

DRAINAGE ACTION PLAN

Prepared for the

MEMORIAL CITY REDEVELOPMENT AUTHORITY

On behalf of

TAX INCREMENT REINVESTMENT ZONE NO. 17
(TIRZ No. 17)

prepared by



2925 Briarpark Drive
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Memorial City Redevelopment Authority - Drainage Action Plan Synopsis of Prior Area Drainage Reports

Introduction

To aid in future planning, the Memorial City Redevelopment Authority (MCRDA) requested Lockwood, Andrews & Newnam, Inc. (LAN) to develop a Drainage Action Plan based on the previously performed drainage reports and studies. To accomplish this task, LAN researched and contacted other governmental agencies to determine what drainage problems existed and to catalogue the recommended improvements and their associated cost.

Area Drainage Characteristics

The MCRDA regulatory area is divided into four (4) drainage regions. Based on the most recent Tropical Storm Allison Recovery Project (TSARP), all of these separate regions are located within the Buffalo Bayou Watershed (See **Exhibit 1**).

The four drainage regions are as follows;

- Rummel Creek (HCFCF Unit No. 156-00-00). Located east of Beltway 8 and south of IH-10. This is the only detailed studied channel within the MCRDA boundary.
- Briar Branch W140-01-00. Located north of IH-10 and east of Bunker Hill North.
- W151-00-00. Located east of Gessner and south of IH-10.
- W153-00-00. Located west of Gessner and south of IH-10.

It is important to note that the TSARP area boundaries were developed for the extreme event. The drainage area divide that separates W153 and W151 varies based on the event analyzed. For lesser events, the W151 subwatershed boundary is determined by drainage within the storm sewer system, and extends further west of the extreme event TSARP boundary.

Due to the lack of natural channels within the MCRDA, there is little potential for ravine flooding conditions, with the exception of Rummel Creek. Many of the drainage problems in the MCRDA result from drainage infrastructure that was designed to standards less conservative than those defined by current drainage criteria. **Exhibit 2** illustrates the division of the (4) TSARP regions into 16 major storm sewer systems. The majority of the storm sewer systems are over capacity for the City of Houston's current 2-year design storm event. Some of the storm sewer systems have been documented as exceeding capacity multiple times a year.

The result of an overcapacity storm sewer system is street flooding in the form of street conveyance or sheetflow. The frequency at which street conveyance is currently being experienced within MCRDA No. 17 is undesirable. It has been documented in multiple reports and verified as part of this study that the MCRDA does in fact have adequate overland slope to convey sheetflow as street conveyance (See **Exhibit 3& 4**).

Reports Reviewed

Drainage studies and reports were obtained from TxDOT, City of Houston and HCFCF, and reviewed. A list of reviewed reports and studies can be found in **Table 1** along with a brief description of each. Of the reports reviewed, only four (4) were determined to provide pertinent

information regarding recommended drainage improvements that impact the MCRDA, and are listed below:

- *Study of Flood Control Improvements for the Rummel Creek Watershed*; HCFCFCD; Klotz Associates, Inc.; 1993
- *Comprehensive Drainage Plan*, City of Houston, Turner Collie and Braden; 1999
- *TIRZ No. 17 Drainage Study*; TIRZ; Walter P. Moore; 2002
- *Drainage and Flood Control Study of HCFCFCD Unit W151-00-00 from Buffalo Bayou to IH-10*; HCFCFCD, COH, TxDOT; Klotz Associates, Inc., PBS&J, J.F. Thompson, Inc.; 2004

A combination of storm sewer improvements, channel improvements, and detention ponds were recommended in the four (4) documents. The recommended projects are approximately shown in **Exhibit 5**. Cost estimates were developed for many of the proposed projects as part of the original studies. These cost estimates were updated as part of the Drainage Action Plan development, to reflect more accurately the present construction costs. Preliminary cost estimates were developed for those projects without pre-existing cost estimates. **Appendix B** contains cost estimates for each of the recommended improvements.

The total costs of the projects are estimated to range between \$78.5 and \$89.9 million. A range of costs are provided due to some of the projects having various alternatives. For example, one alternative for W151 Detention includes an open or enclosed detention pond system located at W151 north of IH-10 and Bendwood Park. The range of cost does not include projects which are under construction, in design or did not benefit the MCRDA. These projects were eliminated from further evaluation as part of the Drainage Action Plan.

Prioritization Method

Determining the prioritization of the identified projects is complicated due to the number of drainage areas within the MCRDA (previously discussed), the alternative projects presented (if one project is constructed, another project may not be required), and range in cost for each project. As a result, an evaluation matrix was developed to assist the Board to prioritize the projects in a more systematic and objective way.

To achieve the prioritization of each of the proposed projects categories of criteria were identified and subsequently assigned a perceived value to indicate a beneficial weight relative to the other criteria. For each category, the range of values was defined such that a lower value indicated a negative influence and a higher value indicated a positive influence. Below are the suggested evaluation criteria and their associated range of value.

- **Potential Project Benefit** – The estimated value or benefit of each improvement was assigned a value between zero (0) and five (5). Projects were rated a zero value if it is anticipated they would not benefit the MCRDA and a higher value was given if the benefit was perceived to be greater. A floodplain reclaim project, for example, provides immediate benefit to the impacted area as well as long term benefits in the form of redevelopment opportunities. As previously discussed, the storm sewer projects within the MCRDA are expected to provide a greater benefit to the MCRDA. As a result, they were ranked between three (3) and five (5). To simplify the ranking, the percent capacity increase from the existing storm sewer size to the recommended proposed storm sewer size was used to linearly assign a value.

- **Limited Right-of-Way Required** –The potential for right-of-way acquisition has a negative impact regarding schedule and cost. Cost estimates included in this report do not include right-of-way acquisition. Projects were given a value of zero (0) if it is anticipated right-of-way acquisition will be required, a value of one (2) if it is anticipated that some right-of-way acquisition will be required, and a value of four (4) if it is likely that minimal right-of-way will be needed to complete the project.
- **Timely Project Completion** – Many of the projects are likely to require extensive “stake holder” input and buy-in. Because of the need to develop a broad based consensus, those projects anticipated to require greater negotiations or those not currently on the Capital Improvement Plan (CIP), receive lower values. Projects which are not perceived to be controversial received higher values.

Estimated Years to Complete	Project Rank
0 - 3	3
3 - 5	2
5 - 10	1
Greater than 10	0

- **Funding Leverage Potential** –A value of zero (0) was assigned if there was no apparent participation from other agencies. A value of three (3) was assigned to those projects most likely to have participation from other agencies.
- **Does Not Require Coinciding Project** – Projects that are not considered stand-alone were given a value of zero (0). Project which can be constructed on their own and provide a benefit were assigned a value of one (1)

Project costs were only used to prioritize projects with identical rankings. The lower the cost, the higher the ranking. To identify the ranking of the projects, the values for each of the categories were summed for each project.

Findings

As requested by the Board, LAN reviewed the available drainage reports and studies. To assist the Board in understanding the benefits of the identified projects and prioritize them, an evaluation matrix was developed. Based on the evaluation presented above, there are a total of 15 projects which can provide benefit to the MCRDA. Some of these projects have the added benefit of improving the drainage to the surrounding area. The individual cost for each project is between \$0.9 and \$29.1 million, and the total cost range between \$78.5 and \$89.9 million. It should be noted, out of the recommended projects, twelve are not listed in the MCRDA’s current 5 year CIP approved by the City of Houston. It should also be noted that very little information was available within the existing studies for the W140-00-00 subwatershed located in the Northeast quadrant of the MCRDA. An ancillary recommendation to the Board is the study of this subwatershed to identify potential drainage issues related to inadequate storm sewer capacity as well as potential sheet flow and floodplain issues.

