Table G4: HEC-1 Peak Flow Rates for Recommended Plan Conditions*

HEC-1 Analysis Point	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	250-Year	500-Year
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
K142A1	302	477	596	723	828	947	1096	1209
FG-1A	504	802	948	1064	1146	1231	1756	2019
K142B	197	313	394	482	554	639	740	819
FG-1B	620	1025	1302	1568	1171	2002	2739	3167
K142C	243	382	474	572	653	744	860	948
K142D	245	388	483	586	671	767	888	981
K142E	135	212	265	319	365	416	481	529
FG-2	1137	1858	2344	2832	3227	3666	4189	4814
K142F	212	330	408	490	558	633	730	803
FG-3	1239	2035	2570	3107	3537	4027	4643	5060
K142G	1528	2336	2878	3437	3909	4424	5094	5595
K100#13	2005	3314	4236	5201	5977	6867	7985	8838

* The flows prorated as identified in part 2.6.3 of this report.

Table G5: Comparison of Water Surface Elevations (100-Year)

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
10	Near Mouth	6989	113.81	6867	113.69	-0.12
80		6989	113.86	6867	113.73	-0.13
510		6989	114.62	6867	114.50	-0.12
1010		6989	117.78	6867	117.68	-0.10
1510		6989	118.73	6867	118.63	-0.10
2010		6989	119.02	6867	118.92	-0.10
2234		6989	119.12	6867	119.02	-0.10
2404		6989	119.28	6867	119.18	-0.10
2650		6989	119.50	6867	119.40	-0.10
2750	Jones Road	6989	119.71	6867	119.61	-0.10
2870		6989	119.85	6867	119.75	-0.10
3050		6989	119.87	6867	119.77	-0.10
3162		6989	119.94	6867	119.84	-0.10
3180		6989	119.96	6867	119.86	-0.10
3182		6989	119.80	6867	119.70	-0.10
3230		6989	120.79	6867	120.70	-0.09
3232		6989	123.05	6867	122.98	-0.07
3279		6989	123.07	6867	123.00	-0.07
3320		6989	123.14	6867	123.07	-0.07
3510		6989	123.25	6867	123.17	-0.08
3990		6989	123.53	6867	123.46	-0.07
4504		6989	123.82	6867	123.74	-0.08
4554	Lakewood Forest Drive	6989	123.85	6867	123.77	-0.08
4594		6989	123.94	6867	123.86	-0.08

Table G5: Comparison of Water Surface Elevations (100-Year) - *continued*

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
4604		6989	123.95	6867	123.88	-0.07
5010		6989	124.19	6867	124.12	-0.07
5546		6989	124.62	6867	124.54	-0.08
6010		6989	125.01	6867	124.92	-0.09
6480		6989	125.49	6867	125.41	-0.08
7010		6989	125.85	6867	125.76	-0.09
7510		6989	126.22	6867	126.12	-0.10
8010		6989	126.76	6867	126.67	-0.09
8784		6147	127.71	5997	127.61	-0.10
8924		6147	127.85	5997	127.75	-0.10
8934	Louetta Road	6147	127.89	5997	127.79	-0.10
8994		6147	128.04	5997	127.93	-0.11
9004		6147	128.06	5997	127.96	-0.10
9067		6147	128.09	5997	127.99	-0.10
9068	Drop Structure	6147	127.72	5997	127.61	-0.11
9080		6147	130.17	5997	130.06	-0.11
9100		6147	130.21	5997	130.10	-0.11
9160		6147	130.36	5997	130.25	-0.11
9510		6147	130.86	5997	130.75	-0.11
10010		6147	131.65	5997	131.52	-0.13
10022		6147	131.66	5997	131.53	-0.13
10507		6147	132.36	5997	132.22	-0.14
11010		6147	133.18	5997	133.04	-0.14
11161		6147	133.43	5997	133.29	-0.14
11483		6147	133.93	5997	133.79	-0.14
12003		4928	134.53	4751	134.38	-0.15
12277		4928	134.73	4751	134.58	-0.15
12287	Eldridge	4928	134.74	4751	134.59	-0.15
12317	Parkway	4928	135.03	4751	134.85	-0.18
12327		4928	135.04	4751	134.86	-0.18
12333		4928	135.05	4751	134.87	-0.18
12343		4928	135.04	4751	134.86	-0.18
12373		4928	135.40	4751	135.18	-0.22
12383		4928	135.41	4751	135.19	-0.22
12500		4928	135.46	4751	135.24	-0.22
12525		4928	135.48	4751	135.27	-0.21
13500		4928	136.37	4751	136.15	-0.22
13525		4928	136.38	4751	136.16	-0.22
14500		4641	137.17	4459	136.94	-0.23
14695		4641	137.33	4459	137.10	-0.23
14745	Water Line	4641	137.37	4459	137.14	-0.23
14755	Crossing	4641	137.39	4459	137.16	-0.23

Table G5: Comparison of Water Surface Elevations (100-Year) - *continued*

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
14805		4641	137.42	4459	137.19	-0.23
15000		4641	137.54	4459	137.31	-0.23
15025		4641	137.54	4459	137.31	-0.23
15500		4641	138.08	4459	137.85	-0.23
15510		4641	138.11	4459	137.88	-0.23
16000		4641	138.77	4459	138.53	-0.24
16500		4641	139.36	4459	139.12	-0.24
17498		4323	140.66	4139	140.41	-0.25
17508	Spring-Cypress	4323	140.66	4139	140.41	-0.25
17538	Road	4323	140.76	4139	140.50	-0.26
17548		4213	140.80	4027	140.54	-0.26
17621		4213	140.01	4027	140.18	0.17
17650		4213	143.00	4027	141.79	-1.21
18040		4213	144.96	4027	141.96	-3.00
18540		4213	145.73	4027	142.19	-3.54
19084		4213	146.77	4027	142.47	-4.30
21301		4121	149.08	3920	143.86	-5.22
22357		3900	150.81	3666	145.87	-4.94
23015		2390	151.83	2094	146.64	-5.19
23344		2390	152.04	2094	146.81	-5.23
23673		2298	152.20	2002	146.99	-5.21
24673		1463	152.36	1285	147.40	-4.96
25786		1463	153.61	1285	147.72	-5.89
25886		1463	153.94	1285	147.75	-6.19
25986		1463	154.09	1285	147.79	-6.30
26086		1463	154.25	1285	147.83	-6.42
26186	Shaw Road	1463	154.41	1285	147.83	-6.58
26259		1463	154.61	1285	147.83	-6.78
26998		1371	155.23	1212	150.91	-4.32
28059		1371	156.70	1212	152.67	-4.03
29009		1249	157.89	1114	153.83	-4.06
29959		1215	158.18	1086	154.77	-3.41

3.0 PLAN IMPLEMENTATION AND MANAGEMENT STRATEGIES

Since a large portion of the Faulkey Gully watershed is still undeveloped, the features identified as part of the recommended plan can be constructed as the watershed develops. As new development continues, mitigation for anticipated increases in storm water runoff can be implemented. The channel extensions and new channel elements through these undeveloped areas have been identified to be used as a guide for new development.

