earthen trapezoidal channels with a minimum bottom width of ten feet, sideslopes of 3:1 and a corresponding roughness coefficient equal to 0.027.
- The maximum allowable design flow velocity was 6 feet per second for grass-lined channels.

8.4 Preliminary Estimate of Probable Construction Cost

Summarized in Table 8.1 are the preliminary estimates of probable construction cost for the major elements in the **Master Drainage Plan** for the ultimate conditions within the detailed study area. The total preliminary estimate of the probable construction cost for these major elements is $ 40,177,300. Preliminary estimate of the probable construction cost for the improvements shown on Shart 3A and 3B have not been developed because they are within the City of Palmhurst and are not the responsibility of the City of Alton. The details on the development of these preliminary estimates of probable construction costs are included in Appendix B.

In addition to these major elements, local storm drainage projects will be required to convey the storm runoff to these major elements. In developing areas, these local conveyance systems are assumed to be incorporated in the planning and design of developments. The construction cost for these local conveyance systems will be included in the cost of the development.

Local stormwater conveyance systems will also be required in some currently developed areas of the City of Alton. The specific detailed planning of these improvement projects is beyond the scope of this study. Specific detailed planning requires field surveying and/or more detailed topographic maps which were not included as a part of this study. To account for the cost of these local stormwater conveyance systems which will likely be borne either totally, or in part, by the citizens of Alton, an allowance of $ 6,800 per currently developed acre has been included in the preliminary estimates of probable construction cost. For the estimated currently developed acreage, this adds $ 4,500,000 to the construction cost. Including this estimate for the local stormwater conveyance systems in the currently developed area, increases the total preliminary estimated probable construction cost to $ 44,677,300. A portion of this cost could be shared with adjacent cities if regional facilities were developed.

8.5 Preliminary Estimate of Probable Annual Operation and Maintenance Cost

Initially, the City of Alton can use existing city personnel to man and operate the watershed and storm drainage management program. However, once the program has been fully established, funding should be available to provide for personnel, administrative, and maintenance needs. Depending on the rate at which development takes place, minimum staffing requirements would be clerk/typist at $ 34,300 and a staff engineer at $ 88,000, or a total of $122,300. This amount includes allowances for salary burden and office space and supplies.

It is assumed that the maintenance of the drainage facilities would be handled through out-sourced contracts. Using the information presented in Section 4.4, on page 4.3, for recently

Table 8.1

Summary of Preliminary Estimate of Probable Construction Costs

Project	Preliminary Estimate of Probable Construction Costs
South Central Area	
South Central Drainage Ditch	$ 4,406,200
Improvements to Five Mile and Bryan Road Detention	$ 6,641,700
Subtotal	$ 11,047,900
Southeast Area	
Southeast Drainage Ditch	$ 2,735,700
Sharyland and Four Mile Detention	$ 3,190,000
Subtotal	$ 5,925,700
Northeast Area	
East Drainage Ditch	$ 1,683,900
Northeast Drainage Ditch	$ 756,300
Glasscock and Six Mile Detention	$ 5,340,100
Subtotal	$ 7,780,300
North Central Area	
North Central Drainage Ditch	$ 1,184,200
Bryan and Six Mile Detention	$ 1,111,500
Mayberry and Six Mile Detention	$ 1,438,500
Subtotal	$ 3,734,200

Table 8.1 (continued)

Project	Preliminary Estimate of Probable Construction Cost
Northwest Area	
Northwest Drainage Ditch No. 1	$ 1,113,200
Northwest Drainage Ditch No. 2	$ 255,000
Trosper and Six Mile Detention	$ 2,813,200
Los Ebanos and Six Mile Detention	$ 1,346,100
Subtotal	$ 5,527,500
West Central Area	
West Central Drainage Ditch	$ 723,900
Louisiana Street Detention	$ 1,387,600
Subtotal	$ 2,111,500
West Area	
West No. 2 Detention	$ 1,103,900
West No. 3 Detention	$ 755,900
West No. 4 Detention	$ 1,004,300
West No. 5 Detention	$ 1,186,100
Subtotal	$ 4,050,200
Local Stormwater Conveyance in Developed Areas	$ 4,500,000
Total Preliminary Estimate of Probable Construction Costs	$ 44,677,300

constructed or proposed facilities, the maintenance cost can be estimated as 3 to 5 % of the base construction cost. If average conditions are assumed and full development has occurred, the estimated annual maintenance cost would be $ 1,787,100 in 1997 dollars. This amount will increase with inflation and as facilities age. Experience in the operation and maintenance of the initial facilities should provide excellent guidance in the establishment of annual operating budgets.

9.0 Recommended Master Plan Improvements

The drainage and stormwater management facilities as illustrated on Sheets A-1 through B-3 are recommended as the **Master Plan** improvements for the City of Alton. These improvements are planned to meet the ultimate development conditions within the extraterritorial jurisdiction of the City of Alton. They have received initial coordination with the surrounding communities and Hidalgo County, but this effort should be pursued on a continuous basis as the detailed plans are developed for these improvements.

9.1 Discussion of the Economic Feasibility

The preliminary estimate of the probable total construction cost, in the amount of $ 44,677,300, is certainly a significant sum of money. For the City of Alton to consider the expenditure of such an amount at this time is challenging. What has to be kept in mind is that the development of the drainage and stormwater management system will occur over several years as the community develops.

The test for the reasonableness of the plan at this point in time is whether the total estimated construction cost per person, when the community is totally developed, is realistic. Within the boundaries of the extraterritorial jurisdiction of the City of Alton, there are approximately 5,640 acres. If there is an average of four housing units per acre and an average of four persons per housing unit, then unit costs can be developed. For the approximately 5,640 acres, the unit cost in 1997 dollars would be approximately $ 2,000 per dwelling unit, or $ 500 per person.

Although these are significant amounts, they are certainly within the range of reasonableness.

Planning now to make these investments in the implementation of the drainage and stormwater master plan over the next two to three decades will result in a higher quality of life for all the citizens of the City of Alton.

9.2 Discussion of Safety Considerations

Safety always has to be considered in the planning and design of public works projects. This fact is particularly true with water related projects. Most people find water in a tranquil state, such as a lake or pond, to be pleasant and relaxing. Water in a turbulent state, can be very stimulating and exciting. This can be particularly true for young children who have not developed an appreciation for the danger.

To partially address safety issues the preliminary plans have been developed to the maximum extent possible with wide shallow drainage ditches. The side slopes of the ditches are planned with three feet of width for one foot of rise. This relatively flat side slope approach should allow someone who is caught in the stormwater to exit more easily. Also, regular maintenance of the grass lined drainage ditches will be critically important to maintain their functionality. Mowing of the side slopes, as well as the ditch bottom, will be more comfortably and safely accomplished with the flatter side slopes.

The box culverts at road crossings and the inverted siphons at the irrigation canal crossing may require some special considerations in their planning and design. These can be particularly dangerous locations during higher stormflow rates. Warning signs and protective fencing may be required in some locations. If the drainage ditch is particularly deep, safely devises can be installed

upstream to aid an individual caught in the stormwater to pull themselves out.

9.3 Discussion of Environmental Concerns

Environmental concerns are part of the City of Alton. The Board of Aldermen recently took the necessary steps to enhance habitat for birds within the city. The actual construction of the proposed drainage and stormwater management facilities may have some negative impact on the environment. Some of the proposed facilities are located along natural drainage paths where native vegetation exist. This locations are also likely the homes of the native habitat and potential wetlands may also occur.

Detail evaluation of the environmental impact of the proposed improvements is beyond the scope of this study. Based on available mapping and aerial photographs, alignments were selected that avoided developed areas to the maximum extent possible and to take advantage of the natural terrain. Consideration of the environmental impacts would logically be included in the detail planning and design of each improvement.

Although the construction of the proposed improvements will have a negative impact on the environment during the construction, following the completion an opportunity exists to restore and perhaps enhance the environment. The planned right-of-ways for the proposed drainage ditches are adequate for the construction and maintenance of the facilities. In most locations along the right-of-way, it should be possible to include landscaping on the overbank that would not interfere with the functionality of the ditch and the maintenance of the facility.

9.4 Discussion of Aesthetics

A frequent initial negative reaction to planning and construction of drainage and stormwater management projects occurs in almost every project. This condition is particularly true where concrete lined channels are required in developed areas due to limited space. The proposed grassed lined drainage ditches can, with proper planning, become a positive benefit to the community and improve the overall aesthetics of the City of Alton.

SH 107 is and will continue to be major North-south transportation artery through the heart of Alton. Many of the proposed drainage ditches cross or are planned near SH 107. With carefull planning, the overbank space along the drainage ditches can be used for walking, hike and bike trails that would connect residential neighborhoods with this transportation link. Even those drainage facilities not directly adjacent to SH 107 could be utilized as walkways, and hike-bike trails. With some fairly short connecting segments, all the potential walkways and hike-bike trails along the drainage ditches could be joined to create an extensive network through all segments of the city. Coupling this effort with the proposed environmental landscaping concepts discussed above could result in an exceptional amenity for all sections of the city.

An additional opportunity to increase the aesthetics of the community is the use of the detention basins' bottom areas as athletic fields. The right-of-way area around the detention basins could be landscaped and used as neighborhood park space along with the grassed play area in the bottom of the basin. Funding to plan and construct these types of projects could be available though the TexDOT ISTEA Program and the Texas Parks and Wildlife.

10.0 Implementation Schedule

The following proposed implementation schedule is based on an understanding of the stormwater drainage pattern developed during the preparation of the report. The current growth pattern of the City of Alton was also considered during the development of this implementation schedule. The proposed schedule should be reviewed at regular intervals, but certainly at least every five years.

10.1 Immediately, or during the First Year

Using the general framework outlined in Section 7 and the information contained in this **Master Drainage Plan** and the **Drainage Design Manual**, the City of Alton needs to establish and formally adopt a drainage and stormwater management policy.

Stormwater runoff does not recognize established jurisdiction lines and close coordination with the surrounding communities (McAllen, Mission, and Palmhurst) is essential for a successful stormwater management program. The role that the City of Alton should play in proactively seeking to establish a regional stormwater management program should be thoroughly considered. Such a stormwater management plan can be implemented through a consortium of local governments and Hidalgo County. A steering committee can be established to make recommendations to the respective political bodies within the watershed. However, not being a legislative body, the watershed management group's recommendations may be ignored or given a low priority for action by the individual units of government.

A procedure is needed for pulling watershed communities together through a common theme.

Some sequential steps might included:

1. Organize a series of public meetings to explore the problems and opportunities that need to be addressed.
2. Identify the resources that can be used to assist with watershed planning and implementation.
3. Formulate watershed management alternatives.
4. Select a publicly acceptable watershed management alternative.
5. Implement the watershed management alternative.

There are many options available to the City of Alton on how it can manage a stormwater management program. The City of Alton needs to review the administrative and managerial options outlined in Section 6 and establish a plan for an organizational system to oversee the stormwater management program.

Historically, stormwater management has been financed using general fund revenues for annual operating expenses and a mix of revenue sources for capital improvements. The City of Alton needs to review the financing options outlined in Section 5 and adopt a combination that should provide adequate funding for a stormwater management program.

Two sections of the City of Alton's exterritorial jurisdictional area were identified that should receive immediate attention during the first year. The recommended activities for the first year for these first two areas are to perform a detail study, field surveying, the preparation of preliminary construction plans, and a detailed estimate of the probable construction cost.

The first area is located northwest of the intersection of Five Mile Road North and Glasscock

Road. The general limits of this area are illustrated on Figure 10.1. The streets in this area are Alexandria Street, Bonnie Street, and two unnamed streets in the eastern portion. In the western portion of the area, the existing streets are Jo Beth Lane, Linda Lane, and K & K. Localized flooding is known to exist in all or part of this area.

The second area is located west of Stewart Road and south of Six Mile Road. The general limits of this area are illustrated on Figure 10.2. The streets in this area include Palm Drive, Mission Drive, Lomita Drive, and two unnamed streets. Much of this area is located in a natural low area, or basin, and is potentially subject to severe drainage problems.

Both of these areas need to be studied in greater detail to include field surveying and the preparation of preliminary plans. This effort should include the preparation of a detailed opinion of the probable construction cost. Based on this preliminary design effort, the City of Alton can make specific plans on funding and on how and when to proceed with the preparation of final plans, bidding, and the construction phase of the project.

Both of these areas will require the installation of local stormwater conveyance facilities. To be consistent with the **Master Plan**, these local stormwater conveyance facilities for the first area should take the flow north to the proposed East Drainage Ditch. It is not economically feasible to consider constructing the entire East Drainage Ditch at this time. An approach would be to construct the portion of the East Drainage Ditch north of this area to create a stormwater storage sump. The size and shape should be consistent with proposed East Drainage Ditch and its length would be dependent on the frequency of the storm to be stored. This approach would require the use of a permanent or protable pump station to empty the sump. The use of portable sump pumps would likely be the most economical approach since they could be used at other locations.

IMMEDIATE, OR DURING THE FIRST YEAR PROJECT No. 1

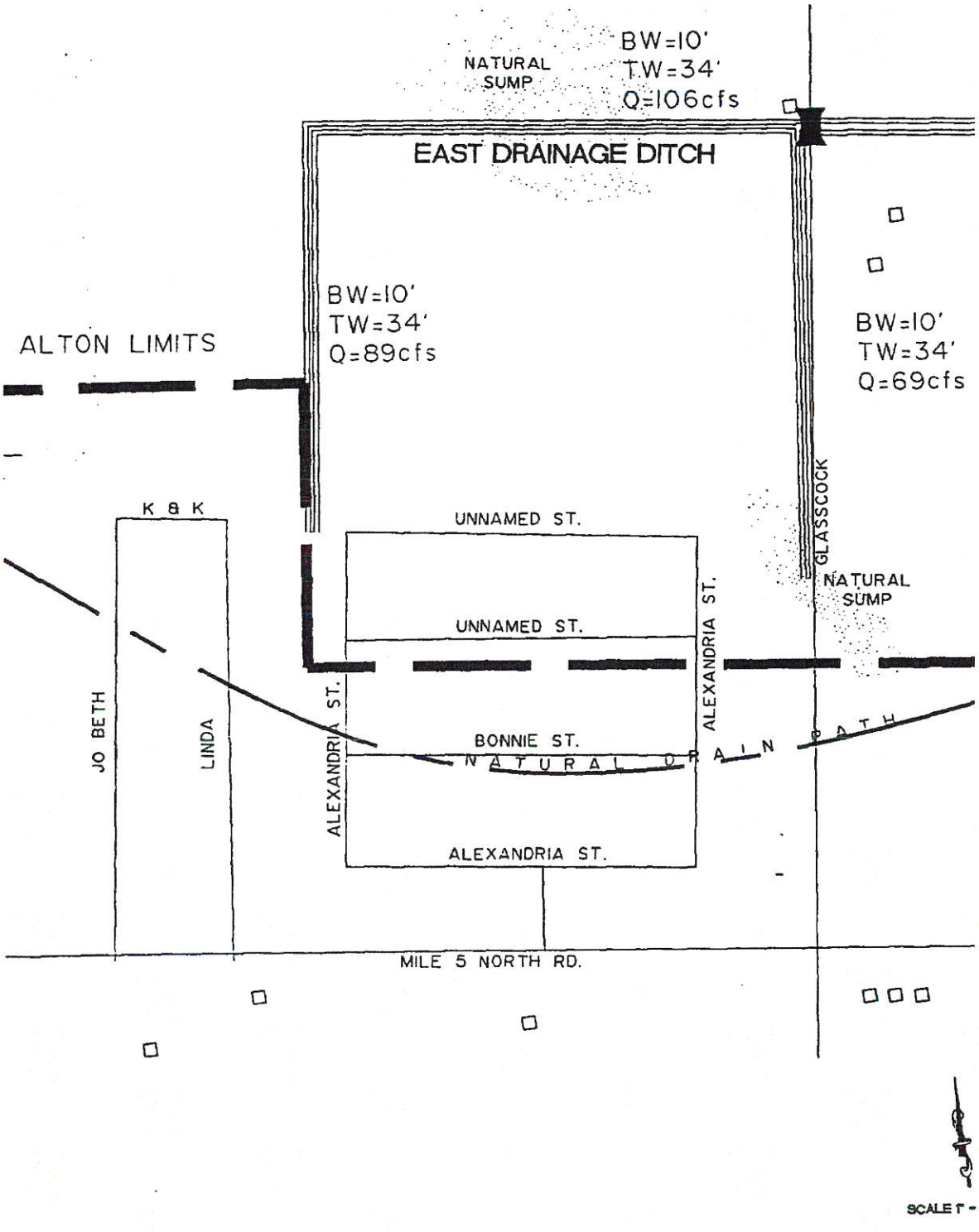


FIGURE 10.1

IMMEDIATE, OR DURING THE FIRST YEAR PROJECT No. 2

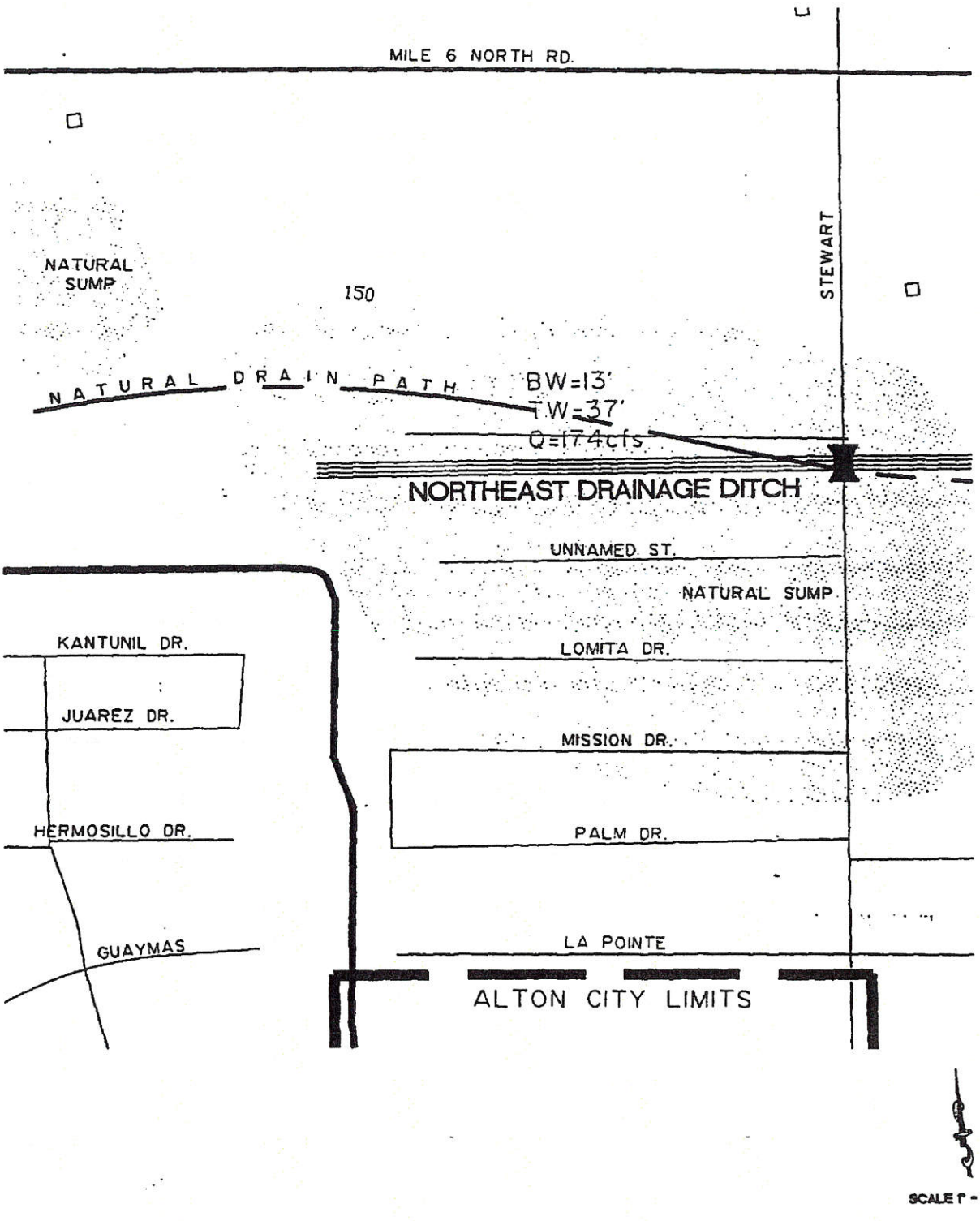


FIGURE 10.2

In the second area to be consistent with the **Master Plan,** the local stormwater conveyance facilities should be designed to deliver the stormwater to the Northeast Drainage Ditch which, as proposed, would pass through this second area. The size and shape should be consistent with the proposed Northeast Drainage Ditch and its length would be dependent on the frequency of the storm to be stored. The use of portable sump pumps would likely be the most economical approach since they could be used at other locations.

10.2 The 1- to 5-year Period

The two projects evaluated during the first year should be funded and constructed during this period. The exact schedule will be a function of the length of time required for the design process and the process adopted to identify and arrange for the construction funding.

A third project that should be undertaken during this period is the detail study, planning, right-of way acquisition, and preliminary design of the West Central Drainage Ditch and the Louisiana Street Detention Basin. The general location and extent of this project are illustrated on Figure 10.3. Due to the general slope of the terrain, much of the stormwater runoff from this area west of the developed area of Alton would naturally pass through the city. As this western area develops and the runoff increases, drainage through the developed area of the City will increase. The second concern with this improvement is the need to identify a specific routing for the West Central Drainage Ditch through the partially developed section of Alton between Louisiana Street and Delaware Street.

10.3 The 6- to 10-year Period

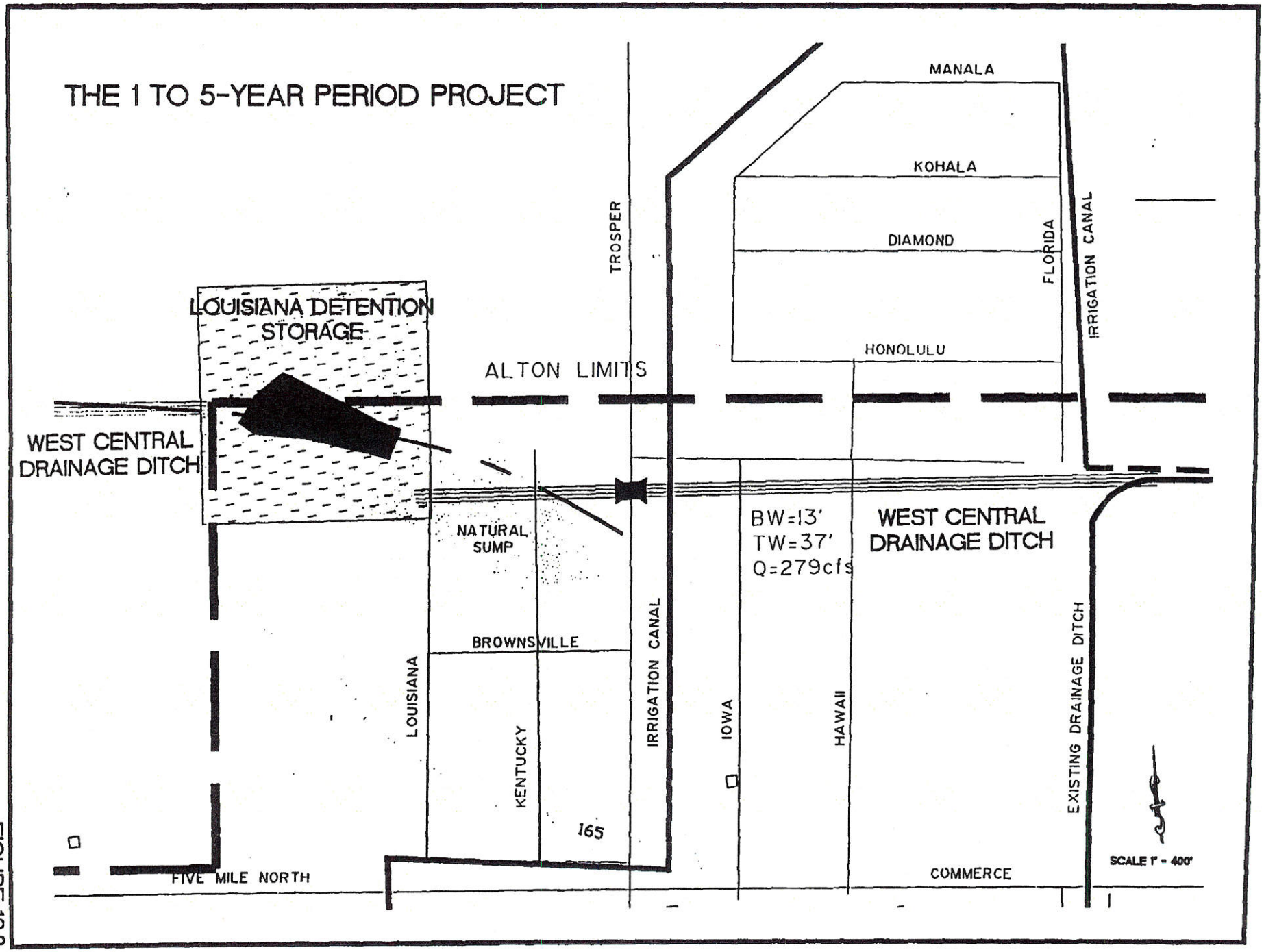

THE 1 TO 5-YEAR PERIOD PROJECT
MANALA
KOHALA
DIAMOND
HONOLULU
TROSPER
FLORIDA
IRRIGATION CANAL
LOUISIANA DETENTION STORAGE
ALTON LIMITS
WEST CENTRAL DRAINAGE DITCH
NATURAL SUMP
BW=13'
TW=37'
Q=279cfs
WEST CENTRAL DRAINAGE DITCH
BROWNSVILLE
LOUISIANA
KENTUCKY
IRRIGATION CANAL
IOWA
HAWAII
EXISTING DRAINAGE DITCH
165
FIVE MILE NORTH
COMMERCE
SCALE 1" = 400'

FIGURE 10.3

The principal project during this period should be the funding and construction of the West Central Drainage Ditch and the Louisiana Detention Basin. The exact schedule will be a function of the length of time require for the design process and the process adopted to identify and arrange for the construction funding.

A second major project scheduled for this period should be the detailed study, planning, right-of-way acquisition and preliminary design of the Five Mile and Bryan Road Detention Basin as illustrated on Figure 10.4. The location of this drainage improvement in the heart of the City of Alton offers an opportunity for the consideration of a multi-use facility. A municipal park could serve the citizens well in this location. If the concept of a number of walk, hike and bike trails throughout the city is pursued, a park in this location of the city could easily serve as junction point for many of the trails. When Alton reaches full development, it will likely have a population of between 75,000 and 90,000. As this level of population is reached, other concepts that could be incorporated in this detention basin would be an amphitheater with seats on one of the sloping sides, or a challenging nine-hole, and perhaps an eighteen-hole, golf course.

Related projects that should be included in this detail study, planning, right-of-way acquisition, and a preliminary design phase are:

- The need for an overflow ditch from the existing Mayberry Road Detention Basin
- The need for an additional overflow pipe or ditch from the existing detention basin between Ave de Mexico and Linares and north of Campeche
- The culverts for the South Central Drainage Ditch under Five Mile Road.
- The stormwater pump station and discharge pipeline to the Hidalgo Drainage District No. 1 drainage ditch north of Six Mile Road.

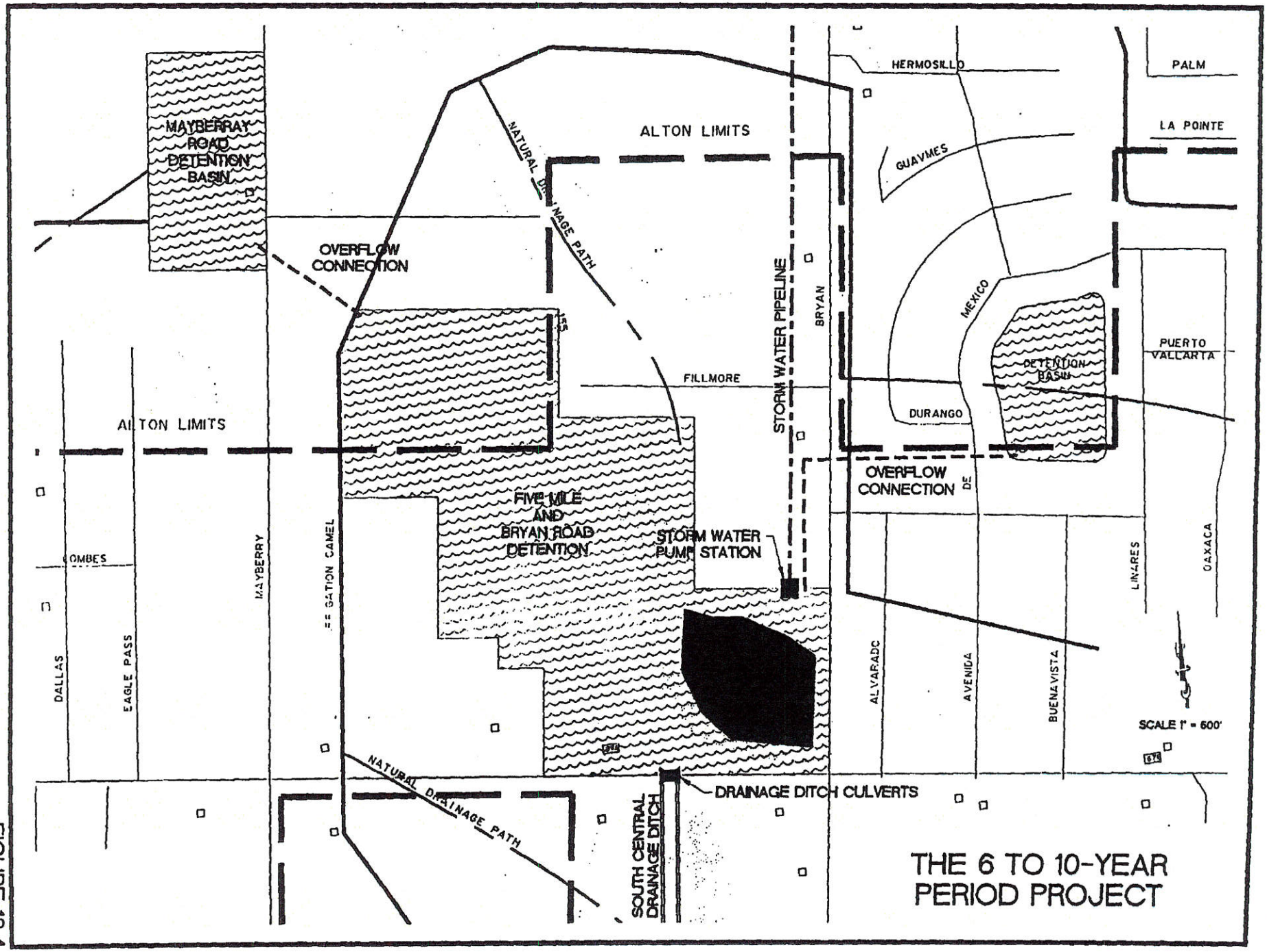

MAYBERRY ROAD DETENTION BASIN
OVERFLOW CONNECTION
NATURAL DRAINAGE PATH
ALTON LIMITS
HERMOSILLO
PALM
LA POINTE
GUAYMES
MEXICO
PUERTO VALLARTA
DETENTION BASIN
STORM WATER PIPELINE
BRYAN
FILLMORE
DURANGO
ALTON LIMITS
OVERFLOW CONNECTION
FIVE MILE AND BRYAN ROAD DETENTION
STORM WATER PUMP STATION
COMBES
DALLAS
EAGLE PASS
MAYBERRY
SANTA GERTRUDIS
LINARES
OAXACA
ALVARADO
AVENIDA
BUENAVISTA
SCALE 1" = 600'
NATURAL DRAINAGE PATH
SOUTH CENTRAL DRAINAGE DITCH
DRAINAGE DITCH CULVERTS
THE 6 TO 10-YEAR PERIOD PROJECT

FIGURE 10.4

10.4 The 11- to 15-year Period

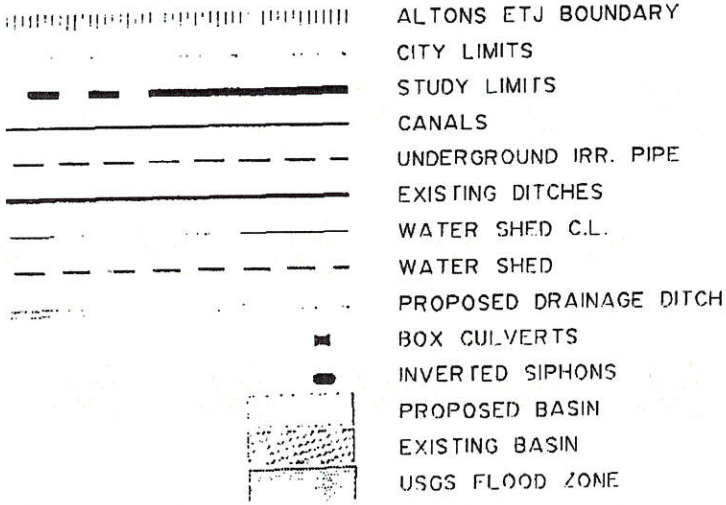
The project elements associated with the Five Mile Road and Bryan Road Detention Basin evaluated during the previous period should be funded and constructed during this period. The exact schedule will be a function of the length of time required for the design process and the process adopted to identify and arrange for the funding.

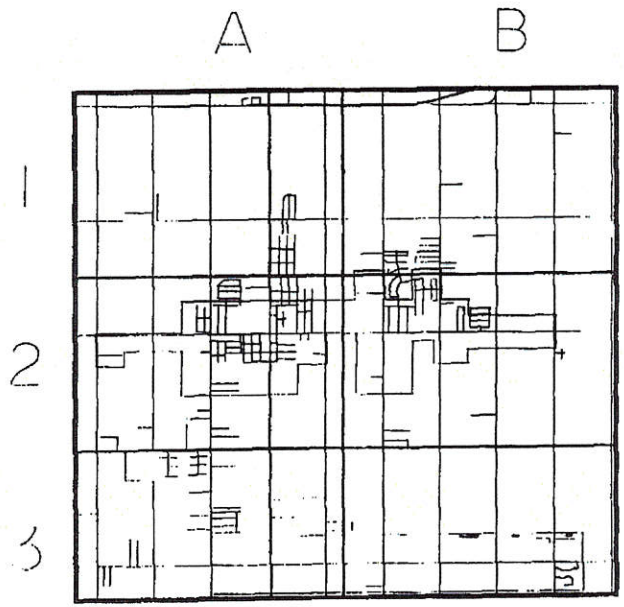
10.5 Improvements that can be Accommodated as Development Proceeds

The remainder of the drainage and stormwater improvements identified on Sheets 1-A through 3-B should be studied and planned as development proceeds. The City of Alton needs to consider and adopt a policy on methods that development will be required to follow to fund, or assist in the funding of, these improvements. These policies need to be reasonably consistent with those of the surrounding communities.

City of Alton
Master Drainage Plan

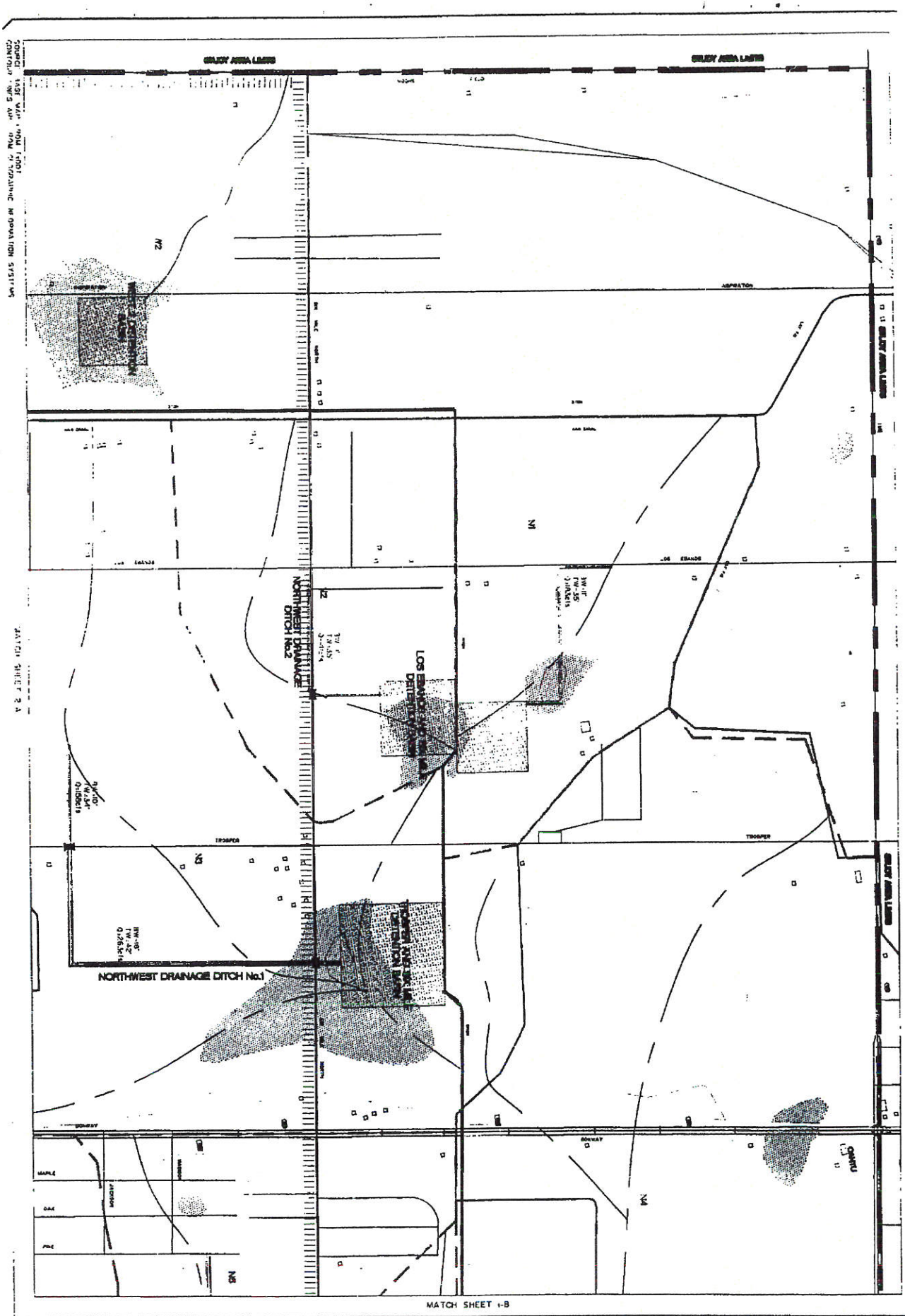
1997





CITY OF ALTON, TEXAS
Master Drainage Plan

NOT FOR CONSTRUCTION



CITY OF ALTON, TEXAS

Master Drainage Plan

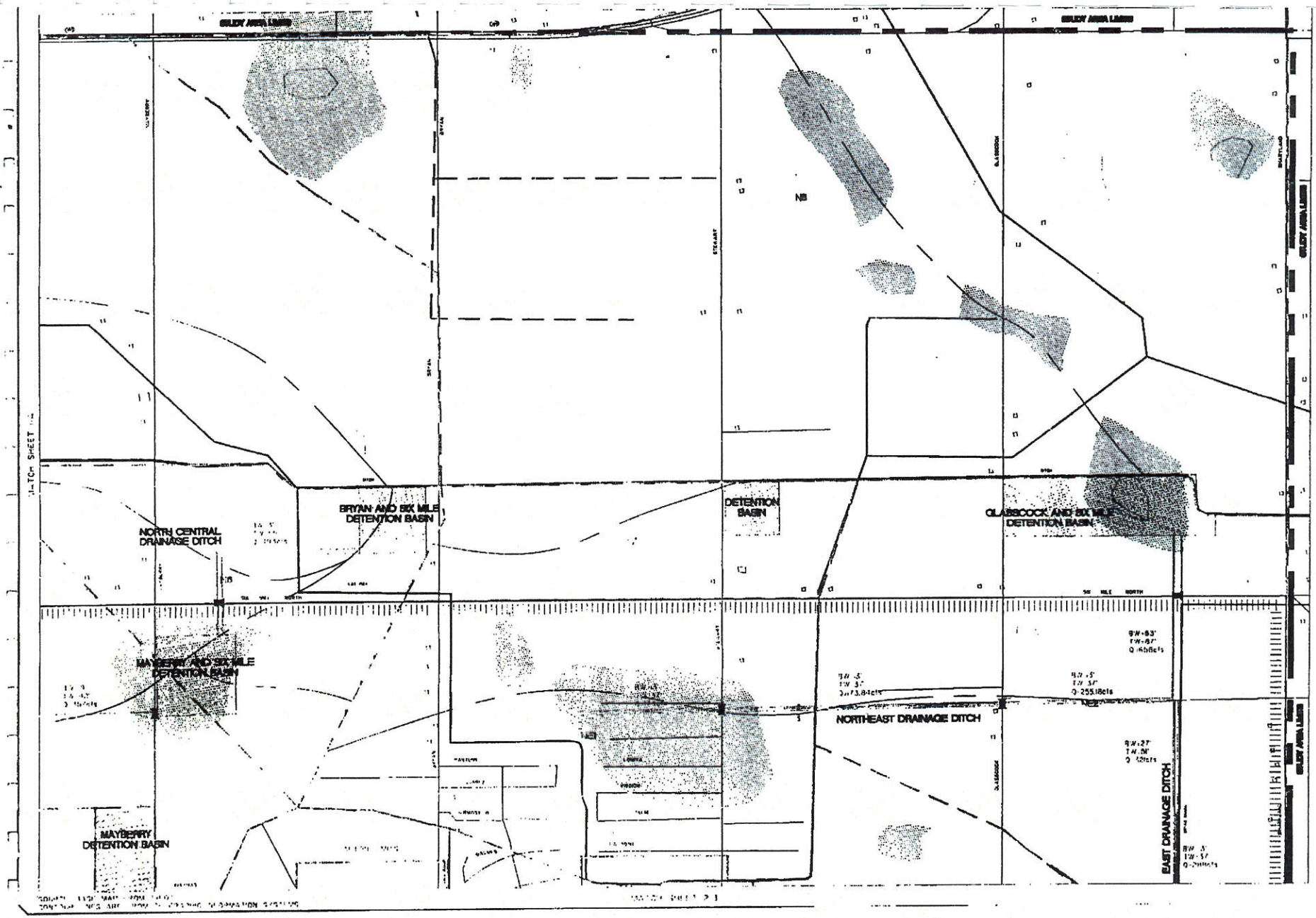
1-A

NOT FOR CONSTRUCTION

PEREZ/FREESE AND NICHOLS, L.L.C.

SHEET 1-A

SHEET NO. 1 OF 6



CITY OF ALTON, TEXAS

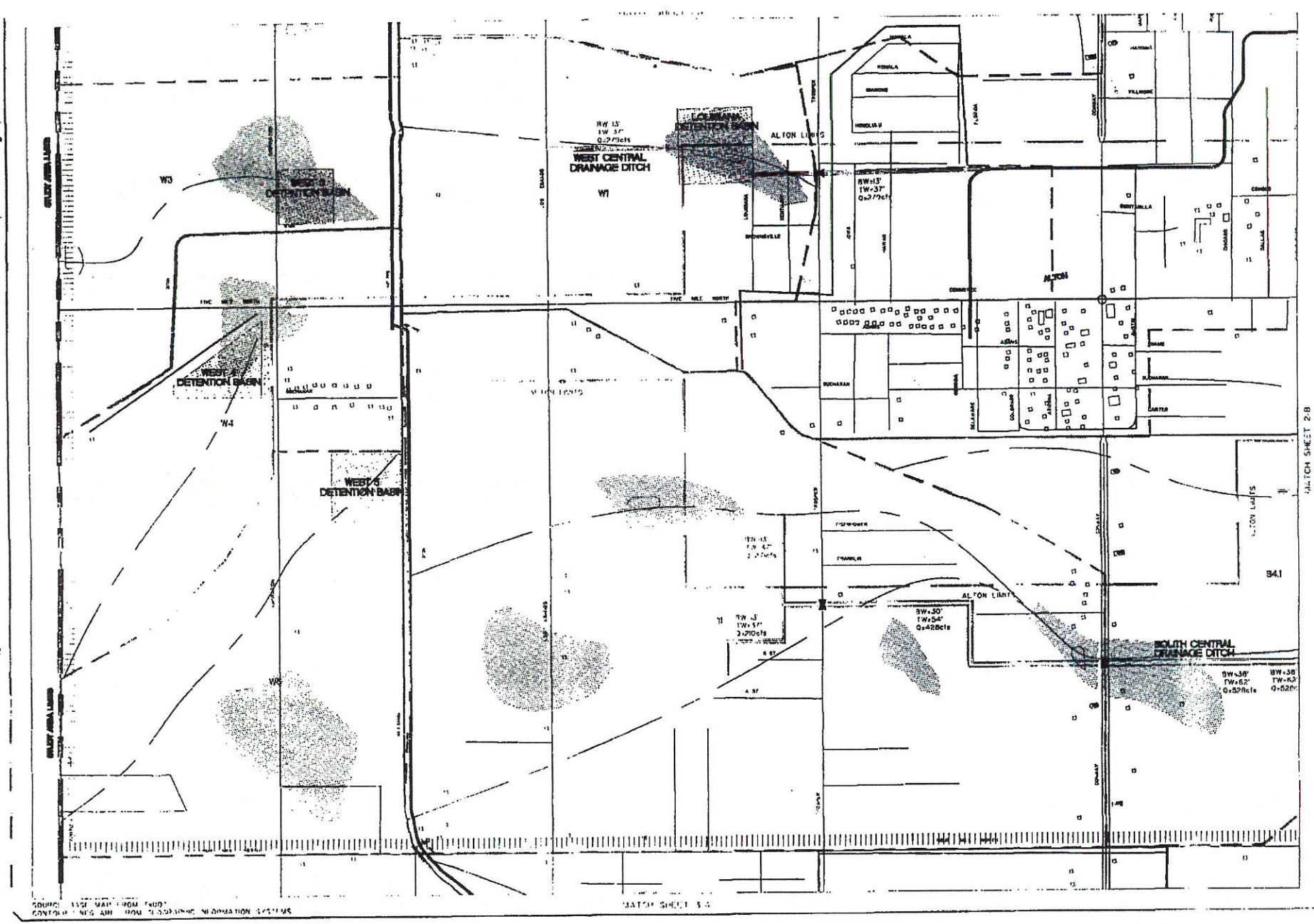
Master Drainage Plan

1-B

NOT FOR CONSTRUCTION

1-B

SHEET 2 OF 6



CITY OF ALTON, TEXAS

Master Drainage Plan

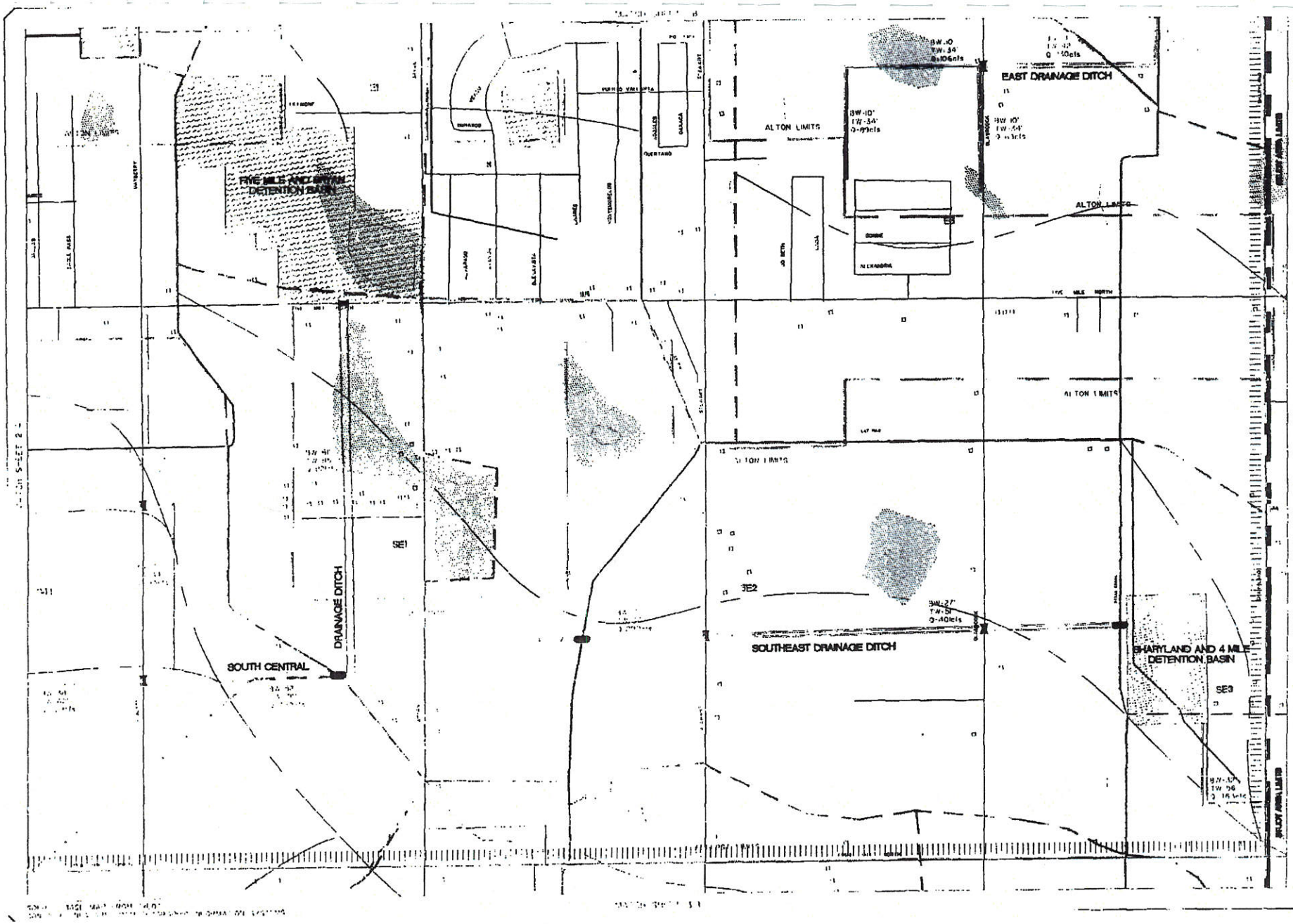
2-A

FREESE/FREESE AND NICHOLS L.L.C.