Exhibits

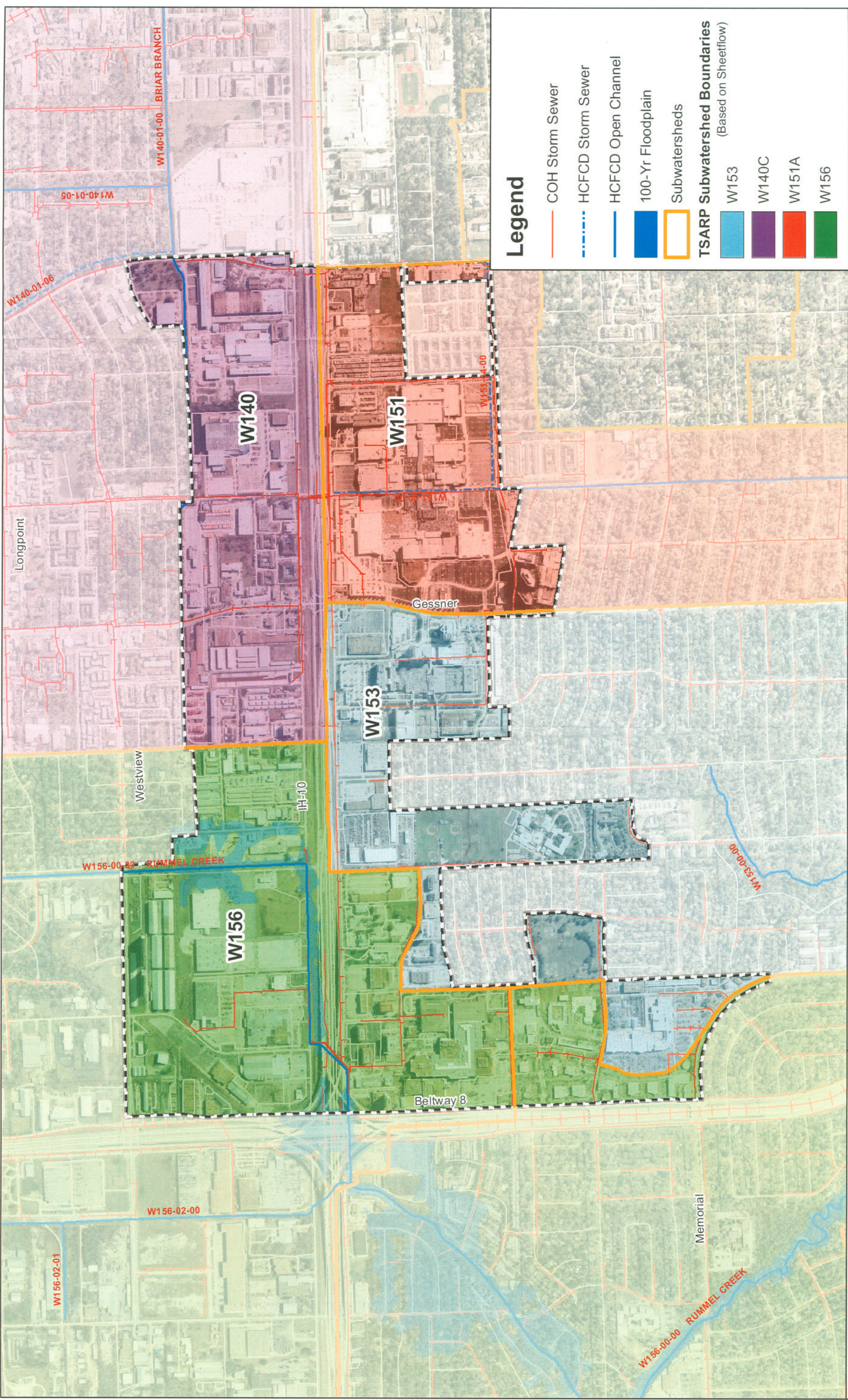
Exhibit 1 – TSARP Subwatersheds

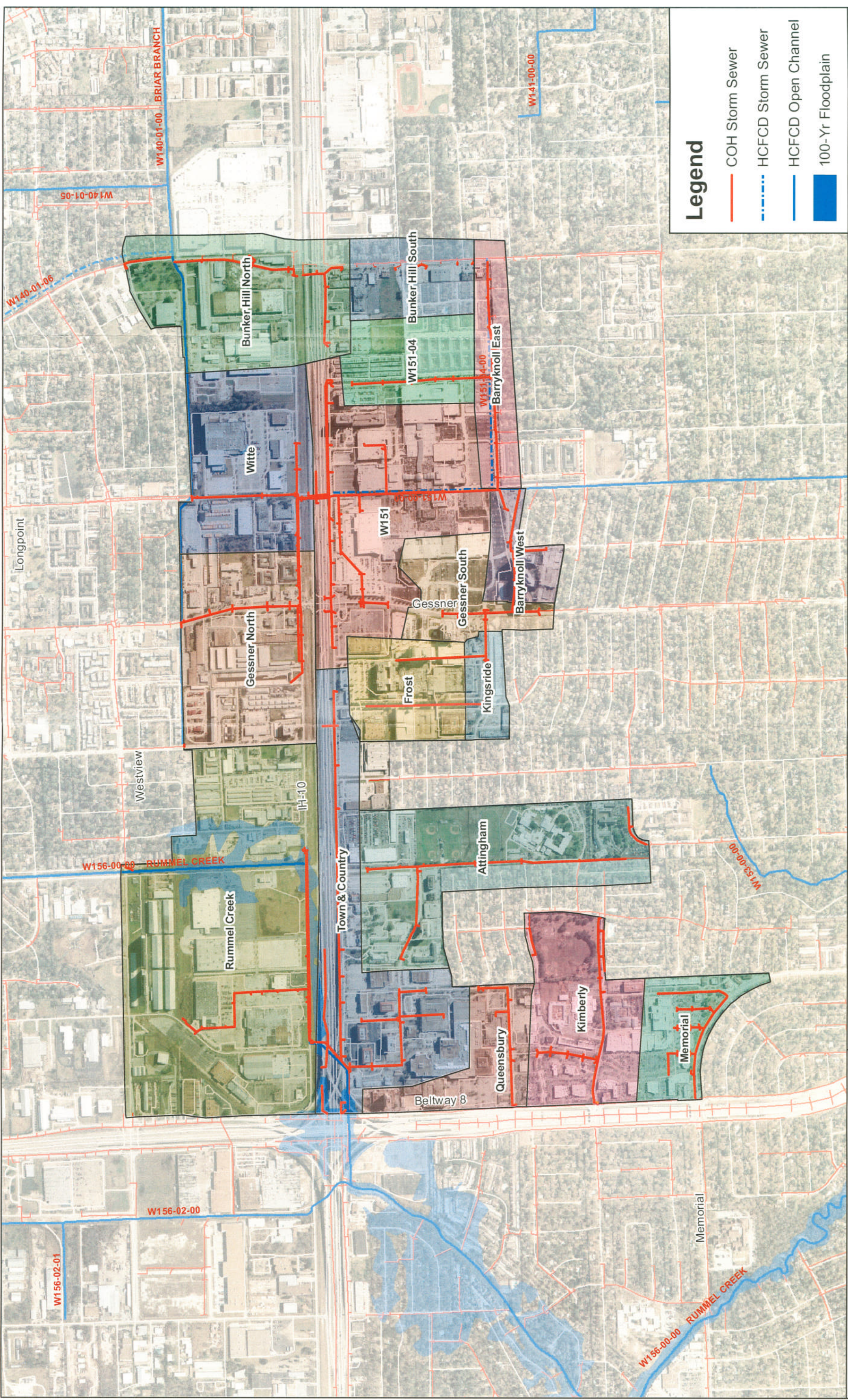
Exhibit 2 – Major Storm Sewer Systems

Exhibit 3 – Sheetflow/Overland Slope

Exhibit 4 – Sheetflow/Overland Slope w/ Storm Sewers

Exhibit 5 – Proposed Drainage Improvement



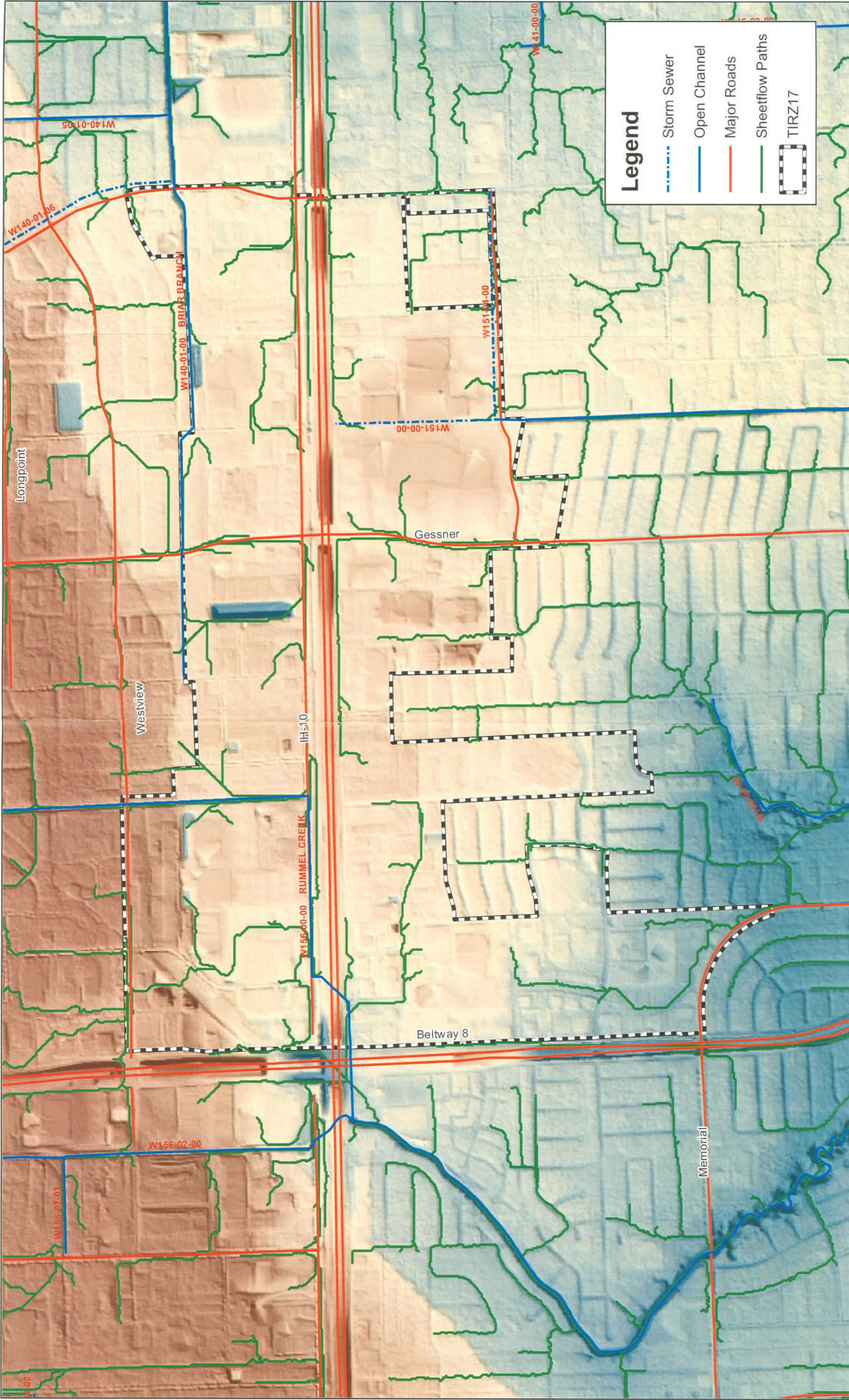


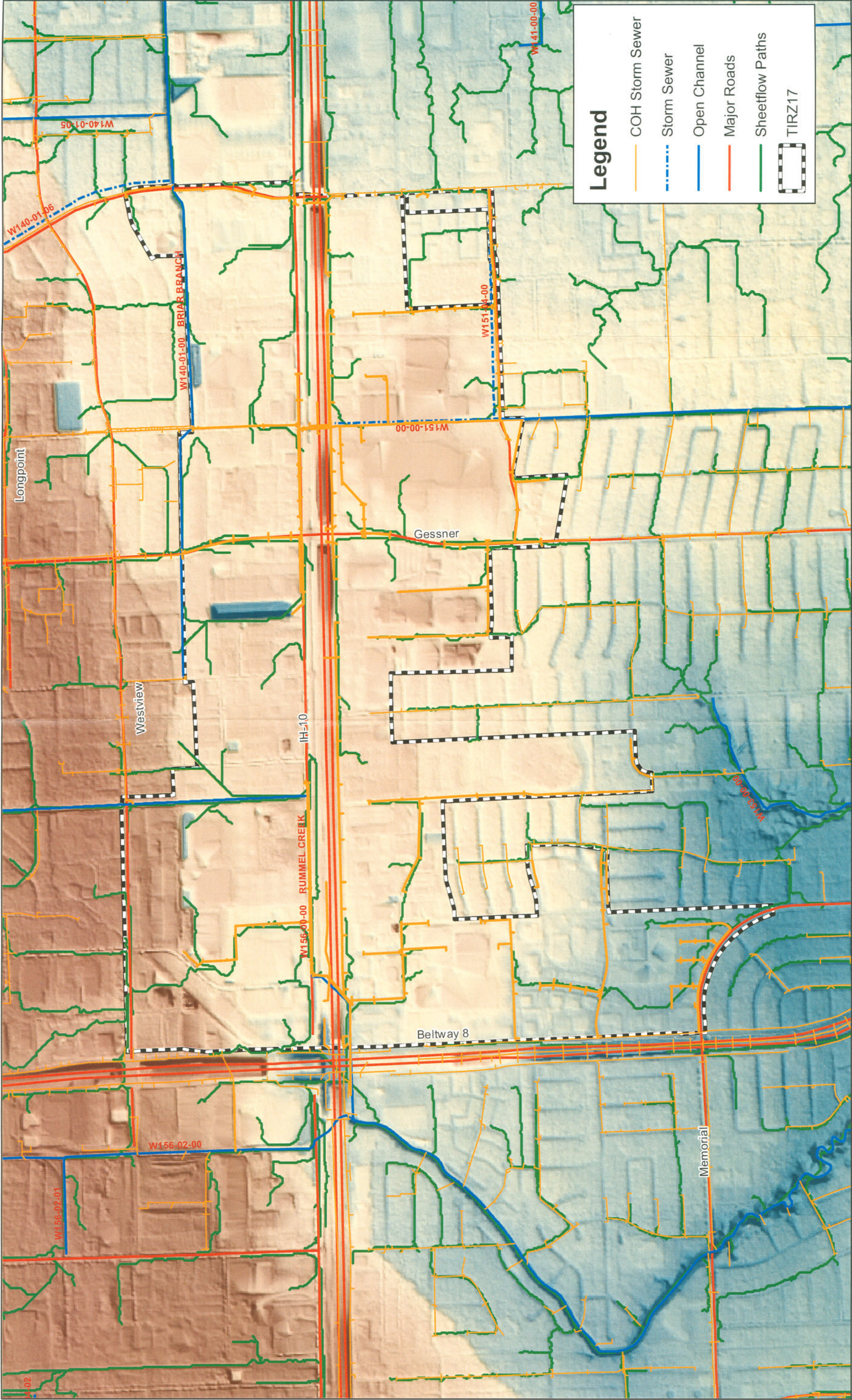
Legend

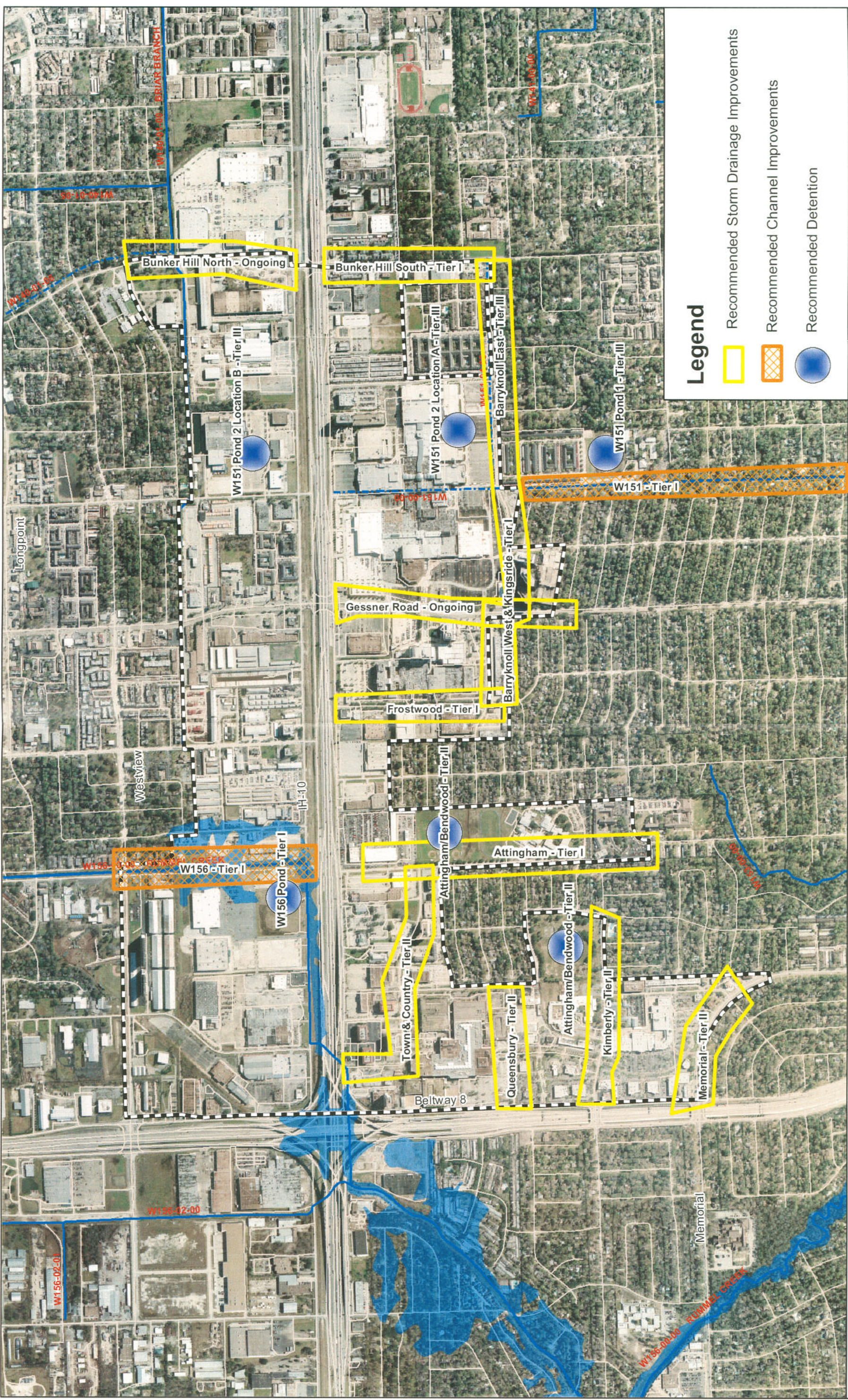
- COH Storm Sewer
- - - HCFCO Storm Sewer
- HCFCO Open Channel
- 100-Yr Floodplain



EXHIBIT 2
Major Storm Sewer Systems







Legend

-  Recommended Storm Drainage Improvements
-  Recommended Channel Improvements
-  Recommended Detention



EXHIBIT 5 Proposed Drainage Improvements

**Table 1
List of Studies and Reports**

REPORT TITLE	ENTITY	PREPARED BY	DATE	SUMMARY	WASHERS	DETERMINATION
CHANNEL SEDIMENT DISPOSAL TESTING W140-00-X007	HCFCO	ESA Specialists of America, Inc.	Mar-05	Water quality	W156	Not applicable
Drainage and Flood Control Study of W151-00-00	HCFCO TXDOT City of Houston	Klotz Associates, Inc. PBS&J J.F. Thompson, Inc.	Oct-04	This report is a feasibility study for drainage and flood control improvements intended to reduce residential and commercial flood damages and reduce nuisance street flooding. Recommendations include channel improvements and detention mitigation.	W140 W151 W156 W153	Applicable
TIRZ 17 Drainage Study	TIRZ 17	Walter P. Moore	Mar-02	This study analyzes existing storm sewer capacity in the district to determine necessary improvements to provide improved drainage for existing and anticipated developed conditions.	W140 W151 W156 W153	Applicable
WETLAND ASSESSMENT-RUMMEL CREEK	HCFCO	Berg - Oliver Associates	Jan-01	Wetland Assessment and delineation along Rummel Creek South of IH-10.	W156	Not applicable
RUMMEL CREEK EROSION REPAIRS AT THE EDITH L. MOORE NATURE SANCTUARY	TXDOT		Jan-01	Evaluation of erosion for Rummel Creek.	W156	Not applicable
WETLAND ASSESSMENT-RUMMEL CREEK	HCFCO	Berg - Oliver Associates	Jan-01	Wetland Assessment and delineation along Rummel Creek South of IH-10.	W156	Not applicable
Comprehensive Drainage Plan City of Houston	City of Houston	Turner Collie and Braden	1999	This study identifies existing storm sewers with insufficient capacity and recommends proposed storm sewer sizes.	W140 W151 W156 W153	Applicable
Frostwood Drainage Improvements Project	City of Houston	Thompson Professional Group	Jul-99	Recommended drainage improvements to the Frostwood subdivision, south of the TIRZ along Gessner Road. Frostwood was isolated from the W151 drainage system and is now served by an alternate storm sewer system down Gessner Road that outfalls into Buffalo Bayou. The report does note that frostwood receives sheet flow from the TIRZ during extreme events.	W153	Not applicable