This information identifies ultimate drainage corridor right-of-way needed to implement the recommended plan features. Further, this identification of right-of-way will help local agencies in their coordination with new development to ensure that the appropriate considerations for drainage are being implemented. The following sections outline a suggested approach for implementing the recommended plan and identify recommended management strategies for the watershed.

3.1 Preservation of Stream Habitat Corridors

As noted above, the recommended plan does not include areas of high-quality stream habitat preservation. The proposed channel modifications and lateral channels are proposed to include some habitat mitigation, once the vegetation and tree plantings have been established.

3.2 New Lateral Channels/Channel Extensions

There are two areas of channel modification and four new channels proposed in the recommended plan. Two of the new channels (K142#C1 and K142#C2) are extensions of channels currently proposed by the NorthPointe development. The channel modifications have been proposed to allow sufficient outfall depth in the watershed. The remaining new channels are placed in areas that will likely be developed. The plan suggests a right-of-way width sufficient to incorporate a channel that has terraced sections and allows for multiple uses (see **Figure 1**). The recommended implementation of this channel corridor would consist of having the Harris County Flood Control District prioritize (as best as possible) the immediate need for these channels, and proceed with the acquisition of a portion of the right-of-way along the proposed lateral channel alignments. This portion of the right-of-way would be the minimum (approximately 100 feet wide) necessary to implement a typical trapezoidal channel with the appropriate depth for outfall. Additional right-of-way and construction of the channel would be provided by adjacent properties of new development as they occur. Coordination with the developers of the NorthPointe development will need to occur prior to this stage in order to facilitate the alteration of their proposed drainage plan. As noted earlier, the channels provide some additional capacity that could also be used by the developer as a trade-off for providing the greater easement width.

An alternative for implementing these plan elements is to request the appropriate easements from the landowner as development occurs in the adjacent area. Another alternate would be to have the appropriate entity such as the Harris County Flood Control District acquire the appropriate right-of-way through the fee title or easement. However, this would severely tax the funding source of the district if implemented on a wide basis. Another alternative would be to allow adjacent developments to construct mitigation facilities such as detention basins and water quality basins (that are a requirement of the development process) in conjunction with the new channels, taking advantage of the additional storage benefits provided in the wider channel sections and to have the use of the corridors for recreational features such as hiking trails. Requirements would have to be placed on the construction of these facilities so that they did not overly disturb the stream habitat that is meant to be fostered in the corridors.

3.3 Detention Facilities

One regional detention facility is identified for the Faulkey Gully watershed recommended plan. It should be noted that the recommended plan continues the current policy of on-site detention as a requirement of development. The regional facility proposed as part of the recommended plan will allow for further reduction of flows in the watershed. Therefore, it will likely not be feasible to allow developers to mitigate individual developments by excavating in a regional facility, as has been occurring in other watersheds, unless the facility in the recommended plan is expanded and designed for that purpose. Implementation of the regional detention facility element of the recommended plan will consist of the actual purchase of the land and construction of the facility by public agencies such as the HCFCD.

3.4 Channel Crossings

As noted earlier, few major thoroughfares cross the channels in the Faulkey Gully watershed. Of the major thoroughfares shown on the exhibits, future Northpointe Road and Spring-Cypress Road have plans for future improvements. The proposed Northpointe Road will cross the main channel of Faulkey Gully and channels K142#C1 and K142#C3. Spring-Cypress Road will also be improved in the future to a four-lane section from its current two-lane configuration. Additionally, the Shaw Road crossing must be replaced as part of the recommended plan. The remaining crossings of the main stem of Faulkey Gully and tributary channels are at their expected levels of service and will not be improved in the near future.

The crossings of the main stem and tributaries of future Northpointe Road will be undertaken by Harris County at a later date and may or may not be in place prior to the implementation of the recommended plan features meant to be crossed. The future crossing of the main channel is located in an area where the channel is proposed for modification. Therefore, the crossing should be required to pass the 100-year recommended plan flows so that the volume and conveyance of the channel is preserved. If the crossing is to convey the recommended plan 100-year flow

(approximately 640 cfs) with a minimal amount of head losses (less than 0.5 feet), a minimum opening of approximately 140 square feet will be necessary. It will be necessary however, to ensure that the spanned distance is sufficient so that the wider channel section is not restricted in a manner that would cause greater head losses in the channel.

The future Northpointe Road crossing of the two tributary channels, K142#C1 and K142#C3 can be accomplished in a similar manner. In the case of the future crossing of K142#C1, if the crossing is to convey the recommended plan 100-year flow (approximately 680 cfs using an area-discharge relation) with a minimal amount of head losses (less than 0.5 feet), an opening of approximately 160 square feet will be necessary. The future crossing of K142#C4 would convey the recommended plan 100-year flow (approximately 370 cfs using an area-discharge relation) with a minimal amount of head losses (less than 0.5 feet), with a minimum opening of approximately 90 square feet.

Spring-Cypress Road will be improved in the future to expand the current two-lane road into a four-lane section, or possibly a dual-bridge section. If the new structure is designed to pass the recommended plan 100-year flow (approximately 3680 cfs) with a minimal (less than 0.5') amount of head losses, an opening of approximately 850 square feet will be necessary.

The current configuration of the Shaw Road does not allow for the channel modification as proposed in the recommended plan. The current crossing is low and has limited conveyance capacity. A new crossing for Shaw Road will be required to pass the recommended plan flows with a minimum amount of head losses. If the crossing is to convey the recommended plan 100-year flow (approximately 835 cfs) with a minimal amount of head losses (less than 0.5 feet), a minimum opening of approximately 190 square feet will be necessary. A grade transition structure will also need to be constructed upstream of Shaw Road where the channel modification changes to a shallower section.

With the exception of Shaw Road, it is assumed that the funding for the proposed and future crossings will be provided by the road-building entity, typically Harris County, and are not included as costs in the recommended plan.

There may be crossings that are constructed as part of developments or as revisions to the major thoroughfare plan. Channel crossings must be considered in light of the goals for the "frontier program" in each of these watersheds. Proposed crossings of the channel extension or new tributary channel included in the recommended plan could be designed in a more conventional manner however, care must be taken to ensure that the storage of the channel is not impacted by the construction of a too-narrow structure.

3.5 Cost Analysis

Costs were identified for implementation of the recommended plan. These costs consider acquisition of right-of-way, engineering, and construction of the plan elements. The table below shows each plan element, the identified right-of-way, the unit costs and total costs for the project. The total cost when fully implemented is approximately $12.3 million, with the bulk of the cost in land acquisition and excavation.