NOT FOR CONSTRUCTION

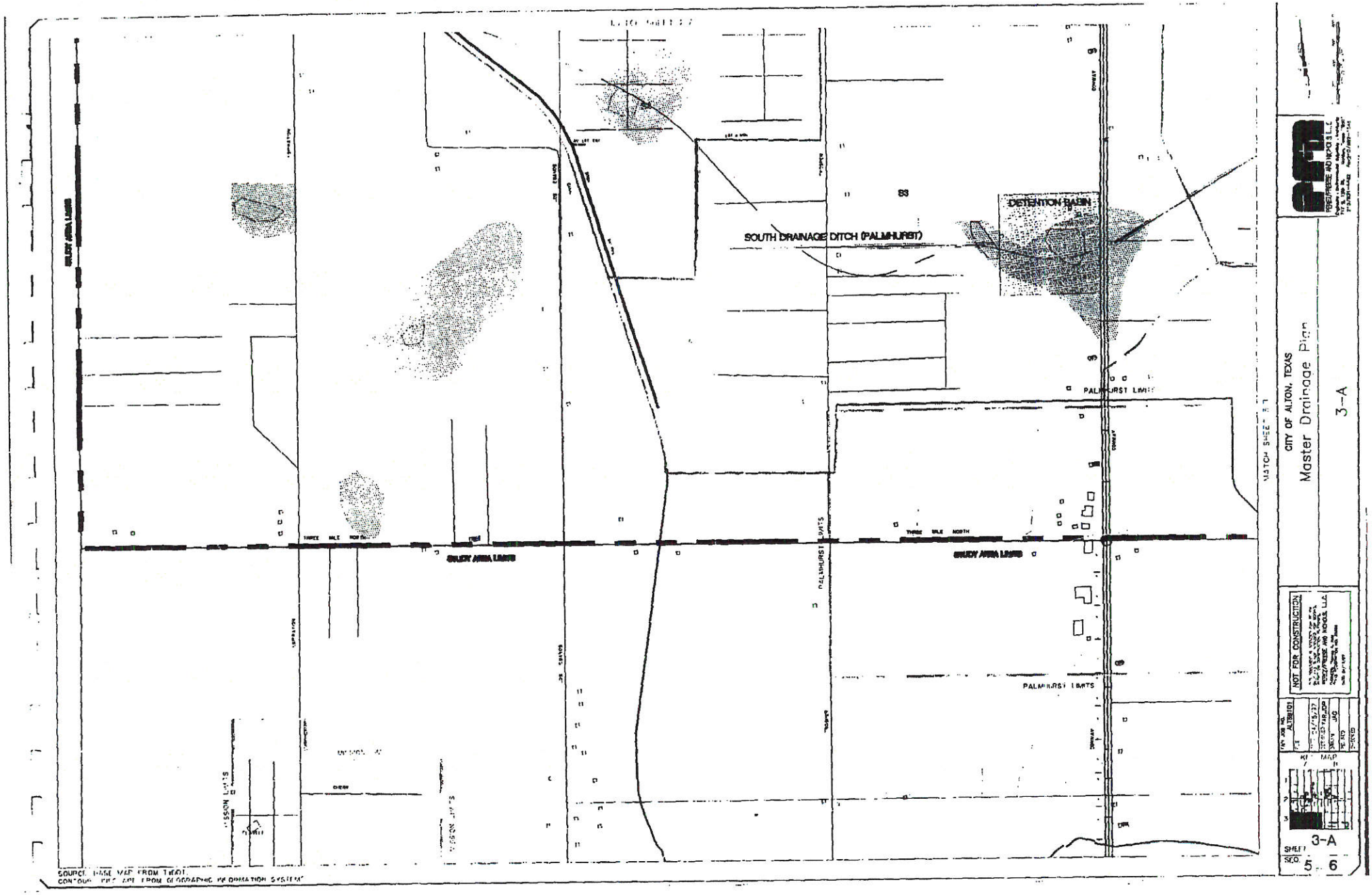
SHEET 2-A

SHEET NO. 3 6

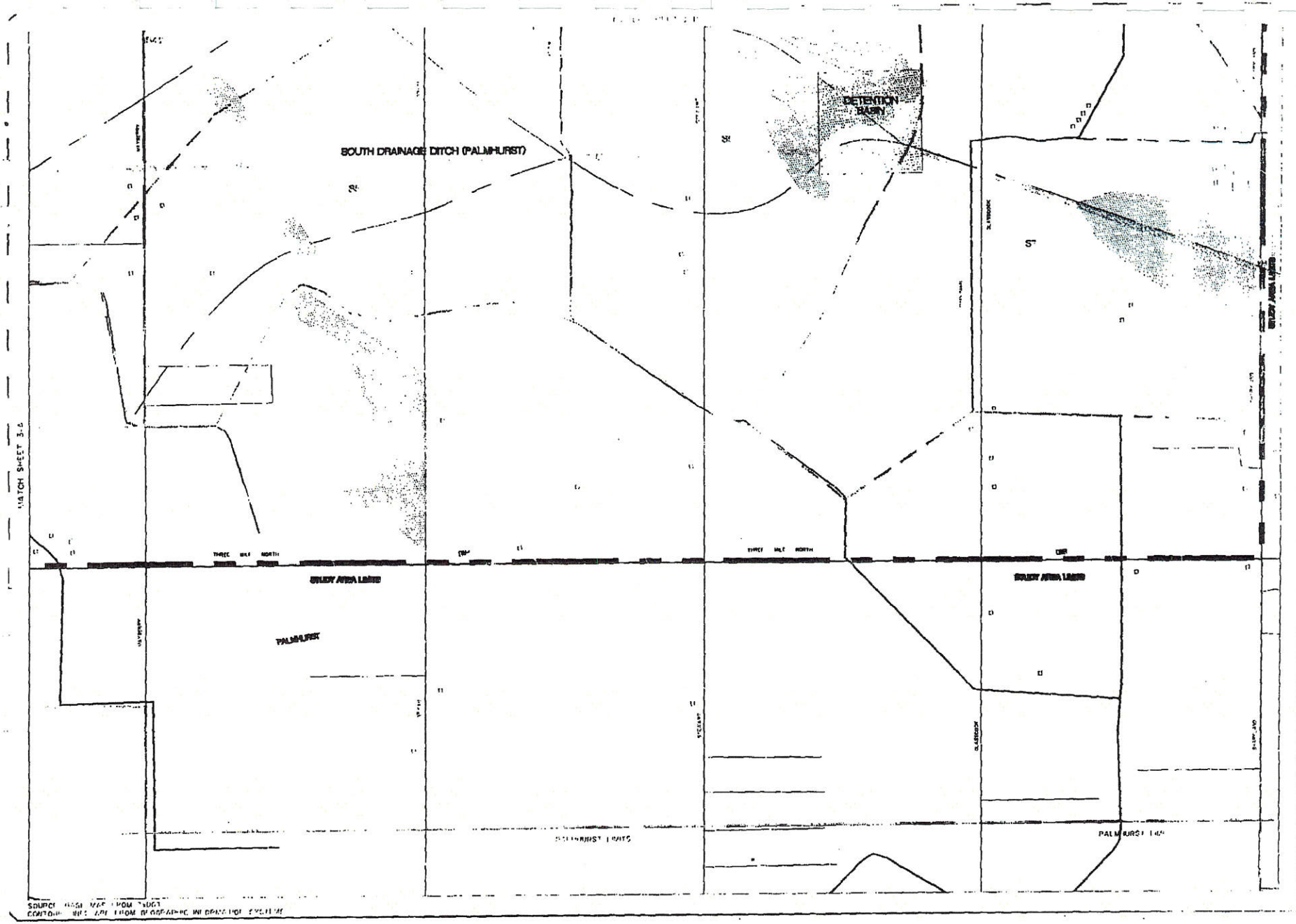


CITY OF ALTON, TEXAS
Master Drainage Plan
2-B

2-B



SOUTH DRAINAGE DITCH (PALMHURST)
DETENTION BASIN
PALMHURST LIMITS
THREE MILE NORTH
STUDY AREA LIMITS
MATCH SHEET 3-1
CITY OF ALTON, TEXAS
Master Drainage Plan
3-A
NOT FOR CONSTRUCTION
ALT88101
SHEET 3-A
SEQ. 5 - 6
SOURCE: BASE MAP FROM TXDOT.
CONTOUR DISCLAIMER FROM GEOGRAPHIC INFORMATION SYSTEM


SOUTH DRAINAGE DITCH (PALMHURST)
DETENTION BASIN
MATCH SHEET 3-A
THREE MILE NORTH
STUDY AREA LIMITS
PALMHURST
PALMHURST LIMITS
CITY OF ALTON, TEXAS
Master Drainage Plan
3-B
NOT FOR CONSTRUCTION
KEY MAP
3-B
SHEET NO. 6 of 6

APPENDIX A

List of References

REFERENCES

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(2) Soil Conservation Service, U.S. Department of Agricultural, SCS National Engineering Handbook Section 4 Hydrology, August 1972.

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(4) Linsley, Ray K. Jr, Kohler, Max A., and Paulhaus, Joseph L.H., Hydrology for Engineers, p.228, McGraw-Hill Book Company, 1958.

(5) Cyre, Hector J., "Stormwater Management Financing," paper presented to the International Public Works Congress, American Public Works Association, 1982.

(6) Cyre, Hector J., "Developing a Stormwater Management Utility," APWA Reporter, March 1987.

(7) Maryland Department of the Environment, Sediment and Stormwater Division: A Planning Guide to Stormwater Management Utilities, draft, Annapolis, 1987.

(8) Texas Department of Community Affairs, City and County Assistance: Texas Community Development Program, Austin, 1987.

(9) Texas Advisory Commission on Intergovernmental Relations: Handbook of Governments in Texas, Austin, 1984.

(10) Harman, Douglas and Diveley, Ann Long, "Fort Worth Improvement District: A First in Texas," Texas Town and City, September 1987.

APPENDIX B

Estimates of Probable Construction Cost

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: South Central Drainage Ditch

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	40.6	acre	$12,000.00	$487,200.00
Site preparation	40.6	acre	$2,000.00	$81,200.00
Unclassified channel excavation	100,700	cu. yd.	$8.00	$805,600.00
Furnish box culvert under Trosper Rd (6 - 5'x3')	120	foot	$670.00	$80,400.00
Headwalls for box culvert	2	each	$13,500.00	$27,000.00
Furnish box culvert under Conway (SH 107) (7 - 5'x3')	200	foot	$775.00	$155,000.00
Headwalls for box culvert	2	each	$15,200.00	$30,400.00
Furnish box culvert under Mayberry (South) (2 - 5'x3')	120	foot	$775.00	$93,000.00
Headwalls for box culvert	2	each	$15,200.00	$30,400.00
Furnish box culvert under Mayberry (North)	120	foot	$245.00	$29,400.00
Headwalls for box culvert	2	each	$6,800.00	$13,600.00
Furnish inverted siphon under irrigation canal	150	foot	$1,750.00	$262,500.00
Headworks for siphon	2	each	$23,500.00	$47,000.00
Furnish box culvert under Five Mile Road (12 - 5'x3')	200	foot	$2,570.00	$514,000.00
Headworks for box culvert	2	each	$23,500.00	$47,000.00
Hydromulch seeding	40.6	acre	$6,000.00	$243,600.00

Subtotal	$2,947,300.00
Mobilization at 5%	$147,365.00
Overhead and Profit at 10%	$294,730.00
Subtotal	$3,389,395.00
Contingencies at 30%	$1,016,818.50
Total Project Construction Cost	$4,406,213.50

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: Southeast Drainage Ditches

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	20	acre	$12,000.00	$240,000.00
Site preparation	20	acre	$2,000.00	$40,000.00
Unclassified channel excavation	107,400	cu. yd.	$8.00	$859,200.00
Furnish inverted siphon under irrigation canal	150	foot	$580.00	$87,000.00
Headwalls for siphon	2	each	$10,200.00	$20,400.00
Furnish box culvert under Stewart Rd. (3 - 5'x3')	120	foot	$350.00	$42,000.00
Headwalls for box culvert	2	each	$8,500.00	$17,000.00
Furnish box culvert under Glasscock (5 - 5'x3')	120	foot	$560.00	$67,200.00
Headwalls for box culvert	2	each	$11,800.00	$23,600.00
Furnish box culvert under Sharyland (6 - 5'x3')	120	foot	$670.00	$80,400.00
Headwalls for box culvert	2	each	$13,500.00	$27,000.00
Furnish inverted siphon under Main Canal	150	each	$1,150.00	$172,500.00
Headwalls for inverted siphon	2	each	$16,800.00	$33,600.00
Hydromulch seeding	20	acre	$6,000.00	$120,000.00

Project: Southeast Drainage Ditches - (continued)

Subtotal	$1,829,900.00
Mobilization at 5%	$91,495.00
Overhead and Profit at 10%	$182,990.00
Subtotal	$2,104,385.00
Contingencies at 30%	$631,315.50
Total Project Construction Cost	$2,735,700.50

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: Northeast Drainage Ditch

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	10	acre	$12,000.00	$120,000.00
Site preparation	10	acre	$2,000.00	$20,000.00
Unclassified channel excavation	25488	cu. yd.	$8.00	$203,904.00
Furnish box culvert under Stewart Rd (2 - 5'x3')	120	foot	$245.00	$29,400.00
Headwalls for box culvert	2	each	$6,800.00	$13,600.00
Furnish box culvert under Glasscock Rd. (3 - 5'x3')	120	foot	$350.00	$42,000.00
Headwalls for box culvert	2	each	$8,500.00	$17,000.00
Hydromulch seeding	10	acre	$6,000.00	$60,000.00
Subtotal				$505,904.00
Mobilization at 5%				$25,295.20
Overhead and Profit at 10%				$50,590.40
Subtotal				$581,789.60
Contingencies at 30%				$174,536.88
Total Project Construction Cost				$756,326.48

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: East Drainage Ditches

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	21.4	acre	$12,000.00	$256,800.00
Site preparation	21.4	acre	$2,000.00	$42,800.00
Unclassified channel excavation	58,447	cu. yd.	$8.00	$467,576.00
Furnish box culvert under Glasscock Rd (3 - 5'x3')	120	foot	$350.00	$42,000.00
Headwalls for box culvert	2	each	$8,500.00	$17,000.00
Furnish box culvert under Six Mile Rd. (10 - 5'x3')	120	foot	$1,095.00	$131,400.00
Headwalls for box culvert	2	each	$20,200.00	$40,400.00
Hydromulch seeding	21.4	acre	$6,000.00	$128,400.00
Subtotal				$1,126,376.00
Mobilization at 5%				$56,318.80
Overhead and Profit at 10%				$112,637.60
Subtotal				$1,295,332.40
Contingencies at 30%				$388,599.72
Total Project Construction Cost				$1,683,932.12

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: North Central Drainage Ditches

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	11	acres	$12,000.00	$132,000.00
Site preparation	11	acres	$2,000.00	$22,000.00
Unclassified channel excavation	48,640	cu. yd.	$8.00	$389,120.00
Furnish box culvert under Mayberry Rd (4 - 5'x3')	120	foot	$460.00	$55,200.00
Headwalls for box culvert	2	each	$10,200.00	$20,400.00
Furnish box culvert under Six Mile North Rd. (6 - 5'x3')	120	foot	$670.00	$80,400.00
Headwalls for box culvert	2	each	$13,500.00	$27,000.00
Hydromulch seeding	11	acre	$6,000.00	$66,000.00
Subtotal				$792,120.00
Mobilization at 5%				$39,606.00
Overhead and Profit at 10%				$79,212.00
Subtotal				$910,938.00
Contingencies at 30%				$273,281.40
Total Project Construction Cost				$1,184,219.40

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: Northwest Drainage Ditch No 1

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	11	acres	$12,000.00	$132,000.00
Site preparation	11	acres	$2,000.00	$22,000.00
Unclassified channel excavation	52,830	cu. yd.	$8.00	$422,640.00
Furnish box culvert under Trosper Rd (2 - 5'x3')	120	foot	$245.00	$29,400.00
Headwalls for box culvert	2	each	$6,800.00	$13,600.00
Furnish box culvert under Six Mile North Rd. (3 - 5'x3')	120	foot	$350.00	$42,000.00
Headwalls for box culvert	2	each	$8,500.00	$17,000.00
Hydromulch seeding	11	acre	$6,000.00	$66,000.00
Subtotal				$744,640.00
Mobilization at 5%				$37,232.00
Overhead and Profit at 10%				$74,464.00
Subtotal				$856,336.00
Contingencies at 30%				$256,900.80
Total Project Construction Cost				$1,113,236.80

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: Northwest Drainage Ditch No. 2

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	4.3	acre	$12,000.00	$51,600.00
Site preparation	4.3	acre	$2,000.00	$8,600.00
Unclassified channel excavation	5,200	cu. yd.	$8.00	$41,600.00
Furnish box culvert under Six Mile North Rd. (2 - 5'x3')	120	foot	$245.00	$29,400.00
Headwalls for box culvert	2	each	$6,800.00	$13,600.00
Hydromulch seeding	4.3	acre	$6,000.00	$25,800.00
Subtotal				$170,600.00
Mobilization at 5%				$8,530.00
Overhead and Profit at 10%				$17,060.00
Subtotal				$196,190.00
Contingencies at 30%				$58,857.00
Total Project Construction Cost				$255,047.00

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Project: West Central Drainage Ditch

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	8.4	acre	$12,000.00	$100,800.00
Site preparation	8.4	acre	$2,000.00	$16,800.00
Unclassified channel excavation	24,780	cu. yd.	$8.00	$198,240.00
Furnish box culvert under Los Ebanos Rd	120	foot	$350.00	$42,000.00
Headwalls for box culvert	2	each	$8,500.00	$17,000.00
Furnish box culvert under Trosper Rd.	120	foot	$350.00	$42,000.00
Headwalls for box culvert	2	each	$8,500.00	$17,000.00
Hydromulch seeding	8.4	acre	$6,000.00	$50,400.00
Subtotal				$484,240.00
Mobilization at 5%				$24,212.00
Overhead and Profit at 10%				$48,424.00
Subtotal				$556,876.00
Contingencies at 30%				$167,062.80
Total Project Construction Cost				$723,938.80

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Louisiana Street

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	16	acre	$12,000.00	$192,000.00
Site preparation	16	acre	$2,000.00	$32,000.00
Unclassified channel excavation	75,124	cu. yd.	$8.00	$600,992.00
Furnish inlet structure	1	each	$3,600.00	$3,600.00
Furnish overflow discharge weir structure	1	each	$3,600.00	$3,600.00
Hydromulch seeding	16	acre	$6,000.00	$96,000.00
Subtotal				$928,192.00
Mobilization at 5%				$46,409.60
Overhead and Profit at 10%				$92,819.20
Subtotal				$1,067,420.80
Contingencies at 30%				$320,226.24
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Trosper and Six Mile

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	30.2	acre	$12,000.00	$362,400.00
Site preparation	30.2	acre	$2,000.00	$60,400.00
Unclassified channel excavation	159,600	cu. yd.	$8.00	$1,276,800.00
Furnish box inlet structure	1	each	$500.00	$500.00
Furnish overflow discharge weir structure	1	each	$500.00	$500.00
Hydromulch seeding	30.2	acre	$6,000.00	$181,200.00
Subtotal				$1,881,800.00
Mobilization at 5%				$94,090.00
Overhead and Profit at 10%				$188,180.00
Subtotal				$2,164,070.00
Contingencies at 30%				$649,221.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Mayberry and Six Mile

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	16	acre	$12,000.00	$192,000.00
Site preparation	16	acre	$2,000.00	$32,000.00
Unclassified channel excavation	79,300	cu. yd.	$8.00	$634,400.00
Furnish inlet structure	1	each	$3,900.00	$3,900.00
Furnish overflow discharge weir structure	1	each	$3,900.00	$3,900.00
Hydromulch seeding	16	acre	$6,000.00	$96,000.00
Subtotal				$962,200.00
Mobilization at 5%				$48,110.00
Overhead and Profit at 10%				$96,220.00
Subtotal				$1,106,530.00
Contingencies at 30%				$331,959.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Bryan and Six Mile

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	7	acre	$12,000.00	$84,000.00
Site preparation	7	acre	$2,000.00	$14,000.00
Unclassified channel excavation	70,300	cu. yd.	$8.00	$562,400.00
Furnish inlet structure	1	each	$21,200.00	$21,200.00
Furnish overflow discharge weir structure	1	each	$19,900.00	$19,900.00
Hydromulch seeding	7	acre	$6,000.00	$42,000.00
Subtotal				$743,500.00
Mobilization at 5%				$37,175.00
Overhead and Profit at 10%				$74,350.00
Subtotal				$855,025.00
Contingencies at 30%				$256,507.50
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Glasscock and Six Mile

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	30	acre	$12,000.00	$360,000.00
Site preparation	30	acre	$2,000.00	$60,000.00
Unclassified channel excavation	364,000	cu. yd.	$8.00	$2,912,000.00
Furnish inlet structure	1	each	$39,700.00	$39,700.00
Furnish overflow discharge weir structure	1	each	$20,300.00	$20,300.00
Hydromulch seeding	30	acre	$6,000.00	$180,000.00
Subtotal				$3,572,000.00
Mobilization at 5%				$178,600.00
Overhead and Profit at 10%				$357,200.00
Subtotal				$4,107,800.00
Contingencies at 30%				$1,232,340.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Sharyland and Four Mile

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	21	acre	$12,000.00	$252,000.00
Site preparation	21	acre	$2,000.00	$42,000.00
Unclassified channel excavation	214,100	cu. yd.	$8.00	$1,712,800.00
Furnish inlet structure	1	foot	$500.00	$500.00
Furnish overflow discharged weir structure	1	foot	$500.00	$500.00
Hydromulch seeding	21	acre	$6,000.00	$126,000.00
Subtotal				$2,133,800.00
Mobilization at 5%				$106,690.00
Overhead and Profit at 10%				$213,380.00
Subtotal				$2,453,870.00
Contingencies at 30%				$736,161.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Los Ebanos and Six Mile

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	15	acre	$12,000.00	$180,000.00
Site preparation	15	acre	$2,000.00	$30,000.00
Unclassified channel excavation	74,300	cu. yd.	$8.00	$594,400.00
Furnish box inlet structure	1	each	$3,000.00	$3,000.00
Furnish overflow discharge weir structure	1	each	$3,000.00	$3,000.00
Hydromulch seeding	15	acre	$6,000.00	$90,000.00
Subtotal				$900,400.00
Mobilization at 5%				$45,020.00
Overhead and Profit at 10%				$90,040.00
Subtotal				$1,035,460.00
Contingencies at 30%				$310,638.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin:West 2

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	13	acre	$12,000.00	$156,000.00
Site preparation	13	acre	$2,000.00	$26,000.00
Unclassified channel excavation	58,400	cu. yd.	$8.00	$467,200.00
Furnish box inlet structure	1	each	$5,600.00	$5,600.00
Furnish overflow discharge weir structure	1	each	$5,600.00	$5,600.00
Hydromulch seeding	13	acre	$6,000.00	$78,000.00
Subtotal				$738,400.00
Mobilization at 5%				$36,920.00
Overhead and Profit at 10%				$73,840.00
Subtotal				$849,160.00
Contingencies at 30%				$254,748.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: West 3

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	9	acre	$12,000.00	$108,000.00
Site preparation	9	acre	$2,000.00	$18,000.00
Unclassified channel excavation	39,800	cu. yd.	$8.00	$318,400.00
Furnish box inlet structure	1	each	$3,600.00	$3,600.00
Furnish overflow discharge weir structure	1	each	$3,600.00	$3,600.00
Hydromulch seeding	9	acre	$6,000.00	$54,000.00
Subtotal				$505,600.00
Mobilization at 5%				$25,280.00
Overhead and Profit at 10%				$50,560.00
Subtotal				$581,440.00
Contingencies at 30%				$174,432.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin:West 4

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	12	acre	$12,000.00	$144,000.00
Site preparation	12	acre	$2,000.00	$24,000.00
Unclassified channel excavation	53,000	cu. yd.	$8.00	$424,000.00
Furnish box inlet structure	1	each	$3,900.00	$3,900.00
Furnish overflow discharge weir structure	1	each	$3,900.00	$3,900.00
Hydromulch seeding	12	acre	$6,000.00	$72,000.00
Subtotal				$671,800.00
Mobilization at 5%				$33,590.00
Overhead and Profit at 10%				$67,180.00
Subtotal				$772,570.00
Contingencies at 30%				$231,771.00
Total Project Construction Cost				[redacted]

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: West 5

Description	Quantity	Unit	Unit Price	Total
Purchase property for construction	14	acre	$12,000.00	$168,000.00
Site preparation	14	acre	$2,000.00	$28,000.00
Unclassified channel excavation	63,200	cu. yd.	$8.00	$505,600.00
Furnish box inlet structure	1	each	$3,900.00	$3,900.00
Furnish overflow discharge weir structure	1	each	$3,900.00	$3,900.00
Hydromulch seeding	14	acre	$6,000.00	$84,000.00
Subtotal				$793,400.00
Mobilization at 5%				$39,670.00
Overhead and Profit at 10%				$79,340.00
Subtotal				$912,410.00
Contingencies at 30%				$273,723.00
Total Project Construction Cost				

City of Alton Master Drainage Plan

Opinion of Probable Construction Cost

Detention Basin: Five Mile and Bryan

Description	Quantity	Unit	Unit Price	Total
Unclassified channel excavation	808,296	cu. yd.	$4.00	$3,233,184.00
Subtotal				$3,233,184.00
Mobilization at 5%				$161,659.20
Overhead and Profit at 10%				$323,318.40
Subtotal				$3,718,161.60
Contingencies at 30%				$1,115,448.48
Total Project Construction Cost				[redacted]
Stormwater Pump Station	1	L.S.		$1,100,000.00
Contingencies at 30%				$330,000.00
Total Project Construction Cost				[redacted]
24-inch Stormwater Pipeline	5,400	Ft	$54.00	$291,600.00
Contingencies at 30%				$87,480.00
Total Project Construction Cost				[redacted]
Total Cost of Project				$6,642,690.08

APPENDIX C

Texas Water Development Board Review Comments for the City of Alton Flood Protection Planning Contract- Contract No. 96-483-158 on the Final Draft Report

TEXAS WATER DEVELOPMENT BOARD

William B. Madden, *Chairman*
Charles W. Jenness, *Member*
Lynwood Sanders, *Member*

Craig D. Pedersen
Executive Administrator

Noé Fernández, *Vice-Chairman*
Elaine M. Barrón, M.D., *Member*
Charles L. Geren, *Member*

JUN 16 1997

June 9, 1997

Mr. Salvador Vela
Mayor, City of Alton
P. O. Drawer 9004
Alton, Texas 78572

Re: Review Comments for Draft Report Submitted by the City of Alton, TWDB Contract No. 96-483-158

Dear Mr. Vela:

Staff members of the Texas Water Development Board have completed a review of the draft report under TWDB Contract No. 96-483-158. As stated in the above referenced contract, the City will consider incorporating comments from the EXECUTIVE ADMINISTRATOR shown in Attachment 1 and other commentors on the draft final report into a final report. The City must include a copy of the EXECUTIVE ADMINISTRATOR's comments in the final report.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Alfredo Rodriguez, the Board's Contract Manager, at (512) 463-7987, if you have any questions about the Board's comments.

Sincerely,

Carolyn L. Brittain

Tommy Knowles
Deputy Executive Administrator
for Planning

cc: Alfredo Rodriguez, TWDB

ATTACHMENT 1
TEXAS WATER DEVELOPMENT BOARD
REVIEW COMMENTS FOR THE CITY OF ALTON
FLOOD PROTECTION PLANNING CONTRACT
CONTRACT NO. 96-483-158

Comments on the Master Drainage Plan:

1. Table 2.1 is on section 2, page 3. On section 2 Page 4, there is a "continued Table 2.5". There is no reference on the text on Table 2.5. It appears that the table on page 4 of section 2 is the continuation of Table 2.1, and if so, the headings on both tables should be the same (i.e. on Table 2.1 the heading Discharge/Develop and Undeveloped do not have CN values as in the table on Page 4).

2. In section 2.3 (section 2, page 5) the source and the methodology by which the Runoff Curve Numbers are calculated need to be included.

3. In section 2.8 (section 2, page 7) the source of the Muskingum Equation needs to be referenced.

4. For clarification purposes the statement on Section 10.5 (section 10, page 6) that refers to the improvements identified should read "Sheets 1-A through 3-B" to match the title of the sheets.

5. The table of contents should include Appendix A - References and Appendix B - Estimates of Probable Construction Costs.

6. Task III - Existing Storm Sewer Assessment in the Scope of Work calls for the delivery of a map(s) showing existing storm sewer systems. Looking through the report, the existing maps do not show the storm sewer system. Please provide such maps.

7. The reports call for a population of 75,000 to 90,000 when the City of Alton will reach full development (section 10.3) but it does not state when this full development might be reached. TWDB population projections calls for a maximum of 22,510 people by the year 2050. There is a need for clarification on how the 75,000 to 90,000 population numbers were calculated.

8. Cost analysis need to be made available for improvements in the 3A and 3B quadrants of the regional map. (South drainage ditch)

9. Flow capacity of receiving drainage courses toward the southeast flowing out of the study area need to be included and the probable impact the improved system would have on these existing unimproved drainageways need to be addressed.

10. Any probably impact fees caused from increased flows on existing systems need

to be addressed, especially to the southeast and out of the study area.

11. In the Scope of Work, flow and holding capacity evaluations need to be included in the report, particularly when in Table 2.1 Developed Discharges exceed Hidalgo County DD #1 flow capacities.

12. In the Scope of Work, the evaluation of the system's outlet points into the Hidalgo county Drainage District's system need to be included in the report, particularly when in Table 2.1 Developed Discharges exceed the DD's flow capacities.

13. An analysis of the 100-year storm event comparisons need to be included in the report.

14. Identifiable non-structural alternatives need to be included in the report.

15. In the Scope of Work, evaluation of alternatives on economic feasibility, safety considerations, environmental concerns and aesthetics need to be included in the report.

16. Onsite detention should have been one non-structural alternative evaluated.

Comments on the Drainage Design Manual:

1. The definition of Swales on Appendix B needs to be included.

2. Computation Sheet 5-1 needs to be included.

3. On Table 5-5 the meaning of R-20, R-12.5, CBD, PO, HCO, etc, need to be included.

4. Computation Sheet 7-2 has 23 columns, there is an explanation for columns 1 through 14, but the explanations for columns 15 through 22 are missing and need to be included. All other Computation sheets within the manual are fully explained.

5. Appendices D, E, and F, missing from the manual need to be included.

ATTACHMENT 2
TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
REVIEW COMMENTS FOR CITY OF ALTON
FLOOD PROTECTION PLANNING CONTRACT
CONTRACT NO. 96-483-158

1. An Application for Approval of Reclamation Project need not be filed with the Texas Natural Resource Conservation Commission for the referenced proposal. It was determined from our review that the proposed project, since it is in the City of Alton, needs to be permitted by the City. The City of Alton by virtue of its participation in the National Flood Insurance Program, and in accordance with Section 16.236 (d) (3&4) of the Texas Water Code, has approval authority for the project. If the City has not already done so, they should insure that the proposed construction is documented and permitted in accordance with their Flood Hazard Prevention Ordinance. This documentation should also be submitted by the City to the Federal Emergency Management Agency to obtain a Letter of Map Revision (LOMR) of Alton's Flood Insurance Rate Map.

2. The technical content of the referenced report is based on acceptable hydrological and hydraulic methods and is complete. Therefore, the merits of the proposed project can be evaluated from the report.

Responses to Texas Water Development Board Comments on Final Draft Report

Comments on the Master Drainage Plan:

1. Concur

2. Concur

3. Concur

4. Concur

5. Concur

6. The map of the existing storm sewer systems as required in Task III- Existing Storm Sewer Assessment in the Scope of Work has been developed and furnished as a separate document. A large scale map of the developed area of the city is required to show the existing storm sewer system.

7. The full development population range was developed by assuming five to six dwelling units per acre and four persons dwelling unit.

8. The improvements in the 3A and 3B quadrants are within the City of Palmhurst. Their cost will not be the responsibility of the City of Alton.

9. The evaluation of the flow capacity of the receiving drainage courses toward the southeast is not included in the Scope of Work. Coordination meetings were held with the City of McAllen so that they would be informed about the proposed plans.

10. Not included in the Scope of Work.

11. Numerous attempts were made to coordinate with Hidalgo County Drainage District No.1. The capacity of their existing system is approximately a 10-year frequency storm. Hidalgo County Drainage District No. 1 currently has consultants evaluating improvements to its system. A meeting was held with the District's consultant to make them aware of the City

of Alton Master Drainage Plan.

12. See response to number 11.

13. The drainage system was evaluated in the study and presented in the report.

14. Non-structural alternatives are discussed in Section 3.

15. Discussions on economic feasability, safety considerations, environmental concerns and aesthetics are included in Section 9.

16. A future detailed land use plan does not exist for the City of Alton. The level of detail possible in establishing the runoff characteristics of the contributing watersheds can only be on an average basis. The proposed approach to watershed management is to permit the land developer to evaluate and proposed alternatives, including on-site detention, that achieve the prescribed level in the most economical matter.

Comments on the Drainage Design Manual

1. Concur

2. Concur

3. Concur

4. Explanations for columns 15 through 22 are included on Section 7, Page 6.

5. Appendices D, E, and F have been included in the manual.

TEXAS WATER DEVELOPMENT BOARD

William B. Madden, *Chairman*
Charles W. Jenness, *Member*
Lynwood Sanders, *Member*

Craig D. Pedersen
Executive Administrator

Noé Fernández, *Vice-Chairm*
Elaine M. Barrón, M.D., *Mem*
Charles L. Geren, *Mem*

November 3, 1997

Mr. Salvador Vela
Mayor, City of Alton
P. O. Drawer 9004
Alton, Texas 78572

Re: Response to Comments Regarding Flood Protection Planning Contract Between the Texas Water Development Board (Board) and the City of Alton (City), TWDB Contract No. 97-483-158

Dear Mayor Vela:

Staff members of the Texas Water Development Board have completed a review of the consultant's response to our comments and have determined that our comments have not been completely addressed. The attached comments should be considered before the report is finalized.

The Board looks forward to receiving your response to the comments in Attachment 1. Please contact Mr. Gilbert Ward, the Board's Contract Manager, at (512) 463-6418, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

cc: Gilbert Ward, TWDB

ATTACHMENT 1
TEXAS WATER DEVELOPMENT BOARD

RESPONSE COMMENTS FOR THE CITY OF ALTON
FLOOD PROTECTION PLANNING CONTRACT
CONTRACT NO. 97-483-158

1. Your response to TWDB comment #1 is not complete.
Table 2.1 is continued from page 3 to page 4, but the headings on the columns are not the same. Also, it should be clear by looking at the table (by column headings) that the table compares calculated discharges from SCS methodology to calculated discharges by HCDD#1 (which methods were used by HCDD#1?).

2. On page 4, portion of Table 2.1, what does the Q2 after Drainage District No. 1 in column heading mean?

3. Response to TWDB comment #2 - the source and methodology for Runoff Curve No. discussion was added, but the reference was not added to the List of References in Appendix A.

4. Your response to TWDB comment #3 was not what we desired. It appears that nearly all of Section 2.8 is taken from "Hydrology for Engineers" by Linsley, Kohler and Paulus (2nd ed, copyright date 1975, Section 9-8, page 300). The text should be denoted as a quotation and properly cited, otherwise it could be construed as plagiarism.

5. Please include the formula which introduces the constant K in the storage equation.

6. Eagle Point software, Watershed Modeling Manual needs to be included in the List of References.

7. TxDOT Drainage Manual needs to be included in the List of References.

8. It is assumed that the last sentence of Section 2.3 is citing that the Curve Number Values used by Eagle Point came originally from a SCS document, Section 4-Hydrology. This is not clear and not properly cited (and not in the List of References).

9. Response to TWDB comment #6 - the map provided of Existing Drainage Facilities has no legend.

10. Response to TWDB comment #13- as defined in the Scope of Work for Task III, Subtask 6, develop analysis of the 100-year storm event and compare to FEMA Insurance Rate Maps. Your response states that the 100-year storm event was evaluated, but the evaluation or a comparison to FEMA maps cannot be located in the report. Please note where in the report this is performed.

Responses to Texas Water Development Board on Final Report

Comments on the Master Drainage Plan:

1. Concur.

2. Concur.

3. Modified as requested.

4. Modified as requested.

5. Modified as requested.

6. Modified as requested.

7. Modified as requested.

8. Modified as requested.

9. The map will be modified as requested.

10. The drainage system concept proposed in the study was sized to accommodate the 100-year frequency storm. The FEMA FIRM Flood Insurance Rate Map for the unincorporated area of Hidalgo County around the City of Alton only contains Zone A designated areas in the form of depressed areas in the ground surface. The FEMA explanation of Zone A is "Areas of 100-year flood; base flood elevation and flood hazard factors not determined." In the consultants opinion, a detailed comparison in the report of the proposed drainage-ditch system to the FEMA approximate 100-year flooded areas would not add to the understanding and value of the Master Plan. Many of these depressed areas were incorporated into the drainage ditch routes and the detention storage areas.

11. New comment from TWDB. Section 3 has been reorganized as requested by the TWDB.

12. New comment from TWDB. Section 3 has been reorganized as requested by the TWDB.

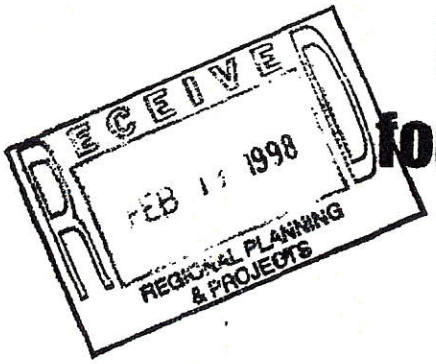
APPENDIX B

L&G Engineering
Transportation Consulting Engineers

Turner Collie & Braden Inc.

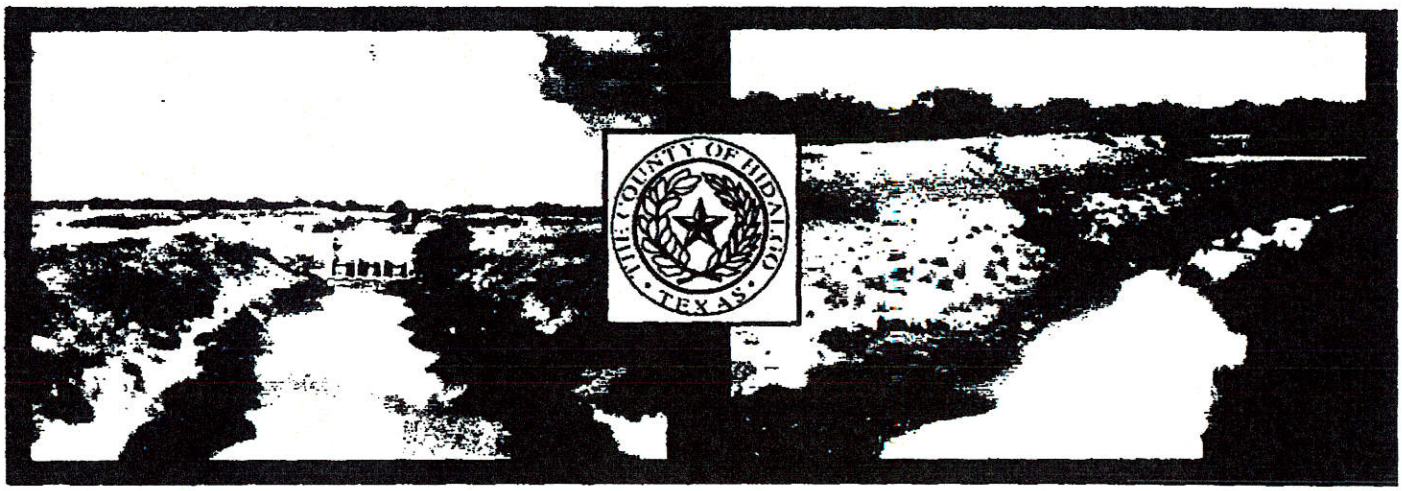
Engineers • Planners • Project Managers

Engineering Report to Hidalgo County Drainage District No. 1 Texas Water Development Board



Flood Protection Plan for Hidalgo County, Texas

September 1997



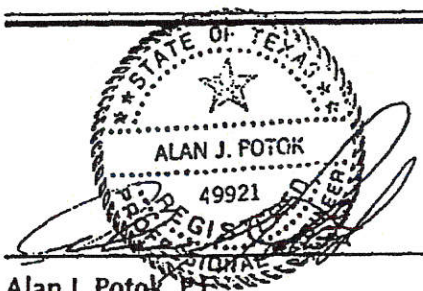
County Judge	Renato Cuellar	Commissioner Precinct #1	Sylvia Handy
Drainage District Manager	Godfrey Garza, Jr.	Commissioner Precinct #2	Lalo Arcaute
Director of Right-of-Way	Vona Walker	Commissioner Precinct #3	Juan Rosel
		Commissioner Precinct #4	Lupe Garces, Jr.

Turner Collie & Braden Inc.

ENGINEERING REPORT TO
HIDALGO COUNTY DRAINAGE DISTRICT NO. 1
TEXAS WATER DEVELOPMENT BOARD

Turner Collie & Braden Inc.
Job No. 31-00300-001

FLOOD PROTECTION PLAN FOR HIDALGO COUNTY, TEXAS



Alan J. Potok, P.E.
Vice President

DECEMBER 1997

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During the late 1970s and through the mid-1980s, Hidalgo County Drainage District No. 1 constructed a series of drainage channels intended to provide relief from local flooding problems that occur within the County. These ditches, referred to as the Hidalgo County Master Drainage System (HCMDS), were financed and constructed using County resources after an unsuccessful attempt to gain federal authorization for a similar project. These early channels were designed to convey agricultural runoff from a 10-year storm event; they were not designed to accommodate the urban runoff presently associated with the population explosion Hidalgo County has been experiencing over the past 15 years. As this population expansion has occurred, two principal deficiencies have been identified with the HCMDS. These include the overall drainage capacity, and the lack of an adequate lateral drainage system to access the HCMDS. Both of these issues had been previously addressed in the original federal study effort; however, no action to their implementation has been taken to date.

The purpose of this study is to determine the drainage requirements necessary to convey runoff into the HCMDS. To achieve this purpose, the study has the following objectives: (1) to evaluate current drainage criteria and recommend modifications to drainage policies in developing areas; (2) to identify the watersheds associated with the lateral drainage systems that drain into the primary HCMDS; (3) to develop a basic mapping system for the lateral drain system; and (4) to define a Capital Improvement Plan for future construction of the lateral channels.

Hidalgo County, Texas is located in the Lower Rio Grande Valley (LRGV) and is one of the nation's richest agricultural areas. Agricultural land surrounds most urban communities in the County, and provides the primary industry. However, the accessibility to the Mexican border, combined with the region's moderate climate, has contributed to a rapidly developing economic community. The population of Hidalgo County is also growing rapidly, and the Lower Rio Grande Valley Development Council projects the population to increase to more than 500,000 by the year 2000. Commercial development has occurred, principally along major highways, railroads, and some drainage channels. Residential growth continues to expand the limits of the cities, resulting in the gradual conversion of some of the peripheral agricultural lands.

The Rio Grande forms the southern boundary of Hidalgo County, and is also the international boundary between the United States and Mexico. The Rio Grande provides the drainage outlet for the westernmost portions of Hidalgo County. A series of floods that inundated large portions of the LRGV, resulting in extensive damage, caused the International Boundary and Water Commission (IBWC) to construct a system of floodways to convey the flows that exceeded the Rio Grande's capacity.

Even with the federal floodway project in place, Hidalgo County suffered from a lack of adequate local drainage channels. In 1969, the US Soil Conservation Service (now the Natural Resource Conservation Service, NRCS) conducted a study concerning the flooding problems in the LRGV, and recommended that a comprehensive drainage plan be developed. The plan was to be accomplished in three phases. Phase One would address the major outlet channels within the study area, with phases Two and Three dealing with the lateral and on-farm drainage systems.

The U.S. Army Corps of Engineers undertook the first phase, and published the "Lower Rio Grande Basin, Texas Flood Control and Major Drainage Project" in October of 1980. The results of the first phase study showed that the proposed project would afford benefits from: the prevention of flood damages to existing and future urban and agricultural development; a reduction in public health and relief costs; enhancement of land values; an increase in net financial returns to farm and ranch operators; and the overall enhancement of the economy of the area. Phases Two and Three of the NRCS plan were never executed.

As part of the study, meetings were held between participants in the development community and local drainage authorities. One of the principal concerns of these stakeholders is the lack of an adequate outfall. In many cases, the development does not have access to an outfall ditch. There was a general consensus that all parties were willing to solve the drainage problem, providing that the costs were reasonable and criteria were consistent.

In review of the drainage criteria, the following recommendations are made to enhance overall drainage management:

1) Obtain recent aerial mapping in digital form and enhance the HCDD No. 1 GIS system, using this data to assist in determining channel alignments and land use.
2) Municipalities and the HCDD No. 1 should agree on a performance standard for the drainage system that encourages participation by the development community, as well as the public interests.
3) Pursue the lateral drainage channel plan defined in this report.
4) Develop a drainage criteria manual for the County.
5) Define a consistent methodology, such as the one presented in this report, for calculating channels, detention basins, and storm sewers.
6) Pursue a cooperative program with the IBWC that allowed for a major expansion of the flow from the HCMDS into the IBWC floodway system.

