FEMA

Technical Support Data Notebook

DFIRM Update for Fort Bend County, Texas, Part 1

Task 42 – Hydrology
Oyster Creek and Lower Oyster Creek

Prepared by

CF3R Joint Venture
Comprehensive Flood Risk Resources and Response

Riverine Flood Insurance Studies Through out FEMA Region VI

Contract No. EMT-2002-CO-0049
Task Order 016

June 2006
(Revised August 2006, February 2007)

Baker Carter::Burgess MOFFATT & NICHOL ENGINEERS CDM

TABLE OF CONTENTS

APPENDICES

A. TSDN Documents

A-1 – Deliverables Checklist
A-2 – Certificate of Compliance
A-3 – Hydrological Analysis Index
A-4 – Mapping Information Index
A-5 – Digital Data Submission Checklist

B. Supporting Documents

Oyster Creek and Lower Oyster Creek Hydrology Analysis, Prepared for FEMA Region VI, Fort bend County, and the City of Sugar Land, by CF3R Joint Venture, June 2006 (Revised August 2006, February 2007) (submitted separately)

C. QAP Forms

D. Digital Files on CD-ROM

D-1 PDF of TSDN
D-2 ReadMe File
D-3 CD ROM Directory
D-4 DFIRM Metadata
D-5 DCS Format Database – uploaded to MIP at:

K:\R06\TEXAS_48\FORT_BEND_48157\FORT_BEND_157C\MICS_16017\Hydrology

I. Introduction

The Comprehensive Flood Risk Resources & Response Joint Venture (hereinafter referred to as CF3R) has completed the hydrologic analysis in accordance with Task Order 016, Task 42, for Fort Bend County, Texas. The hydrologic analysis completed for Task 42 were for streams studied by detailed analysis only as stated in the contract task order. The hydrology consists of developing the peak discharges for Oyster Creek and Lower Oyster Creek for use in hydraulic models. Data generated during the hydrology analyses was assembled and is included herein.

II. Project Work Statement (Task 42)

CF3R has completed the hydrologic data processing activities in accordance with Task Order 016, Task 42, for Fort Bend County, Texas. The Statement of Work for Task 42 is provided below:

Task 42 – Hydrologic Analyses

Oyster Creek only

- Conduct hydrologic analyses for the streams scheduled to receive a detailed study, reviewing existing hydrologic information including any provided by Private Developers or participating communities, and either using regression equations or HEC-HMS to calculate the peak discharges for the 10-, 2-, 1- and 0.2-percent annual chance events. HEC-HMS will be used to perform hydrologic analysis for the detailed studies. No regression equation calculations are anticipated in this Task Order.
- Prepare acquired data in a format consistent with FEMA DCS guidelines and upload it to the MIP once it becomes available. This service is based on the Draft DCS with the assumption that uploading will be a simple transmission process.
- Perform QA/QC in accordance with the approved QAP and prepare the appropriate QAP certification.

III. County Map of Coverage Area

Fort Bend County is located in the southeastern portion of Texas, as shown in **Figure 1** below. It is bordered by Waller County to the north, Wharton County to the south and west, Harris County to the north and east, Brazoria County to the south and east, and Austin County to the west. The county is approximately 886 square miles in size and had a population of 419,772 people at the time of the 2003 census. Richmond is the county seat and is located in the central part of the county approximately twenty-eight miles west-southwest of Houston. Sugar Land, located in the northeastern region of the county, is the largest city.