Table G6 - Estimate of Recommended Plan Construction Costs for Faulkey Gully

Description	Unit	Quantity	Unit Cost	Cost
1. Mobilization	Each	5	$10,000	$50,000
2. Clearing & Grubbing	Acre	66	$1,500	$99,000
3. Excavation & Haul	Ac-Ft	995	$5,000	$4,975,000
4. Bridge Installation	S.F.	6000	$60	$360,000
5. Culvert Installation	S.F.	0	$75	$0
6. Drop/Control Structures	L.S.	6	$100,000	$600,000
7. Backslope Drains	Each	73	$3,000	$219,000
8. Utilities Relocation	Each	0	$100,000	$0
9. Right-of-Way	Acre	200	$14,000	$2,800,000
10. Seeding & Mulching	Acre	170	$1,000	$170,000
11. Tree/Shrub Planting	Acre	47	$10,000	$470,000
SUB TOTAL				$9,743,000
Contingencies (15%)				$1,461,450
TOTAL CONSTRUCTION COST				$11,204,450
ENGINEERING AND ADMINISTRATION (10%)				$1,120,445
TOTAL				**$12,324,895**

3.6 Implementation Phasing

Implementation of the recommended plan features is suggested to occur in phases so that the appropriate funding can be identified for each fiscal year. First priority should be given to implementing projects that result in flood reduction benefits to existing flood-prone structures. In the Faulkey Gully watershed, there are no plan elements that fully fit this category although the channel modification project will reduce water surface elevations in the upper portion of the watershed. Second priority should be given to acquiring right-of-way ahead of new development and coordination with the NorthPointe development to ensure that future drainage projects can be implemented according to the recommended plan. This acquisition will also coincide with future major roadway thoroughfare projects. The proposed new channels and right-of-way extensions in the recommended plan fit this category. Final priority should be placed on an ongoing land acquisition program to purchase right-of-way for stream corridor preservation projects and for remaining recommended plan elements. The stream corridor and detention elements of the recommended plan would fit this category.

Since there are currently few flooding problems in the Faulkey Gully watershed, implementation of the plan could be delayed until there is development pressure on areas slated for improvements. The recommended plan is estimated to take approximately 4 years to implement. The order of implementation would then be to construct the channel modification element in the first year of implementation. The easternmost lateral channels (K140#C1 & K142#C2 would also be constructed within the first year of implementation, as the NorthPointe development begins to develop these areas. Channel K142#C3 would then follow. Once channel K142#C3 was under way, detention facility K142#B1 should follow, with channel K142#C4 following in the final year. The stream corridors and water quality basin should be identified and right-of-way secured as development begins to occur in the adjacent areas, as noted above.

3.7 Identification of Possible Funding Sources

Implementation of the plan is dependent upon the cooperation of other stakeholders in addition to the Harris County Flood Control District. The District's primary role is to implement flood reduction projects. The construction of parks and the creation of mitigation for new development cannot be implemented with District funds.

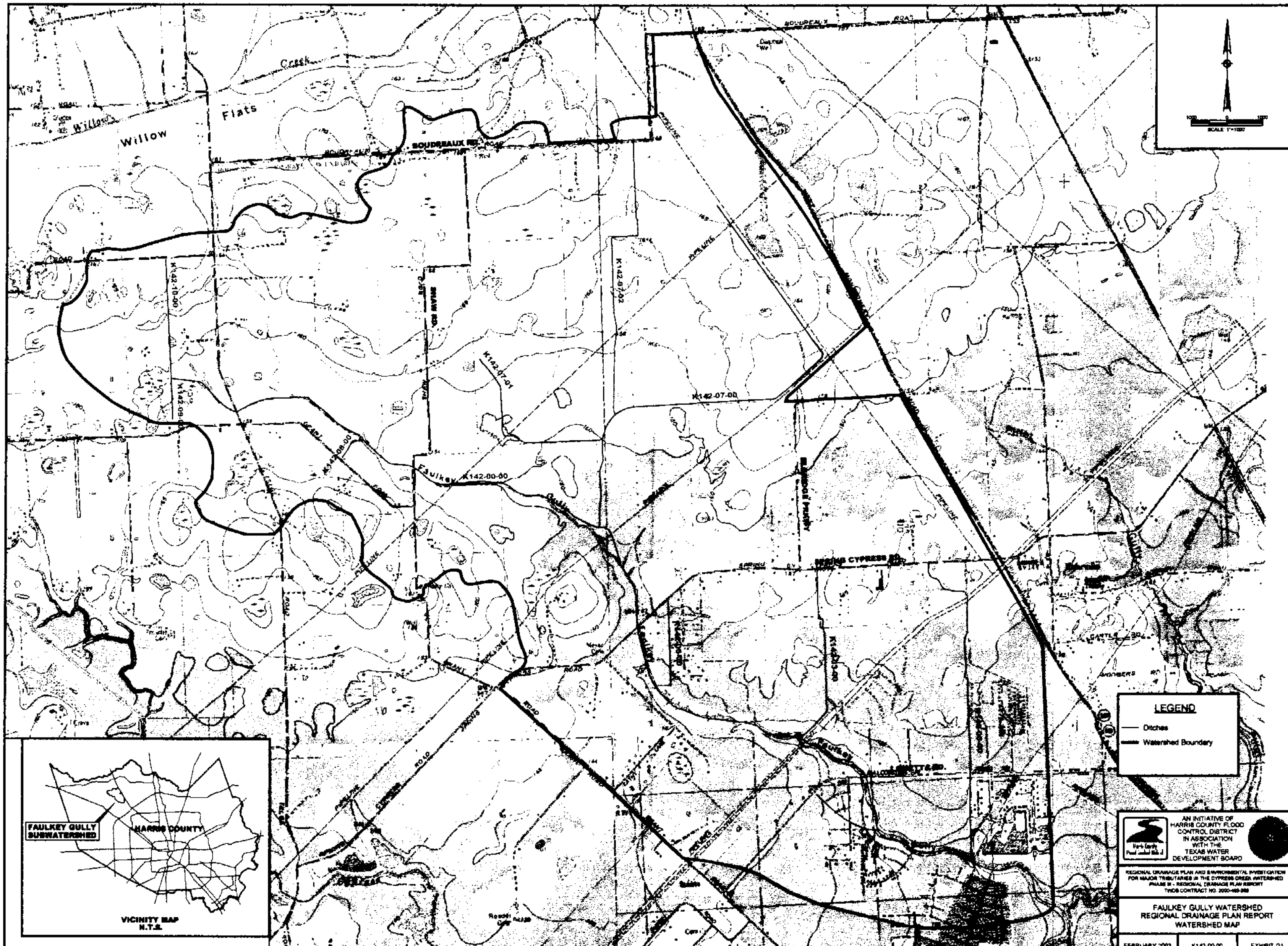
It is anticipated the implementation of parks or trails within the right-of-way could proceed through agreements between the District and stakeholders such as the Texas Parks and Wildlife, Legacy Land Trust, Harris County, and through civic associations. Management of these uses and respective maintenance of the facilities would also be performed by the stakeholders. The District could enter into an agreement to construct the necessary detention, with consideration for multiple uses such that the park will take over maintenance of the facility. As noted earlier, a bikeway is proposed for the lower portions of the watershed. If this bikeway is expanded, additional funding might be available in the Parks Department to assist with funding of a more comprehensive trail system.