One of the primary objectives of this study was to plan for a series of lateral channels that would provide drainage to all local areas allowing access to the HCMDS. To perform this task, all previous and ongoing drainage studies were examined. To the extent practical, the results of these studies are incorporated into the lateral channel plan. The irrigation districts in Hidalgo County currently operate and maintain a significant number of channels. In most cases, the alignments of these channels was used to guide development of the lateral drains that would be operated by HCDD No. 1. An extensive array of channels and their corresponding drainage areas are shown on *Exhibit 5*. *Table 3* summarizes the physical characteristics of each channel, and *Table 4* shows the approximate cost for each. The total cost of the lateral channel system is approximated as $141,983,000. Maintenance costs associated with the channels are anticipated to be $2,330,000 annually.

Purpose

Outfall drainage in Hidalgo County, Texas, is provided by a series of large ditches that were constructed during the late 1970s through the mid-1980s. These ditches, referred to as the Hidalgo County Master Drainage System (HCMDS), were financed and constructed using county resources after an unsuccessful attempt to gain federal authorization for a similar project. The channels were designed at that time to convey agricultural runoff from a 10-year storm event, and subsequently do not accommodate the urban runoff associated with the population explosion Hidalgo County has experienced over the past 15 years. As this population expansion has occurred, two principal deficiencies have been identified with the HCMDS. These include the overall drainage capacity and the lack of an adequate lateral drainage system to access the HCMDS. Both of these questions had been previously addressed in the original federal study effort; however, no action has been taken to date to implement them.

The purpose of this study is to determine the drainage requirements necessary to convey runoff into the HCMDS. To achieve this purpose, the study has the following objectives: (1) to evaluate current drainage criteria and recommend modifications to drainage policies in developing areas; (2) to identify the watersheds associated with the lateral drainage systems that drain into the primary HCMDS; (3) to develop a basic mapping system for the lateral drain system; and (4) to define a Capital Improvement Plan for future construction of the lateral channels.

Study Participants

Hidalgo County Drainage District No. 1 (HCDD No. 1) is responsible for the maintenance of the HCMDS, and provides this service over the majority of Hidalgo County, as depicted on *Exhibit 1*. In support of its activities, HCDD No. 1 has implemented a permitting program that requires land development activities to gain HCDD No. 1 approval before accessing the HCMDS as an outfall. Recognizing the difficulty being experienced by the developing properties in the region, and also in response to numerous concerns by the municipalities in the County, HCDD No.1 developed the scope of services for this project. In August 1996, HCDD No. 1 completed an application for a regional Flood Protection Planning Grant for the Texas Water Development Board (TWDB). Other communities participating in the planning grant application were the cities of Pharr, McAllen, and Edinburg. The planning grant was issued on December 17, 1996. Selection of a consultant was completed, and work began on the study in January 1997.

Hidalgo County Drainage District No. 1 Service Area

HCDD No. 1 is a Conservation and Reclamation District created under Article 16, Chapter 59 of the Texas Constitution. It is responsible for the operation and maintenance of the major drainage channels constructed as part of the HCMDS. The service area encompasses most of, but not all of, Hidalgo County, as depicted on *Exhibit 1*. The service area extends from east of La Joya on the west, to the Willacy and Cameron County lines on the east, and from the Rio Grande on the south, to an area south of Hargill on the north. The total service area encompasses approximately 790 square miles within Hidalgo County.

Description of the Area

Hidalgo County, Texas is located in the Lower Rio Grande Valley, and is one of the nation's richest agricultural areas. The soils are fertile and produce high yields of citrus, vegetables, cotton, and other crops through the use of irrigation with adequate drainage. These favorable natural conditions in the Lower Rio Grande Valley, together with the development of water sources for irrigation, have resulted in an increase in the Lower Rio Grande Valley's irrigated area from a few thousand acres to more than 679,000 acres over the past 50 years. Hidalgo County represents about half of the total amount.

Hidalgo County comprises approximately 1,583 square miles in south Texas along the Texas Mexico border. Its proximity to Mexico has contributed to its high rate of population growth over the past 20 years. In 1970, the U.S. Census Bureau estimated the population of the County to be 181,525 persons. In 1990, the U.S. Census Bureau estimated the population to be 383,545. The majority of this growth has occurred along the route of U.S. 83, and between U.S. 83 and the Rio Grande.

The overall population of Hidalgo County is growing rapidly, and the Lower Rio Grande Valley Development Council projects the County's population to increase to more than 500,000 by the year 2000. The largest city in Hidalgo County is the City of McAllen, with an estimated population of 83,000. The second largest city is Edinburg, with a population of 32,700. Other major cities include Pharr, Mission, Weslaco, Donna, San Juan, and Mercedes.

Agricultural land surrounds most urban communities in the County, and serves as the primary industry. Commercial development has occurred principally along major highways, railroads, and some drainage channels. Residential growth continues to

expand the limits of the cities, resulting in the gradual conversion of some of the peripheral agricultural lands.

Physical Features

The Lower Rio Grande Valley is a smooth, nearly flat plain that includes two physiographic features, the Rio Grande Delta and the Gulf Coastal Plain. The Rio Grande Delta covers all of Cameron County, the southern portion of Willacy County, and an eight mile-wide strip along the southern and eastern portions of Hidalgo County. The remainder of Hidalgo County is underlain by marine sedimentary formations of the Coastal Plain.

The minor surface slopes that do exist are related primarily to the Mission Ridge and to a natural levee which extends along the north bank of the Rio Grande from a point southwest of the City of Mission to the mouth of the Rio Grande. Mission Ridge is a minor rise that forms a drainage divide extending generally along U.S. 83, from just west of Mission to a point midway between Weslaco and Mercedes. The southern portion of Mission Ridge is part of the Coastal Plain and it slopes from the highway southeastward to the Main Floodway. The delta lands between the Main Floodway and the Rio Grande have a general northeastern slope towards the Floodway and away from the natural levee bordering the river. The coastal plain north of U.S. 83 and east of Mission slopes generally northeastward, towards the North Floodway and the Laguna Madre. The westernmost portions of the County slope towards the Rio Grande.

The Rio Grande provides a drainage outlet only for the westernmost portions of Hidalgo County, with the International Boundary and Water Commission (IBWC) Main Floodway, the IBWC North Floodway, and the Arroyo Colorado constituting the outlet for the remainder of Hidalgo County (*Exhibit 3*). The ultimate outfall of the floodway system is through Willacy and Cameron counties into the Laguna Madre. The Main Floodway was developed by constructing levees along each side of a series of resacas and excavating a pilot channel midway between the levees. The Main Floodway merges with the Arroyo Colorado southwest of Mercedes, creating a distributary of the Rio Grande that extends to the Laguna Madre. That is the only natural outlet channel in the Lower Rio Grande Valley, other than the Rio Grande.

The primary function of the IBWC Main Floodway, IBWC North Floodway, and Arroyo Colorado is to divert excess flows from the Rio Grande. During periods when the floodways are being used for diversions from the Rio Grande, floodgates are closed and local storm runoff is prevented from entering the system until the flood flows have

receded. Since 1958, the floodway has been used five times to divert flows ranging from 3,000 cfs to 55,000 cfs.

The North Floodway branches from the Main Floodway at a point southwest of Mercedes. It was developed in the same manner as the Main Floodway, along other distributaries of the Rio Grande and extends across northwestern Cameron County and southeastern Willacy County to the Laguna Madre. The North Floodway serves as the outlet for most of the area between Mission and north of U.S. Highway 83, through a network of man-made drainage channels developed as part of the HCMDS.

Climate and Soils

Hidalgo County has a subtropical, semi-arid climate, characterized by long, hot summers and short, mild winters. The climate has an annual precipitation ranging from 20 to 24 inches. The climate is generally conducive to the growing of crops year-round, and the average length of the growing season is 330 days. Temperatures range from an average July maximum of 97° F to an average January minimum of 49° F. The highest average monthly rainfall occurs in September, and the lowest occurs in March. Hidalgo County historically experiences 69 percent of its annual rainfall during the period of May through October; this frequently occurs as intense tropical storms.

The land within Hidalgo County generally features gentle sloping to flat slopes with moderately permeable, loam and clay soil. Most of the soil is level, high in natural fertility, easily cultivated, and suitable for irrigation. The well-drained soils have a seasonal water table depth of four to eight feet. Hidalgo County attributes include depression areas with no drainage outlet; these areas have soils with fine-grained materials.

Flat terrain and soils having low infiltration rates severely limit the drainage capabilities within Hidalgo County. As the soils rapidly become saturated, ponding waters converge and begin to sheet flow. With a typical land slope of one foot per 2,500 feet, sheet flow advances very slowly towards the drainage channels. Obstructions such as elevated canals, roadways, dikes, and railroad embankments crisscross Hidalgo County, acting as barriers and preventing the flow to the drainage channels. Because of the flat topography, it may take several days for the storm water to travel overland into the drainage channels. Once the runoff reaches the channels, it continues to flow slowly because of the almost-flat drainage channel bottom slopes of one-foot-per-mile. The flows in the channels also experience excessive backwater because of restrictive culverts crossing under roadways. Overall, the water remains in the channels for prolonged periods of time due to the extremely low velocity of the flow.

Land Use

Hidalgo County remains predominantly agricultural in land use. However, the increasing population and industrial growth has induced conversion of much of the area along US 83 to urban land use. Annual growth rates exceeding 5 percent have been occurring for the past 10 years within the County. Digital land use and land cover were obtained from the US Geological Survey. This information is dated in the mid 1970s. Current mapping efforts by the State of Texas are underway, but were not available at the time of this study. The digital land use map is referenced as a background to *Exhibit 3* and depicts the primary outfall systems.

Localized Flooding Problems

The proximity to the coastal area results in tropical rainfalls and intense storms that often cover only portions of Hidalgo County during a single event. Frequent flooding of streets, homes, and agricultural fields have often been reported as evidenced by the representative news articles contained in *Appendix D*. Repetitive flood claim information was obtained from the Federal Emergency Management Agency (FEMA). These flood claims, shown on *Exhibit 3*, reflect only those houses that have applied for disaster assistance under the Flood Insurance Program more than one time. It does not reflect homes that have flooded and requested assistance only a single time. More importantly, it reflects only those persons who have flood insurance and are able to make a claim. It is believed that a significant number of residents experience flooding and are unable to make an insurance claim.

As part of the study effort, questionnaires were sent to every community within the study area. The questionnaire, a copy of which is also in *Appendix D*, attempted to identify locations of repetitive flooding occurrences and frequent flooding locations. However, no responses to the inquiries were received.

History of Major Flooding in Hidalgo County

There were 23 floods on the Rio Grande having discharges exceeding 60,000 cfs, occurring at Rio Grande City, Starr County, between 1900 and 1939. The floods of 1919, 1922, and 1932 inundated large portions of the Lower Rio Grande Valley and caused extensive damage. The IBWC, a joint agency formed in 1932 by the governments of the United States and Mexico, has constructed a system of floodways to dispose of the flows in excess of the river's capacity. These include the Main and the North floodways, previously described. The Anzalduas Dam diverts water from the Rio

Grande into the Main Floodway, which then crosses southern Hidalgo County in the vicinity of Mercedes, where it splits into the Arroyo Colorado and the North Floodway.

The frequency of large flows entering the Lower Rio Grande Valley has been substantially reduced by the completion of Falcon Reservoir, constructed by the IBWC in 1953. This reservoir has a flood storage pool of 1,685,000 acre-feet, and is used primarily for power generation and water supply. Since development of the reservoir, there have been only five floods requiring the diversion of flows from the Rio Grande. All of these floods, ranging between 3,000 cfs and 55,000 cfs, have been contained in the floodway.

Hidalgo County and the National Flood Insurance Program

Hidalgo County entered the National Flood Insurance Program (NFIP) in 1980, when a study of flood-prone areas was published. The majority of the floodplain designations for the County were based on historical data collected from Hurricane Beulah in 1967, rather than on standard numerical models. As a result, Hidalgo County is not able to benefit from development of numerical rainfall runoff models which could be used to help regulate and manage its floodplain areas. The National Flood Insurance Rate Maps currently in effect are based on the study performed in 1980.

The Federal Emergency Management Agency (FEMA) initiated a Flood Insurance Study (FIS) update for Hidalgo County in 1996. The objective of this study was to determine the limits of regulatory floodplain on approximately 20 miles of channels operated by HCDD No. 1, including portions of West Main III, from Abram Road on the upstream side to Taylor Road at the downstream end; North Main, from the junction with West Main I near McColl Road to the confluence with the South Main; and the East Lateral Drain, from Mile 11-N Road to Mile 2-W Road on the downstream side.

The Rio Grande Floodway System

The Hidalgo County watershed drains naturally north and east away from the Rio Grande. Major flooding and overflows along the Rio Grande result in major flooding of communities in the Lower Rio Grande Valley, most notably the cities of McAllen and Brownsville. The channel of the Rio Grande has never been capable of carrying more than a small portions of its floodwaters through the delta and to the Gulf of Mexico. Before flood control works were undertaken, the river regularly overflowed its banks, spread out over the lands, and collected in natural overflow channels to discharge to the Gulf.

The early efforts of individual farmers to protect their lands by building levees were not

effective. Hidalgo County, in cooperation with Cameron County, began construction in 1925 of the first flood control project in the Lower Rio Grande Valleyin response to major flooding in the early 1900s. The project consisted of constructing levees along natural overflow channels to form the Mission and Hackney Inlets and the Main Floodway.

In 1933, a hurricane decimated the Lower Rio Grande Valley, crippling its economy and preventing the counties from continuing the flood protection plan. Under authority of the Emergency Act of 1933, the federal government assumed responsibility for the operation and maintenance of the Floodway System on a temporary basis. In 1934, a coordinated plan was developed between the United States and Mexico. The system included river levees and levees along natural overflow channels to form interior floodway systems. Further work on the project was authorized in 1935 by the Secretary of State acting through the IBWC. The United States interior floodway consisted of:

1. Mission Floodway, beginning near the river about three miles south of Mission and extending 10.6 miles to the Main Floodway;

2. Hackney Floodway, which had its inlet about four miles east from Anzalduas Dam, and extended four miles to connect to the Mission Floodway to form the Main Floodway;

3. The Main Floodway, extending from southeast of McAllen some 19.9 miles to Mercedes, and dividing there into the North Floodway and the Arroyo Colorado;

4. The North Floodway, constructed by adding levees along a natural overflow channel;

5. Arroyo Colorado, a natural channel that had levees added along its upper portion; and

6. A separate Rancho Viejo Floodway, diverting floodwaters from the Rio Grande, about 20 miles upstream of Brownsville to Resaca del Rancho Viejo.

In September 1967, Hurricane Beulah struck the Valley, dropping up to 35 inches of rain below Falcon Reservoir. The resulting flood had a peak discharge of 220,000 cfs at Rio Grande City, which was considerably higher than the capacity of the floodway systems. As a result, modifications to the flood protection system were developed, including enlargement of the Hackney Floodway through the Anzalduas Dam dike to allow diversion of the river upstream of the dam, and closure of the Mission Floodway;

raising levees along the Main and North Main Floodways. The system was designed to convey approximately 105,000 cfs in the Main Floodway. Of this amount, the Arroyo Colorado is capable of conveying an estimated 21,000 cfs, and the North Floodway can convey 84,000 cfs. The IBWC floodways are depicted on *Exhibit 2*.

The flood protection plan is managed and operated by the IBWC. The IBWC allows for localized drainage improvements to connect to the floodway system, providing that the connection does not interfere with the operation of the floodway. To accommodate this, all confluences are gated, and must be closed during times when the floodways are in use for diversions from the Rio Grande. It should also be noted that the probability of a 100-year frequency diversion on the Rio Grande occurring simultaneously with a 100-year storm event in Hidalgo County is a probability that exceeds the levels of protection considered as normal or economical.

Although the floodways serve a defined purpose in stormwater management, they also provide some of the most fertile agricultural property when they are not inundated by diversions from the Rio Grande. The pilot channels within the floodway system have capacities ranging from a mere 3,000 to 5,000 cfs. This fact, combined with the economic constraints of the HCDD No. 1 when it constructed the HCMDS, limits the actual drainage capacity of the drainage system in Hidalgo County.

The Hidalgo County Master Drainage System

Even with the federal Floodway project in place, Hidalgo County suffered from a lack of adequate local drainage channels. In 1969, the US Soil Conservation Service (now the Natural Resource Conservation Service, NRCS) conducted a study concerning the flooding problems in the Lower Rio Grande Valley, and recommended that a comprehensive drainage plan be developed. The plan was to be accomplished in three phases. Phase One would address the major outlet channels within the study area, and phases Two and Three would deal with the lateral and on-farm drainage systems.

The Corps of Engineers undertook the first phase, and published the "Lower Rio Grande Basin, Texas Flood Control and Major Drainage Project" in October of 1980. The results of the first phase showed that the proposed project would afford benefits from: the prevention of flood damages to existing and future urban and agricultural development; the reduction in public health and relief costs; enhancement of land values; an increase in net returns to farm and ranch operators; and the overall enhancement of the economy of the area. Phases Two and Three of the NRCS plan were never executed.

The Corps of Engineers' plan did not receive authorization for construction as a federal project. Officials in Hidalgo and Willacy counties realized a need for immediate drainage improvements. The counties planned to initiate a local project to alleviate the yearly flooding problems. On November 15, 1975, the voters in Hidalgo County approved a $26 million dollar bond issue to finance the local project. The project represented the beginning of the HCMDS, with construction initiated in the summer of 1981. The original bond issue financed the construction of a drainage ditch from the Laguna Madre to Panchita, a distance of 36 miles. Additional bond issues financed the construction of the following drainage channels: South Main Drain, North Main Drain, East Lateral, Southwest Lateral, Pharr-McAllen Lateral, Mission Lateral, Edinburg Lateral, Mission Inlet and Rado Drain, Weslaco Drain, Mercedes Lateral, and the East Donna Drain.

Prior to the completion of the HCMDS, Hidalgo County's drainage system consisted only of small drainage ditches constructed adjacent to the irrigation delivery system. The drains constructed as part of the HCMDS form the basic outfall system in use today. Capacity in the system is limited to an agricultural runoff rate, assuming approximately a 10-year frequency storm event. *Table 2* depicts the design capacity of the drainage system for each channel in the HCMDS. *Exhibit 3* depicts the HCMDS channel configuration.

All channels in the HCMDS outfall into either the IWBC- U.S. Section floodway channels within the County, or into the HCMDS Main Floodway channel that outfalls into the Laguna Madre. The primary drainage ditches in the southern portions of Hidalgo County outfall into the IBWC Main Floodway. The Arroyo Colorado carries the normal flow from the Main Floodway, but the Arroyo Inlet control structure restricts flows to a maximum of 3,000 cfs, with additional flows being diverted into the IBWC North Floodway. The primary HCMDS drainage ditches in the northern portions of Hidalgo County outfall into the Main Floodwater Channel. The Main Floodwater Channel carries flow through Willacy County to the Laguna Madre. However, the Panchita Structure restricts the flow in the Main Floodwater Channel to 3,750 cfs east of Panchita, with additional flows being diverted over the right bank into the IBWC North Floodway. This restriction prevents flooding downstream in Willacy County.

As part of the background investigation for this study, all available studies performed on drainage and flood control during the past decade were reviewed. Many of these reports were prepared by individual municipalities and address solutions of flooding problems on a localized basis. In many cases, the studies recommend different drainage criteria. The following section summarizes the objectives and overall content of each study.

REGIONAL DRAINAGE STUDIES

Master Drainage Plan Design Information
Hidalgo County Drainage District No. 1
Sigler, Winston, Greenwood and Associates, Inc.
1974

This report describes the basic design criteria for the main drainage channels constructed and operated by HCDD No. 1. It establishes a design level of protection for a 9.5-year storm, using "Runoff Rate of Point Excess" with 0.25 inches per hour infiltration rate, from curves developed by the U.S. Bureau of Reclamation. The report defines drainage areas associated with each main drain, and determines design capacities at key points along each drain. The design capacities are summarized in *Table 2*.

The report also establishes a design for subdivision drainage systems. It recommends a 10-year frequency, using the rational method (Q=CiA), with i equal to a rainfall intensity of 3.2 inches per hour and a runoff coefficient of C = 0.3. The factor Ci is therefore equal to 1.0, resulting in a design capacity of approximately 1.0 cfs per acre. The design was considered valid for areas up to 2,000 acres. It is likely that this method was applied for many of the urban drainage systems installed since the criteria was established. As part of the planning report, recommendations were also included for channel rights-of-way and the basic design criteria for the Main Floodway Channel and all major laterals.

Surface Water Hydrology for Hidalgo and Willacy County Drainage Districts
U.S. Army Corps of Engineers, Galveston District
1977

The purpose of this report was to evaluate the impact on water quality in the Laguna Madre resulting from runoff from the North Floodway Channel, Arroyo Colorado, Raymondville Drain, and Banker Drain. Since the focus of the report was water quality, it involved predominantly low flows (2-year frequency storms), as opposed to larger

storms that contribute to widespread flooding. The report did not address any aspects of the localize drainage systems.

Flood Control and Major Drainage Project, Lower Rio Grande Basin, Texas
Phase I Design Memorandum
U.S. Army Engineer Corps of Engineers, Galveston District
1980

The purpose of this report was to determine the advisability of federal participation in flood control and agricultural drainage improvements in Willacy and Hidalgo counties in the Lower Rio Grande Basin of Texas. The plan proposed a high degree of flood protection and drainage for the urban areas within Hidalgo and Willacy Counties. The results of the study demonstrated the beneficial effects to the area of prevention of future flood damages.

The report recommended that the plan be approved, subject to certain conditions of non-federal cooperation, as a basis for future Phase II advanced engineering and design and construction. The funding for the project never transpired, and eventually Hidalgo County proceeded with its own plan.

Master Plan for Storm Water Disposal for Hidalgo County, Texas
Hidalgo County Drainage District No. 1
Melden and Hunt, Inc. and Sigler, Winston, Greenwood and Associates
1982

This report, and the subsequent construction activities that followed, were spurred by a lack of funding from the federal government for needed drainage improvements. This report follows the report by Sigler, Winston, Greenwood and Associates prepared in 1974. The report addresses the Main Floodway Channel, North Main Drain, South Main Drain, East Lateral, Southwest Lateral, South Floodwater Channel, and interceptor ditches. It includes all of the primary drainage channels that exist today, with the exception of the Rado Drain.

The design criteria established for the primary drainage channels is significant as it relates to the drainage problems being experienced in the County today. The channels were designed on the basis of crop tolerance to inundation. It was considered that full protection against crop damage due to flooding could be provided if the flooding did not persist for more than 48 hours. Previous cost/benefit studies had indicated that one flood every 10 years could be tolerated. At the same time, the design was anticipated to provide sufficient capacity to convey runoff from urban areas resulting from rainfall having an intensity of one inch per hour.

At the time this study was completed, the relative impact of urban runoff was considered to be insignificant when compared to the runoff from agricultural areas. Since that time, population in the County has doubled, and urban runoff impacts are now realized as being significant.

Because the drainage system relies on the capacity of the receiving floodway system operated by the IBWC, provisions had to be made for pumping water from the drainage channels into the floodways when the floodways were full because the drainage system relies on the capacity of the receiving floodway system operated by the IBWC. Eighteen pumping plants were proposed for construction in order to accommodate this scenario.

Master Drainage Plan for Mission Inlet and South Rado Drain
Hidalgo County Drainage District No. 1
Melden and Hunt, Inc. and Sigler, Winston, Greenwood and Associates
1985

Mission Inlet and South Rado Drain provide drainage for portions of the cities of Mission and McAllen, including the International Trade Zone, and an upstream portion of western Hidalgo County. Mission Inlet drains into the Banker Floodway, which in turn drains into the Arroyo Colorado or the North Floodway. The study was initiated because of a concern that modifications to the operation of Mission Inlet could cause downstream flooding.

The pilot channel of the floodway was designed to convey from 3,000 to 5,000 cfs of local runoff when the floodway was not being used for diversions from the Rio Grande. The pilot channel of Mission Inlet was designed for the same purpose. After Hurricane Beulah in 1967, the IBWC elected to construct the Banker Floodway and close the diversion of the Rio Grande to Mission Inlet.

The report proposes several changes to the operation of Mission Inlet including:

- Lowering of the levees to elevation 103,
- Expanding the capacity of the Arroyo Colorado from an existing 3,000 cfs to 5,000 cfs,
- Increasing the size of six gated openings between Mission Inlet and Banker Floodway from 225 sf to 600 sf, and

- Redesigning the overflow weir on South Rado Drain at Mission Inlet to accommodate increased runoff in the upstream watershed.

The design criteria used in this report reflected the results of the previous study completed in 1974.

Rado Drain Alternative
Hidalgo County Drainage District No. 1
Melden & Hunt Inc.
1988

The purpose of this report was to evaluate an alternative route to Rado Drain. This rerouting was proposed for several reasons, including:

- Diverting flow away from the proposed McAllen Civic Center site,
- Making the ditch more accessible to eastern sections of the City of Mission, and
- Avoiding environmentally sensitive areas that would be disrupted by expanding the existing ditch.

Drainage Policies and Permit Procedures
Hidalgo County Drainage District No. 1
Melden & Hunt Inc.
1990

The objective of this report was to establish guidelines that limit discharges into the HCMDS. The master drainage system is comprised of the primary channels described in the 1982 report. The report describes the basis for design of the HCMDS and its limitations on conveying flow, and it recommends a permit system to insure compliance with the capacity of the system.

The permit system requires the submittal and approval of a drainage report for all developing properties. The drainage report submitted must demonstrate that the developing property meets specified limitations on water quantity and water quality that may enter the HCMDS. This permit system, which is broadly defined, offers HCDD No. 1 a significant authority over drainage.

Summary of Regional Drainage Study Reports

The following conclusions are derived from the review of the previous studies and reports:

1) The HCMDS was designed predominantly for agricultural purposes. Neither the storm intensity or the time for runoff are applicable to continued urban development.

2) The floodway systems have significant capacity for conveying runoff when they are not being used for diversions from the Rio Grande. However, these floodways are widely used for agricultural purposes. Frequent, prolonged flooding would not be acceptable because of potential damages to crops. The allowable capacity of these floodways for local drainage is, therefore, limited to the range between 3,000 and 5,000 cfs.

3) Runoff from urbanizing areas is largely restricted through the use of detention.

4) It is impractical at this time to increase the capacity of the HCMDS. Although drainage agreements with IBWC would apparently allow an increase, economics would likely prevent it.

LOCAL DRAINAGE STUDIES

In response to localized drainage problems, and as part of periodic updating of master infrastructure planning, most municipalities in Hidalgo County have prepared master drainage plans. The following summarize the plans reviewed as part of this report.

Report of the Study Phase for Southeast Original Townsite Infrastructure
City of Edinburg
Quintanilla, Headley and Associates, Inc.
1994

This study was a comprehensive evaluation of a portion of the City of Edinburg's storm sewer system. The rational method was used to analyze system capacities. Although the Southeast study was prepared during the same time as the Northeast study, it used different watershed coefficients. The study also recommended a different cross-section for streets that would increase the collection of runoff and enlargement of all storm sewer inlets. The study recommends that regulation of peak flows be achieved by onsite or offsite detention storage, without specifying details of detention volumes or outlet sizes.

Northeast Original Townsite Drainage Study
City of Edinburg
R.E. Garcia & Associates
1994

This study was a comprehensive evaluation of the storm sewer facilities servicing the original townsite of the City of Edinburg. Thirty-two drainage areas were defined. City of Edinburg staff determined that the drainage facilities should be sized for a 25-year storm event. Facilities were sized using the rational method and runoff coefficients of 0.45 for residential areas and 0.95 for commercial areas. Drainage from the study area drains into one of two stormwater detention basins, known as the Northeast pond and the San Juan pond. Runoff in the detention basins is then pumped into the main drainage ditch operated by theHCDD No. 1.

The study concluded that the storm sewer systems were severely undersized for the criteria specified, that the detention basins were operated in an arbitrary manner, and that the receiving streams required maintenance.

Flood Protection Plan
City of Donna
Rust Lichliter/Jameson
1995

The objective of this report was to recommend solutions to localized flooding problems. Localized flooding that hinders mobility and threatens residential and commercial structures has been a frequent problem in downtown Donna and several adjacent neighborhoods. A total of 445 homes is believed to be affected by the local flooding problems. Outfall drainage is provided by a series of five ditches originally designed to convey runoff from agricultural fields. Channels on the eastern side of the City are reported to have historic flooding problems. Local drainage is provided by a series of valley swales and roadside ditches, with limited storm sewers.

Analysis of the flooding problem was performed, using HEC-1 and HEC-2 models for the outfall channels, and the rational method for storm drains. Most of the local drainage system was identified as needing improvements and inadequate culverts and storm sewers were identified as the major problem.

Southwest Edinburg Drainage Study
City of Edinburg
Melden & Hunt, Inc.
1995

This study addressed the infrastructure necessary to accommodate existing and future drainage needs of 1,780 acres in southwest Edinburg. The project area was divided into four drainage basins. The study revealed several alternative methods of drainage, and recommended a system of channels to serve as linear detention storage basins, as well as conveyance. Storm drain systems were proposed to be designed to convey the 25-year flow to provide conveyance in accordance with the rules for discharge from existing development, as determined by HCMDS. The channels were also proposed to provide detention storage for runoff from all new development.

The proposed drainage criteria for this study was:

- Storm sewers (internal to subdivision) 2-year
- Storm sewers (outfall to HCMDS) 25-year
- Channels and ditches 25-year
- Culverts and small bridges 25-year
- Large bridges 100-year
- Floodway between building lines 100-year

The report identifies alternative methods for implementing the drainage program, rather than making specific recommendations. However, the report does recommend that drainage criteria and policies be implemented in order to comply with the HCMDS requirements, achieve consistent design considerations, and arrange for orderly implementation.

Flood Protection Planning Study for Southern McAllen and Mission, Texas
Halff Associates, Inc.
1996

This study examined the potential flooding impact for an area bounded between Mission Inlet and Banker Floodway, assuming continued development of the Mission Inlet watershed. The Mission Inlet watershed includes approximately 76 square miles located west and north of the cities of Mission and McAllen. The watershed is currently considered about 53 percent developed. Concern was raised about the potential

integrity of the levees and about isolating the Inlet from surrounding properties, assuming that development continues.

The study identifies frequent flooding in the study area that results from an insufficient drainage system, inadequate topographic relief, and low permeability soils. Using a rainfall-runoff model to generate flood hydrographs, the report approximates that 1,236 structures could potentially be flooded by overtopping of the Mission Inlet levee at several points.

Recommended improvements from the study include:

- Modification of the Mission Inlet levee at Cimarron Country Club,
- Construction of a 1,470 acre-ft storage basin to alleviate flooding,
- Raising the Mission inlet levee at other points to deter overtopping, and
- Requiring all new developments to provide a minimum of 0.8 acre-ft of storage per acre of development.

Summary of Local Drainage Study Reports

From review of the reports on localized drainage, the following conclusions were derived.

1) Frequent flooding in the urban areas has resulted in an increased emphasis on improving drainage infrastructure. Although the original intent of the HCMDS assumed minimal impact from urban runoff, the limited capacity of the outfall system has become a major constraint on the communities.

2) Most communities are proposing an infrastructure design that exceeds the capacity of the HCMDS. Design frequencies, ranging from 2 to 25 years for storm sewers, are being proposed as methods for conveying runoff from urban areas.

3) Stormwater detention is proposed as a method of controlling runoff into the HCMDS. However, only limited information has been developed for determining guidelines on calculating detention.

4) Access to some conveyance system (such as the HCMDS) is an extremely important component of the solution for the urban areas. The 1995 Southwest

Edinburg Drainage Study attempts to address this issue in its implementation plans.

Meetings with Stakeholders in Flood Control Management

Separate meetings were conducted with representatives of public agencies and land developers as part of the study process. The objective of these meetings was to identify issues that these stakeholders considered to be important.

The municipalities within Hidalgo County have expressed two major concerns with the drainage criteria. First is the lack of uniformity among the incorporated cities relative to the HCDD No. 1 drainage criteria. Second is the need to have a standard set of drainage calculations for all submittals within the County. The desired criteria should state minimum requirements strict enough to achieve the desired outcome, but no more severe than the most restrictive drainage criteria of the incorporated cities. The criteria should establish methods of meeting mutual goals between HCDD No. 1 and the incorporated cities.

The municipalities mutually desire a policy for the HCMDS to protect all structures from the 100-year flood. While the municipalities have varying opinions concerning street flooding, most expect some street flooding to occur under storms greater than the 10-year frequency. The majority of the municipalities desire protection from the 10-year storm event so that at least one lane of a roadway remains passable on major and local collector streets for major thoroughfares. At least one lane should remain passable for emergency vehicles during the 25-year storm event. According to the municipalities, linear detention facilities have been the best solution, but mechanisms to enforce detention requirements upon developers are lacking.

Presently, the engineer who designs a drainage system is responsible for compliance with the drainage requirements. The municipalities also want the contractor held accountable for the construction of the facilities, to ensure that they are constructed as designed. The municipalities believe that many developments currently being designed in the County do not meet minimum requirements for detention due to the lack of restriction on the outfall. The municipalities also have concerns about the inadequacies of the existing FEMA FIRMS in delineating flood-prone areas, and question the validity of using the maps as the basis for limiting development in these areas.

Developers within Hidalgo County expressed the greatest concern regarding drainage issues and costs related to acquiring right-of-way and connecting into the HCMDS. Developments near the HCMDS are often physically prevented from connecting to it, and frequently encounter difficulties in obtaining right-of-way through private property.

Once a developer constructs a drainage ditch or a long segment of storm sewer, the developer receives no reimbursement from other developments located along the ditch or storm sewer. The lack of available outfalls into the HCMDS is the greatest concern with the developers, who noted that the developments cannot support the costs incurred in constructing drainage ditches or storm sewers to connect to the HCMDS (which in some cases may exceed three miles in length).

The developers also stated that they prefer using drainage ditches rather than swales or underground storm sewers. Individual lot owners tend to either fill in or build on the swales, or owners may leave the swales intact but then do not maintain them. Swales also often become a place to dump garbage and pose safety hazards to the community. The major drawback to storm sewers is that their cost is viewed as too expensive.

Introduction

Drainage management in Hidalgo County is unique in its relationship, not only between incorporated and unincorporated areas, but also in the relationship with the federal and international (IBWC) governing bodies that operate the largest flood control system in the Rio Grande Valley. Whereas the facilities operated by the County are inadequate to convey large amounts of runoff, the IBWC system has a comparatively limitless capability to handle local runoff. Unfortunately, the IBWC system is not designed to convey local runoff, it is designed to control flooding of the Rio Grande. However, a permitting process allows for local drainage into the IBWC system, providing the drainage facility does not interfere with the operation of the IBWC system. The following paragraphs describe briefly the methods of control that are used by the various public agencies for drainage management in Hidalgo County.

Hidalgo County Drainage District Number 1

HCDD No. 1 was established in 1908 under Article 13, Section 52 of the State Constitution. The Authority was later converted to a Conservation and Reclamation District under Article 16, Section 59 of the State Constitution. Under this authority, HCDD No. 1 can manage the conservation and development of the natural resources of the State including the storage, preservation, and distribution of its stormwaters. HCDD No. 1 constructed the HCMDS and is responsible for its continued development and maintenance. The District Director controls the HCDD No. 1 and reports to the Board of Commissioners for the HCDD No. 1. The District Director manages two departments: Operations and Maintenance, and System Development. Operations and Maintenance manages the daily maintenance of all channels, laterals, ditches, structures, pumping systems, and right-of-ways within the HCMDS. System Development is responsible for the planning, engineering, right-of-way acquisition, and new construction for the development of the HCMDS.

The HCDD No. 1 obtains income for operational costs through a drainage tax. HCDD No. 1 has the authority to issue bond certificates to finance new construction, upon approval of Hidalgo County voters.

The Hidalgo County Master Drainage System (HCMDS) design, as it currently exists, provides drainage for all watersheds within the HCDD No. 1 boundaries. The current criteria define the system to be "balanced," based upon the assumption that all watersheds will contribute similarly to the total runoff from the HCDD No. 1. Diversity in development of the watersheds would then cause the watersheds to become "unbalanced" as the existing runoff increases and contributes in excess of design values. In an effort to maintain this "balance," as urbanization occurs and land uses change, HCDD No. 1's policy on drainage restricts outfall discharge into the HCMDS to

the unimproved state. Currently, either detention on-site or an approved off-site detention basin is used to limit flows. HCDD No. 1 uses this policy through a drainage permit process to regulate flows into the system.

The drainage permit requires all developments to submit a Proof of Ownership, a Drainage Engineering Report, and an Indemnification of the District. The Drainage Engineering Report is the mechanism that HCDD No. 1 uses to determine compliance with the drainage criteria. The report, signed and sealed by an engineer holding a current registration in the State of Texas, must present evaluations of the site runoff and detention calculations. The permit process is designed to control all connections to the HCMDS to: (1) prevent system unbalancing; (2) to provide added protection from pollutants and contamination to the citizens of Hidalgo County; and (3) to establish a set of standards for channel connection structures.

Agency standards, such as the Texas Department of Transportation Hydraulic Manual to determine the amount of rainfall, and drainage area versus discharge curves based on the NRCS 9.5-year storm event to determine runoff for the existing state, are used when developing the Drainage Engineering Report. The curves are based upon agricultural land use and do not reflect urban development. The criteria also require the rational method for hydraulic computations for storm sewer design.

Municipalities

The municipalities within Hidalgo County are responsible for drainage issues within their incorporated boundaries. Most municipalities distinguish between floodplain criteria and drainage criteria. Each of the principal cities within the County has adopted its own drainage criteria and, in some cases, has developed a master drainage plan. HCDD No. 1 requires the outfall from each municipality's drainage system to meet HCDD No. 1 criteria.

Much of the drainage criteria for the different municipalities is established through either subdivision regulations or Code of Ordinances. For the most part, these criteria attempt to address mobility issues, and ensure that runoff is accommodated through a combination of storm sewer, ditch, or stormwater detention facility. The design standard for storm sewers varies from a 10-year to a 25-year design event, and is typically calculated through use of the rational method. In some cases, however, the 10-year event is a reflection of the agricultural runoff curve used to design the HCMDS. Most cities adopted more conservative standards when they recognized flooding problems using the HCMDS criteria. The major issues surround the inability to gain access to one of the HCMDS channels, because of the relative remoteness of its location to that of the infrastructure being improved. In such cases, runoff frequently is allowed to drain into roadside ditches or is required to pond on the site of the

development. No consistent criteria for sizing of stormwater detention basins or outfalls exists. When possible, the municipality or the land developer may negotiate with one of the irrigation districts for use of one of their drains. However, these drains are designed for agricultural runoff and, in most cases, are not capable of handling urbanized runoff without improvements. These practices have contributed to local flooding complaints by residents because of flooding streets, yards, and, in some cases, structures during even moderate rainfall events.

Hidalgo County

Hidalgo County has authority over developing properties that are located in the unincorporated areas of Hidalgo County. Management of the development is achieved through Subdivision Regulations. Hidalgo County requires a drainage plan report be submitted for approval. These reports are reviewed and approved by HCDD No. 1 staff. The content of these reports parallels the requirements of those in the incorporated areas and include a topographic map, delineation of regulatory floodplain areas, and engineering calculations.

Irrigation Districts

Some 18 irrigation districts operate within Hidalgo County. The irrigation district's primary purpose is to operate a series of raw water supply canals for use by municipalities and agricultural users. These canals extend from the Rio Grande and, in most cases, provide an intense network of either elevated or excavated conveyance structures. Since many of the canals are elevated, they form an obstruction to natural drainage. Because of the potential degradation of water quality, the canals cannot serve a dual purpose of drainage and convey raw water for potable and irrigation use. As a result, many miles of drainage ditches have been constructed parallel to or perpendicular to the canals. These ditches are operated and maintained by the irrigation districts. They vary in size and are intended for drainage of agricultural areas. In some cases, arrangements have been made for HCDD No. 1 to acquire an irrigation district drainage ditch and then expand it for additional capacity and other uses. Since the primary mission of the irrigation districts is water supply, and not drainage, many of the districts would prefer HCDD No. 1 to operate these ditches. However, to do so would require a significant increase to the operating budget of the HCDD No. 1.

International Boundary and Water Commission

The IBWC operates the major floodway systems diverting water from the Rio Grande into the Laguna Madre. The IBWC allows for drainage channels constructed by HCDD No. 1 to tie into the floodway system. However, all of the channels are regulated by floodgates in order to protect the County. In the event that a major diversion occurs, it is expected that local drainage authorities will close the gates. IBWC does regulate this activity and will also close the gates should the need arise. Each outfall proposed for connecting to the IBWC system requires approval of the IBWC through a formal permitting process.

Recommendations to Drainage Criteria

The following recommendations are offered based on the review of information in this study.

1. During the attempt to map proposed lateral channels, and from review of the local drainage planning studies, it became apparent that adequate mapping on a regional basis is not readily available. The State of Texas has entered into a high altitude mapping program which will be very useful to HCDD No. 1; however, the results of this mapping are not yet available. We suggest that the HCDD No. 1 obtain satellite imagery from either SPOT or the IDS. This photographic background image will be useful in examining the routing of lateral channels and in determining land use characteristics. The imagery should be able to be updated on an annual basis at a relatively low cost, on the order of $20,000.

2. The municipalities and HCDD No. 1 should jointly agree on the performance standard of the drainage system. Consensus on this standard should be mutually agreed between City staff, HCDD No. 1 staff, developers, and engineers. Adoption of the standard should be conducted by the various City councils and the HCDD No. 1 board. The following guidelines are offered as a basis:

    a. New construction should be protected from flooding resulting from a 100-year storm event.

    b. Major thoroughfares should remain passable during a 25-year storm event. "Passable" is defined as water being no deeper than curb height.

    c. Local streets should be passable during a 10-year event. "Passable" is defined again as water being no deeper than curb height

d. Storm sewers should be sized for a 3-year storm event, using the rational method and urban watershed coefficients.

e. Lateral channels should be sized to convey the runoff from the agreed-upon level of protection for local streets, assuming that the lateral channels are constructed as linear detention systems feeding into the HCMDS.

It is important that a consensus be reached that is a fair compromise between the cost of development and the integrity of the municipal system. A cost/benefit analysis of the adopted performance standard should be conducted so that all parties can agree to the fairness of the plan.

3. Site development standards should be modified to complement the required size of the drainage system components so that the performance objectives are attained. This could include street grades and cross sections, spacing and size of inlets, lot grades relative to the street grades, and extent of impervious cover.

4. A Drainage Criteria Manual should be developed for HCDD No. 1. Since the integrity of the HCMDS is dependent upon the implementation by the various municipalities, a common Drainage Criteria Manual should be used by all parties.

5. As part of the Drainage Criteria Manual, a consistent method for calculating storm runoff should be applied. Various reports indicated that not all engineers are applying the criteria uniformly. It is suggested that, since FEMA will soon adopt its new FIS for Hidalgo County, the modeling technique used in that study should be adopted as the method for rainfall-runoff modeling on areas in excess of 640 acres, or one square mile. When the rational method is applied for sizing storm sewers and small ditches, standard rainfall patterns, watershed coefficients and time of concentration calculations should be used.

6. Standards for sizing of stormwater detention facilities should be established as part of the Drainage Criteria Manual. There have been many reported failures of on-site detention systems because of a lack of defined criteria for sizing the basins. Other sections of this report address the method by which the lateral drainage channels should be sized for linear detention. A similar approach should be adopted uniformly for all areas.

7. The practice of allowing drainage of developed properties into roadside ditches needs to be abandoned unless modifications to the practice are done to improve the ditch conveyance capacity. Frequently, the project site is limited by grade to drain to an existing outfall or no other outfall exists. Extension of the lateral

drainage system will resolve this problem, provided a method of implementation can be established.

8. HCDD No. 1 should begin a long-range plan to address the expansion of its primary drainage channel system. This system currently is, and will remain, a constraint to the overall drainage program if it not expanded. It is proposed that a channel system that anticipates a 25-year runoff from the watershed, according to the level of development anticipated by the end of the planning period, be used. Negotiations with the IBWC and other federal agencies should begin which examine the issues related to expansion and how these issues can be overcome.

Delineation of Drainage Areas

One of the primary objectives of this study was to plan for a series of lateral channels that would provide drainage to all local areas requiring access to the HCMDS. To facilitate identification of these channels and their sizes, it was necessary to develop background mapping and define drainage areas to be associated with each subwatershed. Background maps were obtained from each of the 18 irrigation districts to define the extent of drainage ditches and water canals operated by these entities. Additional mapping of the existing HCMDS channels was obtained from the HCDD No. 1. The data compiled is graphically depicted on *Exhibit 6*.

In order to determine the system of lateral channels, criteria were established for the depths of the channel and the maximum distance any property located within the district could be, and still have a gravity outfall, assuming construction of a storm sewer. In general, this meant that all locations within the service area of HCDD No. 1 should be within 1,500 feet of some point of a lateral channel. This number can vary depending on the depth of the lateral channel and the surface ground slope. Lateral ditches were then selected to meet this criteria. In many cases, the ditches were located to coincide with those of the existing irrigation district ditches, with the intent that an agreeable conveyance of title could be obtained.

With the lateral drainage ditches located, it was then necessary to delineate the drainage subareas. These subareas were developed on the basis of existing topographic information, and are presented in *Exhibit 5*. In some cases, more detailed information was available, as a result of detailed drainage reports by other entities. In such cases—for example, the area surrounding Weslaco—the drainage subareas appear more defined on *Exhibit 5* than in other areas.

Calculation of Runoff

The objective of the lateral channel planning is to identify the location and size of the channels necessary to accommodate full development of the watershed. Consequently, in planning for these channels, it is assumed that the area will be 100 percent developed. Although the actual phasing of construction will be timed with development, identifying the ultimate size allows for the immediate preservation or acquisition of right-of-way.

As previously indicated, local municipalities rely on Manning's equation for the design of local drainage facilities. The existing HCMDS has a limited capacity, approximating a 10-year agricultural runoff. This limited capacity means that the outfall channels do not have the capacity to convey all of the runoff from the local storm drains, and detention basins are necessary.

In sizing the lateral channels, however, as the future path to convey from the local storm drains to the HCMDS, some consideration of the design frequency had to be considered. Recognizing that the Corps of Engineers is examining the potential to expand the HCMDS to as much as a 25-year capacity, it is prudent to examine an alternative to the lateral channels that is not limited to the existing capacity of the lateral drains. Although the process was somewhat intuitive at this point, the design of the lateral drains assumed that conveyance would be sized for a 25-year storm event. Because of the existing restriction at the HCMDS, however, the flow into the HCMDS would be limited to an existing 10-year agricultural runoff, and the remaining channel capacity would be used for storm water detention.

Storm discharge curves have been developed for the 3, 10, 25, and 100-year recurrence interval design storms under fully developed conditions, and are presented in *Exhibit 4*, along with the 9.5-year agricultural discharge curve. The 9.5-year curve is taken from the HCDD No. 1 Drainage Policies and Permit Procedures manual. The equations for the curves are as follows:

3-Year Developed

$$Q = 4.015A^{0.6215}$$

10-Year Developed

$$Q = 6.105A^{0.6271}$$

25-Year Developed

$$Q = 7.603A^{0.6275}$$

100-Year Developed

$$Q = 9.624A^{0.6387}$$

9.5-Year Agricultural

$$Q = 2.911A^{0.5721}$$

The 3, 10, 25, and 100-year curves were developed using NRCS runoff curve number methodology and the U.S. Army Corps of Engineers HEC-1 computer program. A

series of single-basin models was developed for each design storm, with varying drainage areas, runoff curve numbers (CN), and lag times. The peak flows from the HEC-1 models were then fit to determine the power curve shown in the above equations.