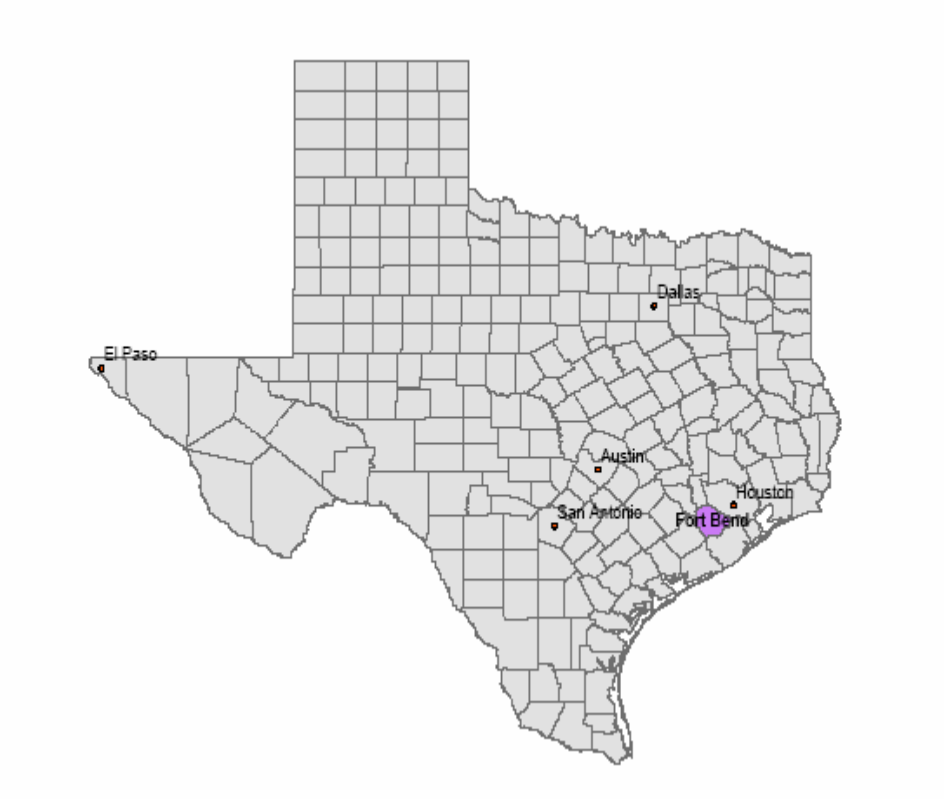

Figure 1: Fort Bend County, TX

IV. METHODOLOGY

Detailed information is provided in the report "(Upper, Middle) Oyster Creek and Lower Oyster Creek Hydrology Analysis, CF3R Joint Venture, June 2006". A summary of the methodology is provided below.

The Oyster Creek study limits are from the junction with Jones Creek 8 miles west of Sugar Land and ends at McKeever Road north of the Sienna Plantation levee. The study reach is divided into 3 sections:

- Upper Oyster Creek from Jones Creek to the Gulf Coast Water Authority (GCWA) Dam 3 in Sugar Land,
- Middle Oyster Creek from the GCWA Dam 3 to the Flat Bank diversion channel in Missouri City,
- Lower Oyster Creek from the Flat Bank diversion channel to the Sienna Plantation levee diversion channel at McKeever Road.

Since the Flat Bank diversion channel diverts all of Oyster Creek flow, the Lower Oyster Creek channel is studied as a separate channel from Upper and Middle Oyster Creek. For simplicity, Upper and Middle Oyster Creek is called Oyster Creek in this study. A map of the watersheds is shown on Figure 2.

The topography of Oyster Creek and Lower Oyster Creek watersheds may best be described as gently sloping to flat. Ground elevations vary from about 90 feet in the northern portion of the watershed to about 60 feet in the Lower Oyster Creek area. Ground slopes in the watersheds are less than 10 feet per mile. Soils in the watersheds are typically clayey or silt-loamy in nature and are characterized by slow permeability, resulting in high runoff potential.