The construction of the necessary roadway crossing of the channels will be funded through the appropriate stakeholder responsible for the project, such as Harris County Engineering for county roads, Texas Department of Transportation for U.S 249, and developers for their respective developments that include roadway channel crossings.

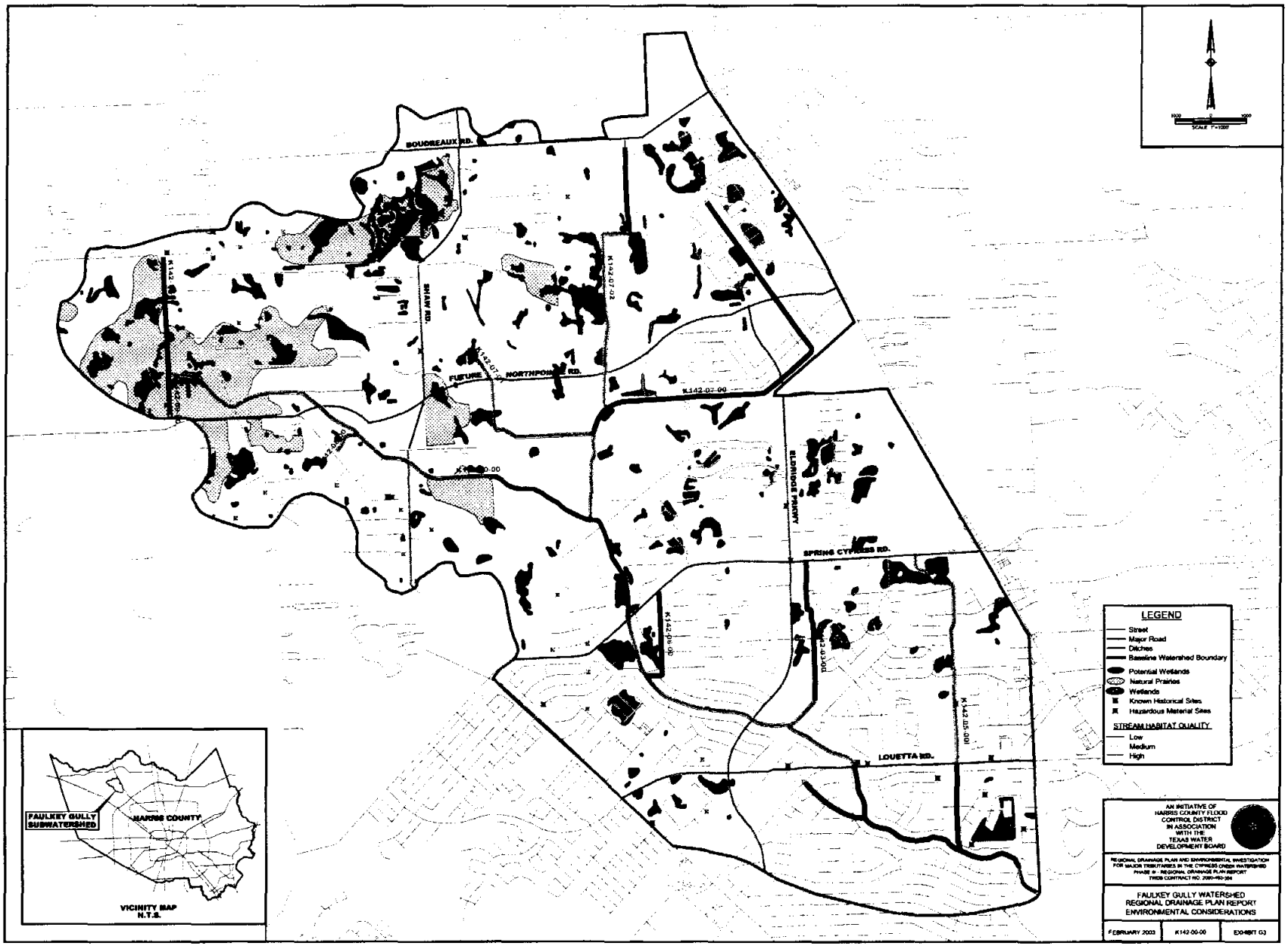
4.0 CONCLUSIONS

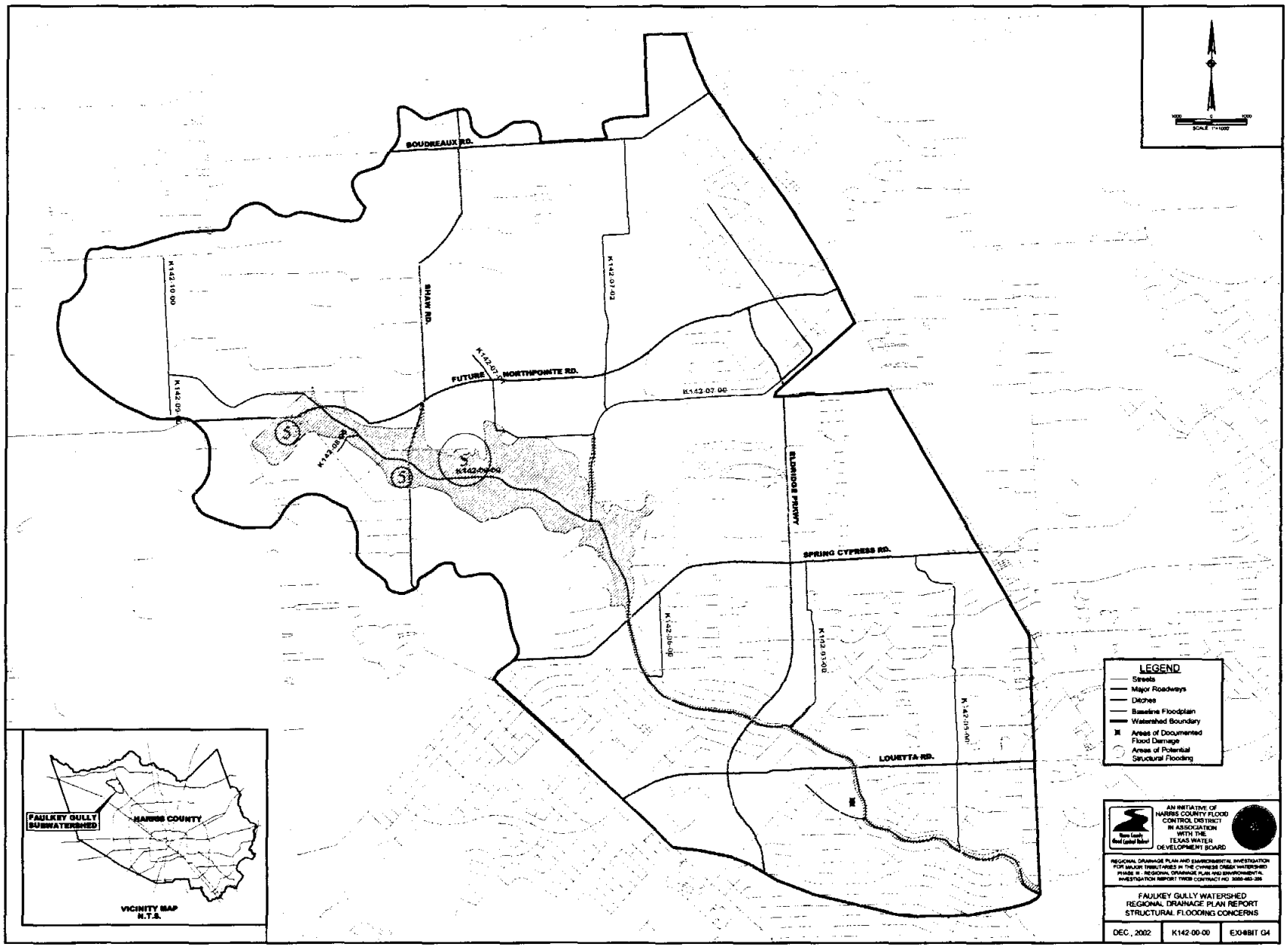
The recommended plan identified in this report represents a feasible solution to providing flood reduction benefits and guidance for drainage planning of new development projects. Existing environmental conditions of the watershed are considered in the plan so they are preserved to the extent possible and, at a minimum, that they are not further degraded. Further, the plan, when implemented, will result in reduced stormwater peak flows into Cypress Creek, suggesting that the plan will also result in flood reduction benefits for existing developments along Cypress Creek.