The design storms developed in HEC-1 require the input of a series of point rainfall depths, as shown in *Table 1*. Point rainfall depths for durations up to and including one hour are taken from the National Weather Service (NWS) document Hydro-35. Depths for durations longer than one hour are from NWS Technical Paper No. 40 (TP-40). Depths were read from the center of Hidalgo County on the isopluvial maps.

The SCS runoff curve number (CN) is a function of soil type and antecedent moisture condition. The composite curve number used is for the watershed under fully developed conditions. The following assumptions were used:

- Antecedent moisture condition II
- Developed watershed is 35 percent impervious
- Pervious surface CN = 74 (open space in good condition)
- Impervious surface CN = 95
- Composite CN = (.65)(74) + (.35)(95) = 81

The lag time is given by the following relationship (ref. SCS Technical Release No. 55):

$$L = \frac{l^{0.8}(S+1)^{0.7}}{1{,}900Y^{0.5}}$$

where:
L = lag time in hours
l = hydraulic length of watershed in feet
S = (1000/CN) - 10
Y = average watershed slope in percent (0.05 percent assumed)

This equation tends to overestimate the lag time for urban watersheds (TR-55). The lag time is adjusted by a lag factor for the presence of impervious area (0.8) and a lag factor for the hydraulic improvement of the main channel (0.72). The hydraulic length, l, is given by the following relationship (ref. SCS Technical Release No. 55):

$$l = 209a^{0.6}$$

where:
l = hydraulic length of watershed in feet
a = drainage area in acres

Lateral Channel Section Design

The lateral channels for the HCMDS were sized based upon Manning's equation, using the flows resulting from the previously discussed equations. Each channel includes one foot of free board for determination of the required right-of-way width, and at least one foot of drop is provided above the depth of the outfalling channel bottom. Topography and physical constraints, such as elevated irrigation channels, railroad embankments, roadways, and limited outfall depths, dictate the depth and placement of the proposed channels. The lateral channels were designed to have a 3:1 (H:V) side slope with a 20-foot maintenance easement on either side of the channel.

Development of the right-of-way for the proposed lateral channels includes a spoil bank berm on either side of the channel. The required excavations for the construction of the drainage channels establish the spoil bank size with a 2:1 (H:V) side slope and a 15-foot top width. The right-of-way widths for the proposed lateral drainage channels are presented in *Table 3*.

Drainage areas for Hidalgo County were determined through the Master Drainage Plans for the incorporated cities previously released and topographic features within the County (*Exhibit 5*).

Storm Water Detention

Increased peak flow due to development must be mitigated to the 9.5-year agricultural peak runoff rate. The total detention rate is 0.29 acre-ft/acre and represents the difference in runoff volumes between the 10-year developed conditions hydrograph and the 9.5-year agricultural hydrograph. The method used is as follows: Peak flows were determined from the 10-year developed discharge curve for a broad range of drainage areas. A hydrograph was developed in each case using the Malcom method. The Malcom method utilizes a pattern hydrograph to obtain a curvalinear design hydrograph

that peaks at the design flow rate, and which contains a runoff volume consistent with the design rainfall. The Malcom method consists of the following equations:

$$T_p = \frac{V}{1.39 Q_p}$$

$$q_t = \frac{Q_p}{2}\left[1 - \cos\left(\frac{\pi t_i}{T_p}\right)\right] \quad \text{for } t_i \le 1.25 T_p$$

$$q_t = 4.34 Q_p e^{-1.3\frac{t_i}{T_p}} \quad \text{for } t_i > 1.25 T_p$$

Where:

T_p = the time to Q_p
Q_p = the peak design flow rate
V = total volume of runoff for the design storm
t_i = time
q_t = flow rate

Detention volume was calculated as the volume between the 10-year hydrograph and a straight line intersecting the receding limb of the hydrograph, at a point equaling the 9.5-year peak discharge rate. The volumes were plotted against drainage area; the points fell on a straight line with a slope equal to 0.29 acre-ft/acre.

The following guidelines are offered for detention requirements for developments outfalling into the HCMDS.

1. Application of Detention

    a. The HCMDS design is based upon conveying a 9.5-year agricultural peak runoff rate. To maintain this standard, areas within HCDD No. 1 boundaries are restricted to limiting runoff from developed land at this rate at the unimproved condition.
    b. Increases in peak flow due to development are required to be mitigated to the 9.5-year agricultural peak runoff rate before outfalling into the HCMDS.

c. The HCMDS proposed lateral channels are designed to accommodate a 25-year developed condition flows, and, upon construction, will provide some detention for developing areas that outfall directly into the lateral channel.
d. Developments increasing the peak flow from the existing conditions must detain on-site or in an approved off-site detention area.
e. Tracts which previously have met these guidelines are not required to provide additional detention, if redevelopment occurs without increasing the overall impervious character of the site.

2. Calculation of Detention Volume

a. Detention volume for developed areas are calculated based upon the point of connection to the outfall.
b. Developments attaching to the HCMDS directly will be required to detain at a rate of 0.29 acre-ft/acre.
c. Developments attaching to the proposed lateral system will be required to detain at a rate of 0.24 acre-ft/acre, as the difference will be provided in the oversized lateral channel.
d. Detention volumes for a redeveloped area are calculated on the basis of the amount of area of increased impervious cover.

3. Calculation of Outlet Size

a. Detention pond discharge pipe into existing HCDD No. 1 channel:
    1. Maximum pool elevation at or below the design hydraulic grade at the outfall: the discharge line shall be sized for the Design Storm with the outfall pipe flowing full. The detention pond will be above the drainage system to provide maximum benefit.
    2. Maximum pool elevation at or above the hydraulic grade at the outfall: provide a reducer or restrictor pipe to be constructed inside the discharge line. The discharge line shall be sized for the Design Storm with the outfall pipe flowing full.
    3. The outfall pipe should connect to the HCMDS or proposed lateral channel at a 30-degree angle to the direction of flow, to provide maximum conveyance within the channel.
b. Reducer or Restrictor Pipes shall be sized as follows:
    1. Use the following equations to calculate the required outflow orifice:

$$Q = CA\sqrt{2gh}$$

$$D = \frac{Q^{1/2}}{2.25 * h^{1/4}}$$

where

Q = outflow discharge in cfs
C = 0.8
h = water surface differential in feet = head
D = orifice diameter

3. Restrictor shall be either of the required diameter or of the equivalent cross-sectional area. The orifice diameter shall be a minimum of 6 inches.

c. In addition to a pipe outlet, the detention basin should be provided with a gravity spillway that will protect structures from flooding, should the detention basin be overtopped.

Calculation of Runoff Coefficient in the Rational Method

The runoff coefficient "C" used in the rational method accounts for many complex phenomena of the runoff process. The "C" value serves the function of converting the average rainfall rate of a particular recurrence interval to the peak runoff intensity of the same frequency. Its magnitude is dependent on several factors, such as antecedent moisture condition, ground slope, natural ground cover, depression storage, soil moisture, shape of drainage area, over-land flow velocity, rainfall intensity, percentage of impervious area, proximity of ground water table, and so on.

Analysis of typical watersheds within Hidalgo County, using the rational method, Urban Hydrology for Small Watersheds (Technical Release 55), and HEC-1, demonstrated an association between the very flat slopes (0.02 to 0.1percent), and a decrease in the magnitude of the value of "C." Through the analysis, it was shown that the very flat slopes could equate to a 20 to 30 percent reduction in the magnitude of "C." However, a straight across-the-board reduction in "C" values will not accurately reflect other phenomena within the diverse watersheds of Hidalgo County.

HCDD No. 1 currently uses TxDOT runoff coefficients. Due to factors within Hidalgo County that are not typical to the rest of the state, the "C" factor should be adjusted to reflect these unique features. The most influential factor in calculating the "C" value in Hidalgo County is the very flat slopes (0.02 to 0.1percent). To more accurately reflect the conditions in Hidalgo County, we recommend the use of the values with magnitudes

near the lower end of the ranges currently being used by HCDD No. 1 with the rational method, as shown in *Table 4*.

As previously stated in this report, standards for sizing stormwater detention facilities and a consistent method for calculating storm runoff should be established through the adoption of a Drainage Criteria Manual. The following examples demonstrate the recommendations in this report, and are provided to aid in instituting a uniformity for calculations submitted to HCDD No. 1.

Example of Detention Pond Design

Given: A 30-acre subdivision is proposed adjacent to a HCMDS channel. The tract proposed for development has a 2-foot drop from a high elevation of 80 feet to a low of 78 feet. Outfall channel is 10 feet deep.

Required: Size a gravity flow detention pond and outflow structure to store the increase in runoff due to development of the subject tract.

Design Procedures:

1) The outlet flowline of the outfall structure from the pond should be one foot above the outfall channel flowline. A preliminary storm sewer analysis should be made to assure there is adequate outfall depth in the pond to facilitate storm sewer outfalls.

2) Determine the required amount of detention storage (S) required from the detention equation. The selection between the detention equations is based upon the point of outfall into the HCMDS.

$S = 0.29A$ for connection directly to HCMDS

$S = 0.24A$ for connection to an oversized lateral of the HCMDS

$S = 0.29(30\text{acres}) = 8.7\ acre\text{-}ft$

3) Using HCDD No. 1 discharge curves (*Exhibit 4*) or the discharge equations provided in this section, determine existing condition 9.5-year agricultural

runoff. The outfall from a developed site is limited to the 9.5-year agricultural runoff.

$$Q = 2.911A^{0.5721} = 20\ cfs$$

4) Size the outfall structure from equations provided in *Section V*. The outfall pipe will act as a restrictor and, as such, will be required to have a diameter of equal to or less than the determined value.

$$D = Q^{1/2} / 2.25 * h^{1/4}$$

Where:

$$Q = 20\ cfs$$
$$h = 0.3\ feet$$

Then:

$$D = 2.7\ feet = 32.5\ inches$$

5) The detention pond is now sized to accommodate 8.7 acre-ft of storage and one foot of freeboard with a 30-inch outfall pipe.

6)

Example of Storm Sewer Design

Given: A 3,700-foot storm sewer system is required to provide stormwater drainage to a residential subdivision consisting of single family lots, ¼ acre in size. The layout of the storm sewer alignment is provided in *Figure 1*. The overland slope is 0.1percent. For TR-55 calculations, CN = 83. The channel is 14 feet deep, with one foot of freeboard at the storm sewer outfall. The outfall pipe should be a minimum of one foot above the flowline of the channel.

Required: Size the storm sewer to accommodate the 3-year storm event.

Design Procedures:

1) A drainage area map should be prepared indicating drainage limits for the site, external tributary areas, location of minor systems, and direction of surface flow. The extreme event flow should be shown on a separate exhibit. For this example, the drainage areas have been assumed and the contributing areas shown at each inlet location.

2) Runoff coefficients should be determined for each subarea in the watershed. The values of "C" can be obtained using *Table 4* in this report. This example has been simplified, and a "C" value of 0.35 will be used for the entire drainage area based on the ¼-acre residential lot land use.

3) The required capacity of each inlet should be calculated using the rational method, with initial time of concentration and intensity. The initial time of concentration will be calculated for overland flow from the Kirpich formula. The Kirpich formula is used due to its general acceptance and use in rural drainage basins. At each successive segment downstream, add the required travel time in the conduit. The intensity will be calculated using the 3-year intensity equation developed for this report, as shown below.

From TR-55: Time of Concentration for overland flow:

$$t_c = 0.0078 * L^{0.77} * S^{-0.385} \quad \text{(Kirpich Formula)}$$

$$L = 209 * A^{0.6}$$

Where:

t_c = Time of Concentration for Overland Flow(min)
S = Watershed Slope (ft/ft)
L = Length of the principal watercourse
A = Area of Sub Watershed Draining to first inlet(acres)

$$T_c = t_t + T_s$$

Where: T_c = Total Time of Concentration
T_s = Travel Time in Storm Sewer

$$i = \frac{83}{(T_c + 9.4)^{0.822}} \quad \text{3-Year Storm Event Intensity Equation}$$

Where: i = Intensity for a specific T_c

For this example, the initial time of concentration and intensity is:

$$L = 209 * (3.1 acres)^{0.6} = 412$$

$$t_c = 0.0078 * (412)^{0.77} * (0.001)^{-0.385} = 11.5 \min$$

$$i = \frac{83}{(11.5 + 9.4)^{0.822}} = 6.8 in / hr$$

The time of concentration and intensity at each manhole is calculated on the spreadsheet provided as *Figure 3*. At a confluence of two or more conduits, the longest time of concentration is selected.

4) Commencing at the upstream end of the system, the discharge to be carried by each successive segment in the downstream direction is calculated on the spreadsheet using the rational method.

$$Q = CiA$$

Where:

Q = Flow (cfs)
C = Runoff Coefficient
i = Intensity (in/hr)
A = Area (acres)

For initial peak flow:

$$Q = (0.35)(6.8)(3.1) = 7.4 cfs$$

5) Once discharges at the upstream end of each pipe segment are computed, a tentative pipe size is selected. The corresponding velocities for the expected flow are determined to calculate the pipe flow time. This time is added to the upstream time of concentration to establish the new time of concentration for that pipe segment. Design velocities in storm sewers should be a minimum of 3 ft/s for self cleaning. The pipe sizes are adjusted to accommodate the flows and the hydraulic grade line remains below the top of curb. To calculate the hydraulic grade line, begin with the starting water surface elevation (which can be obtained from HCDD No. 1), and then use the following equations to work upstream.

$$S_f = \frac{V^2 n^2}{2.22 R^{\frac{4}{3}}}$$

$$h_f = S_f L$$

Where:

S_f = Friction Slope (feet)

h_f = Friction Loss (feet)

V = Actual Velocity (ft/s)

n = Manning's Coefficient

R = Hydraulic Radius

L = Length of Storm Sewer Segment

Probable Costs Associated with the Lateral Channels

The probable costs associated with the construction of the proposed lateral channels summarized in *Table 5* were calculated based on the following information. For excavation, it was assumed that no channel or ditch currently exists where the proposed lateral channels will be located. Many of the proposed lateral channels are designated where current irrigation drainage ditches exist. However, these ditches tend to be comparatively shallow, and it is unlikely that the proposed laterals will have the same flow line as the existing ditch. Excavation costs are calculated using current cost information for Hidalgo County of $1.25 per cubic yard. Excavation spoil was assumed to be placed on adjacent berms in the maintenance easement, with no cost for transportation and disposal.

Flow Control structures will be required along the channels to attain in-line detention within the channel. For planning purposes, control structures were anticipated at ¼-mile intervals along all lateral channels. Many of these control structures could be constructed as part of a roadway crossing. However, we have conservatively assumed the cost of these to be part of the drainage costs. Probable costs for the control structures were determined assuming that the structure consists of a 9' x 9' reinforced concrete box with bedding and back fill material, and concrete slope paving extended 20' on either side to protect against erosion. All channel costs included hydro-mulch seeding after construction to aid in the prevention of bank erosion and siltation of the channel. All construction costs include an engineering and contingency fee of 25 percent.

It is assumed that the level of maintenance of the lateral channels will be the same as the current maintenance level of the HCMDS. The current budget of $2.8 million includes the current work force of 47 employees, and the annual cost of maintenance equipment and supplies. Currently, each channel is being maintained twice a year. The annual maintenance cost for the proposed lateral system was calculated by dividing the current annual maintenance budget of Hidalgo County by the total number of miles of ditch currently being maintained. The annual maintenance cost of the lateral channel system is then determined by multiplying that rate by the total number of miles in each lateral channel. These costs are shown in *Table 5*.

The expected right-of-way costs were established using the current property cost information for Hidalgo County of $8,710 per acre. This unit cost was provided through inquiries with the local municipalities within the County. The right-of-way is inclusive of spoil bank berms and maintenance easements, as shown in *Table 3*. It is assumed that there is no prior existing right-of-way. Many of the lateral channels are designated where a current irrigation drainage ditch exists with some existing right-of-way.

However, in most cases that right-of-way is owned by other entities. The expected right-of-way costs are shown in *Table 5.*

Alternative methods of funding

The potential capital costs associated with the proposed lateral drainage ditch construction are $141,983,000, including right-of-way purchase. An additional $2,330,000 in annual maintenance costs is projected.

Funding for the current HCDD No. 1 maintenance activities is derived from a current tax rate of 0.0409/$100.00 AV. This funding level is not sufficient to accomplish the proposed improvements, and since it is intended for maintenance purposes, it would not be allowed for use in major capital construction. Three potential alternative methods of financing the proposed improvements are discussed: (1) issuance of new bonds, repaid by general tax revenues; (2) a pay-as-you-go approach to financing; and (3) debt recovery using a development impact fee. It is assumed that the construction of the lateral channels would take place within a time frame that the local industry could absorb the construction activity. We have assumed that the construction industry could develop the project at a pace of approximately $ 14,000,000 per year. This would mean a 10-year timeframe for development of the entire project.

Issuance of New Bonds

A new bond issue for channel construction was assumed to have a life of 25 years at an interest rate of 7 percent. In order to obtain the necessary capital funding, bonds in an amount of $175,000,000 would have to be issued to cover all expenses. Under these assumptions, annual payments of $15,017,000 would be required to retire the debt. Based on the current assessed valuation, with an overall appreciation and growth of 3 percent per year, this would result in a tax rate increase of approximately $0.121 per $100 AV. Given the 10-year time over which the activity would be completed, it may be preferable to divide the cost into two separate bond issues.

The increased maintenance costs of $2,330,000 will require an additional tax increase of $0.0272 per $100 AV.

The advantage to this approach is that construction can take place at a pace dictated by the HCDD No. 1, and funds are available to offset increasing costs of inflation associated with the construction.

Pay-As-You-Go

Under the pay-as-you-go approach, projects would be constructed as funds are made available through tax revenues. Under this approach, a cost inflation of 3 percent is assumed as an offset to additional tax income achieved through the growth in assessed valuation. Since projects would not be constructed until the year in which funds were available, the project costs increase every year, and funds are not available for investment to offset this cost, as is the case with bond funds. Alternatively, there is no interest cost on debt associated with the pay-as-you-go approach.

It is assumed that the project would be constructed over a 10-year period, with an annual cost of $14,189,000 (annually increasing according to a 3 percent increase in cost). The tax increase necessary to achieve this rate of construction under the pay-as-you-go approach is approximately $0.1658 per $100 AV.

The alternative answer to this approach would be to stagger construction at a level equal to the tax rate necessary to retire bonds (i.e. $0.121). Under this approach, construction could occur at a rate of $ 10,400,000 annually, and would take approximately 13.7 years to complete.

The advantage to this approach is that it actually costs the County less money overall. However, the pace of construction is dictated by the amount of money available through tax revenues.

Assessment Through Impact Fees

The concept of the impact fee is to require land that benefits from the improvements to pay for the improvements. Special assessment districts can be established so that properties benefiting from the channel construction in one part of the County are assessed differently than other properties receiving benefits from channels in another part of the County. The principal legislative act used to establish these impact fees is Senate Bill 336.

Under this bill, it is necessary to distinguish between those aspects of a project that are benefiting newly developing properties and those aspects necessary to correct existing deficiencies. It is beyond the scope of this current effort to make that distinction accurately. We have assumed that one-half of the channel improvements and all of the in-line control structures would be associated with developing properties. The remaining cost of channels is associated with existing problems. This assumption does somewhat unfairly place a cost on developing properties, since many road crossings may need improvement, and these structures could be used as control structures.

Under these broad assumptions, the cost of the channels associated with developing properties is $68,200,000, excluding right-of-way. Using the parameters of a 7 percent interest rate and a 25-year bond, plus 30 percent bond costs, the annual payments would average $7,585,000. The next part of the solution is to estimate the amount of acreage that will be developed, and the respective timeframe over which this development will occur. Although the lateral channel system assumes full development of the watershed, this will likely not occur in any reasonable timeframe associated with the life of the constructed improvement. The assumption is necessary, however, because it is not known where the development will occur. We have selected a 50-year period for growth as being coincident with the likely life of the channel system.

Studies performed by the Texas Water Development Board indicate a population growth in Hidalgo County of some 1.4 million persons beyond its current population of 700,000, by the year 2050. Using a population density of 8 persons per gross acre (to include all roads, open spaces, etc.), this would indicate development of approximately 175,000 acres of land in the next 50 years. An average of 3,500 acres of land will develop annually. On this basis, an impact fee of approximately $2,200 per acre would be necessary.

The cost associated with solving the existing problems is approximated at $73,693,000 including the right-of-way. This cost, under the assumption of a 7 percent interest, a 25-year bond, and 30 percent bond issuance costs would require an annual payment of $8,220,000, and result in a tax increase of $0.066. It should not be assumed that this capital cost would accomplish all of the drainage improvements necessary to solve existing problems. The figure benefits from the contribution of funds from developing properties, as the figure for developing properties benefits from the figure stated here.

There are several difficulties associated with the implementation of this type of solution. First, debt recovery is dependent on the rate of growth, and where that growth occurs within the County. It is possible that the HCDD No. 1 would end up financing the improvements either because growth did not occur, or because growth was dispersed to a point that the HCDD No. 1 ended up constructing a large portion of the improvements, with no hope that development would ever allow full recovery of the cost. If growth is slowed, it is possible to increase the cost of the impact fee to recover lost investment. However, the fee must remain reasonable so as not to become punitive as development responds to changes in economic growth. Controlling a dispersion of growth could be accomplished by providing incentives for construction along a drainage way that has already been improved.

An alternative approach is for the developing property to pay for the offsite drainage

improvements associated with the lateral channels. If such an approach is taken, the developing property should be able to achieve some cost recovery from the HCDD No. 1 for costs beyond those expected for the development to remain on parity with other properties of its type.

It is unlikely that the impact fee approach can be accomplished without support of a bond issue in some fashion.

Assigning Priority for Ditch Construction

The priority levels for construction for the lateral channels, as shown in *Table 5*, were determined through a weighted point system based on the following information:

- Lateral Channel Designation — 1 (major channel) to 4 (minor channel)
- Flood-Prone Area — 1 (flood prone) to 4 (no reported flooding)
- Level of Development in Area — 1 (highly developing) to 4 (low development)

Determination of the flood-prone areas was based upon reported flooding to HCDD No. 1, the municipalities within the County, and reports of repetitive flood losses to FEMA. The scores were tabulated, and averaged to give a priority level of 1 to 4 for each proposed lateral channel, with 1 being the highest priority channel.

FIGURES

Figure 1. Example of Storm Sewer Design

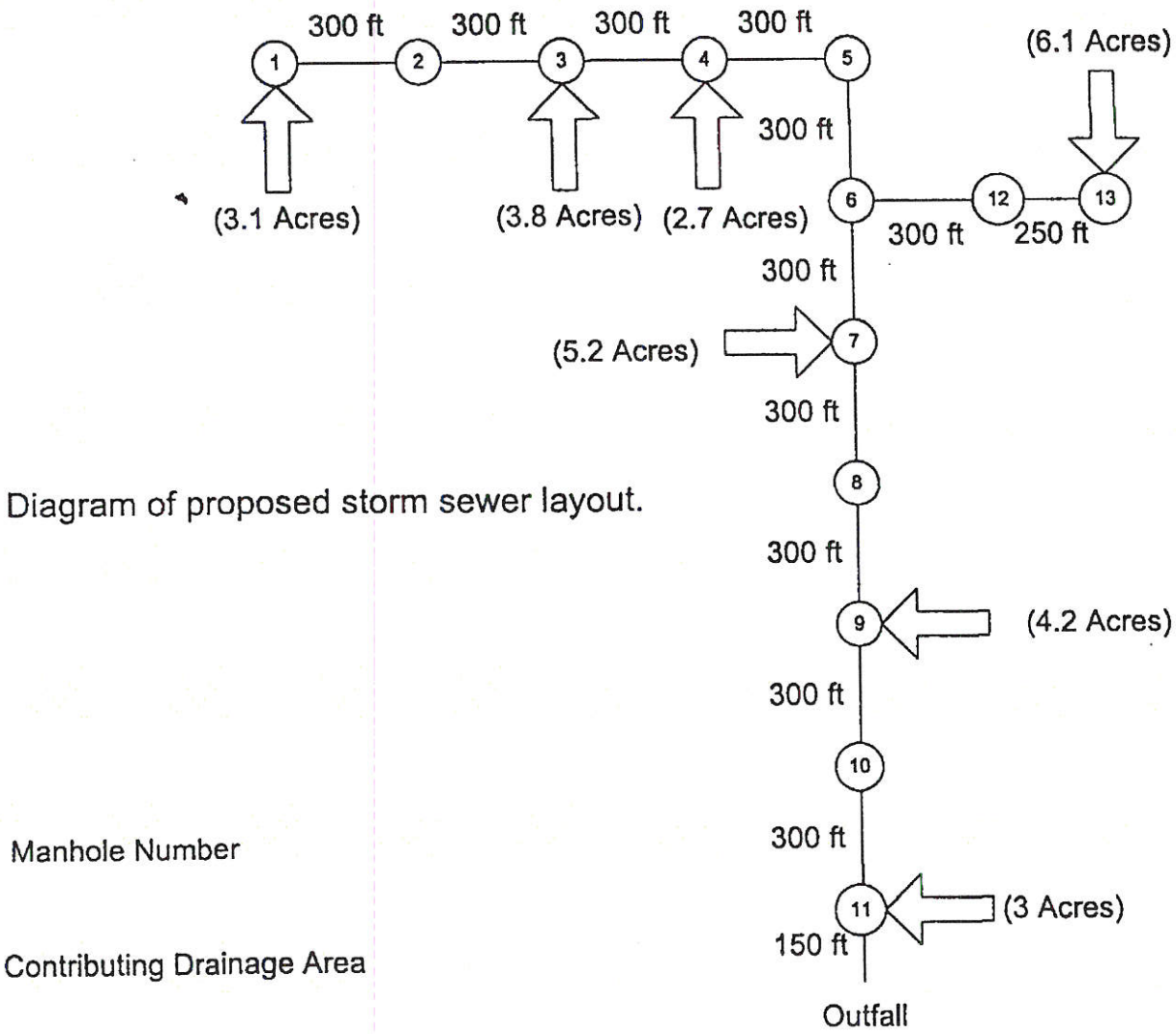


Diagram of proposed storm sewer layout.

Figure 2 - HCDD#1 Storm Sewer Calculation Form

Project: _____
Job No.: _____
System: _____
By: _____ Date: _____
Checked By: _____ Date: _____

M.H. From	M.H. To	Area (acres)	Runoff Coefficien C	Sum of C*A	Intensity I (in/hr)	Sum of Flows (cfs)	Time of Conc. (Minutes)	Reach Length (feet)	Diameter or Rise (inches)	Span (inches)	Slope %	Manning's "n"	Design Capacity (cfs)	Design Velocity (ft/s)	Fall (feet)	Manhole Drop (feet)	Flowline Elevation Upstream (feet)	Flowline Elevation Downstream (feet)	Actual Velocity (ft/s)	Hydraulic Gradient %	Change in Head (feet)	Elevation of Hyd. Grad. Upstream (feet)	Elevation of Hyd. Grad. Downstream (feet)	Natural Ground Upstream (feet)	Natural Ground Downstream (feet)

Figure 3 - HCDD#1 Storm Sewer Calculation Form - Example of Storm Sewer Design

Project: _____
Job No.: _____
System: _____
By: _____ Date: _____
Checked By: _____ Date: _____

M.H. From	M.H. To	Area (acres)	Runoff Coefficient C	Sum of C*A	Intensity I (in/hr)	Sum of Flows (cfs)	Time of Conc. (Minutes)	Reach Length (feet)	Diameter or Rise (inches)	Span (inches)	Slope %	Manning's "n"	Design Capacity (cfs)	Design Velocity (ft/s)	Fall (feet)	Manhole Drop (feet)	Flowline Elevation Upstream (feet)	Flowline Elevation Downstream (feet)	Actual Velocity (ft/s)	R	Hydraulic Gradient %	Change in Head (feet)	Elevation of Hyd. Grad. Upstream (feet)	Elevation of Hyd. Grad. Downstream (feet)	Natural Ground Upstream (feet)	Natural Ground Downstream (feet)
1	2	3.1	0.35	1.085	6.82	7.40	11.5	300	24	NA	0.33	0.013	13.10	3.31	1	0	60.00	59	2.36	0.5	0.0011	0.3195	66.87	66.55	67.00	66.86
2	3	0	0.35	1.085	6.41	14.35	13.2	300	24	NA	0.40	0.013	14.35	3.61	1.2	0	59.00	57.80	4.57	0.5	0.0040	1.2010	66.55	65.35	66.86	66.76
3	4	3.8	0.35	2.415	6.04	28.94	14.8	300	30	NA	0.50	0.013	29.08	5.05	1.5	0	57.80	56.30	5.90	0.625	0.0050	1.4856	65.35	63.86	66.76	66.64
4	5	0	0.35	2.415	5.72	42.75	16.5	300	42	NA	0.20	0.013	45.11	4.47	0.8	0	56.30	55.70	4.44	0.875	0.0018	0.5388	63.86	63.32	66.64	66.52
5	6	0	0.35	2.415	5.43	55.87	18.2	300	42	NA	0.33	0.013	58.24	5.77	1	0	55.70	54.70	5.81	0.875	0.0031	0.9204	63.32	62.40	66.52	66.4
13	12	6.1	0.35	2.135	6.47	13.81	12.9	250	24	NA	0.36	0.013	13.81	3.43	0.9	0	57.50	56.60	4.40	0.5	0.0037	0.9274	64.81	63.88	64.8	64.7
12	5	0	0.35	2.135	6.10	26.83	14.6	300	30	NA	0.53	0.013	30.03	5.22	1.6	0	56.60	55.00	5.47	0.625	0.0043	1.2773	63.88	62.40	64.7	64.58
6	7	0	0.35	4.55	5.18	106.27	19.8	300	60	NA	0.17	0.013	106.61	5.83	0.5	0	54.70	54.20	5.41	1.25	0.0017	0.4968	62.40	61.90	64.58	64.48
7	8	5.2	0.35	6.37	4.85	137.78	21.5	300	72	NA	0.13	0.013	155.06	6.26	0.4	0	54.20	53.80	4.87	1.5	0.0011	0.3158	61.90	61.59	64.48	64.34
8	9	0	0.35	6.37	4.74	167.96	23.2	300	78	NA	0.13	0.013	191.95	6.78	0.4	0	53.80	53.40	5.06	1.625	0.0010	0.3063	61.59	61.28	64.34	64.22
9	10	4.2	0.35	7.84	4.55	203.81	24.8	300	84	NA	0.13	0.013	233.89	7.30	0.4	0	53.40	53.00	5.29	1.75	0.0010	0.3031	61.28	60.98	64.22	64.1
10	11	3	0.35	8.89	4.37	242.49	26.5	300	90	NA	0.10	0.013	243.47	6.78	0.3	0	53.00	52.70	5.49	1.875	0.0010	0.2976	60.98	60.68	64.1	63.98
11	Out	0	0.35	8.89	4.29	280.64	27.3	150	96	NA	0.33	0.024	285.99	7.15	0.5	0	52.70	52.20	5.58	2	0.0032	0.4815	60.68	60.2	63.98	63.92

TABLES

Table 1. Hidalgo County Point Rainfall Depths

Return Period	Rainfall Depth (inches)							
	5-min	15-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
10-Year	0.64	1.42	2.97	3.95	4.30	5.20	6.10	7.10
25-Year	0.74	1.63	3.53	4.60	5.00	6.20	7.20	8.50
100-Year	0.88	1.95	4.40	5.70	6.30	7.80	9.50	11.00

Table 2 - Design Capacity of the Hidalgo County Master Drainage System

All existing Mains and Branches are designed on a 9.5-Year agricultural storm.

Main Floodwater Channel

1.	Outfall to West Ranch Boundary	4,300 cfs
2.	West Ranch to Junction of W.C.D.D. North Main	4,000 cfs
3.	Junction to Panchita	3,750 cfs
4.	Panchita to Junction North & South Mains	3,750 cfs

North Main

1.	Junction to F.M. 493	1,475 cfs
2.	F.M. 493 to Delta Lake Ditch Junction	1,400 cfs
3.	Delta Lake Ditch Junction to Junction Old Ditch	1,350 cfs
4.	Begin relocation to U.S. 281	1,250 cfs
5.	U.S. 281 to Edinburg Lake	1,250 cfs
6.	Edinburg Lake to S.W. Lateral	1,200 cfs
7.	S.W. Lateral to S.H. 107	300 cfs
8.	S.H. 107 to Main Canal	550 cfs
9.	Main Canal to Junction South Main	300 cfs

South Main

1.	Junction of North Main to Old North Main	2,375 cfs
2.	Old N. Main - E. Donna-West Ditch	2,275 cfs
3.	Ditch to F.M. 493	2,200 cfs
4.	F.M. 493 to Donna Drain	2,000 cfs
5.	Donna Drain to Alamo Road F.M. 907	1,950 cfs
6.	F.M. 907 to Pharr-McAllen Lateral	1,850 cfs
7.	Pharr-McAllen Lateral to Sugar Road	1,350 cfs
8.	Sugar Road to Junction	1,300 cfs

Table 2 - Design Capacity of the Hidalgo County Master Drainage System

North Main to McAllen	
1. Junction to New McAllen Ditch west of McColl	1,300 cfs
2. Ditch to turn west on new route at Junction 18th St. Ditch	1,300 cfs
3. Junction to Mile 4	900 cfs
4. Mile 4 to End	500 cfs
Southwest Lateral	
1. Junction to Old Ditch	1,000 cfs
2. Ditch Junction to Highway 107	925 cfs
3. Highway 107 to Edinburg Main Canal	900 cfs
4. Main Canal to E. Mission Branch	800 cfs
5. Branch to F.M. 494	750 cfs
6. F.M. 494 to S.H. 107	600 cfs
7. S.H. 107 to Inspiration	500 cfs
8. Inspiration to Mile 5	400 cfs
9. Mile 5 to F.M. 492	300 cfs
10. F.M. 492 to End	220 cfs
Mission Branch	
1. Junction to Mile 1½	300 cfs
2. Mile 1½ to Bryan	250 cfs
Rado Drain	
1. Outfall to U.S. 83	800 cfs
2. U.S. 83 to M.P.R.R.	720 cfs
3. M.P.R.R. to Edinburg Main	520 cfs
4. Under Edinburg Main	300 cfs
South Donna Drain	
1. Nominal Capacity	345 cfs
South Weslaco Drain	
1. Nominal Capacity	340 cfs

McAllen Drain

1. Nominal Capacity	1300 cfs

Pharr/McAllen Drain

1. Nominal capacity	600-1500 cfs

Capacity of IWBC Operated Channel System

Banker Floodway (abandoned)	105,000 cfs
Main Floodway	105,000 cfs
North Floodway	84,000 cfs
Arroyo Colorado	21,000 cfs

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
A-01	0	1760	420	10.0	18.0	84	220	124	29
	2640	1680	400	10.0	16.0	82	220	122	28
	5280	1580	380	10.0	13.0	79	210	119	26
	7920	1410	340	10.0	13.0	79	210	119	26
	10560	1230	300	9.0	13.0	73	200	113	22
	13200	1020	250	9.0	8.0	68	190	108	19
	15840	800	200	8.0	8.0	62	180	102	16
								Total Detention	166
E-01	0	820	210	8.0	21.0	75	200	115	22
	2640	800	200	8.0	20.0	74	200	114	21
	5280	550	140	7.0	17.0	65	180	105	16
	7920	410	110	7.0	8.0	56	170	96	12
								Total Detention	72
E-02	0	960	240	9.0	17.0	77	210	117	24
	2640	840	210	9.0	12.0	72	200	112	21
	5280	790	200	9.0	10.0	70	200	110	20
	7920	690	180	9.0	7.0	67	190	107	19
	10560	540	140	8.0	7.0	61	180	101	15
								Total Detention	99
F-01	0	1870	440	10.0	20.0	86	230	126	30
	2640	1860	440	10.0	20.0	86	230	126	30
	5280	1820	430	10.0	19.0	85	230	125	30
	7920	1670	400	10.0	16.0	82	220	122	28
	10560	1600	380	10.0	14.0	80	220	120	27
	13200	1220	300	9.0	13.0	73	200	113	22
	15840	1050	260	8.5	12.0	69	190	109	19
	18480	750	190	8.0	7.0	61	180	101	15
								Total Detention	201

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
F-01-01	0	830	210	10.0	18.0	84	220	124	29
	2640	790	200	9.0	18.0	78	210	118	25
	5280	680	180	8.0	18.0	72	200	112	20
	7920	570	150	7.0	18.0	66	190	106	17
								Total Detention	91
F-03	0	1440	350	9.0	19.0	79	210	119	25
	2640	1380	330	9.0	18.0	78	210	118	25
	5280	1160	280	9.0	11.0	71	200	111	21
	7920	950	240	8.5	9.0	66	190	106	18
	10560	780	200	8.0	8.0	62	180	102	16
	13200	720	180	8.0	8.0	62	180	102	16
	15840	650	170	7.5	7.0	58	170	98	13
								Total Detention	133
F-04	0	930	230	8.0	13.0	67	190	107	18
	2640	930	230	8.0	13.0	67	190	107	18
	5280	900	230	8.0	12.0	66	190	106	17
	7920	750	190	7.5	11.0	62	180	102	15
	10560	490	130	6.5	9.0	54	160	94	11
								Total Detention	80
F-05-01	0	1410	340	9.5	13.0	76	210	116	24
	2640	1380	330	9.5	12.5	76	210	116	24
	5280	1350	330	9.5	11.0	74	200	114	23
	7920	1300	320	9.5	10.5	74	200	114	22
	10560	1240	300	9.5	9.0	72	200	112	22
	13200	1180	290	9.5	8.0	71	200	111	21
	15840	1110	270	9.5	7.0	70	200	110	20
	18480	990	250	9.0	7.0	67	190	107	19
	21120	880	220	8.5	7.0	64	180	104	17
	23760	560	150	7.0	7.0	55	160	95	12
								Total Detention	203

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
F-06	0	1740	410	12.0	14.0	92	240	132	36
	2640	1670	400	12.0	12.0	90	240	130	35
	5280	1490	360	11.5	12.0	87	230	127	32
	7920	1340	330	11.0	12.0	84	220	124	30
	10560	1160	280	10.5	10.0	79	210	119	26
	13200	1030	260	10.0	10.0	76	210	116	24
	15840	950	240	10.0	9.0	75	210	115	24
	18480	870	220	9.5	9.0	72	200	112	22
	21120	640	170	8.5	8.0	65	190	105	17
	23760	640	170	8.5	8.0	65	190	105	17
								Total Detention	264
F-07-00	0	900	230	8.0	12.0	66	190	106	17
	2640	700	180	7.5	9.0	60	170	100	14
	5280	460	120	6.5	8.0	53	160	93	11
								Total Detention	43
F-08	0	1000	250	8.0	15.0	69	190	109	19
	2640	980	240	8.0	15.0	69	190	109	19
	5280	870	220	7.5	15.0	66	190	106	17
	7920	810	210	7.5	13.0	64	180	104	16
	10560	680	180	7.0	13.0	61	180	101	14
	13200	460	120	6.5	7.0	52	160	92	10
	15840	370	100	6.0	6.0	48	150	88	9
								Total Detention	105
F-09-00	0	840	210	7.5	14.0	65	180	105	17
	2640	840	210	7.5	14.0	65	180	105	17
	5280	820	210	7.5	13.0	64	180	104	16
	7920	760	190	7.5	11.0	62	180	102	15
	10560	720	190	7.5	10.0	61	180	101	15
	13200	620	160	7.0	10.0	58	170	98	13
								Total Detention	92

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
F-10-00	0	1200	290	9.0	12.0	72	200	112	21
	2640	1160	280	9.0	11.0	71	200	111	21
	5280	900	230	8.5	9.0	66	190	106	18
	7920	670	170	7.5	8.0	59	170	99	14
								Total Detention	74
F-11-00	0	2040	480	12.0	33.0	111	280	151	50
	2640	1970	460	12.0	33.0	111	280	151	50
	5280	1860	440	12.0	33.0	111	280	151	50
	7920	1820	430	11.5	32.0	107	270	147	46
								Total Detention	197
F-12-00	0	2830	640	15.0	22.5	118	300	158	61
	2640	1610	380	12.0	20.0	98	250	138	41
	5280	1580	380	12.0	19.0	97	250	137	40
	7920	1520	360	12.0	17.0	95	250	135	39
	10560	1450	350	12.0	15.0	93	240	133	37
	13200	1330	320	11.5	15.0	90	240	130	35
	15840	1230	300	11.5	12.0	87	230	127	32
	18480	1180	290	11.5	11.0	86	230	126	32
								Total Detention	316
F-12-01	0	1260	310	11.0	20.0	92	240	132	35
	2640	1190	290	11.0	20.0	92	240	132	35
	5280	1160	290	10.5	19.0	88	230	128	32
	7920	1100	270	10.5	17.0	86	230	126	31
	10560	960	240	10.0	17.0	83	220	123	28
	13200	890	220	9.5	17.0	80	220	120	26
								Total Detention	188

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
F-14-01	0	1490	470	11.5	12.0	87	230	127	32
	2640	1310	400	11.5	10.0	85	230	125	31
	5280	1270	380	11.5	10.0	85	230	125	31
	7920	1230	370	11.0	10.0	82	220	122	29
	10560	1170	340	11.0	9.0	81	220	121	28
	13200	1110	320	10.5	9.0	78	210	118	26
	15840	1030	290	10.5	9.0	78	210	118	26
									203
F-15-00	0	1200	360	9.0	12.0	72	200	112	21
	2640	1130	330	9.0	11.0	71	200	111	21
	5280	1030	290	9.0	10.5	71	200	111	20
	7920	990	280	9.0	10.5	71	200	111	20
	10560	950	260	9.0	10.0	70	200	110	20
									103
J-01-00	0	2960	670	14.0	25.0	115	290	155	57
	2640	2930	660	14.0	22.0	112	280	152	54
	5280	2810	640	14.0	20.0	110	280	150	53
	7920	2670	610	14.0	17.0	107	270	147	50
	10560	2530	580	14.0	16.0	106	270	146	49
	13200	2390	550	13.5	16.0	103	260	143	46
	15840	2220	520	13.0	16.0	100	260	140	43
	18480	2090	490	13.0	14.0	98	250	138	42
	21120	1830	430	12.5	12.0	93	240	133	38
	23760	1490	360	11.5	12.0	87	230	127	32
	26400	1420	340	11.5	10.0	85	230	125	31
	29040	1340	330	11.5	10.0	85	230	125	31
	31680	1260	310	11.0	10.0	82	220	122	29
	34320	1180	290	11.0	9.0	81	220	121	28
	36960	1110	270	10.5	9.0	78	210	118	26
	39600	1090	270	10.5	9.0	78	210	118	26
								Total Detention	635

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
J-02-00	0	3150	710	14.0	40.0	170	320	186	70
	2640	3150	710	14.0	40.0	170	320	186	70
	5280	3150	710	14.0	40.0	170	320	186	70
	7920	2900	660	13.5	40.0	167	310	183	66
	10560	2690	610	13.0	40.0	164	300	180	62
	13200	2460	570	12.5	40.0	161	300	172	59
	15840	2270	530	12.0	40.0	158	290	172	55
								Total Detention	451
J-02-01	0	1030	260	10.0	18.0	84	220	124	29
	2640	1030	260	10.0	18.0	84	220	124	29
	5280	680	180	9.0	12.0	72	200	112	21
	7920	680	180	9.0	12.0	72	200	112	21
								Total Detention	101
J-02-02	0	1430	340	10.0	35.0	101	250	141	39
	2640	1380	330	10.0	33.0	99	250	139	38
	5280	1200	290	10.0	26.0	92	240	132	34
	7920	1080	270	10.0	21.0	87	230	127	31
								Total Detention	142
J-03-00	0	1550	370	11.0	18.0	90	240	130	34
	2640	1490	360	11.0	16.0	88	230	128	33
	5280	1430	340	11.0	14.0	86	230	126	31
	7920	1270	310	11.0	10.0	82	220	122	29
								Total Detention	127
J-04-00	0	1470	350	10.0	11.0	77	210	117	25
	2640	1470	350	10.0	11.0	77	210	117	25
	5280	1140	280	9.5	7.0	70	200	110	20
	7920	1140	280	9.5	7.0	70	200	110	20
	10560	1140	280	9.5	7.0	70	200	110	20
								Total Detention	111

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth ft	Btm Width ft	Top Width ft	Right-of-Way With Berm ft	Right-of-Way W/O Berm ft	Detention Volume acre-ft
J-05-00	0	2920	660	14.0	22.0	112	280	152	54
	2640	2900	660	14.0	22.0	112	280	152	54
	5280	2870	650	14.0	21.0	111	280	151	53
	7920	2820	640	14.0	20.0	110	280	150	53
	10560	2820	640	14.0	20.0	110	280	150	53
	13200	2260	520	13.0	18.0	102	260	142	45
	15840	1920	450	12.5	14.0	95	250	135	39
	18480	1740	410	12.0	14.0	92	240	132	36
	21120	1380	330	11.0	13.0	85	230	125	31
								Total Detention	418
J-05-01	0	1310	320	10.0	20.0	86	230	126	30
	2640	1310	320	10.0	20.0	86	230	126	30
								Total Detention	60
J-06-00	0	2940	670	14.0	23.0	113	280	153	55
	2640	2940	670	14.0	23.0	113	280	153	55
	5280	2900	660	14.0	22.0	112	280	152	54
	7920	2850	650	14.0	21.0	111	280	151	53
	10560	2610	600	13.5	21.0	108	270	148	50
	13200	2470	570	12.0	14.0	92	240	132	36
	15840	2270	530	12.0	14.0	92	240	132	36
	18480	2170	500	9.0	10.0	70	200	110	20
	21120	2170	500	9.0	9.0	69	190	109	20
	23760	1990	470	9.0	9.0	69	190	109	20
	26400	1900	450	9.0	8.0	68	190	108	19
	29040	1790	420	8.5	8.0	65	190	105	17
	31680	1600	380	8.0	8.0	62	180	102	16
	34320	1600	380	8.0	8.0	62	180	102	16
								Total Detention	468

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
J-07-00	0	2710	620	14.0	18.0	108	270	148	51
	2640	2710	620	14.0	18.0	108	270	148	51
	5280	2710	620	14.0	18.0	108	270	148	51
	7920	2540	580	14.0	17.0	107	270	147	50
	10560	2450	560	13.5	17.0	104	270	144	47
	13200	2350	540	11.5	17.0	92	240	132	36
	15840	2160	500	11.0	17.0	89	230	129	33
	18480	1960	460	9.0	9.0	69	190	109	20
	21120	2030	470	9.0	9.0	69	190	109	20
	23760	1810	430	8.5	9.0	66	190	106	18
	26400	1660	400	8.0	9.0	63	180	103	16
	29040	1500	360	8.0	8.0	62	180	102	16
	31680	1470	350	8.0	8.0	62	180	102	16
	34320	1380	330	7.5	8.0	59	170	99	14
	36960	1270	310	7.5	7.0	58	170	98	13
								Total Detention	450
J-07-01	0	590	150	8.0	10.0	64	180	104	16
	2640	590	150	8.0	10.0	64	180	104	16
								Total Detention	33