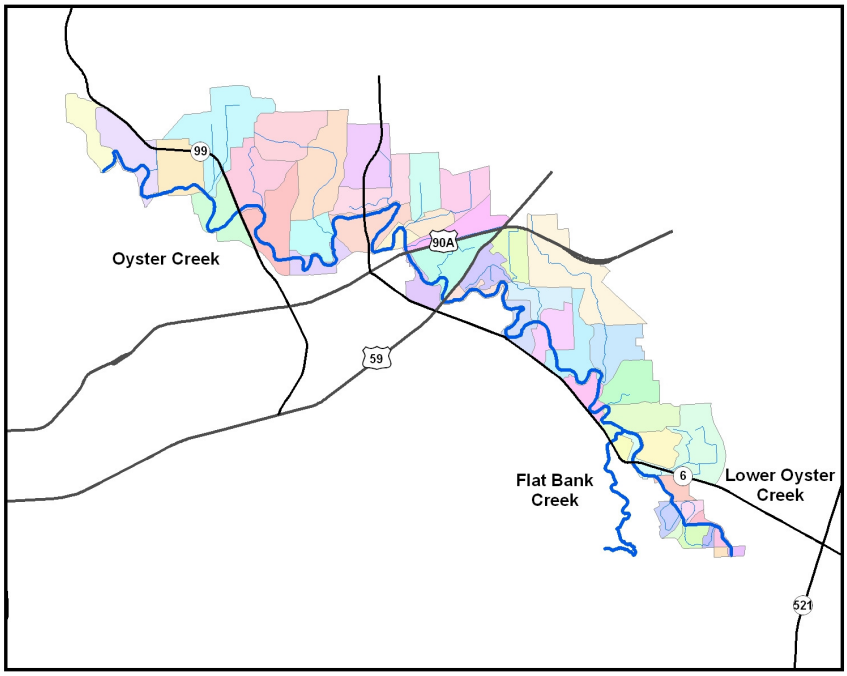

Figure 2: Oyster Creek and Lower Oyster Creek Watersheds

Land use in the watersheds varies from residential, commercial, to undeveloped areas. The majority of the development consists of single-family, residential communities with curb-and-gutter streets and underground storm sewer drainage systems.

Oyster Creek Analysis

The Upper and Middle Oyster Creek watershed covers approximately 46 square miles. The drainage areas were delineated based on the LIDAR topography data collected in 2005 as part of this study. Oyster Creek was also field surveyed to obtain channel cross-sections and structure geometry. The Corps of Engineers HEC-HMS hydrology model version 2.2.2 was used for this analysis.

A recent study of Oyster Creek was performed by Brown & Gay and Costello in 2002 (BGE 2002). The BGE 2002 study was used as a reference for this study.

Rainfall data were obtained from the Fort Bend County Drainage Criteria Manual (1999). No aerial adjustment was made to the point rainfall data. Land use data was developed based on the County GIS data and 2005 aerial imagery. Since the exponential loss function was not available in HEC-HMS version 2.2.2, Green-Ampt loss function was used to compute infiltration loss. Clark Unit Hydrograph was used to calculate runoff volume with the time of concentration TC and storage Coefficient R computed using the methodology from the Fort Bend Drainage Criteria Manual. The modified Puls Routing method was used to route hydrographs between model nodes.

Three Gulf Coast Water Authority (GCWA) dams are located along Upper Oyster Creek to control the water level for the water supply operation. GCWA personnel indicated that the water supply operations should not have an effect during flooding conditions.

The Brooks Lake diversion channel upstream of Dam 2 diverts the Oyster Creek flow during high flow conditions to Ditch H located west of the Levee Improvement District 2 (LID 2). Three AMIL constant upstream level gates regulate the flow from Oyster Creek to Ditch H. The diversion rate was obtained from the BGE 2002 report.

It was previously determined that overflow occurs upstream of GCWA Dam 1 during the 1% event. This study confirmed the overflows location using results from the Oyster Creek HEC-RAS hydraulic model and a detailed mapping of the floodplain. Overflow rating curves were generated by HEC-RAS unsteady analyses.