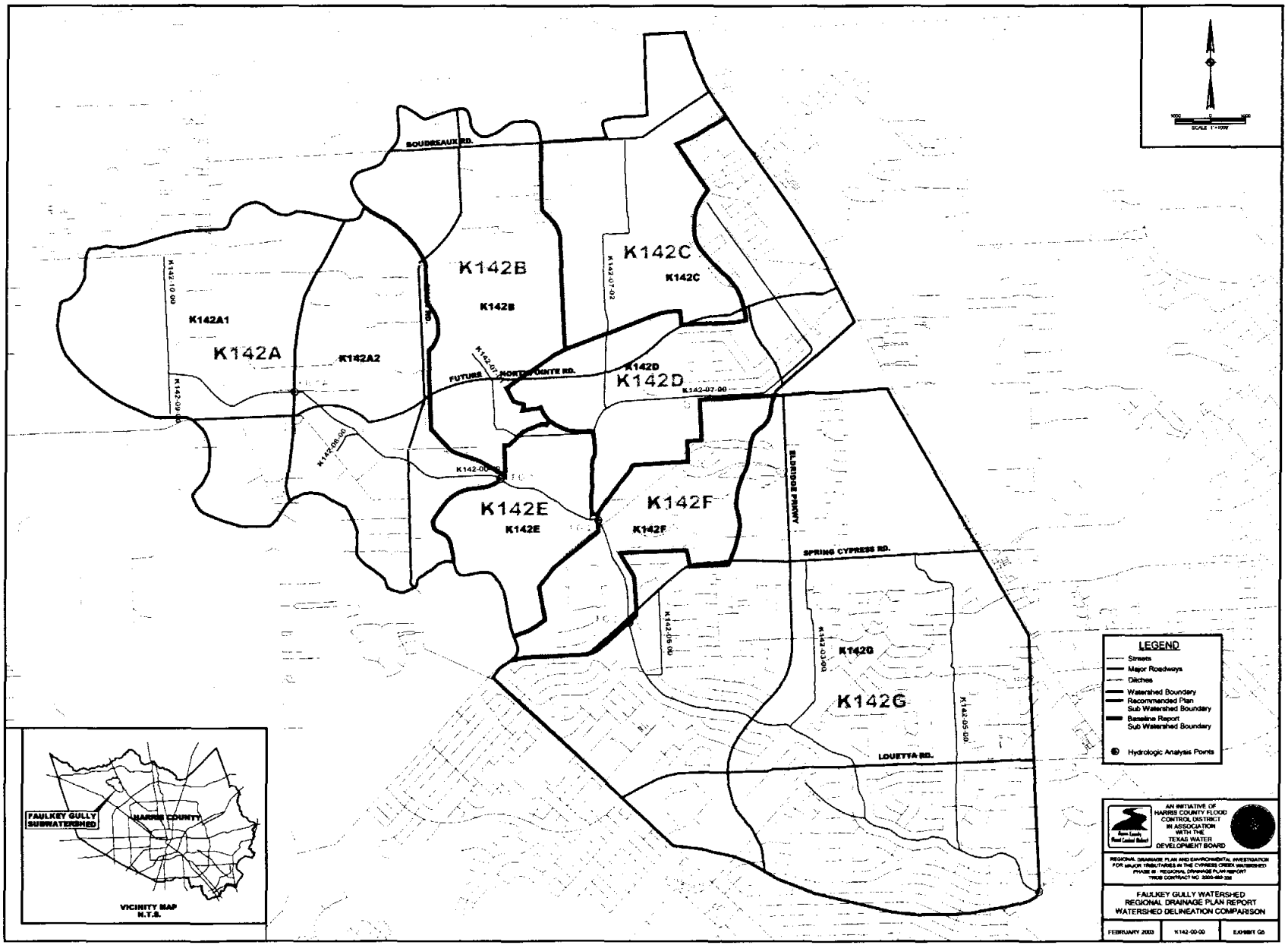
Implementation of the plan will occur over multiple years and will require the cooperation of additional stakeholders. Prioritization of the plan elements has been performed, suggesting that there is not an immediate need to implement plan features along Faulkey Gully. However, coordination with local developers and land acquisition or reservation should be planned for the watershed. It is estimated that it will take approximately 4 years to implement the entire plan, with an average expenditure of $3.1 million per year.