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
J-08-00	0	5400	1160	18.0	24.0	138	340	178	85
	2640	5400	1160	18.0	24.0	138	340	178	85
	5280	5400	1160	18.0	24.0	138	340	178	85
	7920	5400	1160	18.0	24.0	138	340	178	85
	10560	5400	1160	18.0	24.0	138	340	178	85
	13200	5280	1140	16.0	18.0	120	300	160	64
	15840	5280	1140	16.0	18.0	120	300	160	64
	18480	5280	1140	12.0	18.0	96	250	136	39
	21120	5280	1140	12.0	18.0	96	250	136	39
	23760	5170	1110	12.0	16.0	94	250	134	38
	26400	5170	1110	12.0	16.0	94	250	134	38
	29040	5170	1110	12.0	16.0	94	250	134	38
	31680	5090	1100	12.0	16.0	94	250	134	38
	34320	5090	1100	12.0	16.0	94	250	134	38
	36960	5010	1080	12.0	16.0	94	250	134	38
	39600	5010	1080	12.0	16.0	94	250	134	38
	42240	4930	1070	12.0	16.0	94	250	134	38
	44880	4930	1070	12.0	16.0	94	250	134	38
	47520	2460	570	9.0	13.0	73	200	113	22
	50160	2460	570	9.0	13.0	73	200	113	22
	52800	2390	550	9.0	12.0	72	200	112	21
	55440	2390	550	9.0	12.0	72	200	112	21
	58080	2170	500	9.0	12.0	72	200	112	21
	60720	1940	460	8.5	12.0	69	190	109	19
	63360	1940	460	8.5	12.0	69	190	109	19
	66000	1700	400	8.0	12.0	66	190	106	17
	68640	1480	350	7.5	12.0	63	180	103	16
	71280	1230	300	7.0	10.0	58	170	98	13
	73920	960	240	6.5	10.0	55	160	95	12
	76560	620	160	6.0	6.0	48	150	88	9
								Total Detention	1185

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
J-08-01	0	920	230	8.5	10.0	67	190	107	18
	2640	920	230	8.5	10.0	67	190	107	18
	5280	920	230	8.5	10.0	67	190	107	18
								Total Detention	55
J-08-02	0	2610	600	9.0	15.0	75	210	115	23
	2640	2610	600	9.0	15.0	75	210	115	23
	5280	2610	600	9.0	15.0	75	210	115	23
	7920	2610	600	9.0	15.0	75	210	115	23
	10560	2610	600	9.0	15.0	75	210	115	23
	13200	2380	550	9.0	13.0	73	200	113	22
	15840	2120	490	8.5	13.0	70	190	110	20
	18480	1860	440	8.0	13.0	67	190	107	18
	21120	1860	440	8.0	13.0	67	190	107	18
	23760	1860	440	8.0	13.0	67	190	107	18
								Total Detention	210
J-08-03	0	2310	530	9.0	11.0	71	200	111	21
	2640	2310	530	9.0	11.0	71	200	111	21
	5280	2220	510	9.0	10.0	70	200	110	20
	7920	2070	480	9.0	10.0	70	200	110	20
	10560	1910	450	8.5	9.0	66	190	106	18
	13200	1750	410	8.5	7.0	64	180	104	17
	15840	1540	370	8.0	7.0	61	180	101	15
	18480	1300	320	7.5	7.0	58	170	98	13
	21120	730	190	6.0	6.0	48	150	88	9
								Total Detention	154
J-09-00	0	1130	280	9.0	10.0	70	200	110	20
	2640	1120	270	9.0	10.0	70	200	110	20
	5280	980	240	8.5	10.0	67	190	107	18
	7920	850	210	8.0	10.0	64	180	104	16
	10560	710	180	7.5	10.0	61	180	101	15
	13200	540	140	7.0	6.0	54	160	94	11
								Total Detention	101

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth ft	Btm Width ft	Top Width ft	Right-of-Way With Berm ft	Right-of-Way W/O Berm ft	Detention Volume acre-ft
K-01-00	0	2190	510	13.5	16.5	104	270	144	47
	2640	2190	510	13.5	16.5	104	270	144	47
	5280	2160	500	13.5	16.0	103	260	143	46
	7920	2150	500	13.5	16.0	103	260	143	46
	10560	1810	430	13.0	12.0	96	250	136	40
	13200	1790	420	13.0	12.0	96	250	136	40
	15840	1760	420	13.0	11.0	95	250	135	39
	18480	1750	410	13.0	11.0	95	250	135	39
	21120	1730	410	13.0	11.0	95	250	135	39
	23760	1280	310	11.5	10.0	85	230	125	31
	26400	1250	310	11.5	10.0	85	230	125	31
	29040	1230	300	11.5	10.0	85	230	125	31
	31680	1160	280	11.0	10.0	82	220	122	29
	34320	620	160	9.0	8.0	68	190	108	19
	36960	590	150	8.5	8.0	65	190	105	17
	39600	540	140	8.5	6.0	63	180	103	16
	42240	500	130	8.5	6.0	63	180	103	16
								Total Detention	575
K-01-01	0	880	220	8.5	13.0	70	190	110	20
	2640	810	210	8.5	10.0	67	190	107	18
	5280	720	180	8.5	7.0	64	180	104	17
		0						Total Detention	55
K-01-02	0	940	240	9.0	11.0	71	200	111	21
	2640	840	210	9.0	10.0	70	200	110	20
	5280	810	210	8.5	10.0	67	190	107	18
	7920	750	190	8.5	8.0	65	190	105	17
								Total Detention	76
K-01-03	0	950	240	10.0	11.0	77	210	117	25
	2640	870	220	10.0	10.0	76	210	116	24
	5280	820	210	9.5	10.0	73	200	113	22
	7920	650	170	9.0	8.0	68	190	108	19
	10560	580	150	8.5	8.0	65	190	105	17
	13200	500	130	8.0	8.0	62	180	102	16
								Total Detention	123

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
K-02-00	0	1190	290	10.0	10.0	76	210	116	24
	2640	1180	290	10.0	10.0	76	210	116	24
	5280	1110	270	10.0	8.0	74	200	114	23
	7920	1110	270	10.0	8.0	74	200	114	23
	10560	900	230	9.5	6.0	69	190	109	20
	13200	900	230	9.5	6.0	69	190	109	20
	15840	650	170	8.5	6.0	63	180	103	16
	18480	650	170	8.5	6.0	63	180	103	16
	21120	500	130	7.5	6.0	57	170	97	13
	23760	500	130	7.5	6.0	57	170	97	13
								Total Detention	193
K-03-00	0	2720	620	13.0	20.0	104	270	144	46
	2640	2720	620	13.0	20.0	104	270	144	46
	5280	2720	620	13.0	20.0	104	270	144	46
	7920	2720	620	13.0	20.0	104	270	144	46
	10560	2380	550	12.5	18.0	99	260	139	42
	13200	2380	550	12.5	18.0	99	260	139	42
	15840	2380	550	12.5	18.0	99	260	139	42
	18480	2050	480	12.0	15.0	93	240	133	37
	21120	2050	480	12.0	15.0	93	240	133	37
	23760	1550	370	11.0	12.0	84	220	124	30
	26400	990	250	9.5	8.0	71	200	111	21
	29040	990	250	9.5	8.0	71	200	111	21
	31680	990	250	9.5	8.0	71	200	111	21
	34320	990	250	9.5	8.0	71	200	111	21
								Total Detention	500
K-03-01	0	950	240	9.0	11.0	71	200	111	21
	2640	820	210	8.5	11.0	68	190	108	19
	5280	750	190	8.5	8.0	65	190	105	17
	7920	580	150	8.0	6.0	60	180	100	15
								Total Detention	71

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
K-03-02	0	900	230	8.5	14.0	71	200	111	20
	2640	820	210	8.5	11.0	68	190	108	19
	5280	700	180	8.0	10.0	64	180	104	16
	7920	540	140	7.5	8.0	59	170	99	14
								Total Detention	70
K-03-03	0	1080	270	8.5	21.0	78	210	118	24
	2640	1000	250	8.5	18.0	75	200	115	22
	5280	910	230	8.5	14.0	71	200	111	20
	7920	720	180	8.0	11.0	65	180	105	17
	10560	620	160	7.5	11.0	62	180	102	15
	13200	480	130	7.0	9.0	57	170	97	13
	15840	380	100	6.5	7.0	52	160	92	10
								Total Detention	122
K-03-04	0	1020	250	8.0	24.0	78	210	118	23
	2640	900	230	7.5	24.0	75	200	115	21
	5280	810	210	7.5	20.0	71	200	111	19
	7920	500	130	6.0	20.0	62	180	102	14
								Total Detention	78
K-03-05	0	990	250	8.0	23.0	77	210	117	23
	2640	990	250	8.0	23.0	77	210	117	23
	5280	900	230	8.0	19.0	73	200	113	21
	7920	900	230	8.0	19.0	73	200	113	21
	10560	580	150	7.0	14.0	62	180	102	15
								Total Detention	102
K-04-00	0	1200	290	9.0	20.0	80	210	120	26
	2640	1110	270	9.0	17.0	77	210	117	24
	5280	840	210	8.0	16.0	70	190	110	19
								Total Detention	69

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section			Right-of-Way With Berm ft	Right-of-Way W/O Berm ft	Detention Volume acre-ft
				Depth ft	Btm Width ft	Top Width ft			
K-05-00	0	1840	430	11.0	19.0	91	240	131	35
	2640	1750	410	11.0	19.0	91	240	131	35
	5280	1660	390	10.5	19.0	88	230	128	32
	7920	1560	370	10.5	15.0	84	220	124	30
	10560	1450	350	10.5	14.0	83	220	123	29
	13200	1230	300	10.0	12.0	78	210	118	25
	15840	980	250	9.0	12.0	72	200	112	21
								Total Detention	207
K-05-01	0	900	230	8.5	14.0	71	200	111	20
	2640	840	210	8.5	12.0	69	190	109	19
	5280	750	190	8.0	12.0	66	190	106	17
	7920	580	150	7.5	10.0	61	180	101	15
	10560	500	130	7.0	10.0	58	170	98	13
								Total Detention	85
K-05-02	0	980	250	8.0	22.0	76	210	116	22
	2640	920	230	8.0	20.0	74	200	114	21
	5280	840	210	8.0	17.0	71	200	111	20
	7920	750	190	7.5	17.0	68	190	108	18
	10560	650	170	7.0	17.0	65	180	105	16
								Total Detention	98
K-07-01	0	920	230	10.0	10.0	76	210	116	24
	2640	810	210	9.5	10.0	73	200	113	22
	5280	720	180	9.0	10.0	70	200	110	20
									67
K-07-02	0	750	190	9.0	11.0	71	200	111	21
	2640	670	170	9.0	8.0	68	190	108	19
	5280	580	150	8.5	8.0	65	190	105	17
									57

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
K-08-00	0	750	190	9.0	11.0	71	200	111	21
	2640	670	170	9.0	8.0	68	190	108	19
	5280	580	150	8.5	8.0	65	190	105	17
								Total Detention	57
L-02-01	0	900	230	8.0	19.0	73	200	113	21
	2640	780	200	7.5	19.0	70	190	110	19
	5280	580	150	7.0	14.0	62	180	102	15
								Total Detention	55
L-03-00	0	1680	400	11.0	15.0	87	230	127	32
	2640	1670	400	11.0	15.0	87	230	127	32
	5280	1650	390	11.0	15.0	87	230	127	32
	7920	1630	390	11.0	15.0	87	230	127	32
	10560	1550	370	11.0	15.0	87	230	127	32
	13200	1490	360	10.5	15.0	84	220	124	30
	15840	1440	350	10.5	13.0	82	220	122	28
	18480	1250	310	10.0	12.0	78	210	118	25
	21120	960	240	9.0	12.0	72	200	112	21
	23760	750	190	8.0	12.0	66	190	106	17
								Total Detention	282
L-04-00	0	1060	260	9.0	15.0	75	210	115	23
	2640	1060	260	9.0	15.0	75	210	115	23
	5280	1060	260	9.0	15.0	75	210	115	23
	7920	750	190	8.0	12.0	66	190	106	17
								Total Detention	86
M-01-00	0	950	240	9.0	11.0	71	200	111	21
	2640	950	240	9.0	11.0	71	200	111	21
	5280	950	240	9.0	11.0	71	200	111	21
								Total Detention	62

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
M-02-00	0	1260	310	10.0	12.0	78	210	118	25
	2640	1200	290	10.0	12.0	78	210	118	25
	5280	1110	270	9.5	12.0	75	210	115	23
	7920	1000	250	9.5	9.0	72	200	112	22
	10560	840	210	9.0	8.0	68	190	108	19
	13200	650	170	8.0	8.0	62	180	102	16
								Total Detention	130
M-03-00	0	1990	470	12.0	14.0	92	240	132	36
	2640	1990	470	12.0	14.0	92	240	132	36
	5280	1900	450	12.0	14.0	92	240	132	36
	7920	1800	430	11.5	14.0	89	230	129	34
	10560	1700	400	11.5	11.0	86	230	126	32
	13200	1700	400	11.5	11.0	86	230	126	32
								Total Detention	206
M-04-00	0	1160	280	10.0	10.0	76	210	116	24
	2640	1160	280	10.0	10.0	76	210	116	24
	5280	1160	280	10.0	10.0	76	210	116	24
								Total Detention	73
M-05-00	0	1840	430	11.0	19.0	91	240	131	35
	2640	1840	430	11.0	19.0	91	240	131	35
	5280	1610	380	10.5	18.0	87	230	127	32
	7920	1510	360	10.5	15.0	84	220	124	30
	10560	1000	250	9.0	13.0	73	200	113	22
	13200	900	230	9.0	10.0	70	200	110	20
	15840	750	190	8.5	8.0	65	190	105	17
	18480	640	170	8.0	8.0	62	180	102	16
	21120	500	130	7.5	6.0	57	170	97	13
								Total Detention	218

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
M-05-01	0	960	240	8.0	21.0	75	200	115	22
	2640	810	210	7.5	20.0	71	200	111	19
	5280	650	170	7.0	18.0	66	190	106	17
	7920	580	150	7.0	15.0	63	180	103	15
	10560	500	130	6.5	15.0	60	170	100	14
								Total Detention	87
S-01-00	0	1160	280	11.0	16.0	88	230	128	33
	2640	1120	280	11.0	16.0	88	230	128	33
	5280	1090	270	10.5	16.0	85	230	125	30
	7920	1020	250	10.5	15.0	84	220	124	30
	10560	940	240	10.0	15.0	81	220	121	27
	13200	850	220	9.5	15.0	78	210	118	25
	15840	790	200	9.5	15.0	78	210	118	25
	18480	700	180	9.0	13.0	73	200	113	22
	21120	610	160	8.5	12.0	69	190	109	19
	23760	500	130	8.0	11.0	65	180	105	17
								Total Detention	261
S-02-00	0	1450	350	11.0	24.0	96	250	136	38
	2640	1340	330	11.0	24.0	96	250	136	38
	5280	1230	300	10.5	22.0	91	240	131	34
	7920	1110	270	10.0	22.0	88	230	128	32
	10560	980	240	9.5	21.0	84	220	124	29
								Total Detention	170

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
W-01-00	0	4360	950	16.0	30.0	132	320	172	76
	2640	4290	940	16.0	30.0	132	320	172	76
	5280	4190	920	15.5	30.0	129	320	169	72
	7920	4040	890	15.5	30.0	129	320	169	72
	10560	3930	870	15.5	27.0	126	310	166	69
	13200	3690	820	15.0	27.0	123	300	163	65
	15840	3300	740	14.5	25.0	118	290	158	60
	18480	3300	740	14.5	25.0	118	290	158	60
	21120	3300	740	14.5	25.0	118	290	158	60
	23760	3000	680	14.0	24.0	114	290	154	56
	26400	3000	680	14.0	24.0	114	290	154	56
	29040	3000	680	14.0	24.0	114	290	154	56
	31680	3000	680	14.0	24.0	114	290	154	56
	34320	3000	680	14.0	24.0	114	290	154	56
	36960	2630	600	13.5	21.0	108	270	148	50
	39600	2190	510	13.0	16.0	100	260	140	43
	42240	2190	510	13.0	16.0	100	260	140	43
	44880	2190	510	13.0	16.0	100	260	140	43
	47520	2190	510	13.0	16.0	100	260	140	43
	50160	2000	470	12.5	16.0	97	250	137	41
	52800	1480	350	11.5	11.0	86	230	126	32
	55440	1480	350	11.5	11.0	86	230	126	32
	58080	1250	310	11.0	9.0	81	220	121	28
	60720	910	230	10.0	7.0	73	200	113	22
	63360	910	230	10.0	7.0	73	200	113	22
	66000	910	230	10.0	7.0	73	200	113	22
	68640	910	230	10.0	7.0	73	200	113	22
								Total Detention	1335

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
W-01-01	0	1330	320	10.0	21.0	87	230	127	31
	2640	1200	290	9.5	21.0	84	220	124	29
	5280	1070	260	9.0	21.0	81	220	121	26
	7920	750	190	8.5	13.0	70	190	110	20
	10560	330	90	6.0	12.0	54	160	94	11
								Total Detention	116
W-01-02	0	1180	290	9.5	20.0	83	220	123	28
	2640	1180	290	9.5	20.0	83	220	123	28
								Total Detention	56
W-01-03	0	500	130	7.5	9.0	60	170	100	14
	2640	500	130	7.5	9.0	60	170	100	14
	5280	500	130	7.5	9.0	60	170	100	14
								Total Detention	43
W-01-04	0	910	230	8.5	20.0	77	210	117	23
	2640	910	230	8.5	20.0	77	210	117	23
	5280	910	230	8.5	20.0	77	210	117	23
	7920	910	230	8.5	20.0	77	210	117	23
								Total Detention	94
W-01-05	0	1130	280	8.5	30.0	87	230	127	29
	2640	1130	280	8.5	30.0	87	230	127	29
	5280	1130	280	8.5	30.0	87	230	127	29
	7920	1130	280	8.5	30.0	87	230	127	29
								Total Detention	114
W-02-00	0	1710	410	11.0	24.0	96	250	136	38
	2640	1590	380	10.5	24.0	93	240	133	35
	5280	1510	360	10.5	22.0	91	240	131	34
	7920	1300	320	10.0	20.0	86	230	126	30
	10560	1030	260	9.5	15.0	78	210	118	25
	13200	840	210	9.0	12.0	72	200	112	21
	15840	650	170	8.5	10.0	67	190	107	18
								Total Detention	202

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
W-03-00	0	660	170	8.5	9.0	66	190	106	18
	2640	660	170	8.5	9.0	66	190	106	18
	5280	660	170	8.5	9.0	66	190	106	18
								Total Detention	53
W-04-00	0	1490	360	11.0	16.0	88	230	128	33
	2640	1490	360	11.0	16.0	88	230	128	33
	5280	1490	360	11.0	16.0	88	230	128	33
	7920	1490	360	11.0	16.0	88	230	128	33
								Total Detention	131
W-05-00	0	1490	360	11.0	16.0	88	230	128	33
	2640	1490	360	11.0	16.0	88	230	128	33
	5280	1490	360	11.0	16.0	88	230	128	33
	7920	1490	360	11.0	16.0	88	230	128	33
	10560	1490	360	11.0	16.0	88	230	128	33
								Total Detention	163
W-06-00	0	1390	340	11.0	13.0	85	230	125	31
	2640	1340	330	11.0	13.0	85	230	125	31
	5280	1130	280	10.5	10.0	79	210	119	26
	7920	870	220	9.5	9.0	72	200	112	22
	10560	870	220	9.5	9.0	72	200	112	22
								Total Detention	131
W-07-00	0	810	210	10.0	9.0	75	210	115	24
	2640	780	200	9.0	9.0	69	190	109	20
	5280	750	190	9.0	9.0	69	190	109	20
	7920	670	170	8.5	9.0	66	190	106	18
	10560	580	150	8.0	9.0	63	180	103	16
	13200	500	130	7.5	9.0	60	170	100	14
								Total Detention	111

Table 3 - Hidalgo County Master Drainage System - Lateral R.O.W. Widths

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Station Number for Lateral	Inflow 25 Year Storm Discharge cfs	Outflow 9.5 Year Agr. Discharge cfs	Cross Section					
				Depth	Btm Width	Top Width	Right-of-Way With Berm	Right-of-Way W/O Berm	Detention Volume
				ft	ft	ft	ft	ft	acre-ft
Z-01-00	0	3040	690	10.0	20.0	86	230	126	30
	2640	3040	690	10.0	20.0	86	230	126	30
	5280	3040	690	10.0	20.0	86	230	126	30
	7920	2970	670	10.0	20.0	86	230	126	30
	10560	2960	670	9.5	20.0	83	220	123	28
	13200	2910	660	9.5	20.0	83	220	123	28
	15840	2910	660	9.5	20.0	83	220	123	28
	18480	2810	640	9.5	18.0	81	220	121	27
	21120	2810	640	9.5	18.0	81	220	121	27
	23760	2670	610	9.0	18.0	78	210	118	25
	26400	2540	580	9.0	18.0	78	210	118	25
	29040	2390	550	9.0	17.0	77	210	117	24
	31680	2240	520	9.0	16.0	76	210	116	23
	34320	2090	490	8.5	16.0	73	200	113	21
	36960	1880	440	8.5	13.0	70	190	110	20
	39600	1680	400	8.0	13.0	67	190	107	18
	42240	1450	350	7.5	13.0	64	180	104	16
	44880	1200	290	7.0	12.0	60	170	100	14
	47520	910	230	6.5	10.0	55	160	95	12
	50160	540	140	6.0	6.0	48	150	88	9
	52800	540	140	6.0	6.0	48	150	88	9
								Total Detention	473

** Right-of-way is determined with one foot of freeboard included in all channels.

TABLE 4. RUNOFF COEFFICIENTS FOR RATIONAL METHOD

Type of Drainage Area	Runoff Coefficient
Residential Districts:	
Single Family (Lots less than 1/4 acre)	0.35
Single Family (Lots 1/4 to 1/2 acre)	0.30
Single Family (Lots greater than 1/2 acre)	0.25
Multi-Family (Less than 20 DU/AC)	0.45
Multi-Family (Greater than 20 DU/AC)	0.55
Business District:	0.70
Industrial Districts:	
Light Areas	0.50
Heavy Areas	0.60
Railroad Yard Areas	0.20
Parks	0.10
Unimproved Areas:	
Bare Surface	0.30
Grassland	0.25
Cultivated Land	0.20
Woodlands	0.15
Streets:	
Asphalt	0.70
Concrete	0.75
Drives and Walks:	
Concrete	0.75

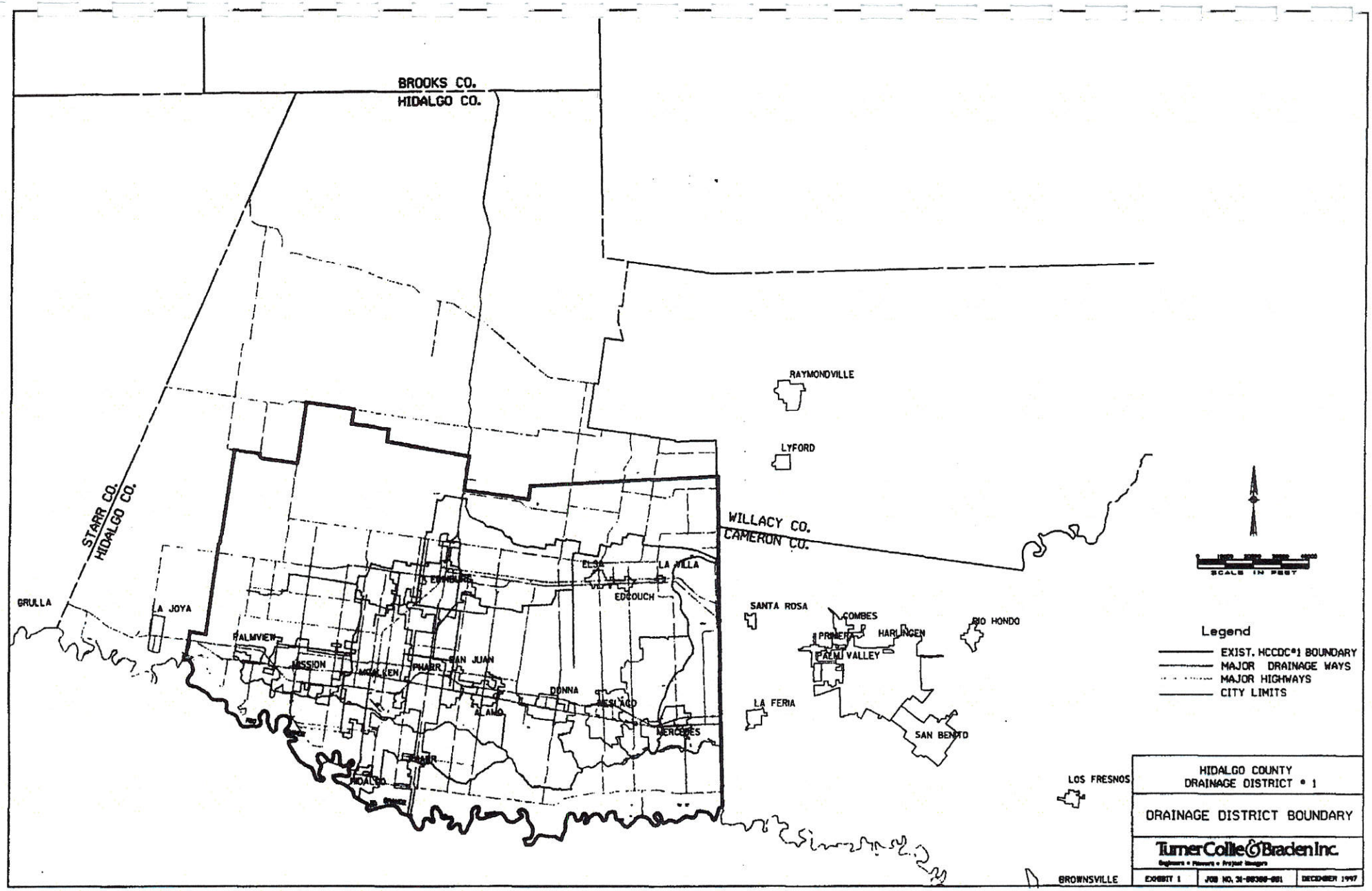
Table 5 - Capital Improvement Costs

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Priority Level for Construction	Proposed Lateral Channel			
		Excavation & Seeding Cost	Control Structure Cost	Right-of-way Cost	Annual Maintenance Cost
A-01	4	$444,500	$700,000	$755,300	$32,900
E-01	3	$196,000	$400,000	$396,100	$18,800
E-02	3	$269,100	$500,000	$517,600	$23,500
F-01	3	$538,000	$800,000	$898,000	$37,600
F-01-01	4	$243,800	$400,000	$433,100	$18,800
F-03	3	$361,400	$700,000	$707,800	$32,900
F-04	4	$220,600	$500,000	$480,800	$23,500
F-05-01	3	$550,300	$1,000,000	$1,029,800	$47,000
F-06	3	$704,700	$1,000,000	$1,130,400	$47,000
F-07-00	3	$119,100	$300,000	$274,700	$14,100
F-08	4	$291,100	$700,000	$655,100	$32,900
F-09-00	4	$256,500	$600,000	$565,300	$28,200
F-10-00	2	$201,100	$400,000	$401,400	$18,800
F-11-00	3	$974,000	$900,000	$1,225,300	$42,300
F-12-00	2	$828,700	$800,000	$1,051,000	$37,600
F-12-01	2	$498,200	$600,000	$729,000	$28,200
F-14-01	1	$538,300	$700,000	$818,700	$32,900
F-15-00	4	$279,400	$500,000	$528,000	$23,500
J-01-00	3	$1,662,000	$1,600,000	$2,086,300	$75,200
J-02-00	2	$1,163,700	$700,000	$1,140,700	$32,900
J-02-01	3	$269,400	$400,000	$443,600	$18,800
J-02-02	2	$374,600	$400,000	$512,300	$18,800
J-03-00	4	$334,900	$400,000	$486,000	$18,800
J-04-00	2	$299,200	$500,000	$538,600	$23,500
J-05-00	4	$1,089,400	$900,000	$1,257,100	$42,300
J-05-01	4	$160,600	$200,000	$243,000	$9,400
J-06-00	2	$1,234,100	$1,400,000	$1,685,200	$65,800
J-07-00	2	$1,193,700	$1,500,000	$1,727,400	$70,500
J-07-01	3	$91,000	$200,000	$190,200	$9,400
J-08-00	1	$3,103,900	$3,000,000	$3,844,600	$141,000
J-08-01	3	$150,000	$300,000	$301,200	$14,100
J-08-02	3	$568,100	$1,000,000	$1,061,700	$47,000
J-08-03	3	$422,000	$900,000	$882,000	$42,300
J-09-00	1	$279,000	$600,000	$586,300	$28,200
K-01-01	3	$150,000	$300,000	$295,900	$14,100
K-01-02	3	$208,300	$400,000	$412,000	$18,800
K-02-00	3	$524,700	$1,000,000	$1,003,600	$47,000
K-03-00	2	$1,145,300	$1,100,000	$1,457,700	$51,700
K-03-01	3	$195,400	$400,000	$401,500	$18,800
K-03-02	3	$190,800	$400,000	$390,900	$18,800
K-03-03	2	$335,100	$700,000	$686,600	$32,900
K-03-04	2	$211,100	$400,000	$417,200	$18,800
K-03-05	2	$276,900	$500,000	$528,100	$23,500
K-04-00	2	$185,700	$300,000	$322,200	$14,100
K-05-00	2	$548,600	$700,000	$824,000	$32,900
K-05-01	2	$233,900	$500,000	$491,300	$23,500

Table 5 - Capital Improvement Costs

HCDD#1 MDS Proposed Lateral Channel I.D. Number	Priority Level for Construction	Proposed Lateral Channel			
		Excavation & Seeding Cost	Control Structure Cost	Right-of-way Cost	Annual Maintenance Cost
K-05-02	2	$265,500	$500,000	$517,600	$23,500
K-07-01	1	$179,600	$300,000	$322,100	$14,100
K-07-02	1	$155,500	$300,000	$306,400	$14,100
K-08-00	1	$155,500	$300,000	$306,400	$14,100
L-02-01	2	$149,300	$300,000	$301,100	$14,100
L-03-00	2	$750,300	$1,000,000	$1,156,800	$47,000
L-04-00	2	$232,700	$400,000	$433,100	$18,800
M-01-00	3	$168,300	$300,000	$316,800	$14,100
M-02-00	3	$352,200	$600,000	$633,800	$28,200
M-03-00	3	$543,500	$600,000	$744,900	$28,200
M-04-00	3	$195,000	$300,000	$332,700	$14,100
M-05-00	3	$585,100	$900,000	$987,800	$42,300
M-05-01	3	$237,700	$500,000	$496,500	$23,500
S-01-00	4	$695,800	$1,000,000	$1,119,800	$47,000
S-02-00	3	$448,100	$500,000	$628,500	$23,500
W-01-00	2	$3,471,500	$2,700,000	$3,829,100	$126,900
W-01-01	3	$312,700	$500,000	$538,800	$23,500
W-01-02	2	$148,600	$200,000	$232,400	$9,400
W-01-03	3	$120,000	$300,000	$269,400	$14,100
W-01-04	3	$252,000	$400,000	$443,600	$18,800
W-01-05	3	$304,000	$400,000	$486,000	$18,800
W-02-00	3	$537,100	$700,000	$824,000	$32,900
W-03-00	3	$146,100	$300,000	$301,200	$14,100
W-04-00	3	$344,800	$400,000	$486,000	$18,800
W-05-00	3	$431,000	$500,000	$607,500	$23,500
W-06-00	2	$349,500	$500,000	$565,100	$23,500
W-07-00	2	$303,200	$600,000	$597,000	$28,200
Z-01-00	1	$1,275,500	$2,100,000	$2,244,800	$98,700
Totals:		$37,226,300	$49,600,000	$56,844,000	$2,332,000

EXHIBITS


BROOKS CO.
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STARR CO.
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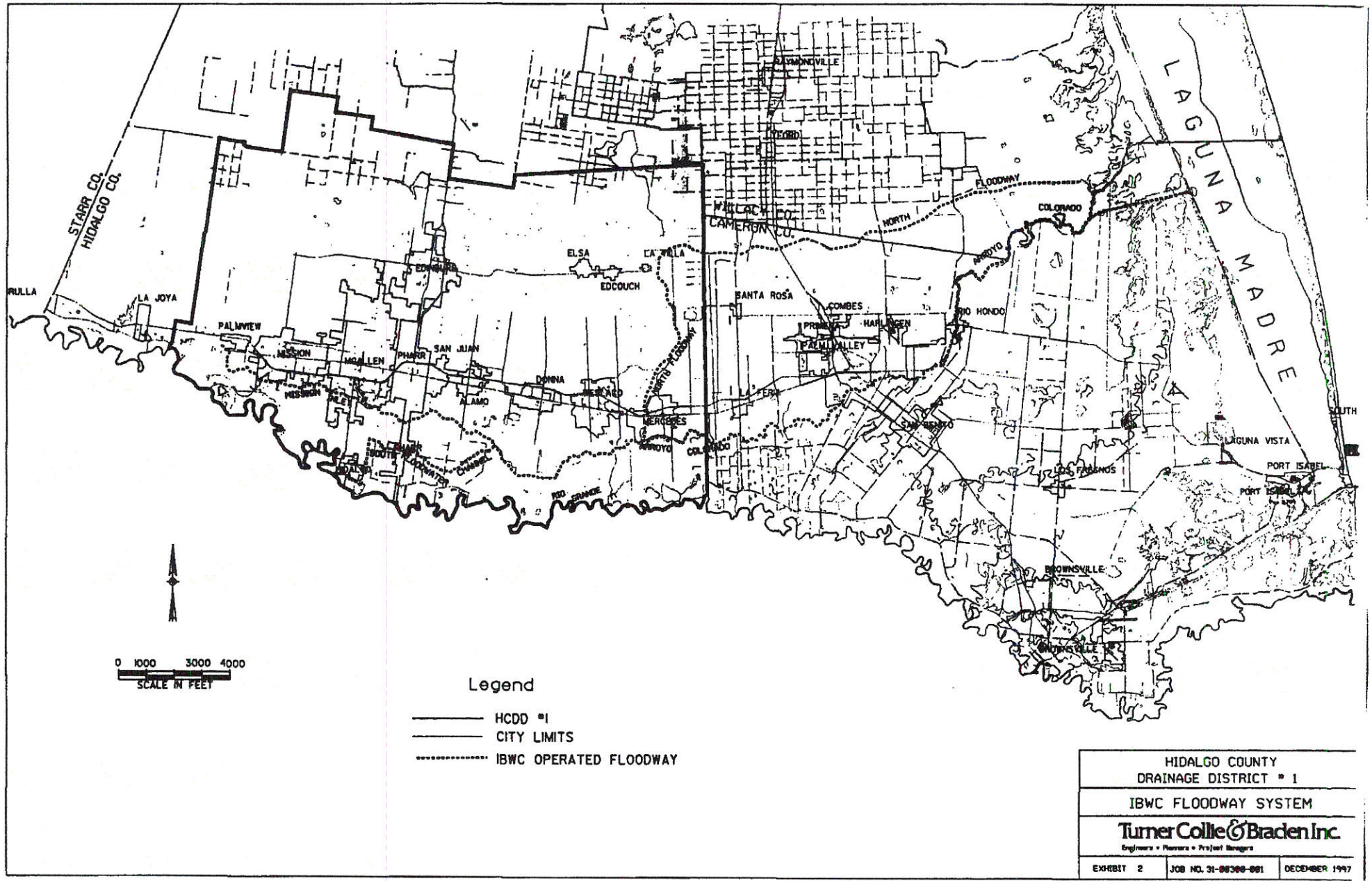
WILLACY CO.
CAMERON CO.
RAYMONDVILLE
LYFORD
GRULLA
LA JOYA
PALMVIEW
MISSION
MCALLEN
PHARR
SAN JUAN
ALAMO
DONNA
MESCAL
EDCOUCH
ELSA
LA VILLA
MERCEDES
HIDALGO
SANTA ROSA
COMBES
PRIMERA
HARLINGEN
RIO HONDO
PALM VALLEY
LA FERIA
SAN BENITO
LOS FRESNOS
BROWNSVILLE
SCALE IN FEET
Legend
EXIST. HCCDC#1 BOUNDARY
MAJOR DRAINAGE WAYS
MAJOR HIGHWAYS
CITY LIMITS
HIDALGO COUNTY
DRAINAGE DISTRICT # 1
DRAINAGE DISTRICT BOUNDARY
Turner Collie & Braden Inc.
EXHIBIT 1
DECEMBER 1997

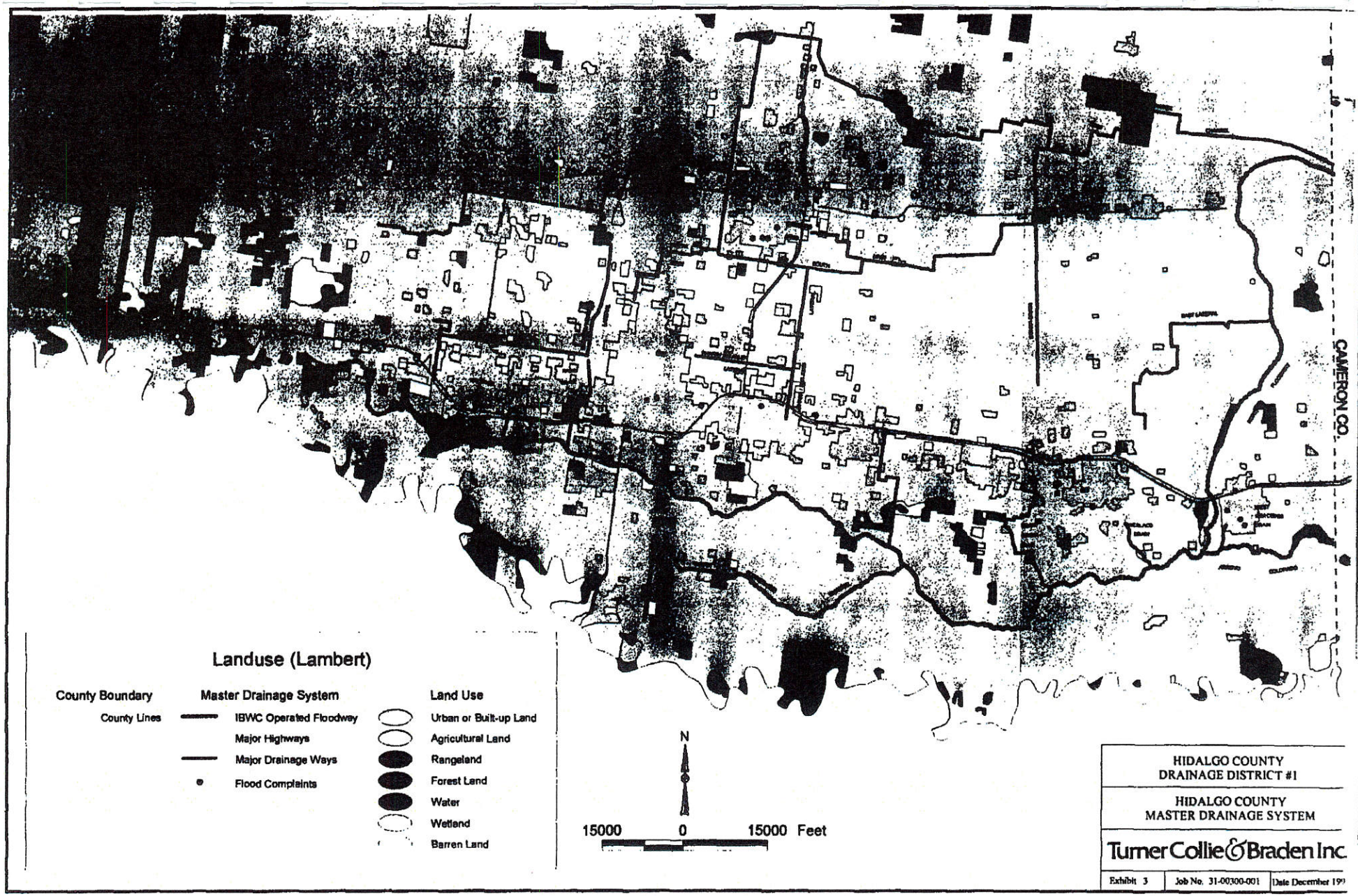


HIDALGO COUNTY
DRAINAGE DISTRICT # 1

IBWC FLOODWAY SYSTEM

Turner Collie & Braden Inc.
Engineers • Planners • Project Managers

EXHIBIT 2	JOB NO. 31-98308-001	DECEMBER 1997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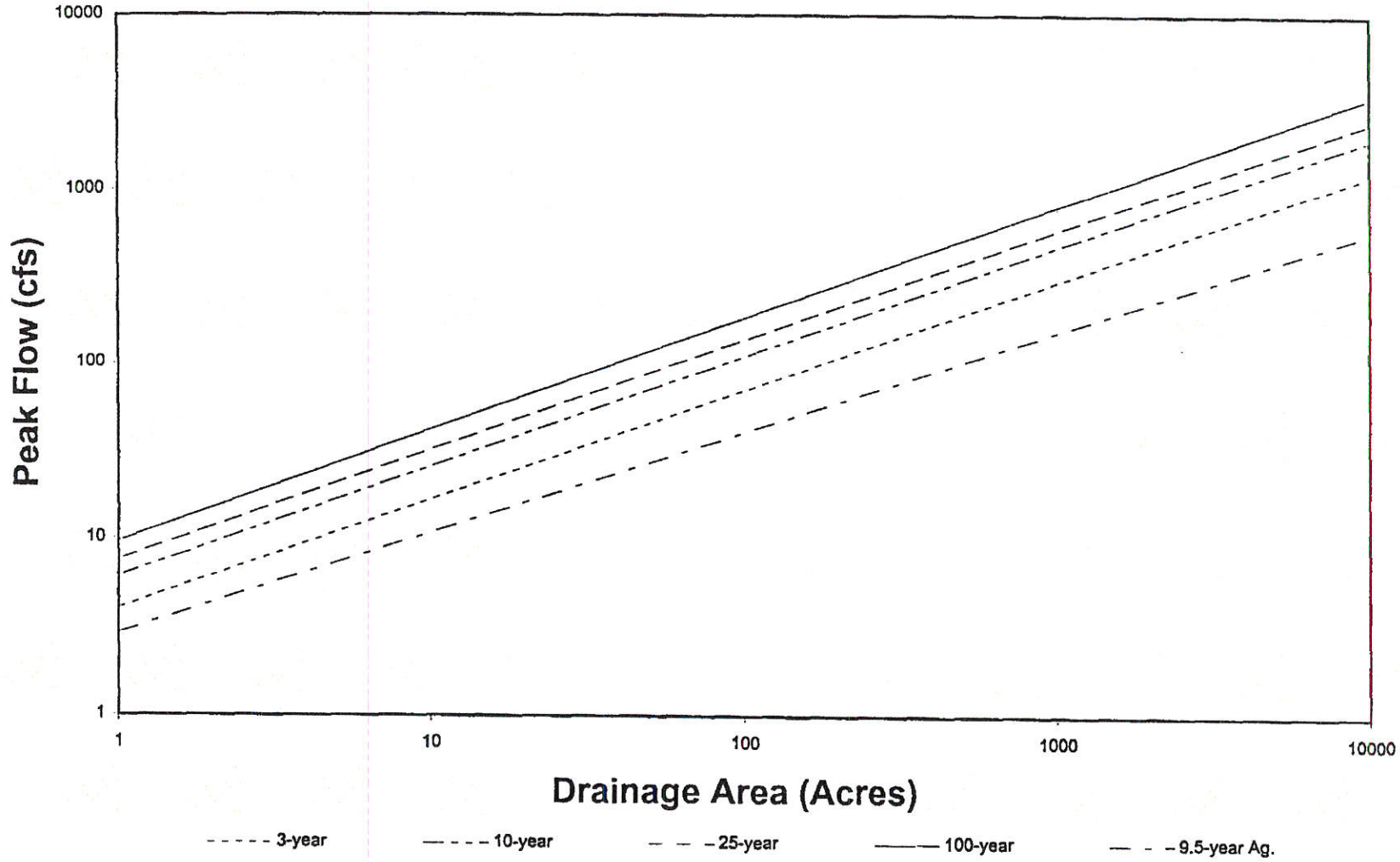
Landuse (Lambert)
County Boundary
County Lines
Master Drainage System
IBWC Operated Floodway
Major Highways
Major Drainage Ways
Flood Complaints
Land Use
Urban or Built-up Land
Agricultural Land
Rangeland
Forest Land
Water
Wetland
Barren Land
N
15000 0 15000 Feet
HIDALGO COUNTY
DRAINAGE DISTRICT #1
HIDALGO COUNTY
MASTER DRAINAGE SYSTEM
Turner Collie & Braden Inc.
Exhibit 3
Job No. 31-00300-001
Date December 19

Exhibit 4 - Hidalgo County Discharge Curves



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«Date»

«ContactName»
«JobTitle»
«CityName»
«CityAddress»
«City», «State» «Zip»

Re: Hidalgo County Drainage District No. 1 Drainage Master Plan
«CityName» Drainage Criteria and Flooding Complaints
Turner Collie & Braden Inc. Job No. 31-00300-001

Dear «Salutation»:

Recently Turner Collie & Braden Inc. has undertaken the project of developing a Master Drainage Plan for Hidalgo County Drainage District No. 1. In part, this project will include: identifying whether or not current design standards for drainage facilities are adequate, creation of a base map of the County drainage network with subareas for design and management purposes, defining the basic channel cross section and right-of-way requirements to allow developments to gain access to the regional drainage system, and to approximate costs associated with the lateral drainage system including a method for implementing the construction program.

To successfully meet the ultimate goals of this project, information pertaining to all cities within Hidalgo County is necessary. Would you please provide to us the following:

Acceptable formats would include an ASCII text file, a database file in a DBF format, or an Excell, Lotus, or Quattro Pro spreadsheet. We can read PC floppy disks, zip disks, 4mm tapes, and 8mm tapes.

We would like to thank you in advance for your assistance in this matter. If you have any questions concerning the information requested please contact Mr. Keith Kindle at (210) 781-6991. Mr. Kindle will contact you within a couple of weeks to follow-up on this request.

Very truly yours,

Mark V. Lowry, P.E.
Sr. Project Manager

Flood victims in Pharr irate

By GILKA ROMERO
The Monitor

LAS MILPAS — Neighborhood residents expressed outrage Thursday about the way Pharr city officials handled the flooding on their street this week.

■ Valley Farmers Smiling — 5A

"We've called and called and the city authorities are not responding," said Maria Garcia, who lives on a cul-de-sac on Veracruz Street. "We haven't had running water for three days."

Gilbert Aguilar, a Pharr city official, said most of the areas in the city have dried up except for Vera-

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Flood

Continued from page one

cruz Street. He plans to drain the street today.

Some of the concerns that Maria Garcia and her husband, Jesus Garcia, had included the well-being of the children who splashed and played in the foul smelling, green-colored water that had traces of gasoline from cars stalling.

"Yuk, ... It stinks," 10-year-old Fernando Garcia said about the standing water that swept into his parents' driveway.

"I just checked outside to make sure none of my children drowned," said Maria Montoya, who lives at the end of the cul-de-sac, where the water accumulated the most.

Flood victims appeared to be most upset that garbage was not picked up and that their mail was not delivered to them for three days.

"It was a lot of water in a short time," Pharr Mayor Victor Garcia said. "We had to pound water out and at the same time work at other places."

Garcia said city crews were having success correcting rain-related problems.

He said Pharr city officials will be traveling to Austin next week to try to get a $22 million grant and a $9 million loan for road work in Las Milpas.

In Donna, American Red Cross officials have sheltered about 50 flood victims at Todd Middle School since Wednesday night. The Red Cross plans to keep the shelter open for a few more days if needed.

"Normally this area has not flooded in the past," said Bob Morton, who is general manager of the Rio Grande Valley chapter of the American Red Cross. "The major problem is that we have to wait for the drainage ditch to drain.

Other cities still fighting flooding Thursday included Weslaco, Elsa and Progreso, Morton said.

Morton said Valley residents can help flood-ravaged families by making contributions to the Red Cross at P.O. Box 250, McAllen, 78501.

National Weather Service forecasters are predicting only a slight chance of rain today.

The forecast calls for partly cloudy skies with highs in the upper 80s. The lows are expected to drop to the low- to mid-50s tonight with a 20 percent chance for rain, NWS meteorologists said.

Cooler temperatures are forecasted for Saturday, when the highs are expected to stay in the lower 60s with a 20 percent chance for rain, NWS meteorologist Greg Flatt said.

Rain causes problems for farmers, but they'll take them

By JEANNE RUSSELL
The Monitor

MONTE ALTO — In this little farm community, a bull's-eye for three recent rainstorms, farmers say too much water beats none.