Lower Oyster Creek Analysis

The Lower Oyster Creek watershed covers approximately 6 square miles. A recent study was performed by Dodson & Associates in 2001 for Missouri City and is summarized in the report entitled "Missouri City Drainage Master Plan Update". The Dodson 2001 study was used as the reference study for this analysis.

Lower Oyster creek was modified during the 1980's to improve the channel conveyance. Two straight-line segments were added to correct the severe meandering upstream of the discharge to the Sienna Plantation Levee diversion channel. The diversion channel directs all Lower Oyster Creek flows to the Brazos River. The diversion channel also conveys flows from Long Point creek.

At its upstream end, Lower Oyster Creek receives inflows from the Mustang Bayou relief channel and the Vicksburg subdivision. The inflow from Mustang Bayou is routed through Kitty Hollow Lake which outfalls to Lower Oyster Creek. The Dodson study combines the inflows from Mustang Bayou via Kitty Hollow Lake and the Vicksburg subdivision with the runoff from the most upstream sub-basin in the Oyster Creek watershed. The resulting hydrograph was adopted in this study.

The old stream meanders were modeled as reservoirs. The outfall pipes from the reservoirs to the straightened channel were field surveyed and the pipe capacities used to compute the reservoir release rates.

The analysis methodology is similar to Oyster Creek as described above.

V. EXCEPTIONS

There were no deviations from the Performance Work Statement or FEMA's Guidelines and Specifications.

VI. RESULTS AND CONCLUSIONS

The following tables compare the peak discharges for the 1% flood event from the previous FIS study with the results of the HEC-HMS models, TX-DOT regression equations, and USGS stream gages within watersheds with similar characteristics. The TX-DOT regression equations are useful for approximating rural, uncontrolled watersheds and therefore not applicable in this study; however, the comparison was added for completeness. As can be seen in Table 2, the flow rates obtained in this study are within the standard error requirements set by FEMA. A Summary of Discharge table is provided at the end of this section.

Stream	Location	HMS Node	HMS		2001 FIS		TX-DOT Regression 1% Q (cfs)
			DA (sq.mi.)	1% Q (cfs)	DA (sq.mi	1% Q (cfs)	
Oyster Creek	Farmer Street	JOC-1	3.03	844			485
	Approx. 1.24 miles U/S of Harlem Road	JOC-2	7.00	1714			1168
	Grand Parkway (SH99)	JOC-3	8.43	1663			1115
	Approx. 0.7 miles D/S of Grand Parkway (SH99)	JOC-4	10.27	2102			1342
	FM 1464	JOC-5	12.21	2101			1408
	Approx. 1.24 miles U/S of State Highway 6	JOC-6	18.77	2299	15.2	700	1723
	State Highway 6	JOC-7A	19.30	2266			
	Approx. 0.75 miles D/S of State Highway 6	JOC-7	22.34	2504			1598
	Approx. 1.12 miles U/S of Harman Road	JOC-8	23.04	2314	20.6	975	1735
	Approx 0.05 miles D/S of Harman Road	JOC-9	26.22	2639	24.5	1950	1998
	Approx. 0.15 miles U/S of US 90A	JOC-10	27.82	3417	26.1	2262	2220
	Approx. 0.75 miles D/S of US 90A	JOC-11	28.36	1176	26.2	2282	
	US 59	JOC-12	29.71	1622	28.0	1330	
	Approx 0.1 miles U/S of Lexington Boulevard	JOC-13	30.17	1553	29.1	800	
	Approx. 0.17 miles D/S of Dulles Avenue	JOC-14	34.08	2417			
	Cartwright Road	JOC-15	35.20	2756	38.0	2575	
	Approx. 0.14 miles U/S of Hampton Drive	JOC-16	41.65	4183			
	Approx. 0.46 miles U/S of Lake Olympia Parkway	JOC-17	43.62	5070			
	Approx. 0.63 miles D/S of Lake Olympia Parkway	JOC-18	45.05	5884	41.3	2800	