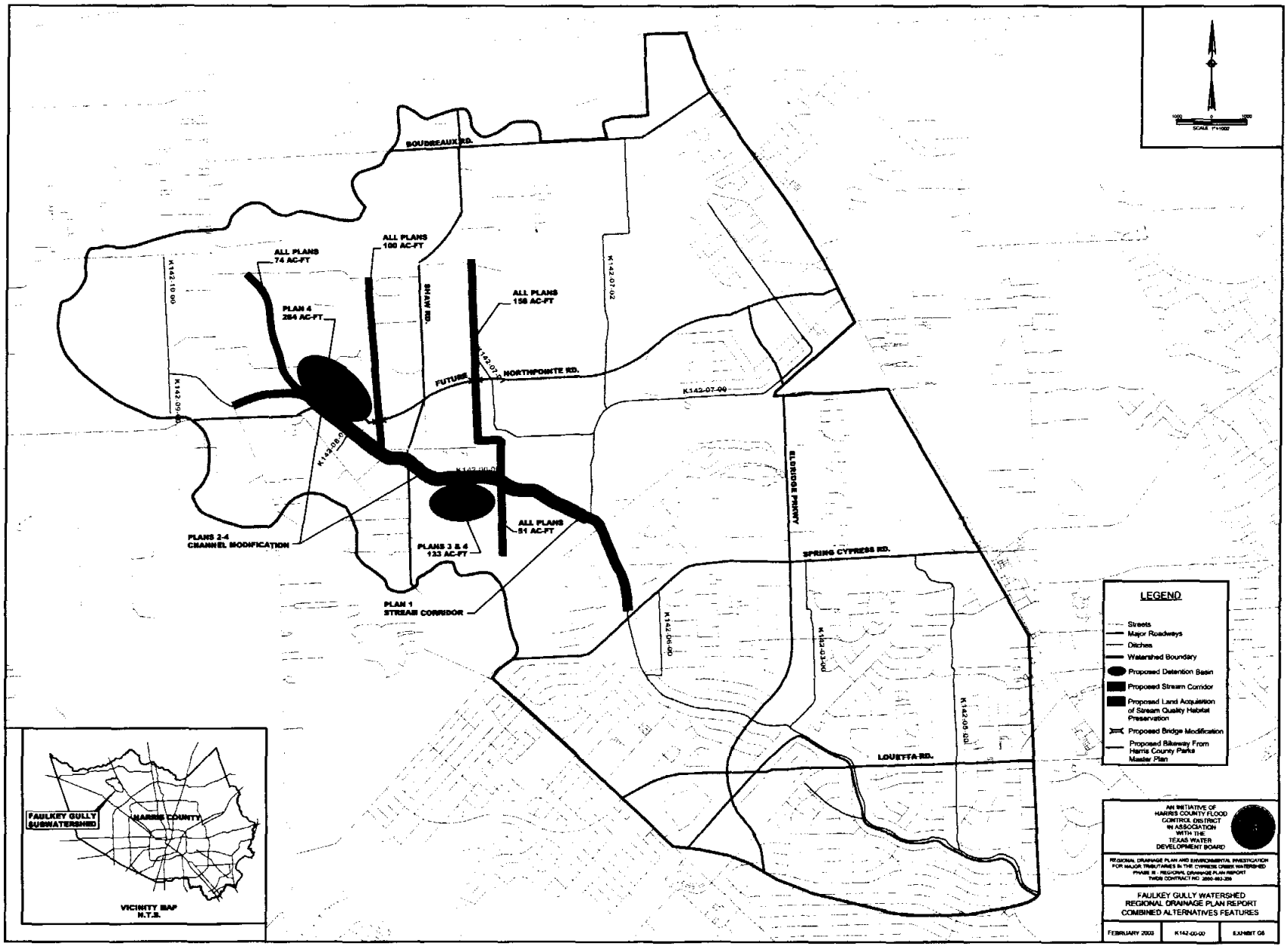


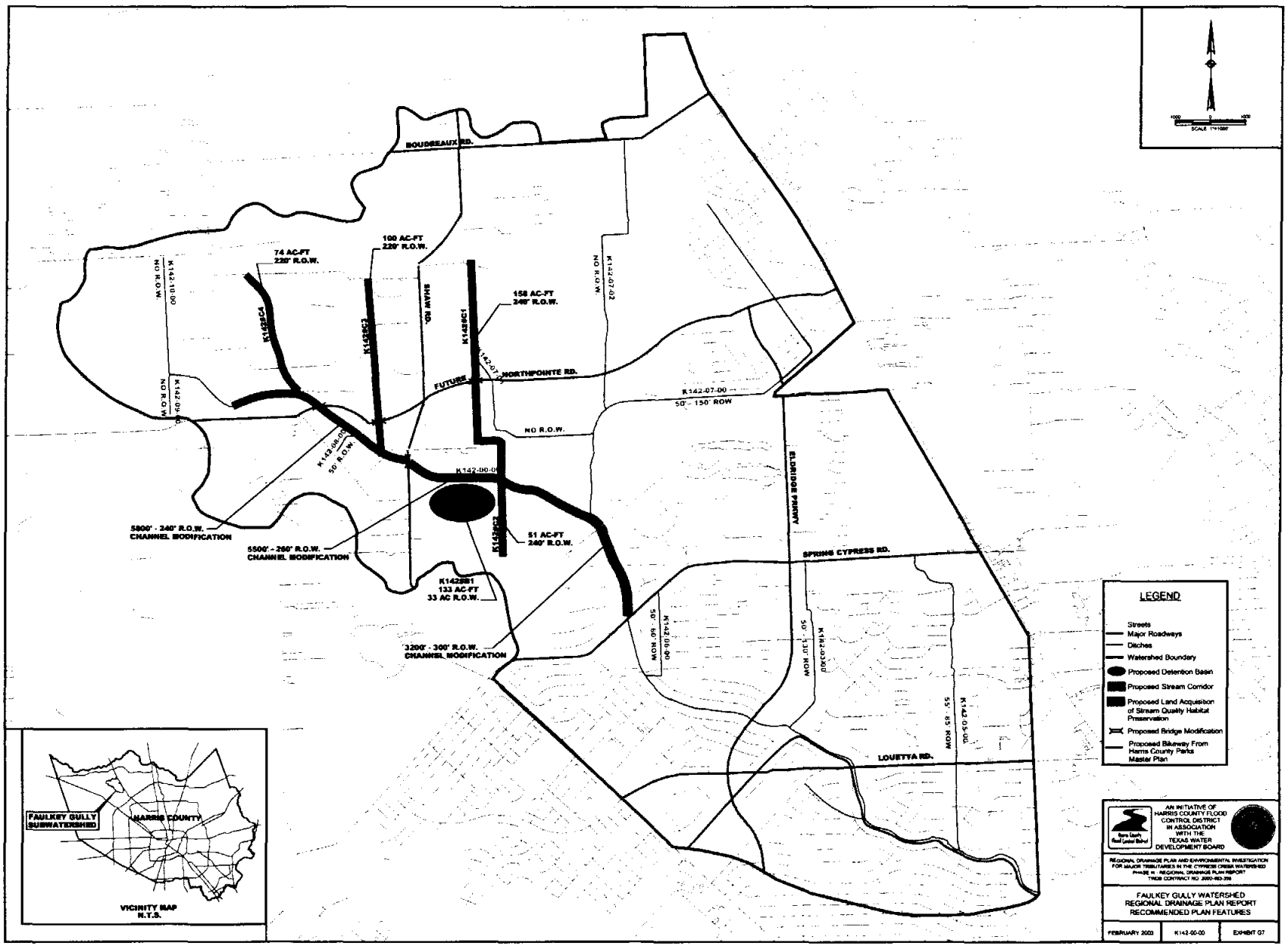
SCALE 1"=1000'
LEGEND
Ditches
Watershed Boundary
AN INITIATIVE OF
HARRIS COUNTY FLOOD
CONTROL DISTRICT
IN ASSOCIATION
WITH THE
TEXAS WATER
DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION
FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-368
FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
WATERSHED MAP
FEBRUARY 2003
K142-00-00
EXHIBIT G1
FAULKEY GULLY SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
Willow
Flats
Creek
BOUDREAUX RD.
SHAW RD.
SPRING CYPRESS RD.
K142-00-00
K142-07-00
K142-07-01
K142-07-02
K142-08-00
K142-09-00
K142-10-00
Faulkey
PIPELINE