"We go from one problem to another, don't we?" Aaron Shields said, referring to farmers' struggles against pests and drought during the last four years.

Farmers across the Rio Grande Valley called the week of water a net gain. Yet in the Monte Alto area north of Elsa, a cumulative 15 inches in the last week drowned some seeds.

"There's going to be replanting going on," Shields said.

Still, planting makes up just a tenth of the total cost of growing cotton, the crop most likely damaged by the heavy rains. And without rain, farmers can't make a crop. So few are complaining.

"It's probably going to do more good than harm, although if I had it in my house I probably wouldn't be saying that," Shields said.

On his farms, Shields had planted about half his cotton and 80 percent of his milo, or grain sorghum. He estimates he will replant about half the cotton he planted and about 20 percent of the grain.

Shields figures he may have been ahead of the average grower in already planting 50 percent of his cotton. Melinda Berg, manager of the Elsa Co-op, estimated cotton growers have planted about 20 percent of their cotton so far.

Baby corn and soy beans could have been damaged, but, like sorghum, they are hardier than cotton, Berg said.

"In certain areas, it rained so hard that it washed the seed right out of the dirt," Berg said.

It could take up to 10 days for the land to dry so farmers can get their equipment back in the fields, pushing them up against a March 31 cotton planting deadline.

"They're going to be very busy once the water dries out," Berg said.

But better busy than dry.

"Some of the crops that were already planted will have to be replanted, but the benefits of the rain far outweigh the costs of replanting," she said.

Clogged drainage system partly blamed for flooding

By KIMBERLY DURNAN
The Monitor

EDINBURG — Refrigerators, couches, bottles and diapers dumped into drainage ditches doubled this week's flooding problems, Hidalgo County officials said Thursday.

"First of all there's a lot of water," Hidalgo County Judge J. Edgar Ruiz said. "Then we have a problem with people throwing a lot of trash into our main drains. Then there are subdivisions that should never have been developed because they are in low areas."

County commissioners are responsible for maintaining the county drainage systems in their own districts, Ruiz said.

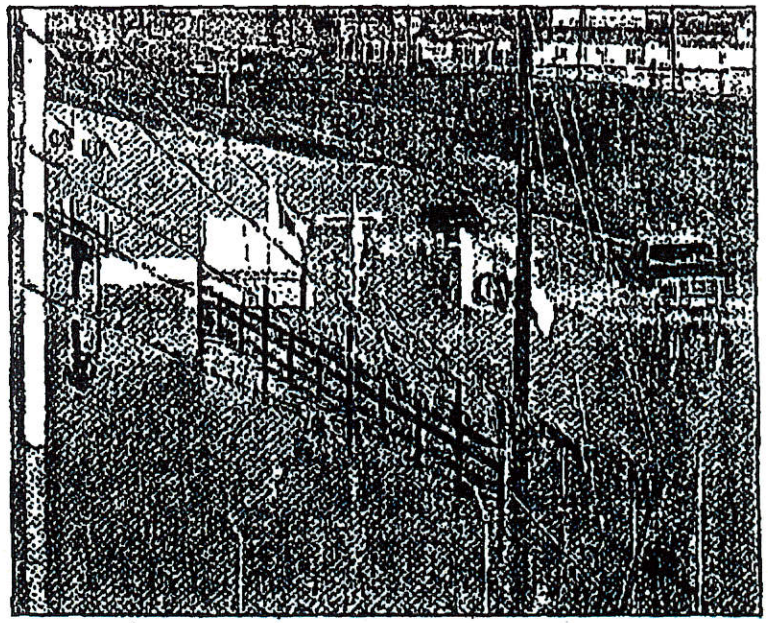
"It's been improperly maintained," Ruiz said. "There is no way out of that. They should have a crew on that constantly."

Precinct 1 Commissioner Sylvia Handy has seen firsthand what clogged drainage systems can do.

Since heavy rains fell earlier this week, precinct workers have cleared drains and relocated about 50 families to temporary shelters. Some areas near Donna, Progreso, Monte Alto and northern Weslaco received more than 7 inches of rain.

The commissioner blamed some of the flooding on the amount of rainfall and the need for an improved drainage system.

See DRAINS page 5A



Delcia Lopez / The Monitor

Still Standing: Vehicles crawl through floodwater still standing on the frontage road of Expressway 83 Thursday in Donna. Clogged drain pipes in several areas of Hidalgo County contributed to the flooding.

Drains

Continued from page one

"We need to replace some of the pipes where population has increased," Handy said. "(The pipes) need to be bigger so more water will flow through."

Meanwhile, ditches need better maintenance and county residents need to help keep their drains clean, Handy said.

"This has really opened their eyes," Handy said. "They know they are suffering because they didn't take preventative measures."

Commissioner Lupe Garces said he agreed county residents should take some responsibility and help maintain drainage ditches.

"It's improper dumping," he said. "We have a big trash bin for people to use. We are trying to make it convenient for them to dump."

Commissioners say they now plan to control subdivisions more strictly and make developers provide adequate drainage.

"We've got to stop approving subdivisions in flood-prone areas," Ruiz said. "Engineers (for developers) come to us and say they can install systems to drain the water, but then they just don't work."

Ruiz said he wants to make it mandatory for developers to use underground pipes to drain water, or a proper surface drain connected to a main county ditch.

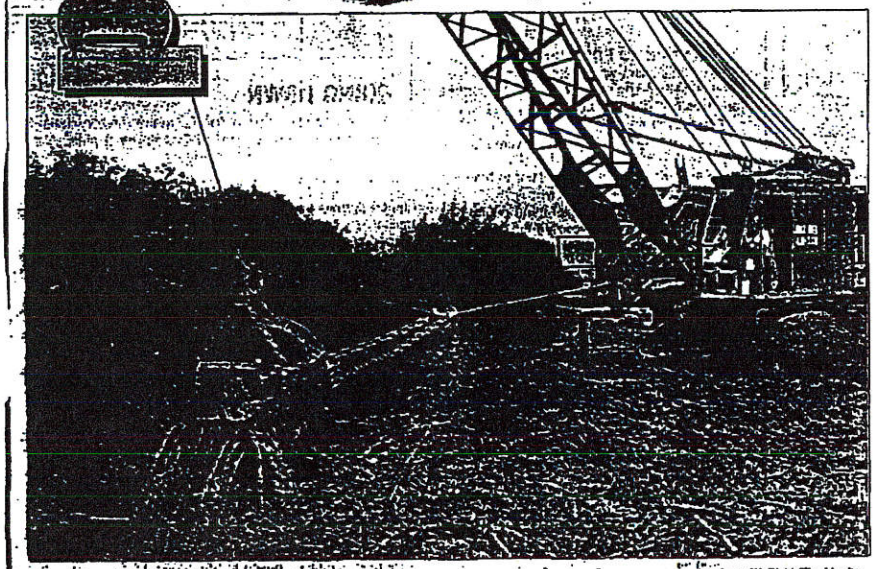
Some older subdivisions or colonias were developed years ago and traditionally flood, Garces said.

And, of course, everyone blamed the rain.

"It's too much water in a short period time," Commissioner Lalo Arcaute said. "There is no drainage system that can get rid of that amount of water."

pipe dreams

The Monitor
11-16-97



Larry W. Clubb/The Monitor

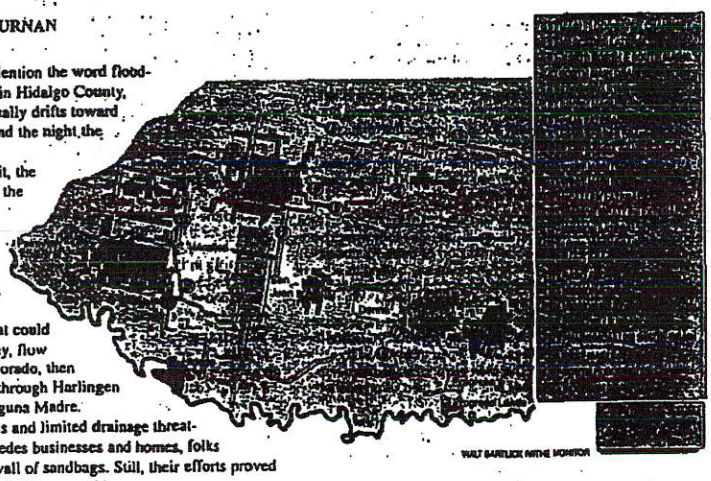
Drain Strain: A dragline operator cleans a county drainage ditch recently north of Donna. The cleaning is part of an ongoing operation by Hidalgo County to improve its drainage system, which is pressed to keep up with a booming population and inherent problems caused by the flatness of the region.

Growth swamping county's drainage system; problem is persistent, answer expensive

By KIMBERLY DURNAN
The Monitor

MERCEDES – Mention the word flooding to some people in Hidalgo County, and the topic eventually drifts toward Hurricane Beulah and the night the dam exploded.

As local lore has it, the time was 1967, and the weir dam in the floodway at Farm-to-Market Road 1015 in Weslaco did its job – at first. It monitored the amount of water that could leave the Mid-Valley, flow into the Arroyo Colorado, then move downstream through Harlingen and out into the Laguna Madre.



WALT BARTLICK IN THE MONITOR

But as heavy rains and limited drainage threatened to flood Mercedes businesses and homes, folks there built a huge wall of sandbags. Still, their efforts proved futile against Beulah's bluster and brawn.

"All of a sudden, the weir dam exploded," recalled Anthony Covacevich, now Urban County director. "It benefited Mercedes, but flooded Harlingen's upscale Treasure Hills area."

Many only half-jokingly speculate Mercedes businessmen blasted the dam with dynamite.

"Some people have taken the secret to their graves," Covacevich said.

The tale underscores the value of drainage in an area increasingly burdened by audacious growth and forever cursed with low-lying land, some of it below sea level.

Farmland that once absorbed excess water into thirsty soil rapidly is giving way to new businesses, expanding neighborhoods and more concrete, and that means the county could be in over its head.

Although the current drainage system was completed in 1993, engineers designed the plan in the post-Beulah 1960s, without foresight of the Valley's future growing pains, said Godfrey Garza, director of Hidalgo County Drainage District No. 1.

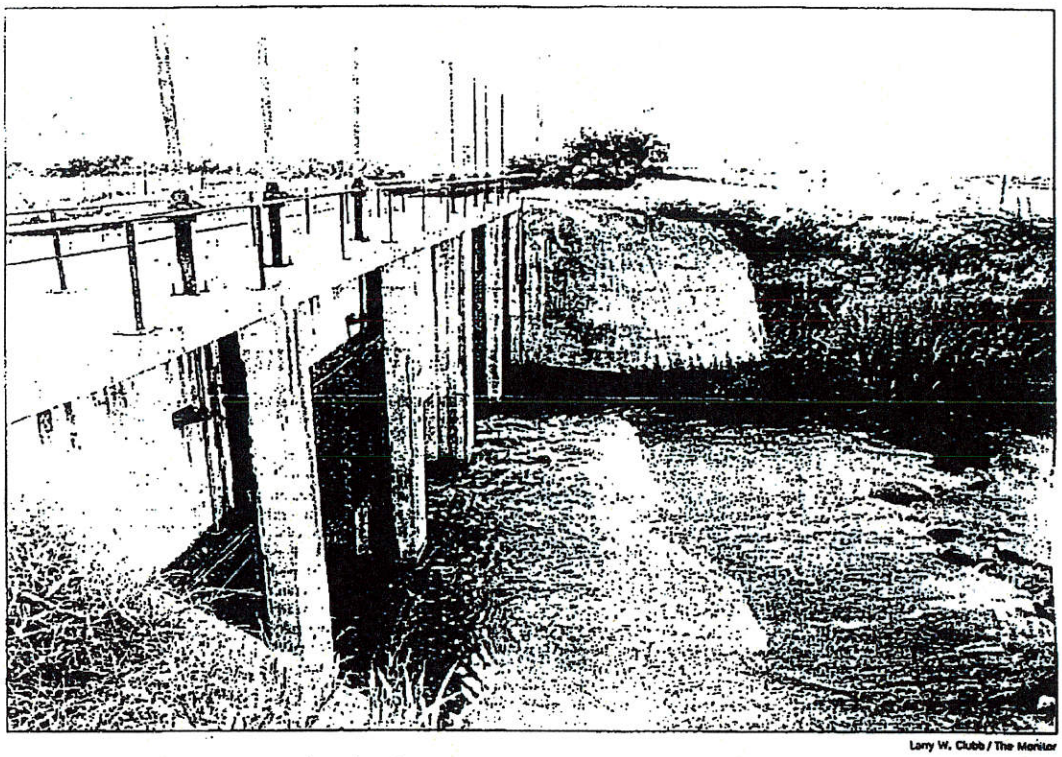
"The growth in Hidalgo County is predicted to double by the year 2010," Garza said. "Our system is based on agriculture."

The master drainage plan has worked as expected, so far

See PIPE page 9A

C. Garza
A. Patak
R. Saucedo

Pipe Continued from page one



Larry W. Clubb / The Monitor

Drainage Control: Water flows through a control structure recently along the drainage system in eastern Hidalgo County.

but it has yet to be tested by serious flood storms because the Valley has been in a 10-year drought, said Vona Walker, right-of-way manager for the county.

A dream system — one that could drain a hurricane — would cost the county $160 million, not including the cost of buying right-of-way property to expand drainage ditches, Walker said.

The estimate comes courtesy of the U.S. Army Corps of Engineers, and does not include the $440 million the Corps would chip in for construction.

That's a lot of money for a county with a total annual budget of $67 million and an average per capita income of $10,000, about $8,000 below the state average.

Until the big-picture solution becomes more affordable, county officials are having to bail water with a bucket — they clean ditches, take over private drainage canals and build small tributaries to the master drainage canal, hoping to alleviate pockets of flooding across the county with each hard, fast rain.

In a colonia named Barbosa-Lopez, north of Weslaco, residents want their area to be more aggressive in eliminating their frequent flooding problems.

When Tranquilino Piñeda moved into the neighborhood 17 years ago, his was the only house. Now, the colonia has about 200 dwellings. Two nearby colonias mean an additional 300 houses in the area, all of which increases the need for better drainage.

Piñeda and his neighbors have found their own stop-gap solution.

"We try to make the drainage work by pulling out the bottles, cans and papers out of the pipes," he said. "Sometimes, the water doesn't move quickly, even with a light rain. Every time it rains a couple of inches, it floods."

When that doesn't work, they dig trenches to the main drainage ditch in their area.

County officials already have targeted the area for drainage improvements, and say they plan to start building more drainage ditches there by the beginning of the year. They understand how frustrated the residents are, they say, and are trying to stop the flooding, but the drainage infrastructure was not in place when the colonia was built.

Because the problem is so widespread, county officials said, they are working on a seven-year plan to clean the 360 miles of existing ditches, some of which are new to the system and formerly owned by irrigation districts or farmers.

"It's being addressed in a systematic manner," Garza said. "The Valley is growing so rapidly, it's a chain effect."

Weslaco Mayor Gene Braught said he has seen some of those county improvements. In the past, he said, Weslaco's 54-inch pipes drained into 32-inch county pipes. That caused water to back up in the city, flooding colonias and more upscale neighborhoods alike.

"All that's changing; we are getting good cooperation," Braught said. "They've done quite a bit of work with drain lines into the floodway."

With expensive costs for elaborate drainage systems, and the region's low, flat land, drainage always will be a concern, he said. And, as in Weslaco's case, taxpayers often have to absorb the costs.

"Drainage is a very expensive project and nobody wants their taxes raised," Braught said. "A hurricane would hurt us, sure. Anytime we get a heavy storm, we are going to be hurt by it, and we have to handle it the best we can with emergency crews."

One solution for new neighborhoods includes building a holding pond for the lowest-lying areas of the city.

"Even the engineers are trying to figure out what to do," Braught said. "Every Valley town has flooding problems."

But Valley cities generally operate more sophisticated drainage systems paid for by stronger tax bases. The county struggles with a smaller, poorer tax base and has less money to provide drainage services. However, it also faces heavier growth than most cities, from new neighborhoods — especially colonias — that contribute little to the tax base.

To buy a home, you generally need a federally protected loan from a bank, and houses bought with federal loans require flood insurance. But many of the new housing developments are poor, even substandard, and are built without federal loans, said Neil King, a partner in the firm Shepard, Walton, King Insurance Company.

"Apparently, the Commissioners Court is allowing people to develop in very flood-prone areas," King said. "It seems like every year we have more flooding because low-income housing is going into areas subject to flooding.

"I don't see these people buying more insurance. Maybe they can't afford it."

But Garza, the county drainage district director, said the county checks subdivisions and new development as best as it can, given limited staff and resources.

Experts say the benefit of insurance is that it requires homeowners and builders to elevate the house to a level that is least likely to flood. Insurance also pays the individual homeowner more money than disaster relief funds.

King, the flood insurance expert, advises property shoppers looking to stay high and dry to head for McAllen, Mission and Edinburg, because those cities have the most efficient drainage systems.

Garza agreed McAllen has good drainage — despite its own problem pockets of flooding — and advises other cities to follow suit.

"McAllen has been the most progressive," he said. "They eliminate flooding with holding ponds. I wish all cities would do that."

Hidalgo County Drainage District #1
Contract No. 97-483-216

The following maps are not attached to this report. Due to their size, they could not be copied. They are located in the official file and may be copied upon request.

Proposed Laterals for HCMDS and Drainage Area Map
Exhibit 5
Job No. 31-00300-001
December 1997

Proposed Laterals for HCMDS
Exhibit 6
Job 31-00300-001
December 1997

Please contact Research and Planning Fund Grants Management Division at (512) 463-7926 for copies.

APPENDIX C

L&G Engineering
Transportation Consulting Engineers

GEOPAK STORM DRAIN CONFIGURATION SUMMARY

	Upstream	Downstream									Upstream	Downstream
ID	ID	ID	Discharge	Length	Shape	#	Rise	Span	n	Slope	Invert	Invert
LA-7	A-7	OUT-A	123.460	90.878	Circul	1	5.000	n/a	0.012	0.250	124.193	123.961
LA-6	A-6	A-7	123.460	563...	Circul	1	5.000	n/a	0.012	0.250	125.611	124.193
LA-5	A-5	A-6	123.460	599...	Circul	1	5.000	n/a	0.012	0.250	127.121	125.611
LA-4	A-4	A-5	123.460	88.572	Circul	1	5.000	n/a	0.012	0.250	127.353	127.121
LA-3	A-3	A-4	123.460	699...	Circul	1	5.000	n/a	0.012	0.250	129.111	127.353
LA-2	A-2	A-3	123.460	696...	Circul	1	5.000	n/a	0.012	0.250	130.861	129.111
LA-1	A-1	A-2	10.760	56.000	Circul	1	2.000	n/a	0.012	0.250	134.011	133.861

GEOPAK STORM DRAIN CONFIGURATION SUMMARY

1

	Upstream	Downstream	Upstream	Downstream					Uniform		Actual	
ID	ID	ID	HGL	HGL	Discharge	Capacity	Slope	Loss	Velocity	Depth	Velocity	Depth
LA-7	A-7	OUT-A	127.662	127.138	123.460	151.753	0.243	0.000	8.000	3.667	9.380	3.177
LA-6	A-6	A-7	129.225	127.662	123.460	151.753	0.243	0.000	8.000	3.667	8.494	3.468
LA-5	A-5	A-6	130.743	129.225	123.460	151.753	0.243	0.000	8.000	3.667	8.126	3.613
LA-4	A-4	A-5	130.975	130.743	123.460	151.753	0.243	0.000	8.000	3.667	8.104	3.622
LA-3	A-3	A-4	132.734	130.975	123.460	151.753	0.243	0.000	8.000	3.667	8.104	3.622
LA-2	A-2	A-3	134.484	132.734	123.460	151.753	0.243	0.000	8.000	3.667	8.102	3.623
LA-1	A-1	A-2	135.798	135.037	10.760	13.181	0.245	0.000	4.358	1.467	5.602	1.176

APPENDIX D

L&G Engineering
Transportation Consulting Engineers

100-YR STORM WITH NO RESTRICTOR ANALYSIS

Plan: Plan 08 FM 676 OUTFALL 2 RS: 12 Profile: 100 YR

E.G. Elev (ft)	123.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.035	
W.S. Elev (ft)	123.04	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		107.51	
E.G. Slope (ft/ft)	0.001316	Area (sq ft)		107.51	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	37.28	Top Width (ft)		37.28	
Vel Total (ft/s)	3.04	Avg. Vel. (ft/s)		3.04	
Max Chl Dpth (ft)	4.55	Hydr. Depth (ft)		2.88	
Conv. Total (cfs)	9010.4	Conv. (cfs)		9010.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		38.76	
Min Ch El (ft)	118.49	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)		3.62	
C & E Loss (ft)	0.00	Cum SA (acres)		1.33	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 11 Profile: 100 YR

E.G. Elev (ft)	123.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.035	
W.S. Elev (ft)	122.90	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		106.09	
E.G. Slope (ft/ft)	0.001364	Area (sq ft)		106.09	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	37.05	Top Width (ft)		37.05	
Vel Total (ft/s)	3.08	Avg. Vel. (ft/s)		3.08	
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)		2.86	
Conv. Total (cfs)	8849.5	Conv. (cfs)		8849.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		38.52	
Min Ch El (ft)	118.39	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)		3.38	
C & E Loss (ft)	0.00	Cum SA (acres)		1.25	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 10 Profile: 100 YR

E.G. Elev (ft)	122.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.035	
W.S. Elev (ft)	122.75	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		104.44	
E.G. Slope (ft/ft)	0.001423	Area (sq ft)		104.44	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	36.79	Top Width (ft)		36.79	
Vel Total (ft/s)	3.13	Avg. Vel. (ft/s)		3.13	
Max Chl Dpth (ft)	4.46	Hydr. Depth (ft)		2.84	
Conv. Total (cfs)	8664.4	Conv. (cfs)		8664.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		38.24	
Min Ch El (ft)	118.29	Shear (lb/sq ft)		0.24	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)		3.14	
C & E Loss (ft)	0.00	Cum SA (acres)		1.16	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 9 Profile: 100 YR

E.G. Elev (ft)	122.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.035	
W.S. Elev (ft)	122.60	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		102.53	
E.G. Slope (ft/ft)	0.001496	Area (sq ft)		102.53	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	36.47	Top Width (ft)		36.47	
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)		3.19	
Max Chl Dpth (ft)	4.41	Hydr. Depth (ft)		2.81	
Conv. Total (cfs)	8450.0	Conv. (cfs)		8450.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		37.91	
Min Ch El (ft)	118.19	Shear (lb/sq ft)		0.25	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)		2.90	
C & E Loss (ft)	0.00	Cum SA (acres)		1.08	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 8 Profile: 100 YR

E.G. Elev (ft)	122.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.035	
W.S. Elev (ft)	122.44	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		100.27	
E.G. Slope (ft/ft)	0.001589	Area (sq ft)		100.27	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	36.10	Top Width (ft)		36.10	
Vel Total (ft/s)	3.26	Avg. Vel. (ft/s)		3.26	
Max Chl Dpth (ft)	4.35	Hydr. Depth (ft)		2.78	
Conv. Total (cfs)	8199.3	Conv. (cfs)		8199.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		37.51	
Min Ch El (ft)	118.09	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)		2.67	
C & E Loss (ft)	0.00	Cum SA (acres)		0.99	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 7 Profile: 100 YR

E.G. Elev (ft)	122.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.035	
W.S. Elev (ft)	122.26	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		97.57	
E.G. Slope (ft/ft)	0.001711	Area (sq ft)		97.57	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	35.65	Top Width (ft)		35.65	
Vel Total (ft/s)	3.35	Avg. Vel. (ft/s)		3.35	
Max Chl Dpth (ft)	4.27	Hydr. Depth (ft)		2.74	
Conv. Total (cfs)	7901.9	Conv. (cfs)		7901.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		37.04	
Min Ch El (ft)	117.99	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)		2.44	
C & E Loss (ft)	0.00	Cum SA (acres)		0.91	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 6 Profile: 100 YR

E.G. Elev (ft)	122.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.035	
W.S. Elev (ft)	122.07	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		94.28	
E.G. Slope (ft/ft)	0.001878	Area (sq ft)		94.28	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	35.09	Top Width (ft)		35.09	
Vel Total (ft/s)	3.47	Avg. Vel. (ft/s)		3.47	
Max Chl Dpth (ft)	4.18	Hydr. Depth (ft)		2.69	
Conv. Total (cfs)	7542.8	Conv. (cfs)		7542.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		36.45	
Min Ch El (ft)	117.89	Shear (lb/sq ft)		0.30	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)		2.22	
C & E Loss (ft)	0.00	Cum SA (acres)		0.83	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 5 Profile: 100 YR

E.G. Elev (ft)	122.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.035	
W.S. Elev (ft)	121.85	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		90.16	
E.G. Slope (ft/ft)	0.002120	Area (sq ft)		90.16	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	34.38	Top Width (ft)		34.38	
Vel Total (ft/s)	3.63	Avg. Vel. (ft/s)		3.63	
Max Chl Dpth (ft)	4.06	Hydr. Depth (ft)		2.62	
Conv. Total (cfs)	7098.8	Conv. (cfs)		7098.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		35.70	
Min Ch El (ft)	117.79	Shear (lb/sq ft)		0.33	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)		2.01	
C & E Loss (ft)	0.00	Cum SA (acres)		0.75	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 4 Profile: 100 YR

E.G. Elev (ft)	121.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.035	
W.S. Elev (ft)	121.59	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		84.72	
E.G. Slope (ft/ft)	0.002510	Area (sq ft)		84.72	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	33.42	Top Width (ft)		33.42	
Vel Total (ft/s)	3.86	Avg. Vel. (ft/s)		3.86	
Max Chl Dpth (ft)	3.90	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	6524.2	Conv. (cfs)		6524.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		34.68	
Min Ch El (ft)	117.69	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)		1.81	
C & E Loss (ft)	0.00	Cum SA (acres)		0.67	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 3 Profile: 100 YR

E.G. Elev (ft)	121.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.035	
W.S. Elev (ft)	121.25	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		76.89	
E.G. Slope (ft/ft)	0.003267	Area (sq ft)		76.89	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	31.98	Top Width (ft)		31.98	
Vel Total (ft/s)	4.25	Avg. Vel. (ft/s)		4.25	
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)		2.40	
Conv. Total (cfs)	5718.0	Conv. (cfs)		5718.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		33.17	
Min Ch El (ft)	117.59	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)		1.62	
C & E Loss (ft)	0.02	Cum SA (acres)		0.60	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 2 Profile: 100 YR

E.G. Elev (ft)	121.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.035	
W.S. Elev (ft)	120.64	Reach Len. (ft)	24.46	24.46	24.46
Crit W.S. (ft)	119.97	Flow Area (sq ft)		61.36	
E.G. Slope (ft/ft)	0.006048	Area (sq ft)		61.36	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	28.92	Top Width (ft)		28.92	
Vel Total (ft/s)	5.33	Avg. Vel. (ft/s)		5.33	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		2.12	
Conv. Total (cfs)	4202.5	Conv. (cfs)		4202.5	
Length Wtd. (ft)	24.46	Wetted Per. (ft)		29.94	
Min Ch El (ft)	117.49	Shear (lb/sq ft)		0.77	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)		1.46	
C & E Loss (ft)	0.04	Cum SA (acres)		0.53	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 1.3 Profile: 100 YR

E.G. Elev (ft)	120.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.		0.035	
W.S. Elev (ft)	119.94	Reach Len. (ft)	229.03	229.09	229.09
Crit W.S. (ft)	119.94	Flow Area (sq ft)		43.55	
E.G. Slope (ft/ft)	0.015516	Area (sq ft)		43.55	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	24.95	Top Width (ft)		24.95	
Vel Total (ft/s)	7.50	Avg. Vel. (ft/s)		7.50	
Max Chl Dpth (ft)	2.49	Hydr. Depth (ft)		1.75	
Conv. Total (cfs)	2623.9	Conv. (cfs)		2623.9	
Length Wtd. (ft)	229.09	Wetted Per. (ft)		25.76	
Min Ch El (ft)	117.45	Shear (lb/sq ft)		1.64	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.50	Cum Volume (acre-ft)		1.43	
C & E Loss (ft)	0.24	Cum SA (acres)		0.51	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 1.1 Profile: 100 YR

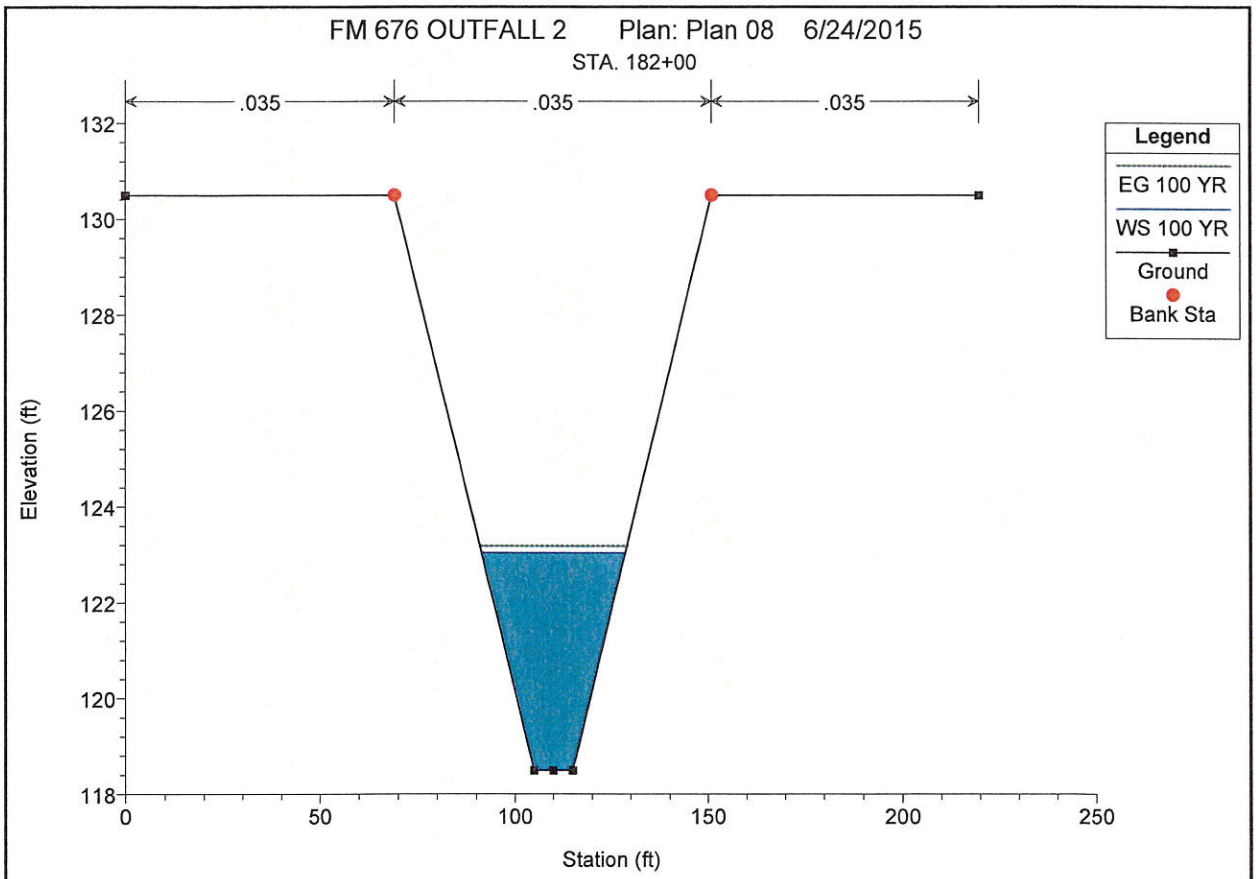
E.G. Elev (ft)	119.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.035	
W.S. Elev (ft)	119.11	Reach Len. (ft)	296.45	296.45	296.45
Crit W.S. (ft)	117.08	Flow Area (sq ft)		134.91	
E.G. Slope (ft/ft)	0.000827	Area (sq ft)		134.91	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	46.86	Top Width (ft)		46.86	
Vel Total (ft/s)	2.42	Avg. Vel. (ft/s)		2.42	
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)		2.88	
Conv. Total (cfs)	11364.5	Conv. (cfs)		11364.5	
Length Wtd. (ft)	296.45	Wetted Per. (ft)		48.27	
Min Ch El (ft)	115.60	Shear (lb/sq ft)		0.14	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)		0.96	
C & E Loss (ft)	0.00	Cum SA (acres)		0.32	

Plan: Plan 08 FM 676 OUTFALL 2 RS: 1 Profile: 100 YR

E.G. Elev (ft)	118.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.035	
W.S. Elev (ft)	118.91	Reach Len. (ft)			
Crit W.S. (ft)	116.60	Flow Area (sq ft)		148.12	
E.G. Slope (ft/ft)	0.000630	Area (sq ft)		148.12	
Q Total (cfs)	326.84	Flow (cfs)		326.84	
Top Width (ft)	48.20	Top Width (ft)		48.20	
Vel Total (ft/s)	2.21	Avg. Vel. (ft/s)		2.21	
Max Chl Dpth (ft)	3.79	Hydr. Depth (ft)		3.07	
Conv. Total (cfs)	13019.2	Conv. (cfs)		13019.2	
Length Wtd. (ft)		Wetted Per. (ft)		49.72	
Min Ch El (ft)	115.12	Shear (lb/sq ft)		0.12	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS Plan: Plan 08 River: FM 676 Reach: OUTFALL 2 Profile: 100 YR