Table 1: Flow Comparison between this study, the effective FIS, and TxDOT regression equations

Stream	Location	HMS Node	HMS		TX-DOT Regression 1% event Q (cfs)
			DA (sq.mi.)	1% event Q (cfs)	
Lower Oyster Creek	Trammel Fresno Road	JLOC-1	5.32	69	342
	Watts Plantation Road	JLOC-2	5.78	220	533
	Approx. 0.38 miles D/S of Watts Plantation Road	JLOC-3	6.19	295	999
	Approx. 0.63 miles D/S of Watts Plantation Road	JLOC-4	6.30	361	1161
	Approx. 0.72 miles D/S of Watts Plantation Road	JLOC-5	6.97	449	1284
	Approx. 0.9 miles U/S of McKeever Road	JLOC-6	7.11	629	1360
	Approx. 0.72 miles U/S of McKeever Road	JLOC-7	7.24	633	1380
	McKeever Road	JLOC-8	14.46	2126	2507
	Approx. 0.19 miles D/S of McKeever Road	JLOC-9	14.66	2143	2541

Table 1: Flow Comparison between this study, the effective FIS, and TxDOT regression equations (continued)

Table 2 – Flow Comparison Between This Study and USGS Gages From Similar Watersheds

USGS Gage ID	Station Name	1% Peak Flow			Drainage Area	Estimated Watershed Slope	Development Area
		Lower	Expected	Upper			
		(CFS)	(CFS)	(CFS)	(MI^2)	(FT/MI)	(%)
08072730	Bear Creek near Barker, TX	3830	6880	10700	21.5	6.6	10
08077000	Clear Creek near Pearland, TX	2500	3230	4170	38.8	4.1	22
08068780	Little Cypress Creek near Cypress, TX	4350	7380	11700	41	9.3	6
08115000	Big Creek near Needville, TX	7470	9710	12200	42.8	9.0	7
	Oyster Creek near Flat Bank Diversion*	(--)	9272	(--)	45.05	6.8	44