Memorial Villages Drainage and Flood Control Study	HCFCO	Dodson & Associates, Inc.	Aug-98	Outside TIRZ		Not applicable
IH-10 from West Loop 610 to Fry Road, Drainage Report	TXDOT	Dodson & Associates, Inc.	Sep-98	Recommended drainage improvements to the IH-10 corridor are currently underway. Many of these improvements take place within the boundaries of the TIRZ, including detention near Beltway 8 and IH-10, additional storm sewer capacity along IH-10 corridor, upsized cross culverts, and enclosing the roadside ditch system along the Old Katy Road corridor.	W140 W151 W156 W153	Not applicable
EROSION CONTROL RECOMMENDATIONS FOR RUMMEL CREEK UNIT W156-00-00		Rust Lichlitter/Jameson	Oct-95	Preliminary Engineering Report recommending erosion control measures along Rummel Creek Between IH-1 and Buffalo Bayou.	W156	Not applicable
EROSION CONTROL RECOMMENDATIONS FOR RUMMEL CREEK UNIT W156-00-00	HCFCO	Rust Lichlitter/Jameson	Jun-95	OUTSIDE TIRZ (from I-10 to Buffalo Bayou outside Beltway 8)	W156	Not applicable
FLOOD CONTROL ALTERNATIVES FOR HCFCO UNIT NUMBER W140-01-00 BRIAR BRANCH	HCFCO	Espy, Huston & Associates, Inc.	May-94	Channel improvements in the form of an 8' x 4' low flow concrete box section have been constructed along Briar Branch just downstream of Voss Road to Bunker Hill Road.	W140	Not applicable
STUDY OF FLOOD CONTROL IMPROVEMENTS FOR THE RUMMEL CREEK WATERSHED HCFCO UNIT W156-00-00 AND W156-02-00	HCFCO	Klotz Associates, Inc.	Jun-93	Study of flood control improvements for the Rummel Creek Watershed. Recommends detention North of IH-10 and East of Beltway 8, replacing road side ditches along Old Katy Road with storm sewer, erosion protection to the main channel downstream of IH-10 and other improvements outside of the TIRZ boundaries. Some of the recommended improvements that influence the TIRZ were implemented as part of the IH-10 expansion. The box culvert under IH-10 that serves the Northwest quadrant of the TIRZ was improved providing benefit to the TIRZ. Old Katy Road roadside ditches are now conveyed in storm sewer. However, the majority of the IH-10 improvements, such as additional detention, were designed to mitigate IH-10 impacts only.	W156	Applicable
Memorial Villages Drainage and Flood Control Study	HCFCO	Espy, Huston & Associates, Inc.	Dec-92	Additional detention is recommended adjacent to the channel north of IH-10.		Not applicable