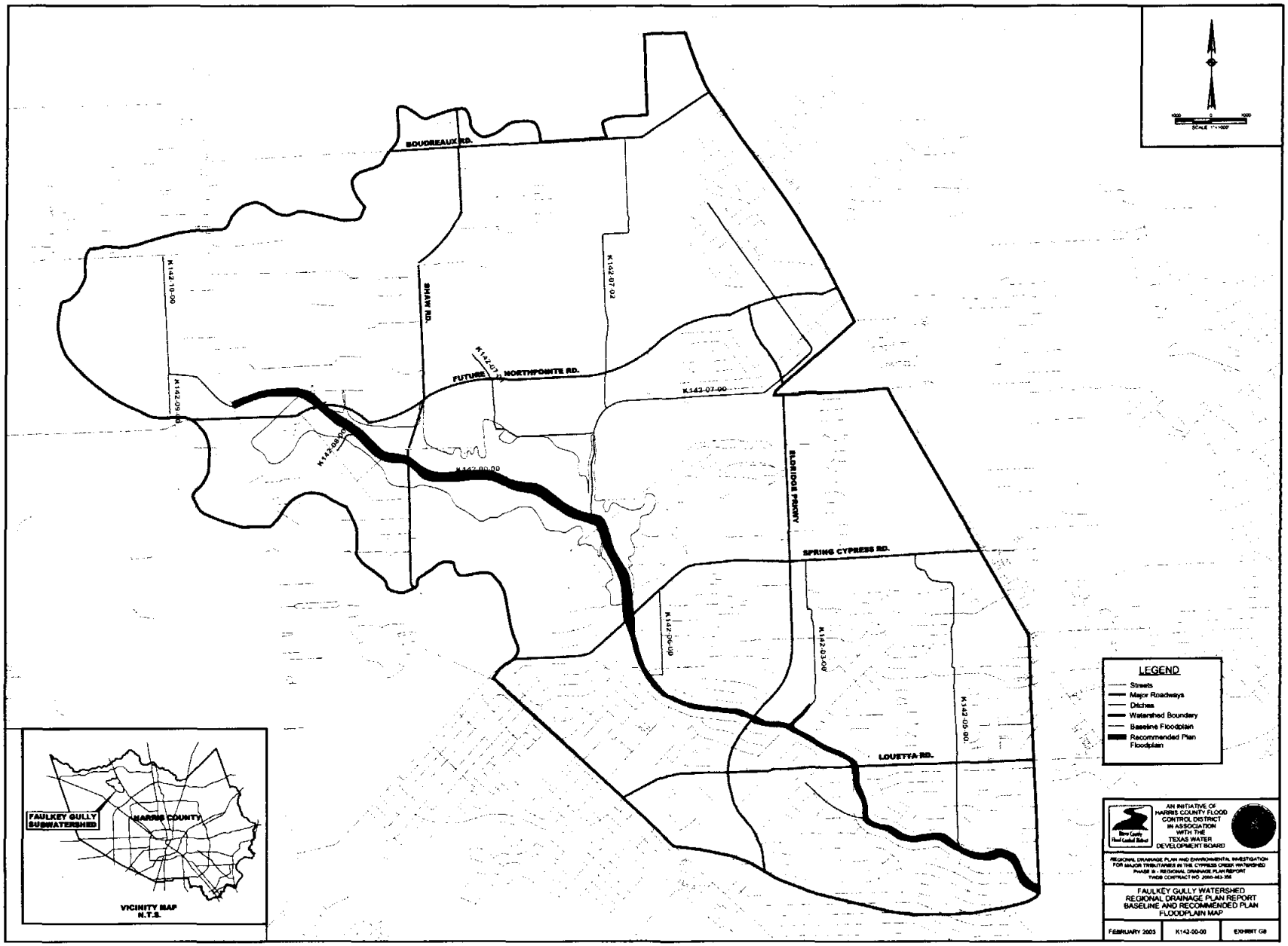

BOUDREAUX RD.
SHAW RD.
FUTURE NORTHPOINTE RD.
K142-07-00
ELDRIDGE PKWY
SPRING CYPRESS RD.
LOUETTA RD.
K142-07-01
K142-07-02
K142-08-00
K142-09-00
K142-10-00
LEGEND
Street
Major Road
Ditches
Baseline Watershed Boundary
Potential Wetlands
Natural Prairies
Wetlands
Known Historical Sites
Hazardous Material Sites
STREAM HABITAT QUALITY
Low
Medium
High
FAULKEY GULLY SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF
HARRIS COUNTY FLOOD
CONTROL DISTRICT
IN ASSOCIATION
WITH THE
TEXAS WATER
DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION
FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-364
FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
ENVIRONMENTAL CONSIDERATIONS
FEBRUARY 2003
K142-00-00
EXHIBIT G3