*Oyster Creek Flow Includes Overflows and Ditch H Diversion

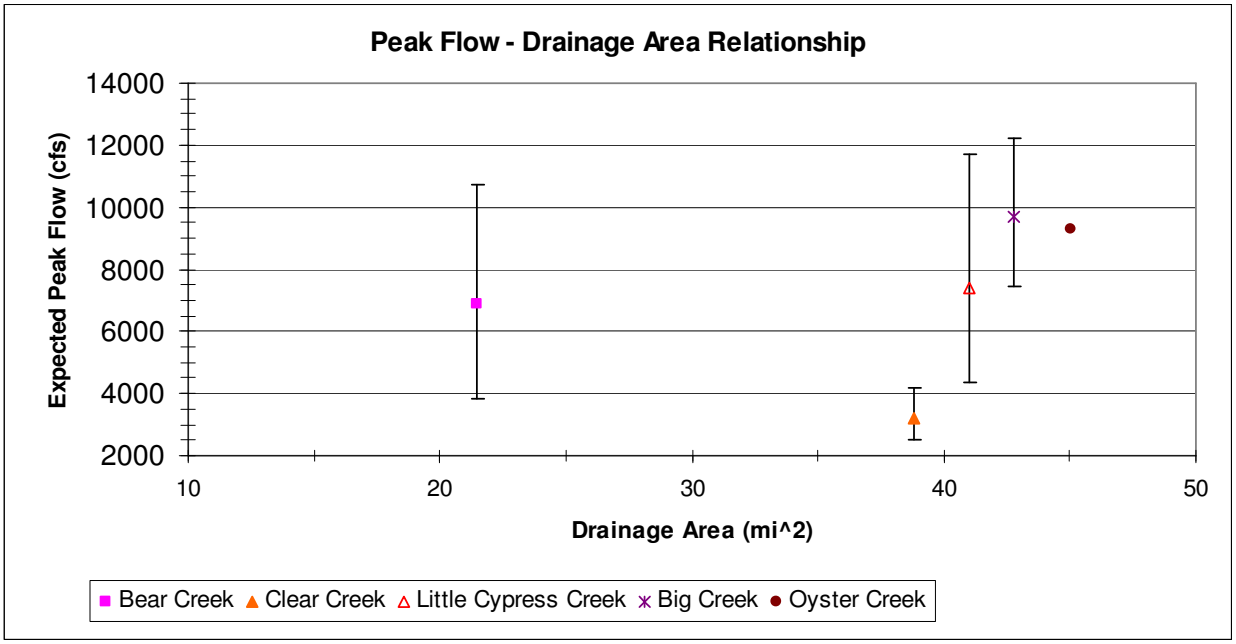

TABLE 3 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
Oyster Creek					
At Farmer Street	3.03	465	712	844	1134
At a point approximately 1.24 miles upstream of Harlem Road	7.00	891	1406	1714	2390
At State Highway 99	8.43	1041	1501	1663	1993
At a point approximately 0.7 miles downstream of State Highway 99	10.27	1227	1852	2102	2648
At FM 1464	12.21	1239	1863	2101	2663
At a point approximately 1.24 miles upstream of State Highway 6	18.77	1363	2043	2299	3006
At State Highway 6	19.30	1349	2008	2266	2888
At a point approximately 0.75 miles downstream of State Highway 6	22.34	1407	2143	2504	3267
At a point approximately 1.12 miles upstream of Harman Road	23.04	1378	2044	2314	2800
At a point approximately 0.05 miles downstream of Harman Road	26.22	1517	2256	2639	3442
At a point approximately 0.15 miles upstream of US Highway 90A	27.82	1892	2929	3417	4551
At a point approximately 0.75 miles downstream of US Highway 90A	28.36	756	1033	1176	1408
At US Highway 59	29.71	936	1387	1622	1919
At a point approximately 0.1 miles upstream of Lexington Boulevard	30.17	890	1319	1553	1859
At a point approximately 0.17 miles downstream of Dulles Avenue	34.08	1208	2013	2417	3227
At Cartwright Road	35.20	1496	2263	2756	3784
At a point approximately 0.14 miles upstream of Hampton Drive	41.65	2300	3412	4183	5819

TABLE 3 - SUMMARY OF DISCHARGES – (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
Oyster Creek (continued)					
At a point approximately 0.46 miles upstream of Lake Olympia Parkway	43.62	2933	4352	5070	6610
At a point approximately 0.63 miles downstream of Lake Olympia Parkway	45.05	3422	5066	5884	7626
Lower Oyster Creek					
At Trammel Fresno Road	5.32	42	61	69	86
At Watts Plantation Road	5.78	173	208	220	242
At a point approximately 0.38 miles downstream of Watts Plantation Road	6.19	217	272	295	346
At a point approximately 0.63 miles downstream of Watts Plantation Road	6.30	232	320	361	447
At a point approximately 0.72 miles downstream of Watts Plantation Road	6.97	282	397	449	557
At a point approximately 0.9 miles upstream of McKeever Road	7.11	318	525	629	849
At a point approximately 0.72 miles upstream of McKeever Road	7.24	322	529	633	853
At McKeever Road	14.46	1074	1767	2126	2874
At a point approximately 0.19 miles downstream of McKeever Road	14.66	1080	1777	2143	2913

VII. REFERENCES

1. Missouri City Master Drainage Plan Update: Mustang Bayou and Lower Oyster Creek, Dodson and Associates, February 2001
2. Upper Oyster Creek and Ditch "H" Drainage Study and Improvement Plan, Brown and Gay Engineers, Inc., Costello, Inc., October 2002
3. Fort Bend County Drainage Criteria Manual, 1999