Table 1
List of Studies and Reports

REPORT TITLE	ENTITY	PREPARED BY	DATE	SUMMARY	Watershed	DETERMINATION
HYDRAULIC IMPACT ANALYSIS FOR PAVING AND DRAINAGE IMPROVEMENTS FOR WESTVIEW DRIVE-SHADOWDALE DITCH (W156-00-00)	City of Houston	Carter-Burgess, Inc.	Jul-92	<p>ANALYSIS OF IMPACT Drainage pattern: the construction of Westview improvements will drain approx. 48.5 acres of land to the Shadowdale Ditch. Of this drainage area, 19.5 acres of land draining from the Lumpkin Rd. roadside ditch system will drain to Westview Dr. storm sewer system into the Shadowdale Ditch. Analysis of 100-year flows: Increasing 60 cfs into the Shadowdale Ditch. Flow into Lumpkin Rd roadside ditch should decrease 55 cfs. This Lumpkin Rd system drains into Rummel Creek at the Katy Freeway, which is the same location as Shadowdale Ditch. Therefore, the hydrologic impact on Rummel Creek due to the increased flows in Shadowdale ditch will be negated by the subsequent reduction of flows in the Lumpkin Road system. Hydraulic analysis of the Shadowdale Ditch: from HEC-2, the 100-year water surface elevation for the existing and proposed drainage conditions are 82.02 and 88.16, respectively. The difference between existing and proposed conditions is only 0.14 foot.</p> <p>CONCLUSION The proposed paving and drainage improvements to Westview Dr. between West Belt and Gessner Rd will slightly improve</p>	W156	Impact analysis to Shadowdale Ditch (W156-00-00). No recommendations
RUMMEL CREEK EROSION STUDY	HCFCO	Klotz Associates, Inc.	1991	<p>CONCLUSION The proposed paving and drainage improvements to Westview Dr. between West Belt and Gessner Rd will slightly improve</p>	W156	Not applicable
EROSION EVALUATION RUMMEL CREEK CHANNEL ALIGN	Klotz Associates, Inc.	Mc Bride-Ratcliff & Associates, Inc.	Mar-89	<p>CONCLUSION Evaluation of erosion for Rummel Creek. Outside TIRZ recommended open-lined channel consent be adopted for the improvement of W 151-00-00. The north portion of watershed has a gradual slope of 4 feet per mile toward the south, and increases to 6 ft per mile in the south portion. Approximately 1300 acres of the 1560 acre watershed is served by storm sewer systems outfalling into Settegast Ditch while the remaining acreage is surface drainage. Storm runoff from part of the watershed lying north of I-10 is intercepted by a tributary of Spring Branch, W140-01-00 which, when improved as proposed by Flood Control District, will have capacity to remove approximately 200 cfs which now flows into Settegast Ditch. R.O.W.: The reach of existing Settegast Ditch is located 1400 feet east of Gessner Road from a point 250' south of Barryknoll Dr. to Buffalo Bayou. Because of the development on both side of the ditch, all construction operations must be inside the 50 foot wide R.O.W. Design Criteria: Runoff coefficients using 25 year frequency. Discharge for existing land usage is 1440 cfs. Interception</p>	W156	Not applicable
SETTEGAST DITCH IMPROVEMENT PROJECT W151-00-00	HCFCO	Edminster, Hinshaw, Russ and Associates, Inc.	Aug-80	<p>Conclusion and Recommendation: Capacity and width of the existing channel are insufficient to carry the design flow and allow unrestricted flow under Kimberly Lane and Memorial Dr. bridges. Recommended: Utilizing the existing pilot channel and constructing a 6 horizontal berm each way from the top of the pilot channel, and a side slope of 1:1 with concrete lining would maintain the existing top of bank and maintain berm and would contain design flow north of Memorial Dr., within the natural channel, the removal of debris and selected clearing or vegetation would contain the design flow. Two methods of completed encasing the ditch was also considered and the configuration of these sections are shown on Exhibit E and F the cost will be higher than the open channel plan but the community used of the reclaimed 50 foot R.O.W. would be some justification for their reconsideration. Watershed: natural terrain of the watershed is typical coastal prairie. The north portion of watershed has a gradual slope of 4 feet per mile toward the south, and increases to 8 ft per mile in the south portion. 2 Types development: Light industrial and residential. Approximately 980 acres of the watershed is served by Storm sewer system out falling into the Shadowdale Ditch while the remaining 200 acres in the southwest portion is dependent on the surface drainage to Old Katy Road.</p>	W151	Applicable Outdated
SHADOWDALE DITCH IMPROVEMENT PROJECT W156-00-00	HCFCO	Edminster, Hinshaw, Russ and Associates, Inc.	Oct-75	<p>Recommendation: construction of a double RCB section under the present roadway of Old Katy Road. Area of study: Bunker Hill Village (contains approx. 93 acres, and additional 120 acres to the north was also investigated), the study area was subdivided into 6 drainage areas, area F west of Bunker Hill Road (92.7 acres) is presently being drained by open ditches west along Taylorcrest Road discharging into HCFCO ditch W151-00-00. Recommendation: The storm drainage should be collected and discharged at the existing outfall point. The exhibits shows the proposed storm sewer system for each area. Outside of TIRZ</p>	W156	Outdated
CITY OF BUNKER HILL VILLAGE DRAINAGE STUDY	City of Bunker Hill Village	Pitney, Moffatt & Easley	Sep-73	<p>Recommendation: construction of a double RCB section under the present roadway of Old Katy Road. Area of study: Bunker Hill Village (contains approx. 93 acres, and additional 120 acres to the north was also investigated), the study area was subdivided into 6 drainage areas, area F west of Bunker Hill Road (92.7 acres) is presently being drained by open ditches west along Taylorcrest Road discharging into HCFCO ditch W151-00-00. Recommendation: The storm drainage should be collected and discharged at the existing outfall point. The exhibits shows the proposed storm sewer system for each area. Outside of TIRZ</p>	W151	Not applicable Outdated



**Appendix A
Project Prioritization Matrix**

ID	Project Description	Watershed	A	B	C	D	E	F	G	H	I	J	Tier
			Original Study Cost Estimate	Current Dollar (2006) Cost Estimate	2006 2-yr Capacity Cost Estimate	Project Within TIRZ	Potential Project Benefit	Limited ROW Required	Timely Project Completion	Funding Leverage Potential	Does not Require Coinciding Project	Redundant Project	
A	Barryknoll West & Kingsride	W153/W151	\$2,800,000	\$5,900,000	\$1,800,000	0-1	0-5	0-2,4	0-3	0-2	0-1		11
B	W156 Flood Plain Reduction Project	W156	?	\$2,300,000	\$2,300,000	1	5.0	2	3	0	0		11
C	Bunker Hill South	W151	\$2,400,000	\$5,100,000	\$1,300,000	1	4.4	2	3	0	0		10.4
D	Frostwood Drive	W153/W151	\$1,100,000	\$1,900,000	\$1,900,000	1	4.4	2	3	0	0		10.4
E	W151 - Channel Improvements	W151	\$900,000	\$1,000,000	\$1,000,000	0	5	2	1	2	0		10
F	Arlingham	W153	\$2,900,000	\$6,100,000	\$1,900,000	1	4.0	2	3	0	0		10
G	Memorial Drive	W156	?	\$900,000	\$900,000	1	3.7	2	2	1	0		9.7
H	Town and Country Way	W156	\$2,200,000	\$4,700,000	\$1,300,000	1	3.5	2	3	0	0		9.5
I	Queensbury	W156	?	\$1,100,000	\$1,100,000	1	3.1	2	3	0	0		9.1
J	Bendwood Park Detention	W153	\$4,600,000	\$6,000,000	\$6,000,000	0	2	4	0	2	1		9
K	Kimberley	W156	?	\$1,400,000	\$1,400,000	1	3.0	2	3	0	0		9
L1	W151 Detention Pond 1 - Storm Sewer	W151	\$12,700,000	\$19,100,000	\$19,100,000	1	2	0	1	2	1	L1	7
L2	W151 Detention Pond 2 - Covered Pond	W151	\$19,200,000	\$22,200,000	\$22,200,000	1	2	0	1	2	1	L2	7
M	Barryknoll East	W151	\$2,400,000	\$2,800,000	\$2,800,000	1	1	2	3	0	0		7
N	W151 Enclosure	W151	\$22,400,000	\$29,100,000	\$29,100,000	0	1	2	0	2	1		6
O1	W151 Pond North of IH-10 W/o Top	W140	\$3,300,000	\$4,300,000	\$4,300,000	1	1	2	0	1	1	O1	6
O2	W151 Pond North of IH-10 W/ Top	W140	\$10,400,000	\$13,600,000	\$13,600,000	1	1	2	0	1	1	O2	6
Total			\$87,300,008	\$127,500,000	\$112,000,000								

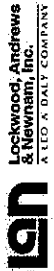
Completed Projects

Project Description	Watershed
Glesner Road	W151
Bunker Hill North	W140
IH-10	All 4
Old Katy Rd	All 4

* Projects Identified in Reports, but either complete or underway.

Notes:

- The above costs include only drainage components and DO NOT consider any roadway components.
- Consulting services such as engineering, surveying, and construction management are not included.
- Storm sewer improvement projects were determined to provide above average benefit to the TIRZ, and therefore were assigned potential project benefit values ranging from 3 to 5. The actual value reflects that percent increase in storm sewer capacity.
- Projects identified in city Comprehensive Drainage Plan, but not previously accounted for in the TIRZ Drainage Study or the W151 study.
- Timely Project Completion Rankings: Estimated years to complete and associated rank: 0-3(Yrs)=3(Rank), 3-5=2, 5-10=1, >10=0



Appendix B1
TIRZ 17 Drainage Study
Project Summary

	2002 Cost Estimate	2006 Cost Estimate	Length (LF)	Cost per LF	2006 2-Yr Capacity Cost Estimate	2-Yr Cost per LF
Proposed Storm Sewer Improvement Projects						
Attingham	\$2,900,000	\$6,100,000	3100	\$1,968	\$1,900,000	\$613
Barryknoll West & Kingsride	\$2,800,000	\$5,900,000	2250	\$2,622	\$1,800,000	\$800
Town and Country Way	\$2,200,000	\$4,700,000	4000	\$1,175	\$1,300,000	\$325
Bunker Hill South	\$2,400,000	\$5,100,000	2000	\$2,550	\$1,300,000	\$650
Total	\$10,300,000	\$21,800,000	11,350	\$1,921	6,300,000	\$555
Existing Storm Sewer Improvement Projects						
IH-10	\$2,000,000	\$4,300,000				
Gessner	\$2,400,000	\$5,100,000				
Old Katy Rd	\$7,600,000	\$16,000,000				
Total	\$12,000,000	\$25,400,000				
Detention Pond Projects						
W151 Pond North of IH-10 W/ Top	\$10,400,000	\$13,600,000				
W151 Pond North of IH-10 W/o Top	\$3,300,000	\$4,300,000				
Bendwood Park	\$4,600,000	\$6,000,000				
W151 Enclosure	\$22,400,000	\$29,100,000				
Total	\$40,700,000	\$53,000,000				

Notes:

1. The above costs include only drainage components and DO NOT consider any roadway components.
2. Consulting services such as engineering, surveying, and construction management are not included.