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)	
OUTFALL 2	12	100 YR	326.84	118.49	123.04		123.18	0.001316	3.04	107.51	37.28	0.32
OUTFALL 2	11	100 YR	326.84	118.39	122.90		123.05	0.001364	3.08	106.09	37.05	0.32
OUTFALL 2	10	100 YR	326.84	118.29	122.75		122.91	0.001423	3.13	104.44	36.79	0.33
OUTFALL 2	9	100 YR	326.84	118.19	122.60		122.76	0.001496	3.19	102.53	36.47	0.34
OUTFALL 2	8	100 YR	326.84	118.09	122.44		122.61	0.001589	3.26	100.27	36.10	0.34
OUTFALL 2	7	100 YR	326.84	117.99	122.26		122.44	0.001711	3.35	97.57	35.65	0.36
OUTFALL 2	6	100 YR	326.84	117.89	122.07		122.26	0.001878	3.47	94.28	35.09	0.37
OUTFALL 2	5	100 YR	326.84	117.79	121.85		122.06	0.002120	3.63	90.16	34.38	0.39
OUTFALL 2	4	100 YR	326.84	117.69	121.59		121.82	0.002510	3.86	84.72	33.42	0.43
OUTFALL 2	3	100 YR	326.84	117.59	121.25		121.53	0.003267	4.25	76.89	31.98	0.48
OUTFALL 2	2	100 YR	326.84	117.49	120.64	119.97	121.08	0.006048	5.33	61.36	28.92	0.64
OUTFALL 2	1.3	100 YR	326.84	117.45	119.94	119.94	120.82	0.015516	7.50	43.55	24.95	1.00
OUTFALL 2	1.1	100 YR	326.84	115.60	119.11	117.08	119.20	0.000827	2.42	134.91	46.86	0.25
OUTFALL 2	1	100 YR	326.84	115.12	118.91	116.60	118.99	0.000630	2.21	148.12	48.20	0.22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STA. 182+00
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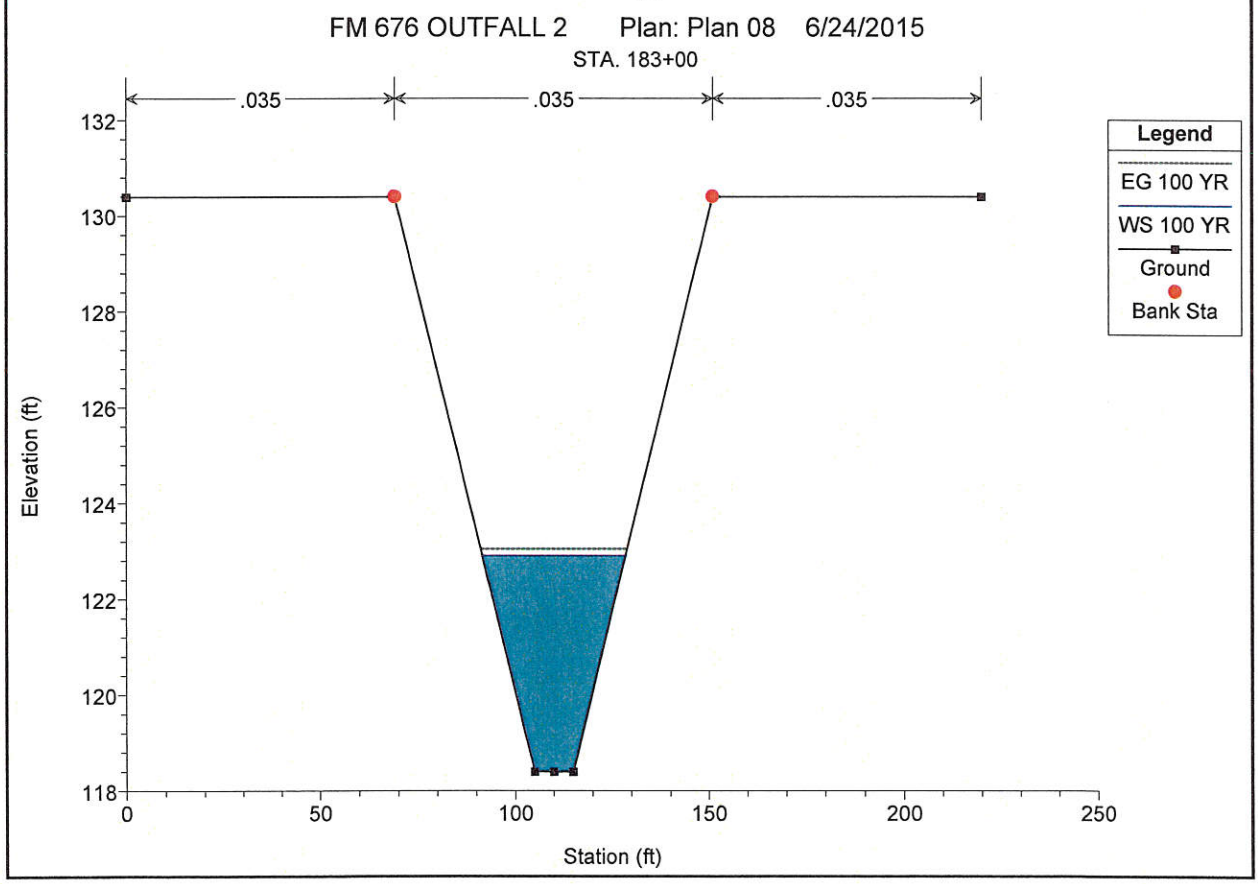
.035
.035
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
132
130
128
126
124
122
120
118
0
50
100
150
200
250
Station (ft)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Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
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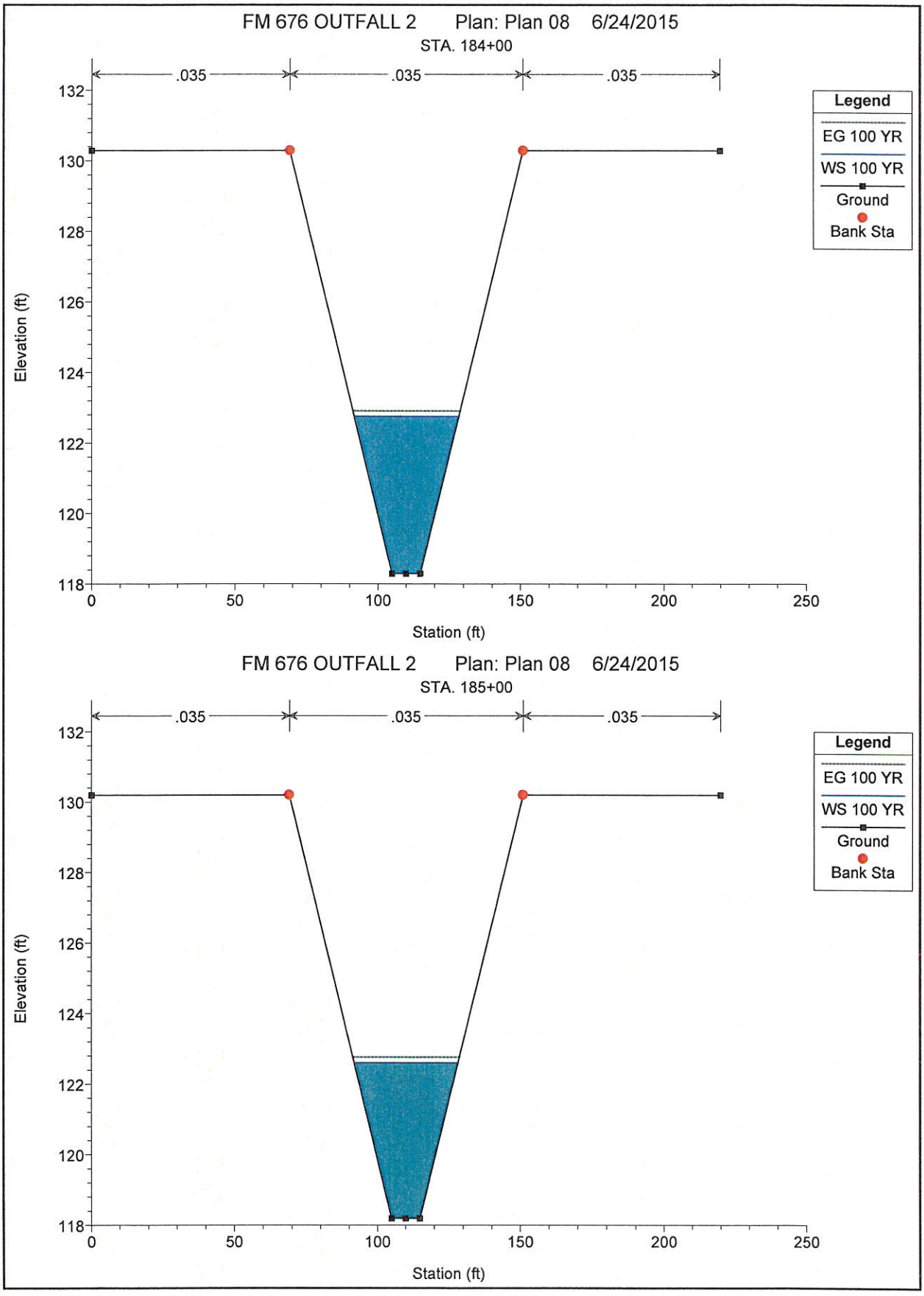
132
130
128
126
124
122
120
118
0
50
100
150
200
250
Station (ft)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Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
FM 676 OUTFALL 2 Plan: Plan 08 6/24/2015
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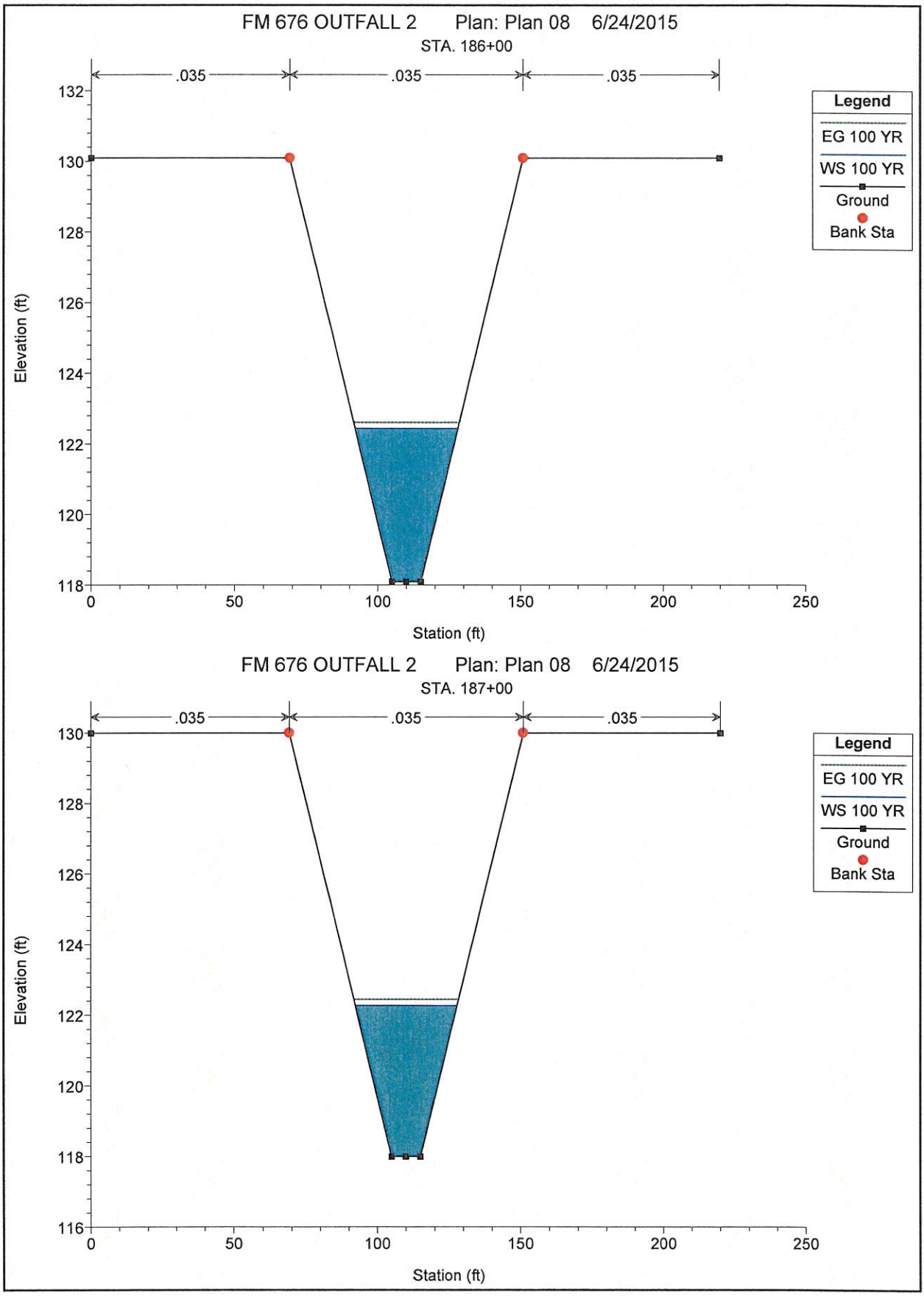
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
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WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
FM 676 OUTFALL 2 Plan: Plan 08 6/24/2015
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Legend
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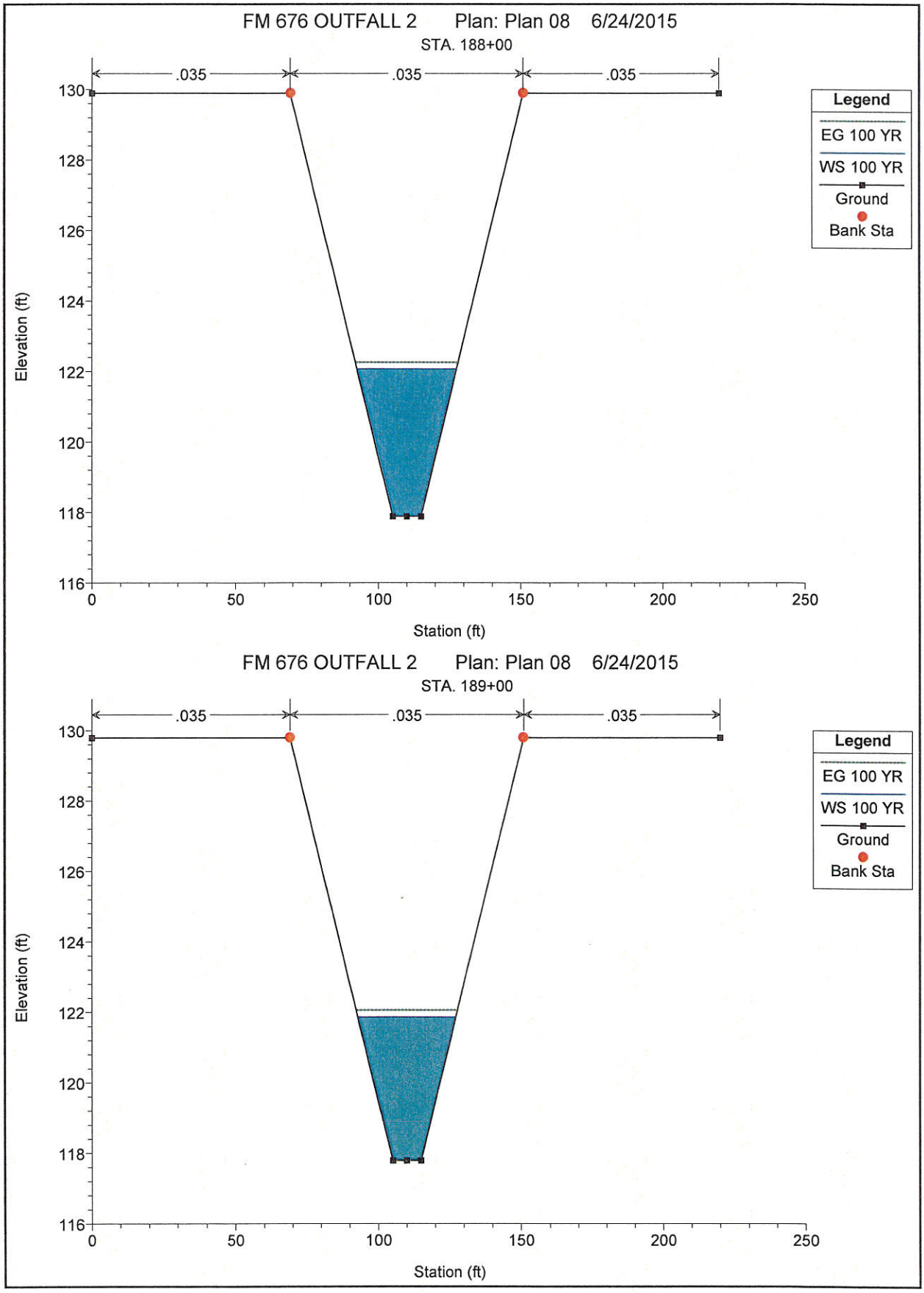
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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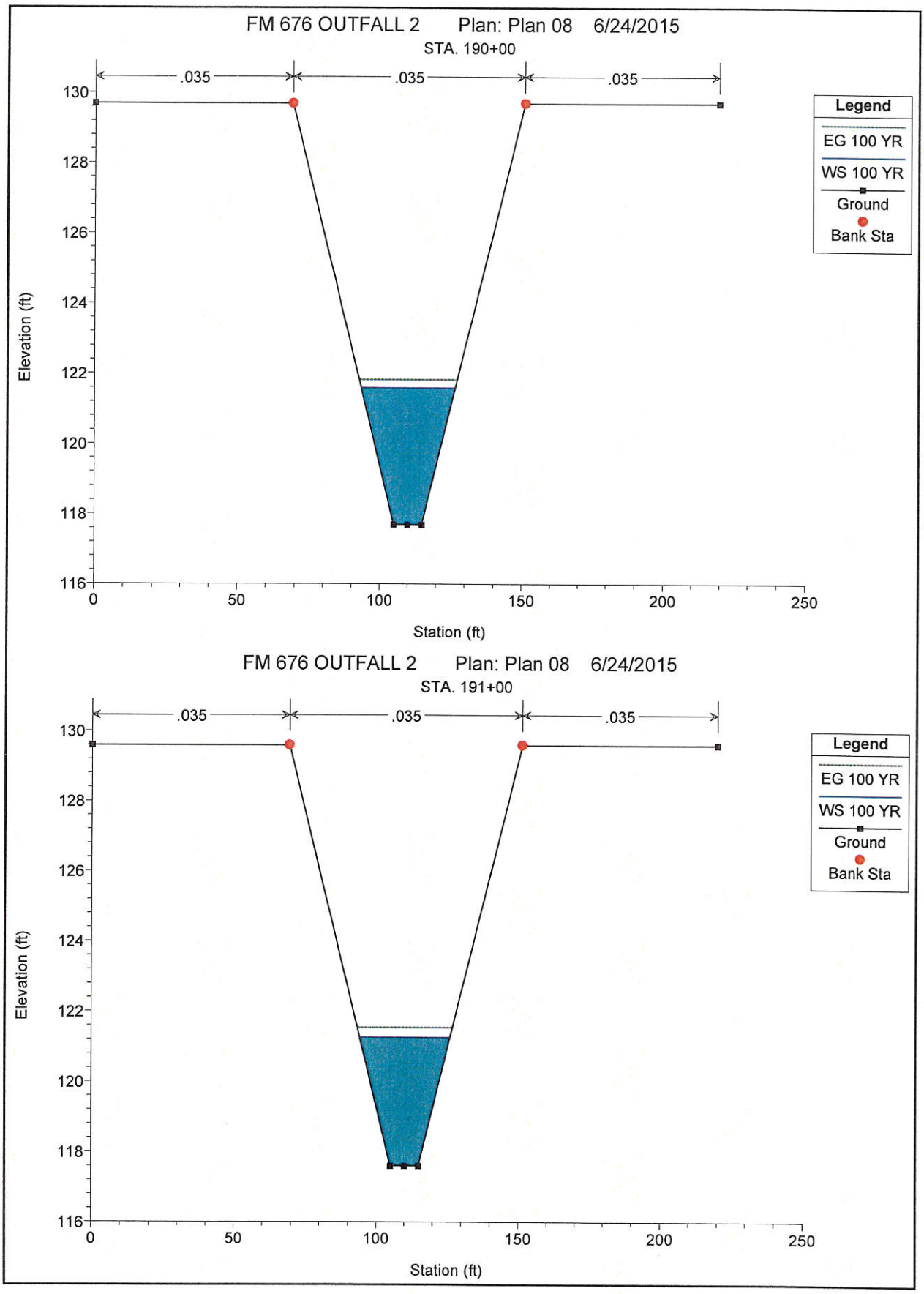
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
130
128
126
124
122
120
118
116
0
50
100
150
200
250
Station (ft)
FM 676 OUTFALL 2 Plan: Plan 08 6/24/2015
STA. 189+00
.035
.035
.035
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
130
128
126
124
122
120
118
116
0
50
100
150
200
250
Station (ft)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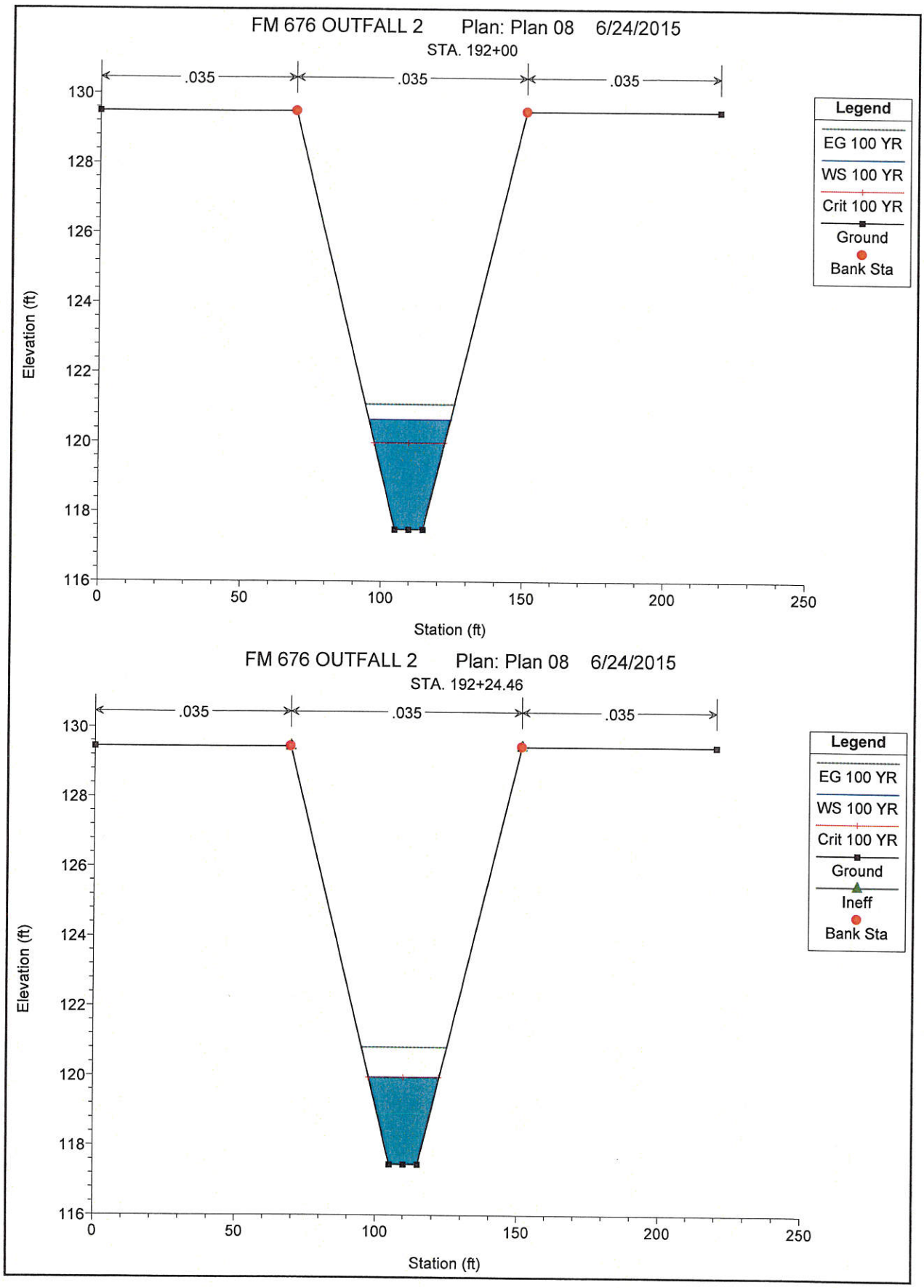
.035
.035
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
130
128
126
124
122
120
118
116
0
50
100
150
200
250
Station (ft)
FM 676 OUTFALL 2 Plan: Plan 08 6/24/2015
STA. 191+00
.035
.035
.035
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
130
128
126
124
122
120
118
116
0
50
100
150
200
250
Station (ft)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.035
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EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Bank Sta
Elevation (ft)
130
128
126
124
122
120
118
116
0
50
100
150
200
250
Station (ft)
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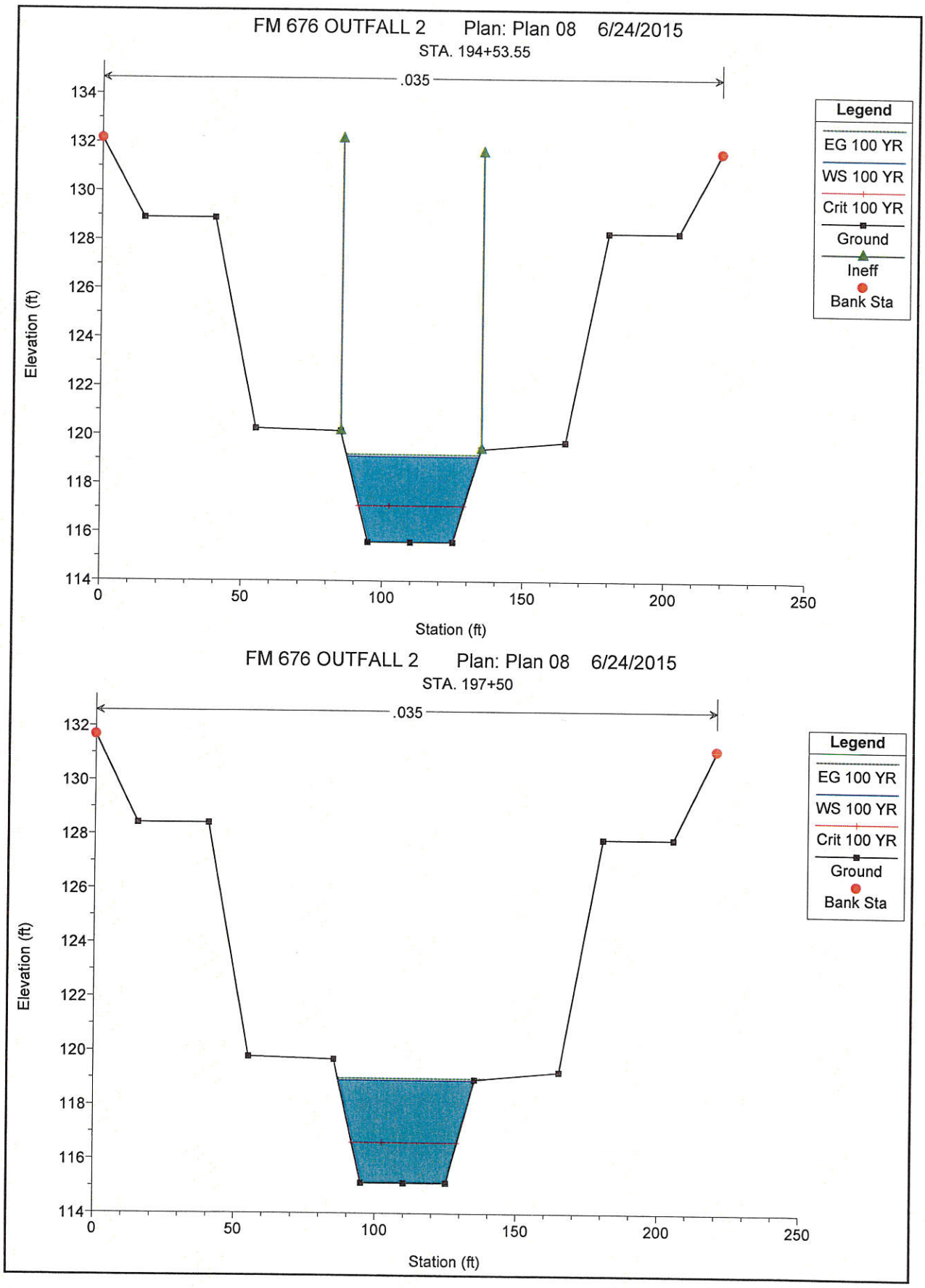
.035
.035
Legend
EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Ineff
Bank Sta
Elevation (ft)
130
128
126
124
122
120
118
116
0
50
100
150
200
250
Station (ft)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Legend
EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
134
132
130
128
126
124
122
120
118
116
114
0
50
100
150
200
250
FM 676 OUTFALL 2 Plan: Plan 08 6/24/2015
STA. 197+50
.035
Legend
EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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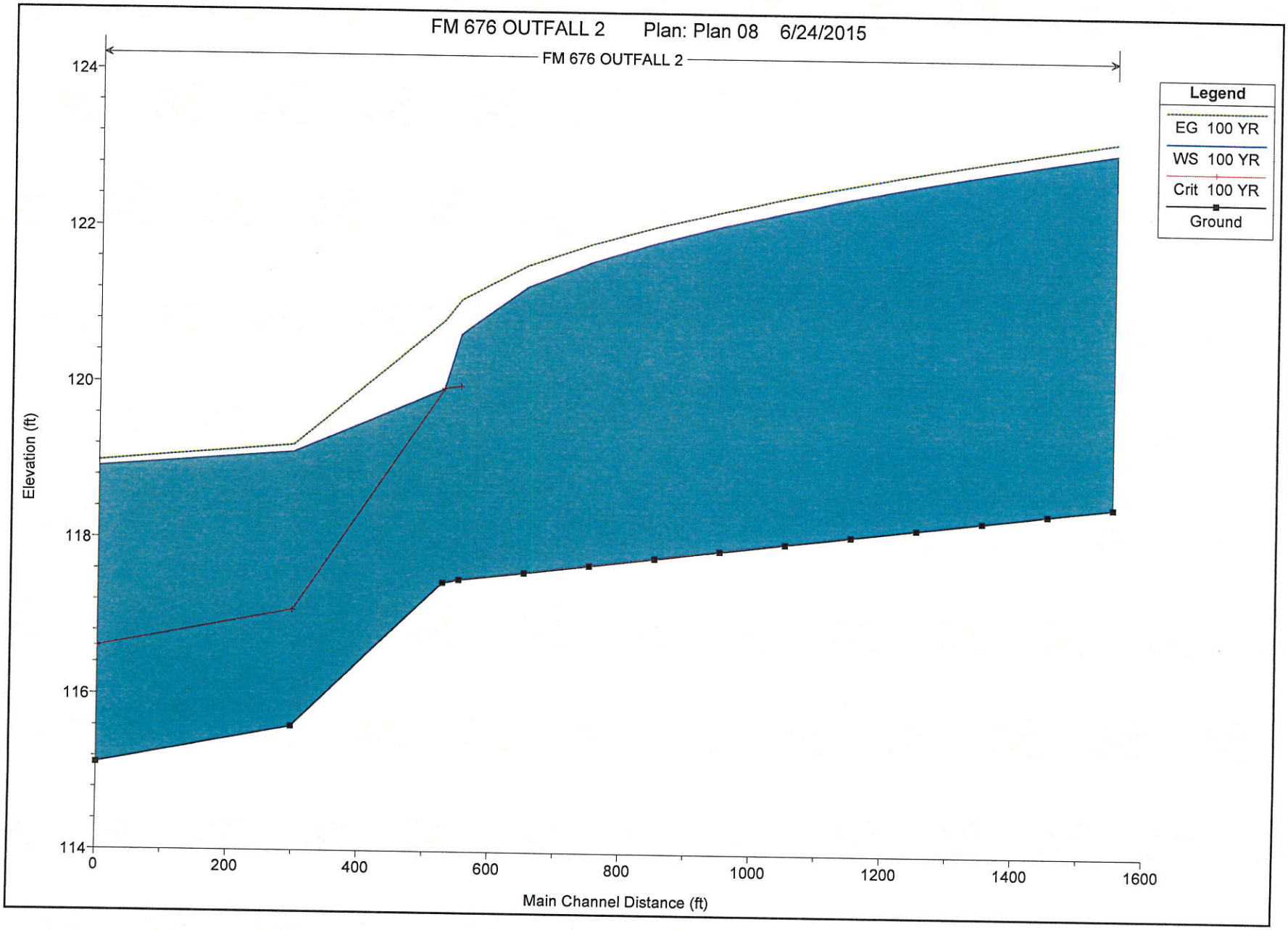
130
128
126
124
122
120
118
116
114
0
50
100
150
200
250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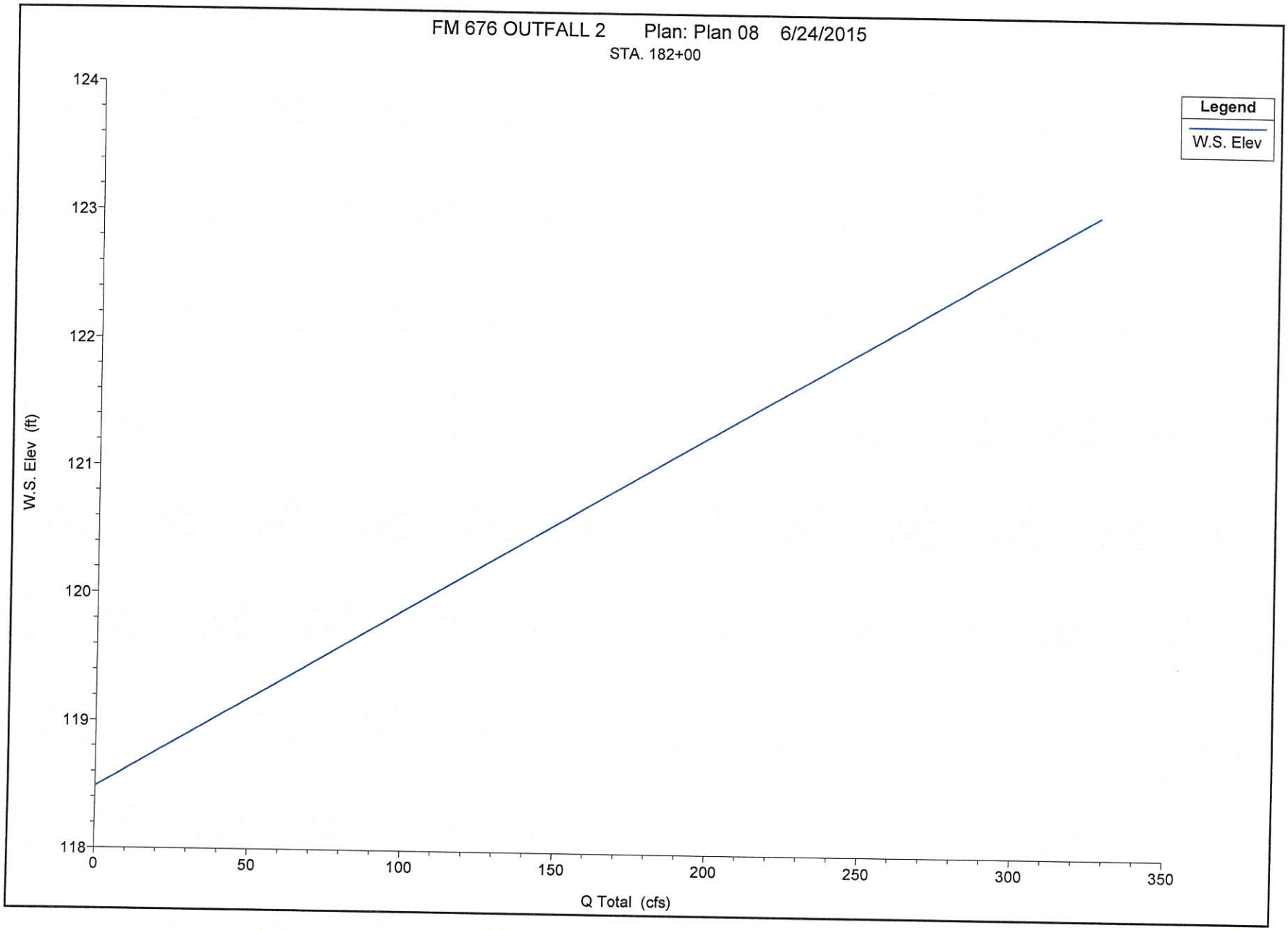
FM 676 OUTFALL 2
Legend
EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Elevation (ft)
124
122
120
118
116
114
0
200
400
600
800
1000
1200
1400
1600
Main Channel Distance (ft)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STA. 182+00
Legend
W.S. Elev
W.S. Elev (ft)
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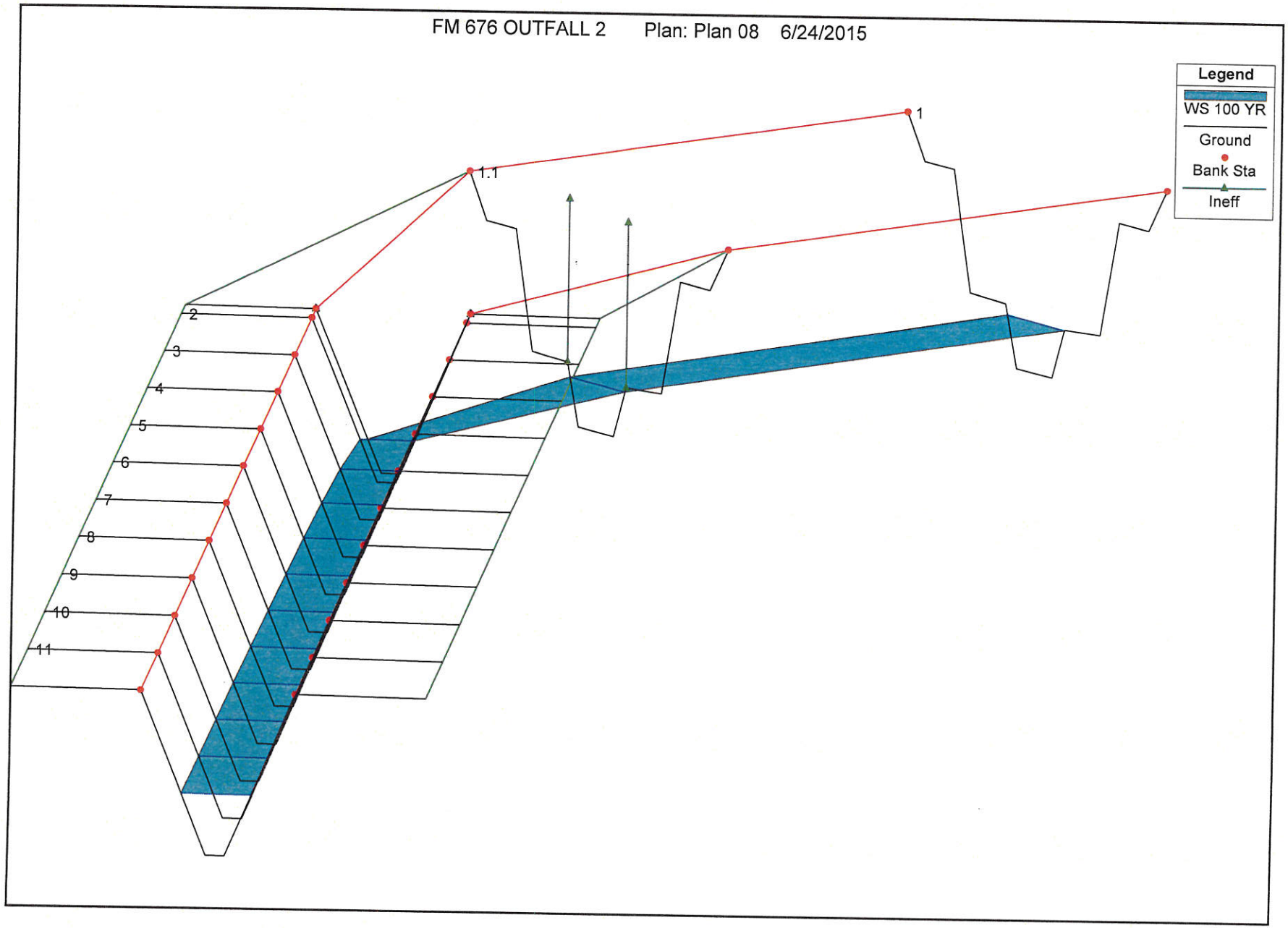
123
122
121
120
119
118
0
50
100
150
200
250
300
350
Q Total (cfs)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Legend
WS 100 YR
Ground
Bank Sta
Ineff
1
1.1
2
3
4
5
6
7
8
9
10
11

25-YR STORM WITH RESTRICTOR ANALYSIS

Plan: Plan 09 FM 676 OUTFALL 2 RS: 12 Profile: 25 YR

E.G. Elev (ft)	127.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.79	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		352.71	
E.G. Slope (ft/ft)	0.000032	Area (sq ft)		352.71	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	65.82	Top Width (ft)		65.82	
Vel Total (ft/s)	0.72	Avg. Vel. (ft/s)		0.72	
Max Chl Dpth (ft)	9.30	Hydr. Depth (ft)		5.36	
Conv. Total (cfs)	44503.7	Conv. (cfs)		44503.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		68.84	
Min Ch El (ft)	118.49	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		10.04	
C & E Loss (ft)	0.00	Cum SA (acres)		2.23	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 11 Profile: 25 YR

E.G. Elev (ft)	127.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.79	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		359.13	
E.G. Slope (ft/ft)	0.000031	Area (sq ft)		359.13	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	66.40	Top Width (ft)		66.40	
Vel Total (ft/s)	0.70	Avg. Vel. (ft/s)		0.70	
Max Chl Dpth (ft)	9.40	Hydr. Depth (ft)		5.41	
Conv. Total (cfs)	45590.7	Conv. (cfs)		45590.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		69.46	
Min Ch El (ft)	118.39	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		9.22	
C & E Loss (ft)	0.00	Cum SA (acres)		2.08	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 10 Profile: 25 YR

E.G. Elev (ft)	127.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.79	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		365.61	
E.G. Slope (ft/ft)	0.000029	Area (sq ft)		365.61	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	66.99	Top Width (ft)		66.99	
Vel Total (ft/s)	0.69	Avg. Vel. (ft/s)		0.69	
Max Chl Dpth (ft)	9.50	Hydr. Depth (ft)		5.46	
Conv. Total (cfs)	46695.5	Conv. (cfs)		46695.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		70.07	
Min Ch El (ft)	118.29	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		8.39	
C & E Loss (ft)	0.00	Cum SA (acres)		1.93	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 9 Profile: 25 YR

E.G. Elev (ft)	127.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.79	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		372.16	
E.G. Slope (ft/ft)	0.000028	Area (sq ft)		372.16	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	67.57	Top Width (ft)		67.57	
Vel Total (ft/s)	0.68	Avg. Vel. (ft/s)		0.68	
Max Chl Dpth (ft)	9.60	Hydr. Depth (ft)		5.51	
Conv. Total (cfs)	47818.0	Conv. (cfs)		47818.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		70.69	
Min Ch El (ft)	118.19	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		7.54	
C & E Loss (ft)	0.00	Cum SA (acres)		1.77	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 8 Profile: 25 YR

E.G. Elev (ft)	127.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.78	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		378.78	
E.G. Slope (ft/ft)	0.000027	Area (sq ft)		378.78	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	68.16	Top Width (ft)		68.16	
Vel Total (ft/s)	0.67	Avg. Vel. (ft/s)		0.67	
Max Chl Dpth (ft)	9.69	Hydr. Depth (ft)		5.56	
Conv. Total (cfs)	48958.5	Conv. (cfs)		48958.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		71.30	
Min Ch El (ft)	118.09	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		6.68	
C & E Loss (ft)	0.00	Cum SA (acres)		1.62	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 7 Profile: 25 YR

E.G. Elev (ft)	127.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.78	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		385.45	
E.G. Slope (ft/ft)	0.000025	Area (sq ft)		385.45	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	68.74	Top Width (ft)		68.74	
Vel Total (ft/s)	0.65	Avg. Vel. (ft/s)		0.65	
Max Chl Dpth (ft)	9.79	Hydr. Depth (ft)		5.61	
Conv. Total (cfs)	50116.9	Conv. (cfs)		50116.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		71.92	
Min Ch El (ft)	117.99	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		5.80	
C & E Loss (ft)	0.00	Cum SA (acres)		1.46	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 6 Profile: 25 YR

E.G. Elev (ft)	127.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.78	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		392.20	
E.G. Slope (ft/ft)	0.000024	Area (sq ft)		392.20	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	69.33	Top Width (ft)		69.33	
Vel Total (ft/s)	0.64	Avg. Vel. (ft/s)		0.64	
Max Chl Dpth (ft)	9.89	Hydr. Depth (ft)		5.66	
Conv. Total (cfs)	51293.5	Conv. (cfs)		51293.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		72.54	
Min Ch El (ft)	117.89	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		4.91	
C & E Loss (ft)	0.00	Cum SA (acres)		1.30	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 5 Profile: 25 YR

E.G. Elev (ft)	127.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.78	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		399.01	
E.G. Slope (ft/ft)	0.000023	Area (sq ft)		399.01	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	69.91	Top Width (ft)		69.91	
Vel Total (ft/s)	0.63	Avg. Vel. (ft/s)		0.63	
Max Chl Dpth (ft)	9.99	Hydr. Depth (ft)		5.71	
Conv. Total (cfs)	52488.2	Conv. (cfs)		52488.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		73.16	
Min Ch El (ft)	117.79	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		4.00	
C & E Loss (ft)	0.00	Cum SA (acres)		1.14	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 4 Profile: 25 YR

E.G. Elev (ft)	127.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.77	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		405.88	
E.G. Slope (ft/ft)	0.000022	Area (sq ft)		405.88	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	70.50	Top Width (ft)		70.50	
Vel Total (ft/s)	0.62	Avg. Vel. (ft/s)		0.62	
Max Chl Dpth (ft)	10.08	Hydr. Depth (ft)		5.76	
Conv. Total (cfs)	53701.1	Conv. (cfs)		53701.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		73.77	
Min Ch El (ft)	117.69	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		3.08	
C & E Loss (ft)	0.00	Cum SA (acres)		0.98	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 3 Profile: 25 YR

E.G. Elev (ft)	127.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.77	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		412.82	
E.G. Slope (ft/ft)	0.000021	Area (sq ft)		412.82	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	71.09	Top Width (ft)		71.09	
Vel Total (ft/s)	0.61	Avg. Vel. (ft/s)		0.61	
Max Chl Dpth (ft)	10.18	Hydr. Depth (ft)		5.81	
Conv. Total (cfs)	54932.2	Conv. (cfs)		54932.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		74.39	
Min Ch El (ft)	117.59	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		2.14	
C & E Loss (ft)	0.00	Cum SA (acres)		0.82	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 2 Profile: 25 YR

E.G. Elev (ft)	127.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.77	Reach Len. (ft)	24.46	24.46	24.46
Crit W.S. (ft)		Flow Area (sq ft)		419.82	
E.G. Slope (ft/ft)	0.000020	Area (sq ft)		419.82	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	71.68	Top Width (ft)		71.68	
Vel Total (ft/s)	0.60	Avg. Vel. (ft/s)		0.60	
Max Chl Dpth (ft)	10.28	Hydr. Depth (ft)		5.86	
Conv. Total (cfs)	56181.7	Conv. (cfs)		56181.7	
Length Wtd. (ft)	24.46	Wetted Per. (ft)		75.01	
Min Ch El (ft)	117.49	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		1.18	
C & E Loss (ft)	0.00	Cum SA (acres)		0.65	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 1.3 Profile: 25 YR

E.G. Elev (ft)	127.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.035	
W.S. Elev (ft)	127.77	Reach Len. (ft)	229.03	229.09	229.09
Crit W.S. (ft)	119.61	Flow Area (sq ft)		422.66	
E.G. Slope (ft/ft)	0.000020	Area (sq ft)		422.66	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	71.92	Top Width (ft)		71.92	
Vel Total (ft/s)	0.60	Avg. Vel. (ft/s)		0.60	
Max Chl Dpth (ft)	10.32	Hydr. Depth (ft)		5.88	
Conv. Total (cfs)	56690.8	Conv. (cfs)		56690.8	
Length Wtd. (ft)	229.09	Wetted Per. (ft)		75.27	
Min Ch El (ft)	117.45	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		0.94	
C & E Loss (ft)		Cum SA (acres)		0.61	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 1.1 Profile: 25 YR

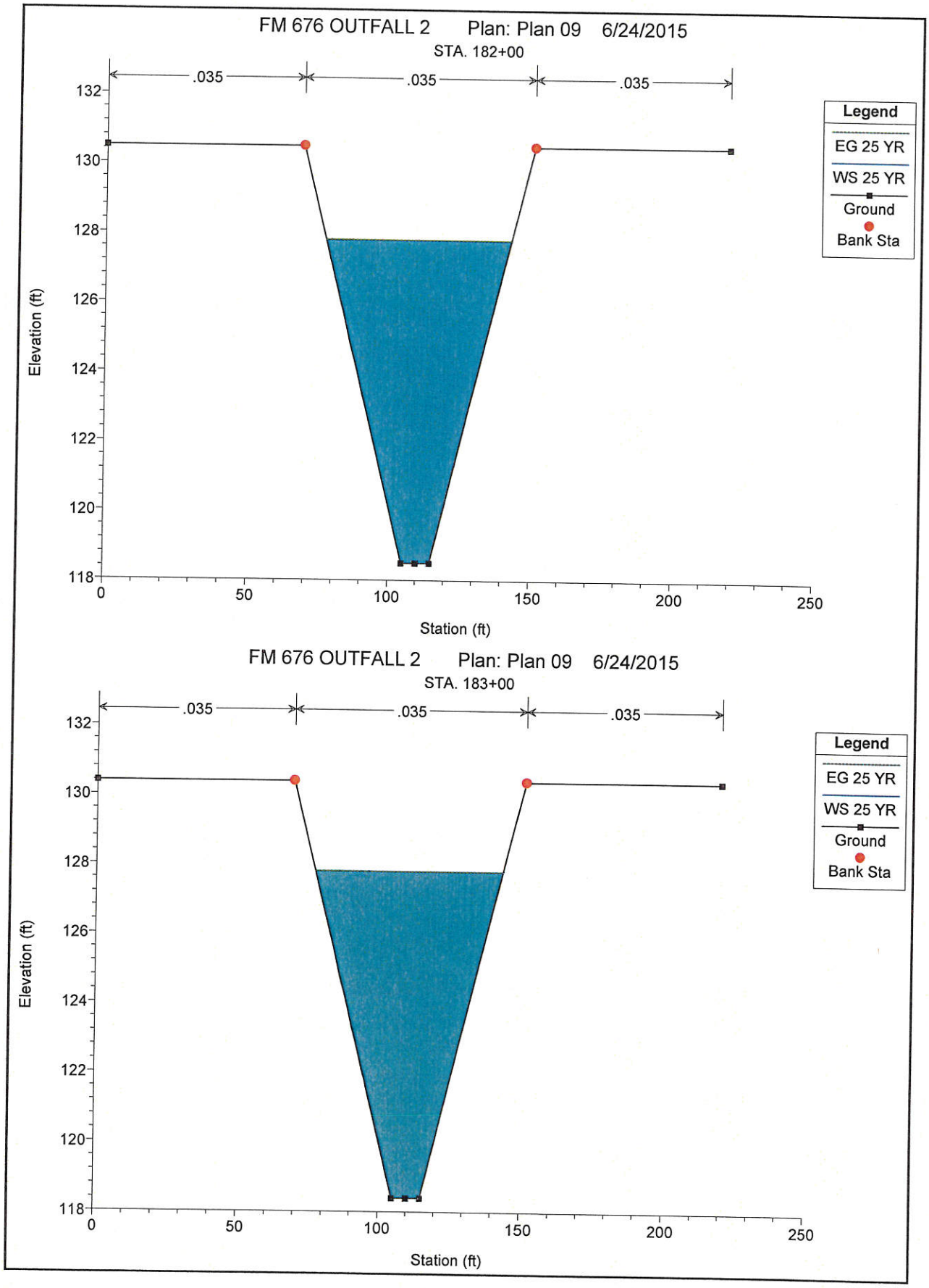
E.G. Elev (ft)	118.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.035	
W.S. Elev (ft)	118.61	Reach Len. (ft)	296.45	296.45	296.45
Crit W.S. (ft)	116.86	Flow Area (sq ft)		111.70	
E.G. Slope (ft/ft)	0.000858	Area (sq ft)		111.70	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	44.42	Top Width (ft)		44.42	
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)		2.26	
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)		2.51	
Conv. Total (cfs)	8614.6	Conv. (cfs)		8614.6	
Length Wtd. (ft)	296.45	Wetted Per. (ft)		45.62	
Min Ch El (ft)	115.60	Shear (lb/sq ft)		0.13	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)		0.80	
C & E Loss (ft)	0.00	Cum SA (acres)		0.31	

Plan: Plan 09 FM 676 OUTFALL 2 RS: 1 Profile: 25 YR

E.G. Elev (ft)	118.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.		0.035	
W.S. Elev (ft)	118.40	Reach Len. (ft)			
Crit W.S. (ft)	116.37	Flow Area (sq ft)		124.04	
E.G. Slope (ft/ft)	0.000630	Area (sq ft)		124.04	
Q Total (cfs)	252.28	Flow (cfs)		252.28	
Top Width (ft)	45.73	Top Width (ft)		45.73	
Vel Total (ft/s)	2.03	Avg. Vel. (ft/s)		2.03	
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)		2.71	
Conv. Total (cfs)	10050.5	Conv. (cfs)		10050.5	
Length Wtd. (ft)		Wetted Per. (ft)		47.05	
Min Ch El (ft)	115.12	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)	220.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS Plan: Plan 09 River: FM 676 Reach: OUTFALL 2 Profile: 25 YR