Attingham
Storm Sewer Cost Estimate

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Standard 48 Inch Manhole	Each	\$1,300	\$2,606	10	\$13,000	\$26,060
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	\$100	40	\$4,000	\$4,000
Standard Type "C" Inlet	Each	\$1,200	\$2,500	20	\$24,000	\$50,000
24 Inch RCP Class III	L.F.	\$35	\$75	100	\$3,500	\$7,500
30 Inch RCP Class III	L.F.	\$45	\$95	1000	\$45,000	\$95,000
36 Inch RCP Class III	L.F.	\$60	\$120	100	\$6,000	\$12,000
Manhole for Box Sewers	Each	\$900	\$2,500	10	\$9,000	\$25,000
12x12 Reinforced Concrete Box	L.F.	\$600	\$1,300	2695	\$1,617,000	\$3,503,500
Class "C" Concrete Seal Slab	C.Y.	\$100	\$100	670	\$67,000	\$67,000
Block SOD	S.Y.	\$2	\$2.50	2872	\$5,744	\$7,180
Connect to Existing Storm Sewer	Each	\$500	\$500	10	\$5,000	\$5,000
Special Structure (See Remarks)	Each				\$0	\$0
Trench Safety	L.F.	\$1	\$1	3895	\$3,895	\$3,895
Extra Excavation	C.Y.	\$10	\$40	1000	\$10,000	\$40,000
Special Excavation	C.Y.	\$15	\$45	1000	\$15,000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	\$75	100	\$7,500	\$7,500

Sub Total		\$1,860,639	\$3,923,635
Misc. Items - 25%		\$465,160	\$980,909
Subtotal		\$2,325,799	\$4,904,544
Contingency - 25%		\$581,450	\$1,226,136
Total		\$2,907,248	\$6,130,680
		\$2,900,000	\$6,100,000

Attingham
Storm Sewer Cost Estimate - 2 Year Capacity

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Standard 48 Inch Manhole	Each	\$2,606	10	\$26,060
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	40	\$4,000
Standard Type "C" Inlet	Each	\$2,500	20	\$50,000
Manhole for Box Sewers	Each	\$2,500	10	\$25,000
Class "C" Concrete Seal Slab	C.Y.	\$100	670	\$67,000
Block SOD	S.Y.	\$2.50	2872	\$7,180
Connect to Existing Storm Sewer	Each	\$500	10	\$5,000
Special Structure (See Remarks)	Each			\$0
Trench Safety	L.F.	\$1	3895	\$3,895
Extra Excavation	C.Y.	\$40	1000	\$40,000
Special Excavation	C.Y.	\$45	1000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	500	\$12,500
Extra Cement - Stablized Sand	C.Y.	\$25	500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	100	\$7,500
30 Inch RCP Class III	L.F.	\$95	21	\$2,032
42 Inch RCP Class III	L.F.	\$160	792	\$126,746
60 Inch RCP Class III	L.F.	\$300	73	\$21,939
66 Inch RCP Class III	L.F.	\$315	357	\$112,534
72 Inch RCP Class III	L.F.	\$330	592	\$195,383
78 Inch RCP Class III	L.F.	\$400	1166	\$466,428

Sub Total	\$1,230,697
Misc. Items - 25%	\$307,674
Subtotal	<u>\$1,538,371</u>
Contingency - 25%	<u>\$384,593</u>
Total	<u>\$1,922,963</u>
	\$1,900,000

**Barryknoll West and Kingsride
Storm Sewer Cost Estimate**

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Standard 48 Inch Manhole	Each	\$1,300	\$2,606	10	\$13,000	\$26,060
Extra Costs for Extra Depth (48" M.H.)	Foot	\$100	\$100	40	\$4,000	\$4,000
Standard Type "C" Inlet	Each	\$1,200	\$2,500	20	\$24,000	\$50,000
24 Inch RCP Class III	L.F.	\$35	\$75	100	\$3,500	\$7,500
30 Inch RCP Class III	L.F.	\$45	\$95	1000	\$45,000	\$95,000
36 Inch RCP Class III	L.F.	\$60	\$120	100	\$6,000	\$12,000
Manhole for Box Sewers	Each	\$900	\$2,500	10	\$9,000	\$25,000
12X12 Reinforced Concrete Box	L.F.	\$600	\$1,300	2585	\$1,551,000	\$3,360,500
Class "C" Concrete Seal Slab	C.Y.	\$100	\$100	670	\$67,000	\$67,000
Block SOD	S.Y.	\$2	\$2.50	2872	\$5,744	\$7,180
Connect to Existing Storm Sewer	Each	\$500	\$500	10	\$5,000	\$5,000
Special Structure (See Remarks)	Each				\$0	\$0
Trench Safety	L.F.	\$1	\$1	3785	\$3,785	\$3,785
Extra Excavation	C.Y.	\$10	\$40	1000	\$10,000	\$40,000
Special Excavation	C.Y.	\$15	\$45	1000	\$15,000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	\$75	100	\$7,500	\$7,500

Sub Total	\$1,794,529	\$3,780,525
Misc. Items - 25%	\$448,632	\$945,131
Subtotal	\$2,243,161	\$4,725,656
Contingency - 25%	\$560,790	\$1,181,414
Total	\$2,803,952	\$5,907,070
	\$2,800,000	\$5,900,000

**Barryknoll West and Kingsride
Storm Sewer Cost Estimate - 2 Year Capacity**

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Standard 48 Inch Manhole	Each	\$2,606	10	\$26,060
Standard Type "C" Inlet	Each	\$2,500	20	\$50,000
Manhole for Box Sewers	Each	\$2,500	10	\$25,000
Class "C" Concrete Seal Slab	C.Y.	\$100	670	\$67,000
Block SOD	S.Y.	\$2.50	2872	\$7,180
Connect to Existing Storm Sewer	Each	\$500	10	\$5,000
Special Structure (See Remarks)	Each			\$0
Trench Safety	L.F.	\$1	2500	\$2,500
Extra Excavation	C.Y.	\$40	1000	\$40,000
Special Excavation	C.Y.	\$45	1000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	100	\$7,500
24 Inch RCP Class III	L.F.	\$75	700	\$52,500
60 Inch RCP Class III	L.F.	\$300	1050	\$315,000
72 Inch RCP Class III	L.F.	\$330	1430	\$471,900

Sub Total	\$1,139,640
Misc. Items - 25%	\$284,910
Subtotal	<u>\$1,424,550</u>
Contingency - 25%	\$356,138
Total	<u>\$1,780,688</u>
	\$1,800,000

**Town & Country Way
Storm Sewer Cost Estimate**

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Standard 48 Inch Manhole	Each	\$1,300	\$2,606	7	\$9,100	\$18,242
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	\$100	28	\$2,800	\$2,800
Standard Type "C" Inlet	Each	\$1,200	\$2,500	14	\$16,800	\$35,000
24 Inch RCP Class III	L.F.	\$35	\$75	1400	\$49,000	\$105,000
30 Inch RCP Class III	L.F.	\$45	\$95	100	\$4,500	\$9,500
36 Inch RCP Class III	L.F.	\$60	\$120	100	\$6,000	\$12,000
Manhole for Box Sewers	Each	\$900	\$2,500	7	\$6,300	\$17,500
12x12 Reinforced Concrete Box	L.F.	\$600	\$1,300	2000	\$1,200,000	\$2,600,000
Class "C" Concrete Seal Slab	C.Y.	\$100	\$100	519	\$51,900	\$51,900
Block SOD	S.Y.	\$2	\$2.50	2222	\$4,444	\$5,555
Connect to Existing Storm Sewer	Each	\$500	\$500	3	\$1,500	\$1,500
Special Structure (See Remarks)	Each				\$0	\$0
Trench Safety	L.F.	\$1	\$1	3600	\$3,600	\$3,600
Extra Excavation	C.Y.	\$10	\$40	1000	\$10,000	\$40,000
Special Excavation	C.Y.	\$15	\$45	1000	\$15,000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	\$75	100	\$7,500	\$7,500

Sub Total	\$1,413,444	\$2,980,097
Misc. Items - 25%	\$353,361	\$745,024
Subtotal	\$1,766,805	\$3,725,121
Contingency - 25%	\$441,701	\$931,280
Total	\$2,208,506	\$4,656,402
	\$2,200,000	\$4,700,000

**Town & Country Way
Storm Sewer Cost Estimate - 2 Year Capacity**

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Standard 48 Inch Manhole	Each	\$2,606	7	\$18,242
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	28	\$2,800
Standard Type "C" Inlet	Each	\$2,500	14	\$35,000
Manhole for Box Sewers	Each	\$2,500	7	\$17,500
Class "C" Concrete Seal Slab	C.Y.	\$100	519	\$51,900
Block SOD	S.Y.	\$2.50	2222	\$5,555
Connect to Existing Storm Sewer	Each	\$500	3	\$1,500
Special Structure (See Remarks)	Each			\$0
Trench Safety	L.F.	\$1	3600	\$3,600
Extra Excavation	C.Y.	\$40	1000	\$40,000
Special Excavation	C.Y.	\$45	1000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	100	\$7,500
36 Inch RCP Class III	L.F.	\$120	130	\$15,600
42 Inch RCP Class III	L.F.	\$160	706	\$112,960
54 Inch RCP Class III	L.F.	\$250	611	\$152,750
66 Inch RCP Class III	L.F.	\$315	1040	\$327,600

Sub Total	\$862,507
Misc. Items - 25%	\$215,627
Subtotal	<u>\$1,078,134</u>
Contingency - 25%	\$269,533
Total	<u>\$1,347,667</u>
	\$1,300,000

**Bunker Hill South
Storm Sewer Cost Estimate**

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Standard 48 Inch Manhole	Each	\$1,300	\$2,606	8	\$10,400	\$20,848
Extra Costs for Extra Depth (48" M.H.)	Foot	\$100	\$100	32	\$3,200	\$3,200
Std. 48-72 Inch Manhole 6	Each	\$1,500	\$1,500	4	\$6,000	\$6,000
Extra Costs for Extra Depth (48-72" M.H.)	Foot	\$150	\$150	16	\$2,400	\$2,400
Standard Type "C" Inlet	Each	\$1,200	\$2,500	16	\$19,200	\$40,000
24 Inch RCP Class III	L.F.	\$35	\$75	960	\$33,600	\$72,000
30 Inch RCP Class III	L.F.	\$45	\$95	240	\$10,800	\$22,800
36 Inch RCP Class III	L.F.	\$60	\$120	240	\$14,400	\$28,800
42 Inch RCP Class III	L.F.	\$94	\$160	240	\$22,560	\$38,400
48 Inch RCP Class III	L.F.	\$106	\$180	240	\$25,440	\$43,200
Manhole for Box Sewers	Each	\$900	\$2,500	8	\$7,200	\$20,000
12X12 Reinforced Concrete Box	L.F.	\$600	\$1,300	2207	\$1,324,200	\$2,869,100
Block SOD	S.Y.	\$2	\$2.50	1226	\$2,452	\$3,065
Connect to Existing Storm Sewer	Each	\$500	\$500	8	\$4,000	\$4,000
Trench Safety	L.F.	\$1	\$1	4127	\$4,127	\$4,127
Extra Excavation	C.Y.	\$10	\$40	1000	\$10,000	\$40,000
Extra Excavation	C.Y.	\$15	\$45	1000	\$15,000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	\$75	100	\$7,500	\$7,500

Sub Total		\$1,547,479	\$3,295,440
Misc. Items - 25%		\$386,870	\$823,860
Subtotal		\$1,934,349	\$4,119,300
Contingency - 25%		\$483,587	\$1,029,825
Total		\$2,417,936	\$5,149,125
		\$2,400,000	\$5,100,000

Bunker Hill South
Storm Sewer Cost Estimate - 2 Year Capacity

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Standard 48 Inch Manhole	Each	\$2,606	8	\$20,848
Extra Costs for Extra Depth (48" M.H.)	Foot	\$100	32	\$3,200
Std. 48-72 Inch Manhole 6	Each	\$1,500	4	\$6,000
Extra Costs for Extra Depth (48-72" M.H.)	Foot	\$150	16	\$2,400
Standard Type "C" Inlet	Each	\$2,500	16	\$40,000
Manhole for Box Sewers	Each	\$2,500	8	\$20,000
Block SOD	S.Y.	\$2.50	1226	\$3,065
Connect to Existing Storm Sewer	Each	\$500	8	\$4,000
Trench Safety	L.F.	\$1	4127	\$4,127
Extra Excavation	C.Y.	\$40	1000	\$40,000
Extra Excavation	C.Y.	\$45	1000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	100	\$7,500
30 Inch RCP Class III	L.F.	\$95	140	\$13,300
48 Inch RCP Class III	L.F.	\$180	305	\$54,900
66 Inch RCP Class III	L.F.	\$315	457	\$143,955
72 Inch RCP Class III	L.F.	\$330	248	\$81,840
78 Inch RCP Class III	L.F.	\$400	273	\$109,200
102 Inch RCP Class III	L.F.	\$500	462	\$231,000

Sub Total	\$855,335
Misc. Items - 25%	\$213,834
Subtotal	<u>\$1,069,169</u>
Contingency - 25%	\$267,292
Total	<u>\$1,336,461</u>
	\$1,300,000

III-10
Storm Sewer Cost Estimate

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Standard 48 Inch Manhole	Each	\$1,300	\$2,600	4	\$5,200	\$10,400
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	\$100	16	\$1,600	\$1,600
Standard Type "C" Inlet	Each	\$1,200	\$2,500	4	\$4,800	\$10,000
24 Inch RCP Class III	L.F.	\$35	\$75	400	\$14,000	\$30,000
30 Inch RCP Class III	L.F.	\$45	\$95	100	\$4,500	\$9,500
36 Inch RCP Class III	L.F.	\$60	\$120	100	\$6,000	\$12,000
42 Inch RCP Class III	L.F.	\$94	\$160	100	\$9,400	\$16,000
Manhole for Box Sewers	Each	\$900	\$2,500	4	\$3,600	\$10,000
12x12 Reinforced Concrete Box	L.F.	\$600	\$1,300	1942	\$1,165,200	\$2,524,600
Convert "B" Inlet to "B-B" Inlet	Each	\$500	\$1,500	8	\$4,000	\$12,000
Adjust Ex M.H. Frame & Cover	Each	\$250	\$250	8	\$2,000	\$2,000
Class "C" Concrete Seal Slab	C.Y.	\$100	\$100	50	\$5,000	\$5,000
Hydromulch Seeding	S.Y.	\$0.20	\$0.20	10789	\$2,158	\$2,158
Block SOD	S.Y.	\$2	\$2.50	647	\$1,294	\$1,618
Connect to Existing Storm Sewer	Each	\$500	\$500	16	\$8,000	\$8,000
Trench Safety	L.F.	\$1	\$1	2642	\$2,642	\$2,642
Extra Excavation	C.Y.	\$10	\$40	1000	\$10,000	\$40,000
Special Excavation	C.Y.	\$15	\$45	1000	\$15,000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	\$75	100	\$7,500	\$7,500

Sub Total		\$1,296,894	\$2,775,017
Misc. Items - 25%		\$324,223	\$693,754
Subtotal		\$1,621,117	\$3,468,772
Contingency - 25%		\$405,279	\$867,193
Total		\$2,026,397	\$4,335,965
		\$2,000,000	\$4,300,000

Gessner
Storm Sewer Cost Estimate

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Standard 48 Inch Manhole	Each	\$1,300	\$2,606	8	\$10,400	\$20,848
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	\$100	32	\$3,200	\$3,200
Std. 48-72 Inch Manhole 6	Each	\$1,500	\$1,500	4	\$6,000	\$6,000
Extra Cost for Extra Depth (48-70" M.H.)	Foot	\$150	\$150	16	\$2,400	\$2,400
Standard Type "C" Inlet	Each	\$1,200	\$2,500	16	\$19,200	\$40,000
24 Inch RCP Class III	L.F.	\$35	\$75	960	\$33,600	\$72,000
30 Inch RCP Class III	L.F.	\$45	\$95	240	\$10,800	\$22,800
36 Inch RCP Class III	L.F.	\$60	\$120	240	\$14,400	\$28,800
42 Inch RCP Class III	L.F.	\$94	\$160	240	\$22,560	\$38,400
48 Inch RCP Class III	L.F.	\$106	\$180	240	\$25,440	\$43,200
Manhole for Box Sewers	Each	\$900	\$2,500	8	\$7,200	\$20,000
12X12 Reinforced Concrete Box	L.F.	\$600	\$1,300	2207	\$1,324,200	\$2,869,100
Block SOD	S.Y.	\$2	\$2.50	1226.11	\$2,452	\$3,065
Connect to Existing Storm Sewer	Each	\$500	\$500	8	\$4,000	\$4,000
Trench Safety	L.F.	\$1	\$1	4127	\$4,127	\$4,127
Extra Excavation	C.Y.	\$10	\$40	1000	\$10,000	\$40,000
Special Excavation	C.Y.	\$15	\$45	1000	\$15,000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	\$75	100	\$7,500	\$7,500

Sub Total		\$1,547,479	\$3,295,440
Misc. Items - 25%		\$386,870	\$823,860
Subtotal		\$1,934,349	\$4,119,300
Contingency - 25%		\$483,587	\$1,029,825
Total		\$2,417,936	\$5,149,125
		\$2,400,000	\$5,100,000

**Old Katy Rd.
Storm Sewer Cost Estimate**

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Standard 48 Inch Manhole	Each	\$1,300	\$2,606	23	\$29,900	\$59,938
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	\$100	92	\$9,200	\$9,200
Standard Type "C" Inlet	Each	\$1,200	\$2,500	46	\$55,200	\$115,000
24 Inch RCP Class III	L.F.	\$35	\$75	4600	\$161,000	\$345,000
30 Inch RCP Class III	L.F.	\$45	\$95	1000	\$45,000	\$95,000
36 Inch RCP Class III	L.F.	\$60	\$120	1000	\$60,000	\$120,000
Manhole for Box Sewers	Each	\$900	\$2,500	23	\$20,700	\$57,500
12x12 Reinforced Concrete Box	L.F.	\$600	\$1,300	7000	\$4,200,000	\$9,100,000
Class "C" Concrete Seal Slab	C.Y.	\$100	\$100	1815	\$181,500	\$181,500
Block SOD	S.Y.	\$2	\$2.50	7778	\$15,556	\$19,445
Connect to Existing Storm Sewer	Each	\$500	\$500	5	\$2,500	\$2,500
Trench Safety	L.F.	\$1	\$1	13600	\$13,600	\$13,600
Extra Excavation	C.Y.	\$10	\$40	1000	\$10,000	\$40,000
Special Excavation	C.Y.	\$15	\$45	1000	\$15,000	\$45,000
Washed Shell in Trench Bottom	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Cement - Stabilized Sand	C.Y.	\$25	\$25	500	\$12,500	\$12,500
Extra Class "A" Concrete	C.Y.	\$75	\$75	100	\$7,500	\$7,500

Sub Total	\$4,851,656	\$10,236,183
Misc. Items - 25%	\$1,212,914	\$2,559,046
Subtotal	\$6,064,570	\$12,795,229
Contingency - 25%	\$1,516,143	\$3,198,807
Total	\$7,580,713	\$15,994,036
	\$7,600,000	\$16,000,000

**W151 Pond North of I-10 w-Top
Cost Estimate**

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Clearing (Brush and Grass Acreage)	Acre	\$3,000	\$3,900	5	\$15,000	\$19,500
Mobilization, Insurance & Bonds	Each	\$50,000	\$65,000	1	\$50,000	\$65,000
Excavation (Storm Sewer)	C.Y.	\$5	\$7	3437	\$17,185	\$22,341
Remove Existing Conc. Pavements	S.Y.	\$7	\$9	24200	\$169,400	\$220,220
Site Pavement	S.Y.	\$50	\$65	1000	\$50,000	\$65,000
Standard 48 Inch Manhole	Each	\$1,300	\$1,690	8	\$10,400	\$13,520
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	\$130	5	\$500	\$650
Standard Type "A" Inlet	Each	\$500	\$650	8	\$4,000	\$5,200
Standard Type "E" Inlet	Each	\$1,000	\$1,300	4	\$4,000	\$5,200
12 Inch PVC Pip (SDR-35)	L.F.	\$18	\$23	100	\$1,800	\$2,340
18 Inch RCP Class III	L.F.	\$25	\$33	500	\$12,500	\$16,250
24 Inch RCP Class III	L.F.	\$35	\$46	2000	\$70,000	\$91,000
Bore & Jack 12 Inch Pipe	L.F.	\$40	\$52	100	\$4,000	\$5,200
Bore & Jack 18 Inch Pipe	L.F.	\$55	\$72	100	\$5,500	\$7,150
Bore & Jack 24 Inch Pipe	L.F.	\$75	\$98	100	\$7,500	\$9,750
10' X 10' Box Culvert	L.F.	\$700	\$1,000	400	\$280,000	\$400,000
Flow Control Structure	Each	\$10,000	\$13,000	1	\$10,000	\$13,000
Adjust Ex M.H. Frame & Cover	Each	\$250	\$325	2	\$500	\$650
Class "C" Concrete Seal Slab	C.Y.	\$100	\$130	3000	\$300,000	\$390,000
Hydromulch Seeding	S.Y.	\$0.20	\$0	53240	\$10,648	\$13,842
Block SOD	S.Y.	\$2	\$3	5000	\$10,000	\$13,000
4" Slope Concrete Pavement	S.Y.	\$25	\$33	15000	\$375,000	\$487,500
Pavement Header Top and Bottom	L.F.	\$20	\$26	3750	\$75,000	\$97,500
Concrete Top for Hard Court Sports	S.F.	\$26	\$34	176250	\$4,582,500	\$5,957,250
Connect to Existing Storm Sewer	Each	\$500	\$650	2	\$1,000	\$1,300
Excavation for Detention Pond	C.Y.	\$7	\$9	64500	\$451,500	\$586,950
Fencing	L.F.	\$2,000	\$2,600	15	\$30,000	\$39,000
Gates	Each	\$2,500	\$3,250	2	\$5,000	\$6,500
Weep Holes	Each	\$50	\$65	60	\$3,000	\$3,900
Traffic Control	L.S.	\$25,000	\$32,500	1	\$25,000	\$32,500
Storm Water Runoff	L.S.	\$25,000	\$32,500	1	\$25,000	\$32,500
Extra Excavation	C.Y.	\$10	\$13	1000	\$10,000	\$13,000
Special Excavation	C.Y.	\$15	\$20	1000	\$15,000	\$19,500
Washed Shell In Trench Bottom	C.Y.	\$25	\$33	100	\$2,500	\$3,250
Extra Cement-Stablized Sand	C.Y.	\$25	\$33	1000	\$25,000	\$32,500
Extra Class "A" Concrete	C.Y.	\$75	\$98	100	\$7,500	\$9,750

Sub Total	\$6,665,933	\$8,701,713
Misc. Items - 25%	\$1,666,483	\$2,175,428
Subtotal	\$8,332,416	\$10,877,141
Contingency - 25%	\$2,083,104	\$2,719,285
Total	\$10,415,520	\$13,596,426
	\$10,400,000	\$13,600,000