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)	
OUTFALL 2	12	25 YR	252.28	118.49	127.79		127.80	0.000032	0.72	352.71	65.82	0.05
OUTFALL 2	11	25 YR	252.28	118.39	127.79		127.80	0.000031	0.70	359.13	66.40	0.05
OUTFALL 2	10	25 YR	252.28	118.29	127.79		127.80	0.000029	0.69	365.61	66.99	0.05
OUTFALL 2	9	25 YR	252.28	118.19	127.79		127.79	0.000028	0.68	372.16	67.57	0.05
OUTFALL 2	8	25 YR	252.28	118.09	127.78		127.79	0.000027	0.67	378.78	68.16	0.05
OUTFALL 2	7	25 YR	252.28	117.99	127.78		127.79	0.000025	0.65	385.45	68.74	0.05
OUTFALL 2	6	25 YR	252.28	117.89	127.78		127.78	0.000024	0.64	392.20	69.33	0.05
OUTFALL 2	5	25 YR	252.28	117.79	127.78		127.78	0.000023	0.63	399.01	69.91	0.05
OUTFALL 2	4	25 YR	252.28	117.69	127.77		127.78	0.000022	0.62	405.88	70.50	0.05
OUTFALL 2	3	25 YR	252.28	117.59	127.77		127.78	0.000021	0.61	412.82	71.09	0.04
OUTFALL 2	2	25 YR	252.28	117.49	127.77		127.78	0.000020	0.60	419.82	71.68	0.04
OUTFALL 2	1.3	25 YR	252.28	117.45	127.77	119.61	127.77	0.000020	0.60	422.66	71.92	0.04
OUTFALL 2	1.2		Culvert									
OUTFALL 2	1.1	25 YR	252.28	115.60	118.61	116.86	118.68	0.000858	2.26	111.70	44.42	0.25
OUTFALL 2	1	25 YR	252.28	115.12	118.40	116.37	118.46	0.000630	2.03	124.04	45.73	0.22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WS 25 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
FM 676 OUTFALL 2 Plan: Plan 09 6/24/2015
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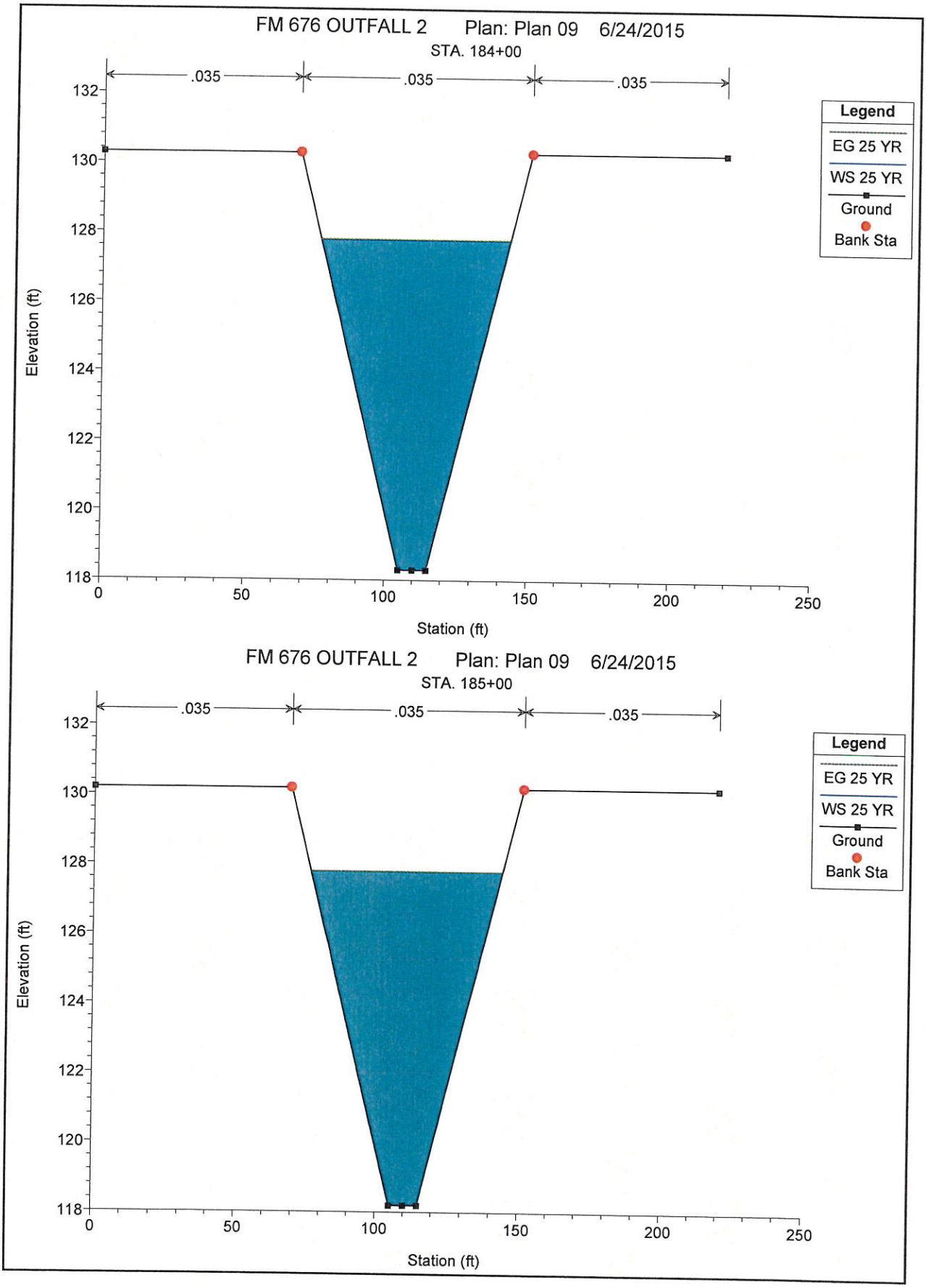
Ground
Bank Sta
Elevation (ft)
Station (ft)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Ground
Bank Sta
Elevation (ft)
Station (ft)
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Bank Sta
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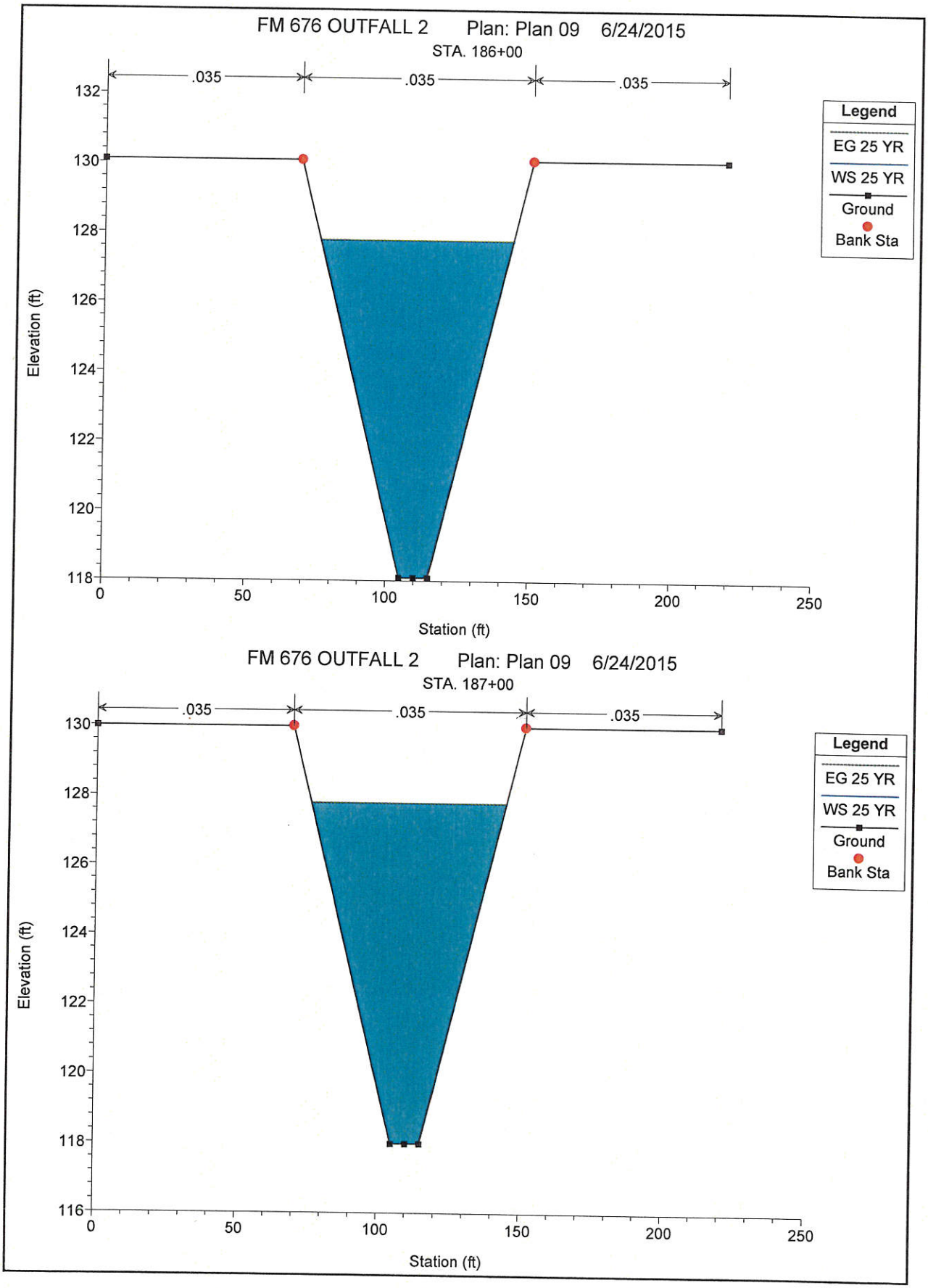
Station (ft)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WS 25 YR
Ground
Bank Sta
Elevation (ft)
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130
128
126
124
122
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150
200
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Station (ft)
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Legend
EG 25 YR
WS 25 YR
Ground
Bank Sta
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200
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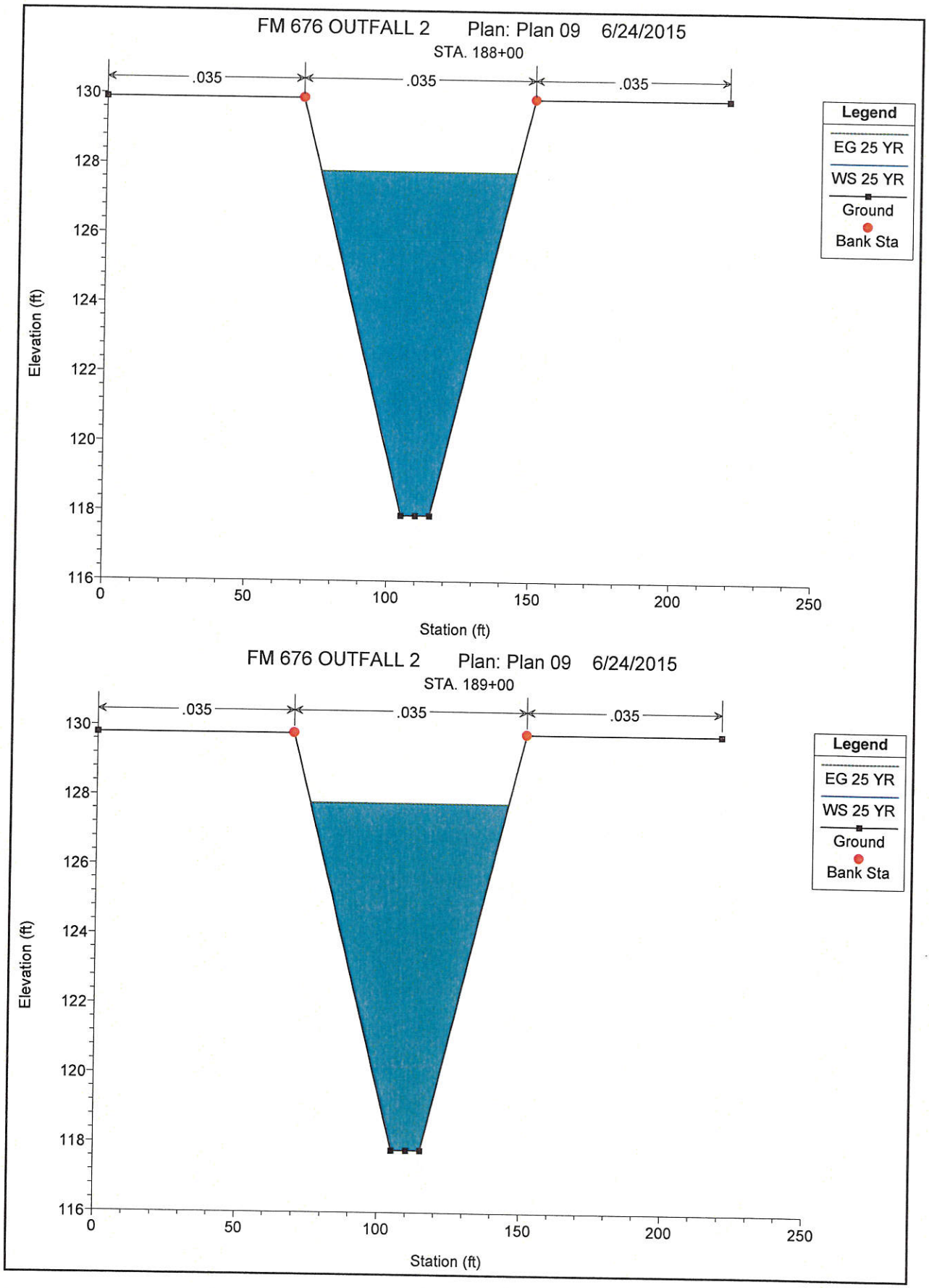
Station (ft)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WS 25 YR
Ground
Bank Sta
Elevation (ft)
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128
126
124
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120
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116
0
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150
200
250
Station (ft)
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STA. 189+00
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Legend
EG 25 YR
WS 25 YR
Ground
Bank Sta
Elevation (ft)
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122
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118
116
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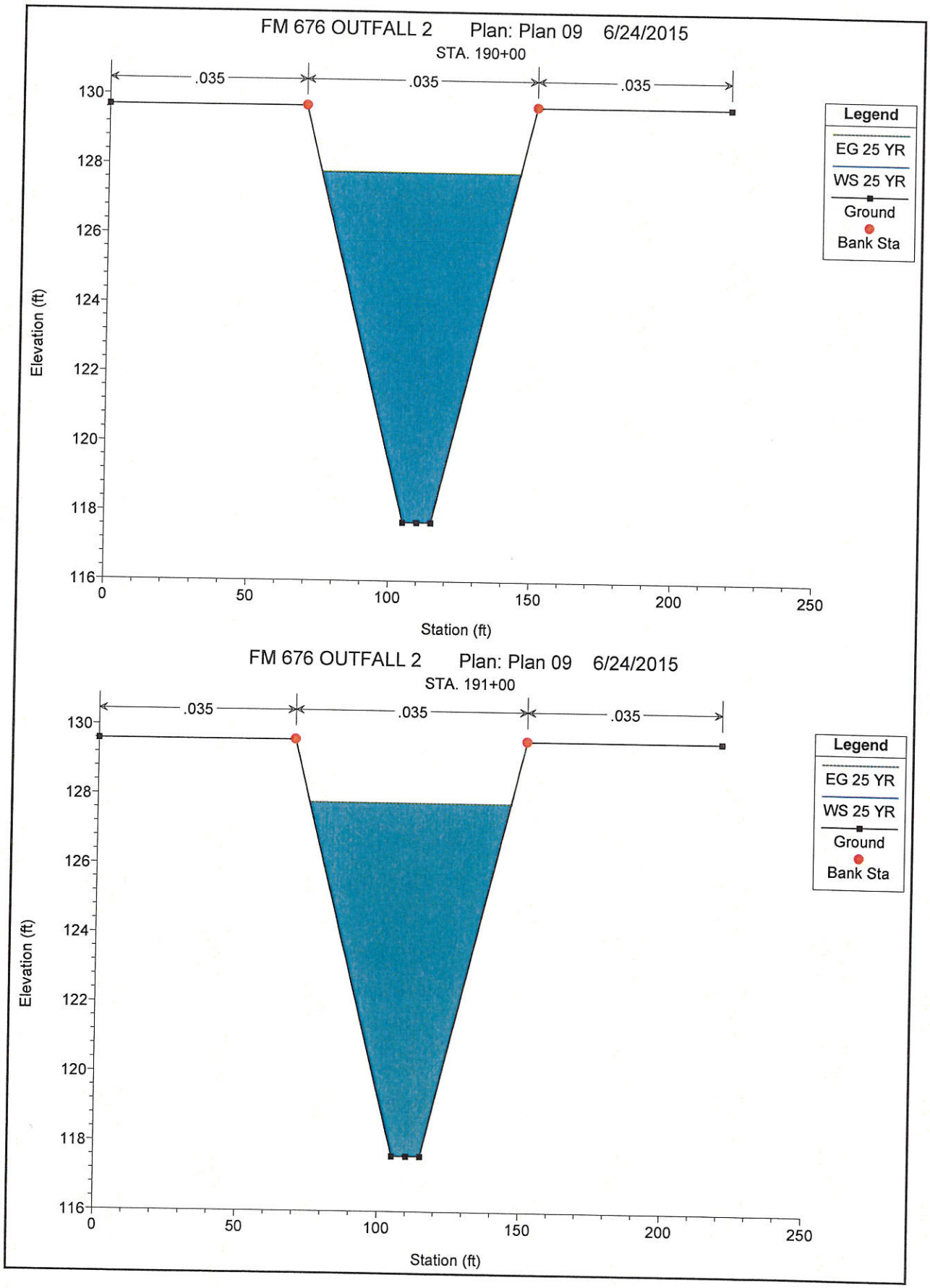
Station (ft)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Legend
EG 25 YR
WS 25 YR
Ground
Bank Sta
Elevation (ft)
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128
126
124
122
120
118
116
0
50
100
150
200
250
Station (ft)
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Legend
EG 25 YR
WS 25 YR
Ground
Bank Sta
Elevation (ft)
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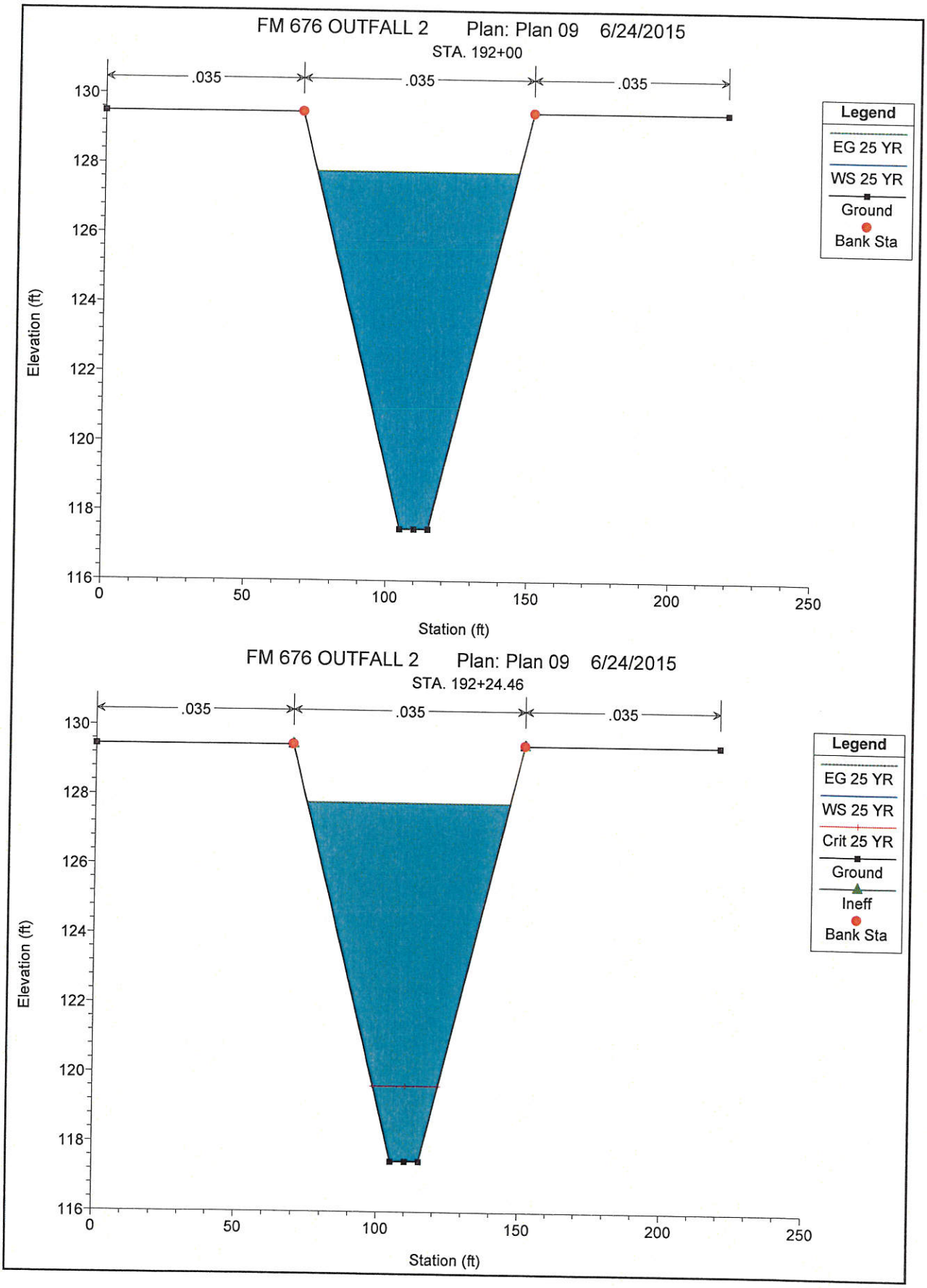
200
250
Station (ft)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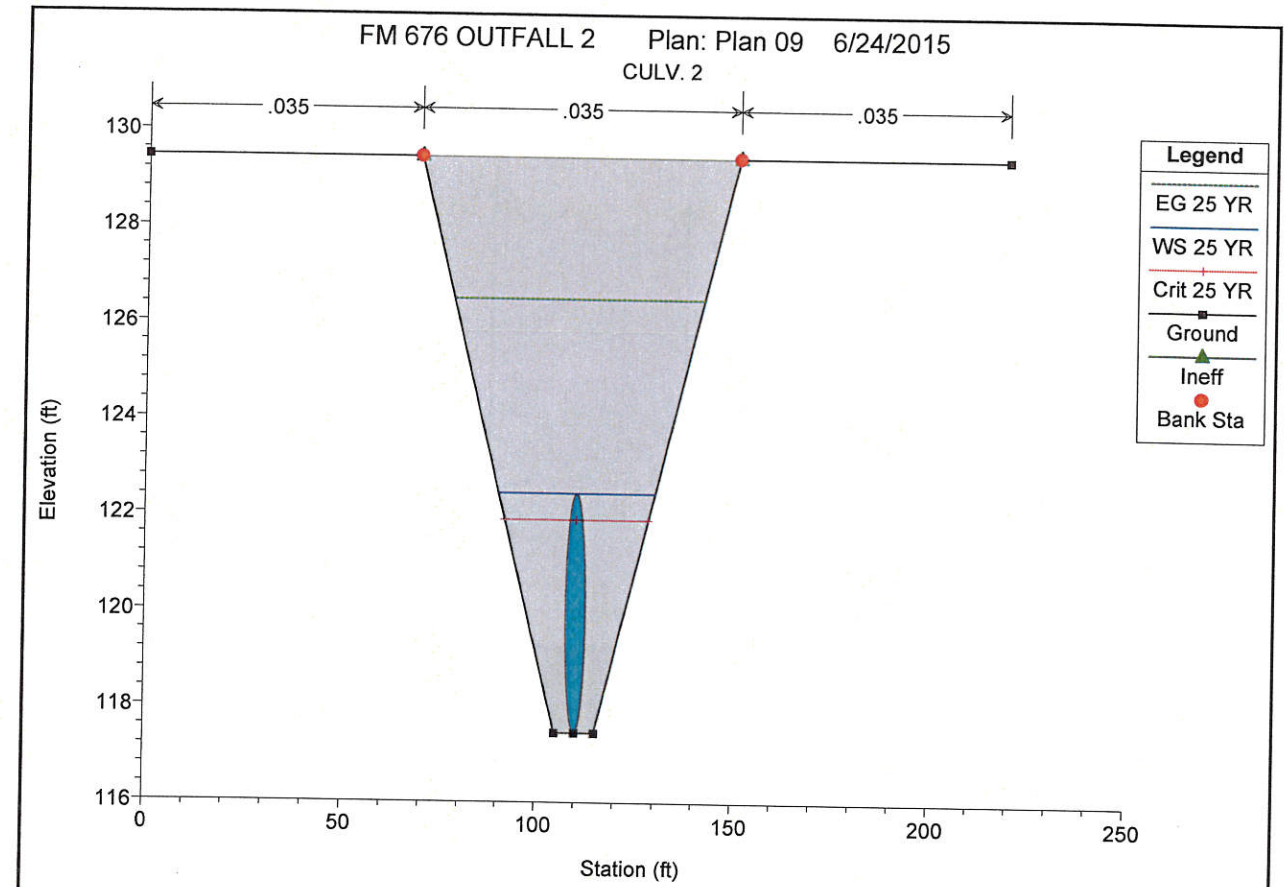
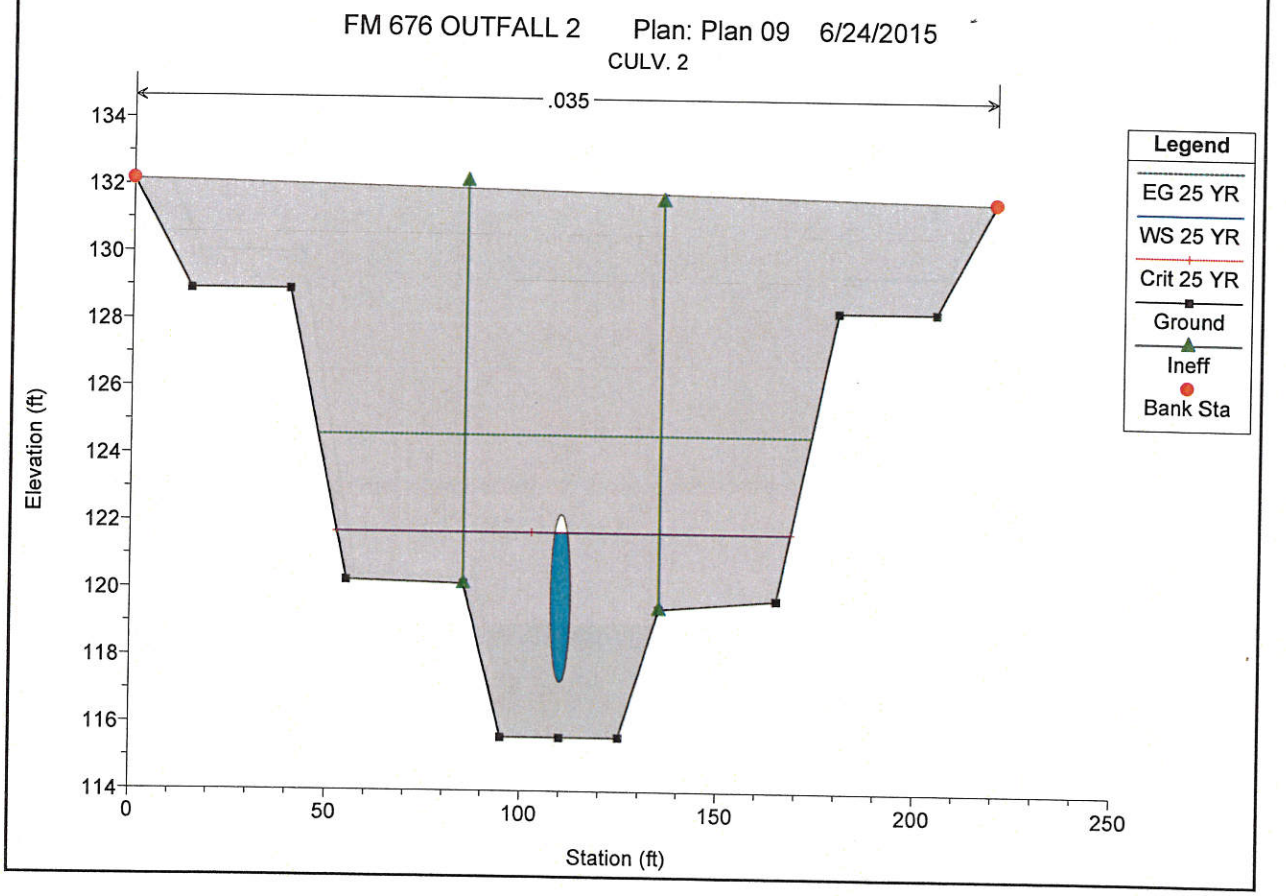
Legend
EG 25 YR
WS 25 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
FM 676 OUTFALL 2 Plan: Plan 09 6/24/2015
STA. 192+24.46
.035
.035
.035
Legend
EG 25 YR
WS 25 YR
Crit 25 YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


FM 676 OUTFALL 2 Plan: Plan 09 6/24/2015
CULV. 2
.035
.035
.035
Legend
EG 25 YR
WS 25 YR
Crit 25 YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
130
128
126
124
122
120
118
116
0
50
100
150
200
250


FM 676 OUTFALL 2 Plan: Plan 09 6/24/2015
CULV. 2
.035
Legend
EG 25 YR
WS 25 YR
Crit 25 YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
134
132
130
128
126
124
122
120
118
116
114
0
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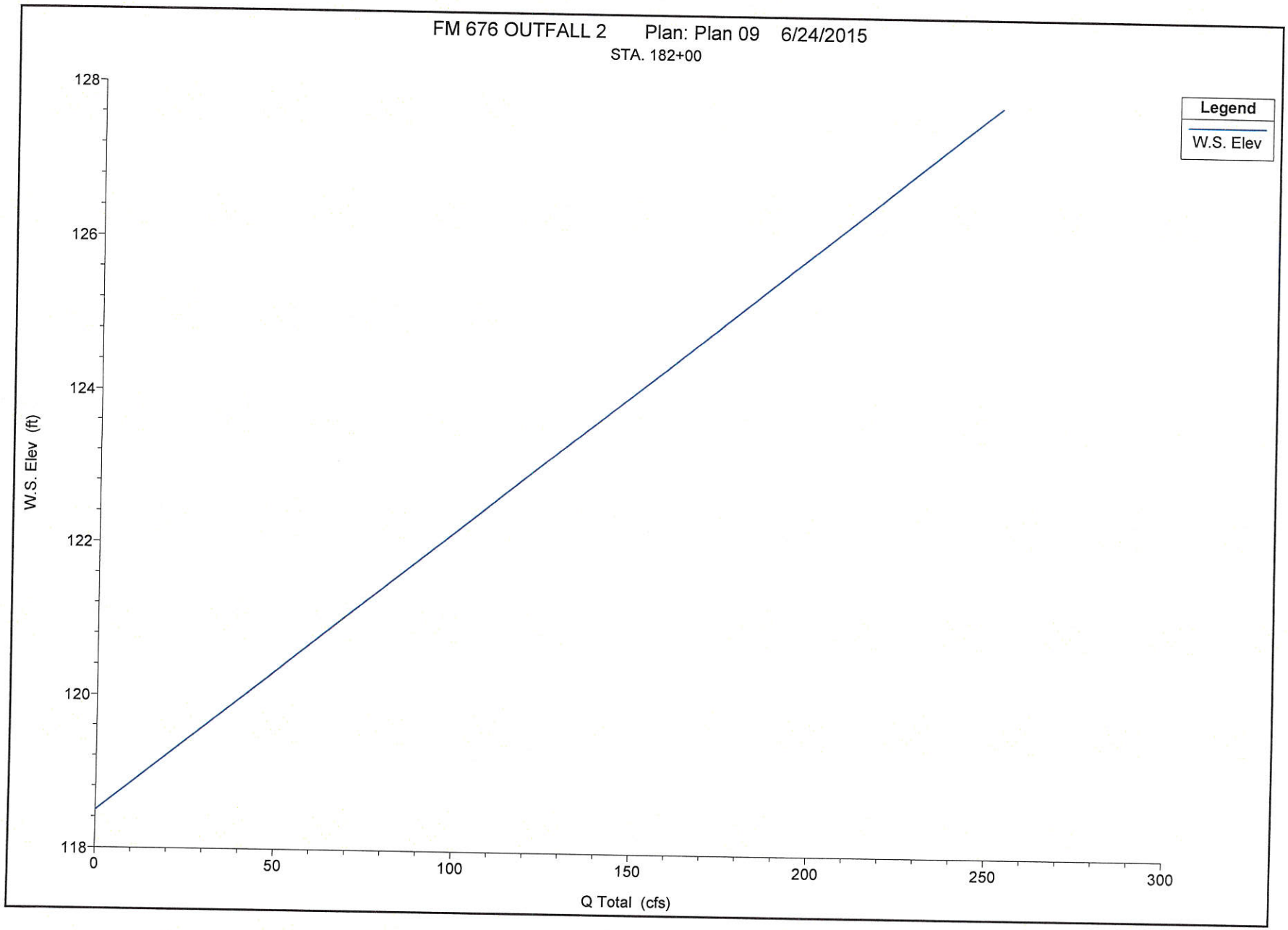
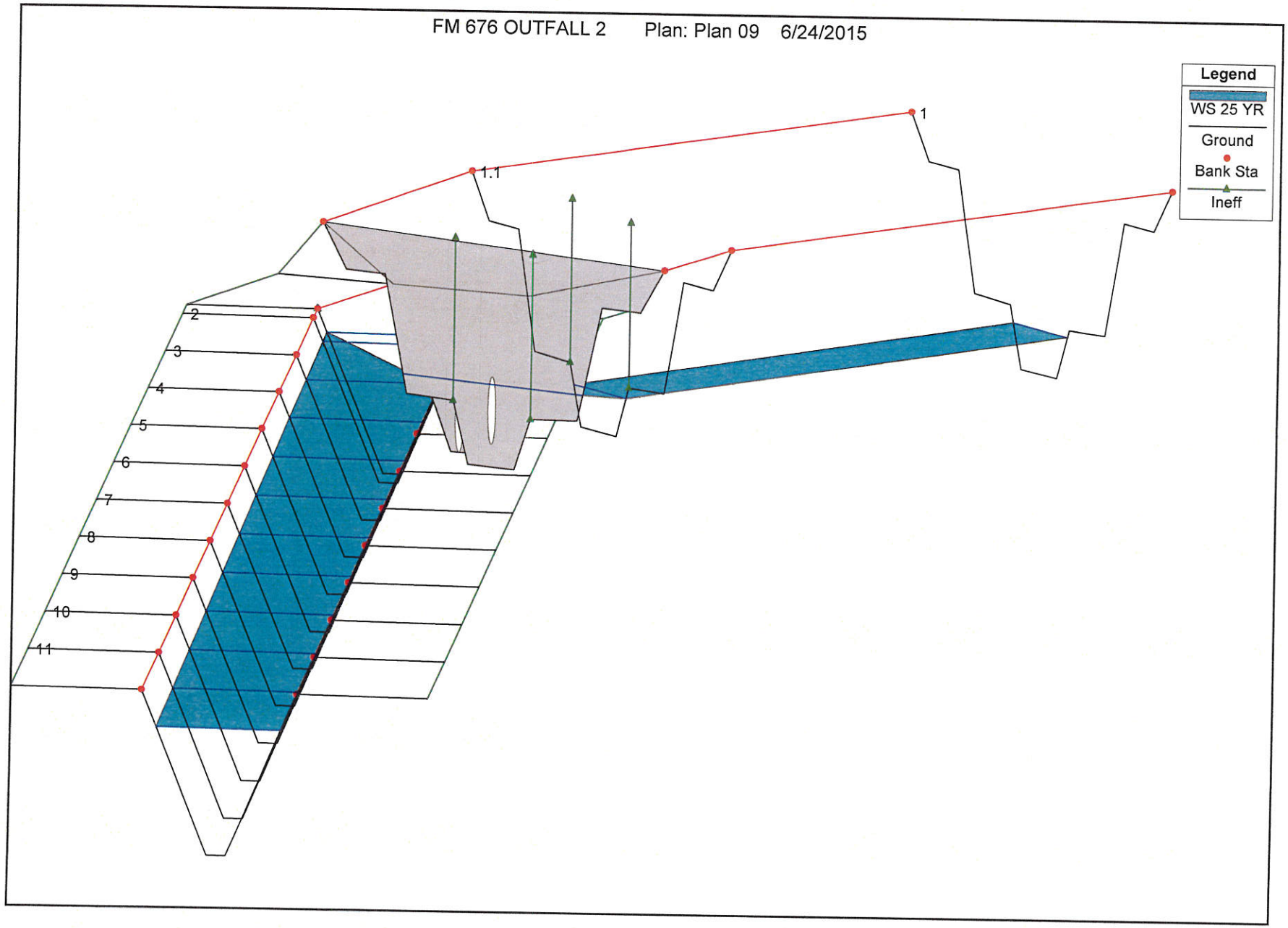
100
150
200
250


FM 676 OUTFALL 2 Plan: Plan 09 6/24/2015
STA. 182+00
Legend
W.S. Elev
W.S. Elev (ft)
128
126
124
122
120
118
0
50
100
150
200
250
300
Q Total (cfs)


FM 676 OUTFALL 2 Plan: Plan 09 6/24/2015
Legend
WS 25 YR
Ground
Bank Sta
Ineff
1
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11

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07/02/2015

HCDD #1

FM 676 Outfall Schem (2 & 2B) (.pdf)
FM 676 Hydrologic Map (.pdf)
FM 676 Outfall Feasibility Report (.pdf)

L&G Engineering
Highway / Civil
Structural / Bridge
Environmental
Firm No. : F-4105

2109 W. Expressway 83
Mercedes, TX. 78570
Phone : (956) 565-6813
Fax : (956) 565-6018

900 S. Stewart Rd., Ste. 10
Mission, TX. 78572
Phone : (956) 686-1908
Fax : (956) 686-1927

Hidalgo County Drainage District No. 1

902 North Doolittle Road Edinburg, Texas 78542 Office: (956) 292-7080

Invoice Processing Checklist/Routing Slip

Invoice/ Backup

Date Received: 7/1/2015

Engineer/Firm Name: L&G Eng.

Project Name/Number: La Joya Watershed WA No. 4

Invoice No.: 11325198

Purchase Order No.: 626396

Received By: Rosa Arce

Forwarded to: Nora D. Cavazos _____ Date: _____

Total # of Pages Submitted: 9

Attachments: CD

Forwarded to: Jose N. Saldivar _____ Date: _____

Forwarded to: Lora Briones _____ Date: _____

Additional Comments: _____

THIS ROUTING SLIP MUST BE KEPT WITH ORIGINAL INVOICE

L&G Consulting Engineers, Inc.

July 1, 2015

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle
Edinburg, Texas 78542

RE: Work Authorization #4 on La Joya Watershed Improvement Project
Job # 130104
P.O. # 625396

Dear Mr. Sesin,

Attached for your review and approval is our invoice for the services rendered during the month of June 2015 on the subject referenced project.

The following is attached:

- L&G's Invoice #11325198
- CD w/ Electronic Files of Data for:
  - R.O.W. Surveying Services – Monthly Progress Reports and Invoices (#R15-053) – June 30, 2015
  - Task A (Task 4a)
  - Task B (Task 4b)
  - Task C (Task 1c & 2c)

TASK		% COMPL
Task A **Construction Plans for Liberty Pit Detention Facility**		
Task 1a ~ Coordination & Management of ROW and Design Survey, & Geotechnical	L&G	100%
Task Complete – See progress report dated June 1, 2015		
Task 2a ~ (SUB): Field and Design Survey (Utility Locates) - #3 (FC150)	ROW SS	100%
Task Complete – See progress report (#R15-032) from R.O.W. S.S dated May 31, 2015		
Task 3a ~ (SUB): ROW Map, Parcel Sketches & Field Notes - #3 (FC130)	ROW SS	100%
Task Complete – See progress report (#R15-032) from R.O.W. S.S dated May 31, 2015		
Task 4a ~ Acquisition of ROW for Proposed Facility; Negotiation with Land Owner(s)	L&G ROW	60.6%
Update – The project file continues to be updated with important documentation that is relevant to the acquisition. Negotiations continue with the property owners as per specification with Title II & III of the Uniform Act and are being included in the files		

2100 W. Expressway 83 • Mercedes, TX 78570 • Office (956) 565-9813 • Fax (956) 565-9018
900 S. Stewart Rd., Ste. 9 • Mission, TX 78572 • Office (956) 585-1909 • Fax (956) 585-1927

for documentation.		
Task 5a ~ (SUB): Geotechnical Exploration & Analyses for Proposed Facility - #2	L&G LAB	100.0%
Task Complete – See progress report from L&G Lab dated April 30, 2015		
Task 6a ~ Conceptual Site Plan Identifying 60% of Recovered ROW & Design Surveys (Prior to PS&E Release)	L&G	100.0%
Task Complete – See progress report dated January 2, 2015		
Task 7a ~ Plans, Specifications & Estimates (PS&E) for Proposed Facility & 400ft. Zone for Commercial Development	L&G	80.0%
No Update – See progress report dated March 2, 2015		
Task B **Construction Plan for South Basin Pit Detention Facility**		
Task 1b ~ Coordination & Management of ROW and Design Survey, & Geotechnical	L&G	100%
Task Complete – See progress report dated June 1, 2015		
Task 2b ~ (SUB): Field and Design Survey (Utility Locates) - #3 (FC150)	ROW SS	100%
Task Complete – See progress report (#R15-031) from R.O.W. S.S dated May 31, 2015		
Task 3b ~ (SUB): ROW Map, Parcel Sketches & Field Notes - #3 (FC130)	ROW SS	100%
Task Complete – See progress report (#R15-031) from R.O.W. S.S dated May 31, 2015		
Task 4b ~ Acquisition of ROW for Proposed Facility; Negotiation with Land Owner(s)	L&G ROW	41.4%
Update – The project files continue to be updated as per the ongoing negotiations with the property owners. Coordination of the acquisition continues with the property owners, appraiser, Drainage District, Title Co., etc. The coordination includes phone calls, emails, meetings, etc.		
Task 5b ~ (SUB): Geotechnical Exploration & Analyses for Proposed Facility - #2	L&G LAB	100.0%
Task Complete – See progress report from L&G Lab dated April 30, 2015		
Task 6b ~ Conceptual Site Plan Identifying 60% of Recovered ROW & Design Surveys (Prior to PS&E Release)	L&G	100.0%
Task Complete – See progress report dated January 2, 2015		
Task 7b ~ Plans, Specifications & Estimates (PS&E) for Proposed Facility	L&G	80.0%
No Update – See progress report dated March 2, 2015		
Task C **Phase I Outfall Development of La Joya Watershed Drainage Master Plan**		

Task 1c ~ Coordination & Management of ROW Base Map, Design Survey & Geotechnical	L&G	50.0%
Update – L&G has held weekly meetings with R.O.W. Surveying Services, LLC and continued to coordinate the ROW and Design Survey aspect of this project.		
Task 2c ~ Design Surveys (Utility Locates) - #3 (FC150)	ROW SS	85.0%
Update – See progress report (#R15-053) from R.O.W. S.S dated June 30, 2015 (see attached)		
Task 3c ~ (SUB): Geotechnical Exploration & Analyses for Proposed Facility	L&G LAB	0.0%
Task Not Started		
Task 4c ~ Preliminary Detailed Schematic for Proposed Phase I Outfall	L&G	100.0%
Task Complete – See progress report dated February 2, 2015		
Task 5c ~ Plans, Specifications & Estimates (PS&E) for Proposed Facility	L&G	60.0%
No Update – See progress report dated June 1, 2015		

Should you have any questions regarding this submittal or would like clarification on any aspect of the project, please do not hesitate to call me at (956) 585-1909.

Sincerely,

David Saenz, P.E., C.F.M.
Project Manager
L&G Engineering

L &G Consulting Engineers Inc
2100 W. Expressway 83
Mercedes, TX 78570
(956)565-9813 Fax (956)565-9018

INVOICE#: 11325198
INVOICE DATE: 6/30/2015

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
12:20 AM / PM
BY: Rosa Ane

BILL TO:
Hidalgo County Drainage District#1
902 N. Doolittle
Edinburg, TX 78542

JOB:130104
La Joya Watershed Imp
WA#4
PO #625396

DESCRIPTION	CONTRACT	PREVIOUS APPLICATIONS	CURRENT COMPLETED	TOTAL COMPLETED	% COMPL	BALANCE TO FINISH
Engineering services for the month of June 2015.						
Task A - Construction Plans for Liberty Pit Detention Facility						
13001-Task 1a - Coord. & Management of ROW & Design Survey	10,704.28	10,704.28		10,704.28	100.0	-
15010-Task 2a - SUB: Field & Design Survey (Utlity Locates	27,168.00	27,168.00		27,168.00	100.0	-
13010-Task 3a - SUB: ROW Map Parcel Sketches & Field Notes	22,400.00	22,400.00		22,400.00	100.0	-
60001-Task 4a - Acquisition of ROW for Proposed Facility	28,100.00	15,225.00	1,815.00	17,040.00	60.6	11,060.00
33010-Task 5a - SUB: Geotech. Exploration & Analysis	27,538.64	27,538.64		27,538.64	100.0	-
11006-Task 6a - Conceptual Site Plan Identify 60% of Reco	11,498.80	11,498.80		11,498.80	100.0	-
16001-Task 7a - Plans, Specification & Estimates (PS&E)	50,384.04	40,317.32		40,317.32	80.0	10,066.72
Task B - Construction Plans for South Basin Pit Detention Facility						
13002-Task 1b - Coord. & Management of ROW & Design Survey	7,928.16	7,928.16		7,928.16	100.0	-
15020-Task 2b - SUB: Field & Design Survey (Utlity Locates	24,935.00	24,935.00		24,935.00	100.0	-
13020-Task 3b - SUB: ROW Map Parcel Sketches & Field Notes	7,488.00	7,488.00		7,488.00	100.0	-
60003-Task 4b - Acquisition of ROW for Proposed Facility	14,800.00	5,100.00	1,020.00	6,120.00	41.4	8,680.00
33320-Task 5b - SUB: Geotech. Exploration & Analysis	21,162.28	21,162.28		21,162.28	100.0	-
11007-Task 6b - Conceptual Site Plan Identify 60% of Reco	8,966.44	8,966.44		8,966.44	100.0	-
16002-Task 7b - Plans, Specification & Estimates (PS&E)	33,589.36	26,874.03		26,874.03	80.0	6,715.33
Task C - Phase I Outfall Development of La Joya Watershed Drainage Master Plan						
13003-Task 1c - Coord. & Management of ROW Base Map, Desig	13,030.24	5,839.83	675.27	6,515.10	50.0	6,515.14
15030-Task 2c - SUB: Desgin Survey (Utlitiy Locates	67,062.00	50,296.50	6,706.00	57,002.50	85.0	10,059.50
33030-Task 3c - SUB: Geotechnical Exploration & Analysis	29,301.96	0.00		0.00	0.0	29,301.96
11008-Task 4c - Preliminary Detailed Schematic for Propose	37,866.28	37,866.28		37,866.28	100.0	-
16003-Task 5c - Plans, Specfications & Estimates (PS&E)	200,524.00	120,373.71		120,373.71	60.0	80,150.29
	644,447.48	471,682.27	10,216.27	481,898.54	74.8	162,548.94
TOTALS:	644,447.48	471,682.27	10,216.27	481,898.54	74.8	162,548.94

ORIGINAL CONTRACT SUM	$	644,447.48
CHANGE BY CHANGE ORDER	$	0.00
CONTRACT SUM TO DATE	$	644,447.48
TOTAL COMPLETED TO DATE	$	481,898.54
LESS PREVIOUS INVOICES	$	471,682.27
CURRENT PAYMENT DUE	$	10,216.27

PROJECT MANAGER'S SIGNATURE

L&G Consulting Engineers, Inc
2100 W. Expressway 83
Mercedes, Texas 78570
(956) 565-9813

Project Workhour Report
La Joya Watershed Improvements WA#4
Reference: Inv# 11325198
Date: 6/30/2015
P.O. #625396

	Hrs		Rate	Total
Senior Project Manager	1.00	X	212.59	$212.59
Senior Engineer	2.00	X	175.07	$350.14
Design Engineer	0.00	X	112.55	$0.00
Senior Engineer Tech	0.00	X	78.16	$0.00
Admin/Clerical	2.00	X	56.27	$112.54

Grand Total of Hours	$	675.27
(Difference due to rounding hours)	$	-

Invoice Summary

Man Hours	$	675.27
Sub Contract	$	9,541.00
(See Attached Sub Invoice for Man Hour Breakdown)		
	$	-
(Difference due to rounding)	$	-
Total Per Invoice Submitted	**$**	**10,216.27**

DAS

R. O. W. SURVEYING SERVICES, L.L.C.

June 30, 2015

Jacinto Garza, President/CEO
L & G Engineering
Attn: Reza Badiozzamani, P.E.
2100 W. Expressway 83
Mercedes, Texas 78570

RE: La Joya Watershed-Work Authorization #8
Invoice #R15-053
Limits: From 3 1/2 Mile North Tom Gill to Liberty Road Caliche Pit

Dear Mr. Badiozzamani:

Attached for your approval is our invoice for services rendered for the month of June, 2015:

ROW's Invoice Exhibit C – Work Schedule Progress Report

FC 150-Field Surveying	Contract Amount	Invoice to Date	Paid to Date	Current Amount Due	Contract Balance	Percent Complete
Phase I - Primary & Secondary Control Phase II – DTM Topography and Cross-Sections Phase III – Final Report and Deliverables Project Management & Oversight	$67,062	$57,003	$40,237	$6,706	$10,059	85%
Total	**$67,062**	**$57,003**	**$40,237**		**$10,059**	**85%**
		Total Due		**$6,706**		

Make Checks Payable to: **R.O.W. Surveying Services, LLC.** JAS

Thank you for your business. Should you have any questions or require additional information, please do not hesitate to give me a call at (956) 451-2670.

Sincerely,

Julio Cerda, P.E.
President/CEO

La Joya Outfall Progress Report as of 06/30/15:

Project Management:

- Continue communication with L&G Engineering on property access for Geotech crews.
- Coordinate office staff with preparation of final deliverable.
- Coordinate with gas companies within project limits to locate and identify depths of existing lines.

General Task:

- Field crews completed topography survey
- Horizontal and Vertical control complete
- Continue to process field data for final deliverable.
- Update digital files for invoice.

Exhibit "C"
Work Schedule
La Joya Watershed Outfall - Work Authorization #4

TASK AND DESCRIPTION	FIRM	2015									
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	NOV
Phase I: ROW Mapping											
A. ROW Map	**ROWSS**										
B. Parcel Plats	**ROWSS**										
Phase I: Field Surveying (Control Hz & Vt)											
A. Primary and Secondary Control	**ROWSS**										
B. Setting Benchmarks	**ROWSS**										
Phase II: DTM Topography and Cross Sections											
A. Topography & X-Sections	**ROWSS**										
B. Utilities, Irrigation Crossings, Outfalls, Driveways, etc.	**ROWSS**										
Phase III: Final Report and Deliverables											
A. Final Report and Deliverables	**ROWSS**										

L&G Engineering
Transportation Consulting Engineers

2100 W. Expressway 83
Mercedes, TX 78570
Phone: (956) 565-9813
Fax: (956) 565-9018
Toll Free: (888) 565-9813

900 S. Stewart Rd., Ste. 10
Mission, TX 78572
Phone: (956) 585-1909
Fax: (956) 585-1927
Toll Free: (866) 585-1909

Firm No. F-4105

Letter of Transmittal

Mr. Raul Sesin, P.E. – District Manager
Hidalgo County Drainage District #1
902 N. Doolittle Rd.
Edinburg, Texas 78542

DATE: July 1, 2015

Project: Progress Report & Invoice Package for Various Work Authorizations
La Joya Watershed Improvement Project
Pharr McAllen Drain & South Floodwater Channel Watershed Improvement Project

L&G PROJECT NO.:

TRANSMITTED:

☒ For Your Use	☐ Please comment	☐ Approved as Noted
☐ As Requested	☐ Reply ASAP	☐ As Noted Below

VIA:

☐ US Mail	☐ Courier	☒ Hand Carry
☐ E-Mail	☐ Lonestar Overnight	☐ Pick up

COPIES	DESCRIPTION
1	Progress Report and Invoice Package (including CD w/Electronic Files) for the following Project:
	• Work Authorization #4 on La Joya Watershed Improvement Project
	○ P.O. #625396, Invoice #11325198
	• Work Authorization #1 on Pharr McAllen Drain & South Floodwater Channel
	○ P.O. #626860, Invoice #11325195
	• Work Authorization #2 on Pharr McAllen Drain & South Floodwater Channel
	○ P.O. #626939, Invoice #11325196

REMARKS:

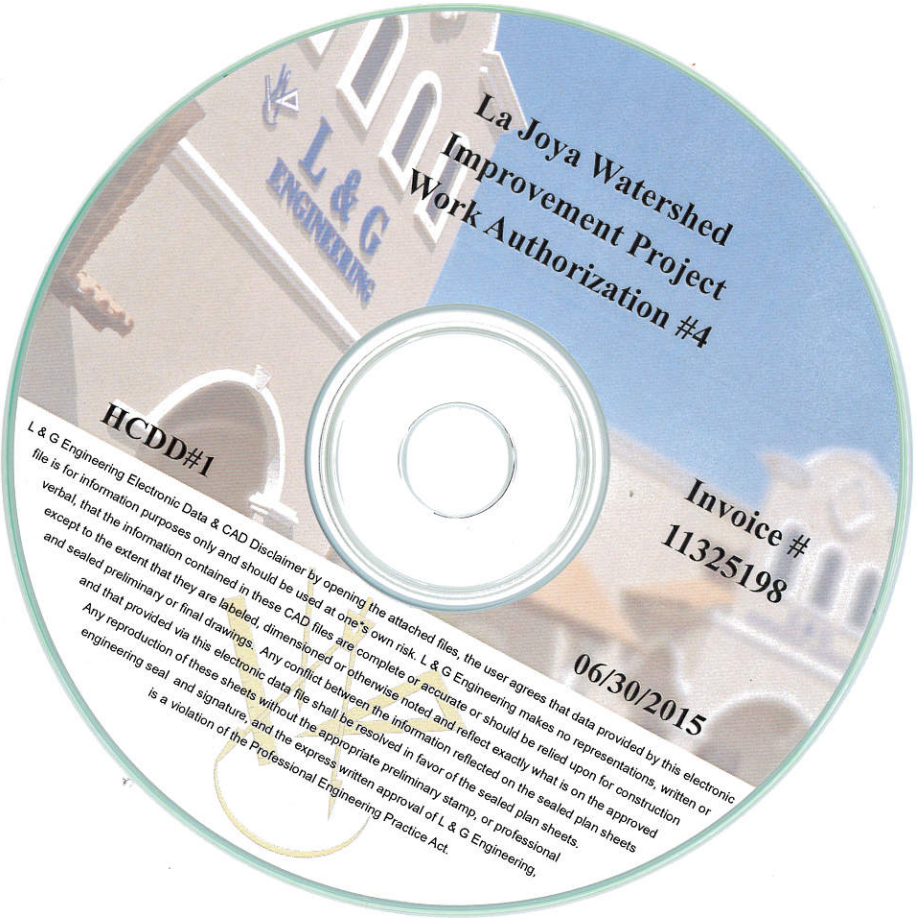
If you have any questions or comments, please feel free to contact me, Mr. David Saenz, P.E. at (956) 585-1909.

RECEIVED
HIDALGO COUNTY
DRAINAGE DISTRICT #1
JUL 01 2015
10:35 AM / PM
BY:

Thank you,

Signed: _____

If enclosures are not as stated, please notify us.



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