**W151 Pond North of I-10
Cost Estimate**

Item Description	Unit	2002 Unit Cost	2006 Unit Cost	Quantity	2002 Subtotal	2006 Subtotal
Clearing (Brush and Grass Acreage)	Acre	\$3,000	\$3,900	5	\$15,000	\$19,500
Mobilization, Insurance & Bonds	Each	\$50,000	\$65,000	1	\$50,000	\$65,000
Excavation (Storm Sewer)	C.Y.	\$5	\$7	3437	\$17,185	\$22,341
Remove Existing Conc. Pavements	S.Y.	\$7	\$9	24200	\$169,400	\$220,220
Site Pavement	S.Y.	\$50	\$65	1000	\$50,000	\$65,000
Standard 48 Inch Manhole	Each	\$1,300	\$1,690	8	\$10,400	\$13,520
Extra Cost for Extra Depth (48" M.H.)	Foot	\$100	\$130	5	\$500	\$650
Standard Type "A" Inlet	Each	\$500	\$650	8	\$4,000	\$5,200
Standard Type "E" Inlet	Each	\$1,000	\$1,300	4	\$4,000	\$5,200
12 Inch PVC Pipe (SDR-35)	L.F.	\$18	\$23	100	\$1,800	\$2,340
18 Inch RCP Class III	L.F.	\$25	\$33	500	\$12,500	\$16,250
24 Inch RCP Class III	L.F.	\$35	\$46	2000	\$70,000	\$91,000
Bore & Jack 12 Inch Pipe	L.F.	\$40	\$52	100	\$4,000	\$5,200
Bore & Jack 18 Inch Pipe	L.F.	\$55	\$72	100	\$5,500	\$7,150
Bore & Jack 24 Inch Pipe	L.F.	\$75	\$98	100	\$7,500	\$9,750
10' X 10' Box Culvert	L.F.	\$700	\$1,000	400	\$280,000	\$400,000
Flow Control Structure	Each	\$10,000	\$13,000	1	\$10,000	\$13,000
Adjust Ex M.H. Frame & Cover	Each	\$250	\$325	2	\$500	\$650
Class "C" Concrete Seal Slab	C.Y.	\$100	\$130	3000	\$300,000	\$390,000
Hydromulch Seeding	S.Y.	\$0.20	\$0	53240	\$10,648	\$13,842
Block SOD	S.Y.	\$2	\$3	5000	\$10,000	\$13,000
4" Slope Concrete Pavement	S.Y.	\$25	\$33	15000	\$375,000	\$487,500
Pavement Header Top and Bottom	L.F.	\$20	\$26	3750	\$75,000	\$97,500
Connect to Existing Storm Sewer	Each	\$500	\$650	2	\$1,000	\$1,300
Excavation for Detention Pond	C.Y.	\$7	\$9	64500	\$451,500	\$586,950
Fencing	L.F.	\$2,000	\$2,600	15	\$30,000	\$39,000
Gates	Each	\$2,500	\$3,250	2	\$5,000	\$6,500
Weep Holes	Each	\$50	\$65	60	\$3,000	\$3,900
Traffic Control	L.S.	\$25,000	\$32,500	1	\$25,000	\$32,500
Storm Water Runoff	L.S.	\$25,000	\$32,500	1	\$25,000	\$32,500
Extra Excavation	C.Y.	\$10	\$13	1000	\$10,000	\$13,000
Special Excavation	C.Y.	\$15	\$20	1000	\$15,000	\$19,500
Washed Shell In Trench Bottom	C.Y.	\$25	\$33	100	\$2,500	\$3,250
Extra Cement-Stablized Sand	C.Y.	\$25	\$33	1000	\$25,000	\$32,500
Extra Class "A" Concrete	C.Y.	\$75	\$98	100	\$7,500	\$9,750

Sub Total	\$2,083,433	\$2,744,463
Misc. Items - 25%	\$520,858	\$686,116
Subtotal	\$2,604,291	\$3,430,579
Contingency - 25%	\$651,073	\$857,645
Total	\$3,255,364	\$4,288,223
	\$3,300,000	\$4,300,000

Appendix B2
Drainage and Flood Control Study of HCFCD Unit No. W151-00-00
Project Summary

	2004 Cost	2006 Cost	length	Cost per
	Estimate	Estimate	(LF)	LF
Storm Sewer Improvement Projects				
Frostwood	\$1,100,000	\$1,900,000	1460	\$1,301
Barryknoll East	\$2,400,000	\$2,800,000	4,170	\$671
Non-Storm Sewer Improvement Projects				
Channel Improvements	\$900,000	\$1,000,000		
Detention Pond 1 - Storm Sewer	\$12,700,000	\$19,100,000		
Detention Pond 2 - Covered Pond	\$19,200,000	\$22,200,000		
Total	\$36,300,000	\$47,000,000	5,630	\$8,348

Notes:

1. The above costs include only drainage components and DO NOT consider any roadway components.
2. Consulting services such as engineering, surveying, and construction management are not included.

**Frostwood Drive
Storm Sewer Cost Estimate**

Item Description	Unit	2004 Unit Cost	2006 Unit Cost	Quantity	2004 Subtotal	2006 Subtotal
Mobilization (4%)	LS	\$44,000	\$72,000	1	\$44,000	\$72,000
Traffic Control	LS	\$15,000	\$15,000	1	\$15,000	\$15,000
Flagmen	LS	\$10,000	\$10,000	1	\$10,000	\$10,000
Trench Safety System	LF	\$5	\$6	1500	\$7,500	\$9,000
SWPPP	LS	\$5,000	\$5,000	1	\$5,000	\$5,000
Utility Relocation-Major	LF	\$100	\$120	50	\$5,000	\$6,000
Utility Relocation-Minor	LF	\$50	\$75	50	\$2,500	\$3,750
Remove 36" Storm Sewer	LF	\$15	\$20	1500	\$22,500	\$30,000
Remove 60" Storm Swer	LF	\$20	\$25		\$0	\$0
Dewatering	LF	\$25	\$30.00	200	\$5,000	\$6,000
Filter Bedding	LF	\$25	\$30	200	\$5,000	\$6,000
Inlets	Ea	\$2,000	\$2,500	10	\$20,000	\$25,000
Manholes	Ea	\$2,000	\$2,600	5	\$10,000	\$13,000
24" Storm Sewer Leads	LF	\$75	\$75	400	\$30,000	\$30,000
66" RCP Storm Sewer	LF	\$250	\$305	800	\$200,000	\$244,000
72" RCP Storm Sewer	LF	\$275	\$330	260	\$71,500	\$85,800
1 -7'x5' Box Culvert	LF	\$135	\$400	740	\$99,900	\$296,000
1 -7'x6' Box Culvert	LF	\$150	\$425	900	\$135,000	\$382,500

Sub Total	\$687,900	\$1,239,050
Misc. Items - 25%	\$171,975	\$309,763
Subtotal	<u>\$859,875</u>	<u>\$1,548,813</u>
Contingency - 25%	\$214,969	\$387,203
Total	<u>\$1,074,844</u>	<u>\$1,936,016</u>
	\$1,100,000	\$1,900,000

**Barryknoll Lane East
Storm Sewer Cost Estimate**

Item Description	Unit	2004 Unit Cost	2006 Unit Cost	Quantity	2004 Subtotal	2006 Subtotal
Mobilization (4%)	LS	\$110,000	\$110,000	1	\$110,000	\$110,000
Traffic Control	LS	\$50,000	\$50,000	1	\$50,000	\$50,000
Flagmen	LS	\$60,000	\$60,000	1	\$60,000	\$60,000
Trench Safety System	LF	\$5	\$6	4,500	\$22,500	\$27,000
SWPPP	LS	\$10,000	\$10,000	1	\$10,000	\$10,000
Utility Relocation-Major	LF	\$100	\$120	100	\$10,000	\$12,000
Utility Relocation-Minor	LF	\$50	\$75	200	\$10,000	\$15,000
Remove 48" Storm Sewer	LF	\$15	\$20	2,420	\$36,300	\$48,400
Remove 60" Storm Swer	LF	\$20	\$25	1,750	\$35,000	\$43,750
Dewatering	LF	\$25	\$30	1,000	\$25,000	\$30,000
Filter Bedding	LF	\$25	\$30	1,000	\$25,000	\$30,000
Inlets	Ea	\$2,000	\$2,500	14	\$28,000	\$35,000
24" Storm Sewer Leads	LF	\$75	\$75	400	\$30,000	\$30,000
Manholes	Ea	\$2,000	\$2,600	14	\$28,000	\$36,400
60" RCP Storm Sewer	LF	\$225	\$300	2,420	\$544,500	\$726,000
72" RCP Storm Sewer	LF	\$275	\$315	1,750	\$481,250	\$551,250

Sub Total		\$1,505,550	\$1,814,800
Misc. Items - 25%		\$376,388	\$453,700
Subtotal		\$1,881,938	\$2,268,500
Contingency - 25%		\$470,484	\$567,125
Total		\$2,352,422	\$2,835,625
		\$2,400,000	\$2,800,000

W151 - Detention Pond Option 1
50 Acre-Foot Detention - Box Culverts - 10'10' - Cost Estimate

Item Description	Unit	2004 Unit Cost	2006 Unit Cost	Quantity	2004 Subtotal	2006 Subtotal
Mobilization	LS	\$120,000	\$138,000	1	\$120,000	\$138,000
Site Preparation and Restoration	LS	\$10,000	\$11,500	1	\$10,000	\$11,500
Pavement Demolition	SY	\$3	\$3	35470	\$106,410	\$122,372
Utility Relocation -Major	LF	\$100	\$115	1,200	\$120,000	\$138,000
Utility Relocation -Minor	LF	\$50	\$58	1200	\$60,000	\$69,000
Dewatering	LF	\$25	\$29	1000	\$25,000	\$28,750
10'x10' Box Culvert -Pre-cast	LF	\$280	\$450	21800	\$6,104,000	\$9,810,000
Asphalt Pavement Repair	SY	\$35	\$40	35,470	\$1,241,450	\$1,427,668
Chain Link Fence	LF	\$10	\$12	2,260	\$22,600	\$25,990
SWPPP	LS	\$10,000	\$11,500	1	\$10,000	\$11,500
Stabilized Construction Access	EA	\$2,000	\$2,300	2	\$4,000	\$4,600
Traffic Control	LS	\$20,000	\$23,000	1	\$20,000	\$23,000
Temporary Fence	LF	\$5	\$6	2260	\$11,300	\$12,995
Interconnect to W151						
Box Culvert	LF	\$200	\$300	1,000	\$200,000	\$300,000
Pavement Removal & Replacement	SY	\$50	\$58	1,300	\$65,000	\$74,750
Dewatering	LF	\$25	\$29	200	\$5,000	\$5,750
Filter Bedding	LF	\$25	\$29	200	\$5,000	\$5,750
Connect to 10'x10' Boxes	LS	\$10,000	\$11,500	1	\$10,000	\$11,500
Connect to W151 Box	LS	\$10,000	\$11,500	1	\$10,000	\$11,500

Sub Total	\$8,149,760	\$12,232,624
Misc. Items - 25%	\$2,037,440	\$3,058,156
Subtotal	\$10,187,200	\$15,290,780
Contingency - 25%	\$2,546,800	\$3,822,695
Total	\$12,734,000	\$19,113,475
	\$12,700,000	\$19,100,000

W151 - Detention Pond Option 2
50 Acre-Foot Detention - Covered Pond - Cost Estimate

Item Description	Unit	2004 Unit Cost	2006 Unit Cost	Quantity	2004 Subtotal	2006 Subtotal
Mobilization	LS	\$200,000	\$230,000	1	\$200,000	\$230,000
Site Preparation and Restoration	LS	\$10,000	\$11,500	1	\$10,000	\$11,500
Pavement Demolition	SY	\$3	\$3	28900	\$86,700	\$99,705
Utility Relocation -Major	LF	\$100	\$115	1,100	\$110,000	\$126,500
Utility Relocation -Minor	LF	\$50	\$58	1100	\$55,000	\$63,250
Basin Excavation	CY	\$5	\$6	116000	\$580,000	\$667,000
Excavation and Backfill for Walls	CY	\$8	\$9	25400	\$203,200	\$233,680
Dewatering	LF	\$25	\$29	1,000	\$25,000	\$28,750
Drilled Shafts	LF	\$28	\$32	28,830	\$807,240	\$928,326
Concrete Bottom Slab (Non-Structural)	SY	\$35	\$40	24,550	\$859,250	\$988,138
Concrete -Walls, & Top	CY	\$550	\$633	13,600	\$7,480,000	\$8,602,000
Footings	CY	\$400	\$460	1050	\$420,000	\$483,000
Maintenance Access	LS	\$100,000	\$115,000	1	\$100,000	\$115,000
Asphalt Pavement Repair	SY	\$35	\$40	28900	\$1,011,500	\$1,163,225
Chain Link Fence	LF	\$10	\$12	2,040	\$20,400	\$23,460
SWPPP	LS	\$10,000	\$11,500	1	\$10,000	\$11,500
Stabilized Construction Access	Ea	\$2,000	\$2,300	2	\$4,000	\$4,600
Traffic Control	LS	\$20,000	\$23,000	1	\$20,000	\$23,000
Temporary Fence	LF	\$5	\$6	2,040	\$10,200	\$11,730
Interconnect to W151						
Box Culvert	LF	\$200	\$300	1,000	\$200,000	\$300,000
Pavement Removal & Replacement	SY	\$50	\$58	1,300	\$65,000	\$74,750
Dewatering	LF	\$25	\$29	200	\$5,000	\$5,750
Filter Bedding	LF	\$25	\$29	200	\$5,000	\$5,750
Headwall	LS	\$10,000	\$11,500	1	\$10,000	\$11,500
Connect to W151 Box	LS	\$10,000	\$11,500	1	\$10,000	\$11,500

Sub Total	\$12,307,490	\$14,223,614
Misc. Items - 25%	\$3,076,873	\$3,555,903
Subtotal	\$15,384,363	\$17,779,517
Contingency - 25%	\$3,846,091	\$4,444,879
Total	\$19,230,453	\$22,224,396
	\$19,200,000	\$22,200,000

Appendix B3
City of Houston Comprehensive Drainage Plan
Project Summary

Storm Sewer Improvement Projects	2006 Cost Estimate	Length (LF)	Cost per LF
Bunker Hill North	\$1,900,000	1900	\$1,000
Kimberly	\$1,400,000	2,141	\$654
Queensbury	\$1,100,000	1,692	\$650
Memorial	\$900,000	1,251	\$719
Total	\$5,300,000	6,984	\$759

Notes:

1. The above costs include only drainage components and DO NOT consider any roadway components.
2. Consulting services such as engineering, surveying, and construction management are not included.

**Bunker Hill Lane North
Storm Sewer Cost Estimate**

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Mobilization (4%)	LS	\$96,000	1	\$96,000
Traffic Control	LS	\$50,000	1	\$50,000
Flagmen	LS	\$60,000	1	\$60,000
Trench Safety System	LF	\$6	1,800	\$10,800
SWPPP	LS	\$10,000	1	\$10,000
Utility Relocation-Major	LF	\$120	100	\$12,000
Utility Relocation-Minor	LF	\$75	200	\$15,000
Dewatering	LF	\$30	900	\$27,000
Filter Bedding	LF	\$30	900	\$27,000
Inlets	Ea	\$2,500	22	\$55,000
Manholes	Ea	\$2,600	16	\$41,600
90" RCP Storm Sewer	LF	\$800	550	\$440,000
66" RCP Storm Sewer	LF	\$315	350	\$110,250
60" RCP Storm Sewer	LF	\$300	350	\$105,000
54" RCP Storm Sewer	LF	\$250	625	\$156,250
30" RCP Storm Sewer	LF	\$95	275	\$26,125
24" RCP Storm Sewer	LF	\$75	960	\$72,000

Sub Total	\$1,314,025
Misc. Items - 25%	\$328,506
Subtotal	<u>\$1,642,531</u>
Contingency - 25%	\$410,633
Total	<u>\$2,053,164</u>
	\$2,100,000

**Kimberley Rd
Storm Sewer Cost Estimate**

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Mobilization (4%)	LS		1	\$0
Traffic Control	LS	\$50,000	1	\$50,000
Flagmen	LS	\$60,000	1	\$60,000
Trench Safety System	LF	\$6	2,200	\$13,200
SWPPP	LS	\$10,000	1	\$10,000
Utility Relocation-Major	LF	\$120	100	\$12,000
Utility Relocation-Minor	LF	\$75	200	\$15,000
Dewatering	LF	\$30	1,100	\$33,000
Filter Bedding	LF	\$30	1,100	\$33,000
Inlets	Ea	\$2,500	22	\$55,000
24" Storm Sewer Leads	LF	\$75	1100	\$82,500
Manholes	Ea	\$2,600	11	\$28,600
36" RCP Storm Sewer	LF	\$120	706	\$84,704
54" RCP Storm Sewer	LF	\$250	500	\$125,108
66" RCP Storm Sewer	LF	\$315	788	\$248,144
72" RCP Storm Sewer	LF	\$330	147	\$48,536

Sub Total	\$898,793
Misc. Items - 25%	\$224,698
Subtotal	<u>\$1,123,491</u>
Contingency - 25%	\$280,873
Total	<u>\$1,404,364</u>
	\$1,400,000

**Queensbury Rd
Storm Sewer Cost Estimate**

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Mobilization (4%)	LS		1	\$0
Traffic Control	LS	\$50,000	1	\$50,000
Flagmen	LS	\$60,000	1	\$60,000
Trench Safety System	LF	\$6	1,692	\$10,152
SWPPP	LS	\$10,000	1	\$10,000
Utility Relocation-Major	LF	\$120	100	\$12,000
Utility Relocation-Minor	LF	\$75	200	\$15,000
Dewatering	LF	\$30	846	\$25,379
Filter Bedding	LF	\$30	846	\$25,379
Inlets	Ea	\$2,500	18	\$45,000
24" Storm Sewer Leads	LF	\$75	900	\$67,500
Manholes	Ea	\$2,600	9	\$23,400
36" RCP Storm Sewer	LF	\$120	1,040	\$124,850
66" RCP Storm Sewer	LF	\$315	652	\$205,229

Sub Total	\$673,889
Misc. Items - 25%	\$168,472
Subtotal	<u>\$842,361</u>
Contingency - 25%	\$210,590
Total	<u>\$1,052,952</u>
	\$1,100,000



**Memorial Rd
Storm Sewer Cost Estimate**

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Mobilization (4%)	LS		1	\$0
Traffic Control	LS	\$50,000	1	\$50,000
Flagmen	LS	\$60,000	1	\$60,000
Trench Safety System	LF	\$6	1,251	\$7,508
SWPPP	LS	\$10,000	1	\$10,000
Utility Relocation-Major	LF	\$120	100	\$12,000
Utility Relocation-Minor	LF	\$75	200	\$15,000
Dewatering	LF	\$30	626	\$18,769
Filter Bedding	LF	\$30	626	\$18,769
Inlets	Ea	\$2,500	14	\$35,000
24" Storm Sewer Leads	LF	\$75	700	\$52,500
Manholes	Ea	\$2,600	7	\$18,200
36" RCP Storm Sewer	LF	\$120	225	\$27,055
42" RCP Storm Sewer	LF	\$160	212	\$33,982
48" RCP Storm Sewer	LF	\$180	305	\$54,949
54" RCP Storm Sewer	LF	\$250	248	\$61,983
66" RCP Storm Sewer	LF	\$315	260	\$81,966

Sub Total	\$557,680
Misc. Items - 25%	\$139,420
Subtotal	<u>\$697,100</u>
Contingency - 25%	\$174,275
Total	<u>\$871,375</u>
	\$900,000



Appendix B4
Study of Flood Control Improvements for the Rummel Creek Watershed
Project Summary

	2006 Cost Estimate
W156 Flood Plain Reduction Project	\$2,300,000

Notes:

1. Consulting services such as engineering, surveying, and construction management are not included.



**W156 Channel Improvements with Detention
Cost Estimate**

Item Description	Unit	2006 Unit Cost	Quantity	2006 Subtotal
Mobilization (4%)	LS	\$23,000	1	\$23,000
Site Preparation and Restoration	LS	\$11,500	1	\$11,500
Utility Relocation -Major	LF	\$115	0	\$0
Utility Relocation -Minor	LF	\$58	0	\$0
Utility Relocation-Small	LF	\$29	0	\$0
Excavation	CY	\$6	110,000	\$632,500
Dewatering	LF	\$29	1000	\$28,750
Filter Bedding	LF	\$29	0	\$0
Low Flow Wall	CY	\$403	0	\$0
Low Flow Floor	CY	\$288	0	\$0
Concrete Liner (1.5:1 SS)	SY	\$46	2,000	\$92,000
Transition to Box Culvert	LS	\$5,750	1	\$5,750
Transition at Downstream End	LS	\$5,750	1	\$5,750
Rip Rap at Downstream End	SY	\$29	500	\$14,375
SWPPP	LS	\$11,500	1	\$11,500
Stabilized Construction Access	EA	\$2,300	4	\$9,200
Concrete Pond Liner-Side Slopes	SY	\$46	200	\$9,200
Concrete Pond Liner-Floor	SY	\$40	200	\$8,050
Metal Beam Guardrail	LF	\$32	2080	\$66,976
Top Soil -6" thick	CY	\$17	5040	\$86,940
Turf Establishment	Ac	\$3,450	6.25	\$21,563
Chain Link Fence	LF	\$12	2320	\$26,680
Stabilized Construction Access	EA	\$2,300	2	\$4,600
Traffic Control	LS	\$23,000	1	\$23,000
Temporary Fence	LF	\$6	2320	\$13,340
Interconnect to W156				
Box Culvert	LF	\$230	1000	\$230,000
Pavement Removal & Replacement	SY	\$58	1300	\$74,750
Dewatering	LF	\$29	200	\$5,750
Filter Bedding	LF	\$29	200	\$5,750
Headwall	LS	\$11,500	1	\$11,500
Traffic Control	EA	\$5,750	4	\$23,000

Subtotal	\$1,445,424
Misc. Items - 25%	\$361,356
Subtotal	<u>\$1,806,779</u>
Contingency - 25%	\$451,695
Total	<u>\$2,258,474</u>
	\$2,300,000