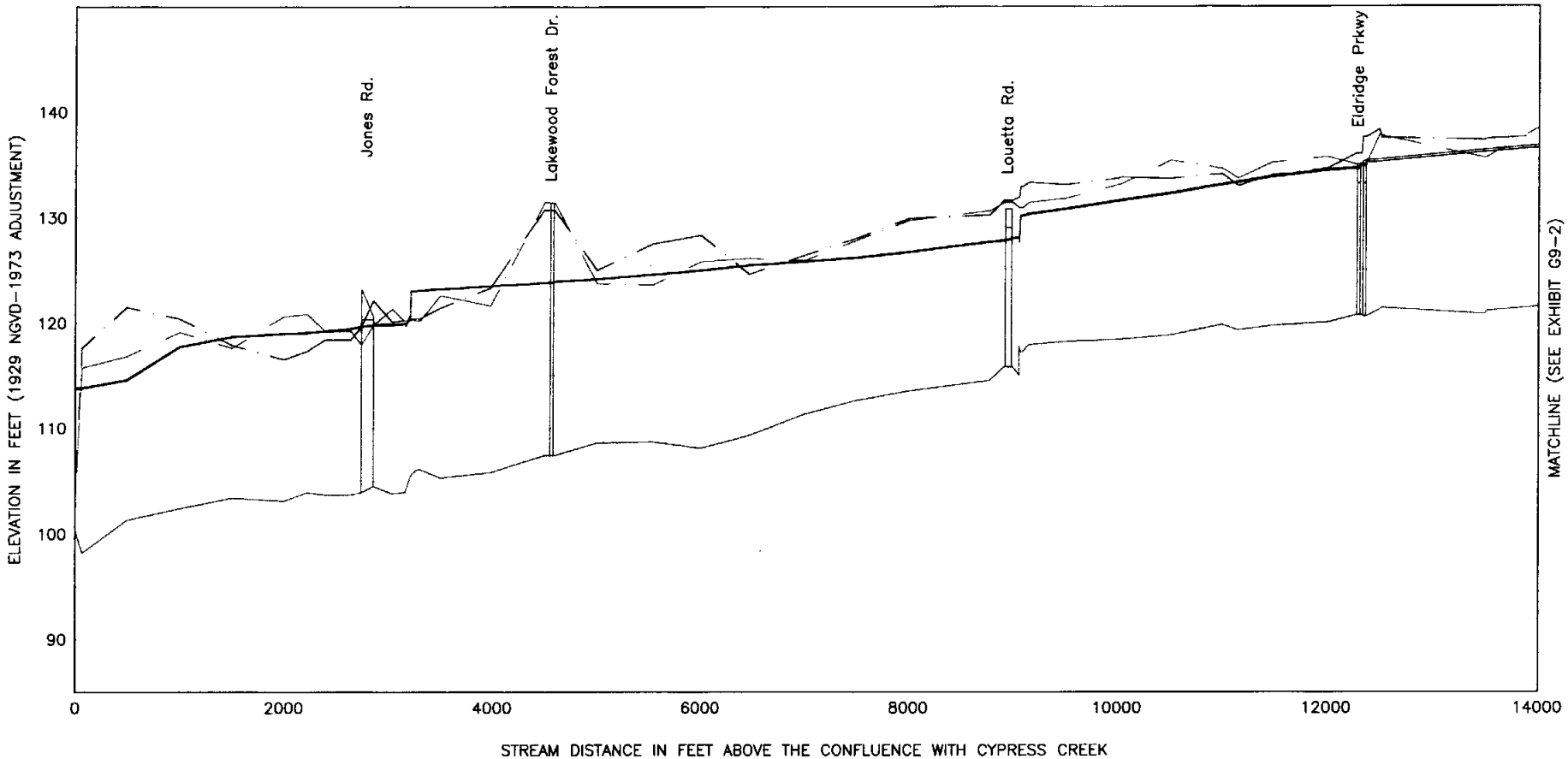

BOUDREAUX RD.
SHAW RD.
FUTURE NORTHPOINTE RD.
K142-07-00
K142-10-00
K142-10-02
K142-09-00
K142-08-00
K142-09-00
ELDRIDGE PKWY
SPRING CYPRESS RD.
K142-06-00
K142-01-00
K142-11-00
LOUETTA RD.
LEGEND
Streets
Major Roadways
Ditches
Baseline Floodplain
Watershed Boundary
Areas of Documented Flood Damage
Areas of Potential Structural Flooding
FAULKEY GULLY SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE II - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO 3000-483-386
FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
STRUCTURAL FLOODING CONCERNS
DEC., 2002
K142-00-00
EXHIBIT G4


BOUDREAUX RD.
K142B
K142B
K142C
K142C
K142A1
K142A
K142A2
K142D
K142D
FUTURE NORTH POINTE RD.
K142-10-00
K142-09-00
K142-08-00
K142-07-00
K142-07-02
K142-06-00
K142E
K142E
K142F
K142F
ELDRIDGE PKWY
SPRING CYPRESS RD.
K142G
K142G
K142-05-00
LOUETTA RD.
LEGEND
Streets
Major Roadways
Ditches
Watershed Boundary
Recommended Plan Sub Watershed Boundary
Baseline Report Sub Watershed Boundary
Hydrologic Analysis Points
FAULKEY GULLY SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
SCALE 1"=1000'
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356
FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
WATERSHED DELINEATION COMPARISON
FEBRUARY 2003
K142-00-00
EXHIBIT G5


BOUDREAUX RD.
ALL PLANS
74 AC-FT
ALL PLANS
100 AC-FT
ALL PLANS
158 AC-FT
PLAN 4
284 AC-FT
SHAW RD.
FUTURE
NORTHPOINTE RD.
K142-10-00
K142-09-00
K142-08-00
K142-07-02
K142-07-01
K142-07-00
K142-06-00
K142-03-00
K142-05-01
ELDRIDGE PKWY
SPRING CYPRESS RD.
LOUETTA RD.
PLANS 2-4
CHANNEL MODIFICATION
PLANS 3 & 4
133 AC-FT
ALL PLANS
51 AC-FT
PLAN 1
STREAM CORRIDOR
SCALE 1"=1000
LEGEND
Streets
Major Roadways
Ditches
Watershed Boundary
Proposed Detention Basin
Proposed Stream Corridor
Proposed Land Acquisition of Stream Quality Habitat Preservation
Proposed Bridge Modification
Proposed Bikeway From Harris County Parks Master Plan
FAULKEY GULLY SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF
HARRIS COUNTY FLOOD
CONTROL DISTRICT
IN ASSOCIATION
WITH THE
TEXAS WATER
DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION
FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-339
FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
COMBINED ALTERNATIVES FEATURES
FEBRUARY 2003
K142-00-00
EXHIBIT G6


BOUDREAUX RD.
74 AC-FT
220' R.O.W.
100 AC-FT
220' R.O.W.
158 AC-FT
240' R.O.W.
K142-10-00
NO R.O.W.
K142-09-00
NO R.O.W.
K142SC4
K142SC3
SHAW RD.
K142SC1
K142-07-02
NO R.O.W.
K142-07-01
NORTHPointe RD.
FUTURE
K142-07-00
50' - 150' ROW
NO R.O.W.
K142-08-00
50' R.O.W.
K142-06-00
ELDRIDGE PARKWAY
5800' - 240' R.O.W.
CHANNEL MODIFICATION
5500' - 260' R.O.W.
CHANNEL MODIFICATION
K142SC2
51 AC-FT
240' R.O.W.
SPRING CYPRESS RD.
K142SB1
133 AC-FT
33 AC R.O.W.
3200' - 300' R.O.W.
CHANNEL MODIFICATION
50' - 60' ROW
K142-06-00
50' - 131' ROW
K142-03-00
55' - 85' ROW
K142-05-00
LOUETTA RD.
FAULKEY GULLY SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
LEGEND
Streets
Major Roadways
Ditches
Watershed Boundary
Proposed Detention Basin
Proposed Stream Corridor
Proposed Land Acquisition of Stream Quality Habitat Preservation
Proposed Bridge Modification
Proposed Bikeway From Harris County Parks Master Plan
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE II - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356
FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
RECOMMENDED PLAN FEATURES
FEBRUARY 2003
K142-00-00
EXHIBIT G7


BOUDREAUX RD.
SHAW RD.
FUTURE NORTHPOINTE RD.
K142-19-00
K142-05-00
K142-07-02
K142-07-01
K142-07-00
K142-06-00
K142-00-00
SPRING CYPRESS RD.
K142-06-00
K142-03-00
K142-05-00
LOUETTA RD.
LEGEND
Streets
Major Roadways
Ditches
Watershed Boundary
Baseline Floodplain
Recommended Plan Floodplain
FAULKEY GULLY SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-354
FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
BASELINE AND RECOMMENDED PLAN
FLOODPLAIN MAP
FEBRUARY 2003
K142-00-00
EXHIBIT G8



LEGEND

FLOWLINE
LEFT BANK
RIGHT BANK
BRIDGES

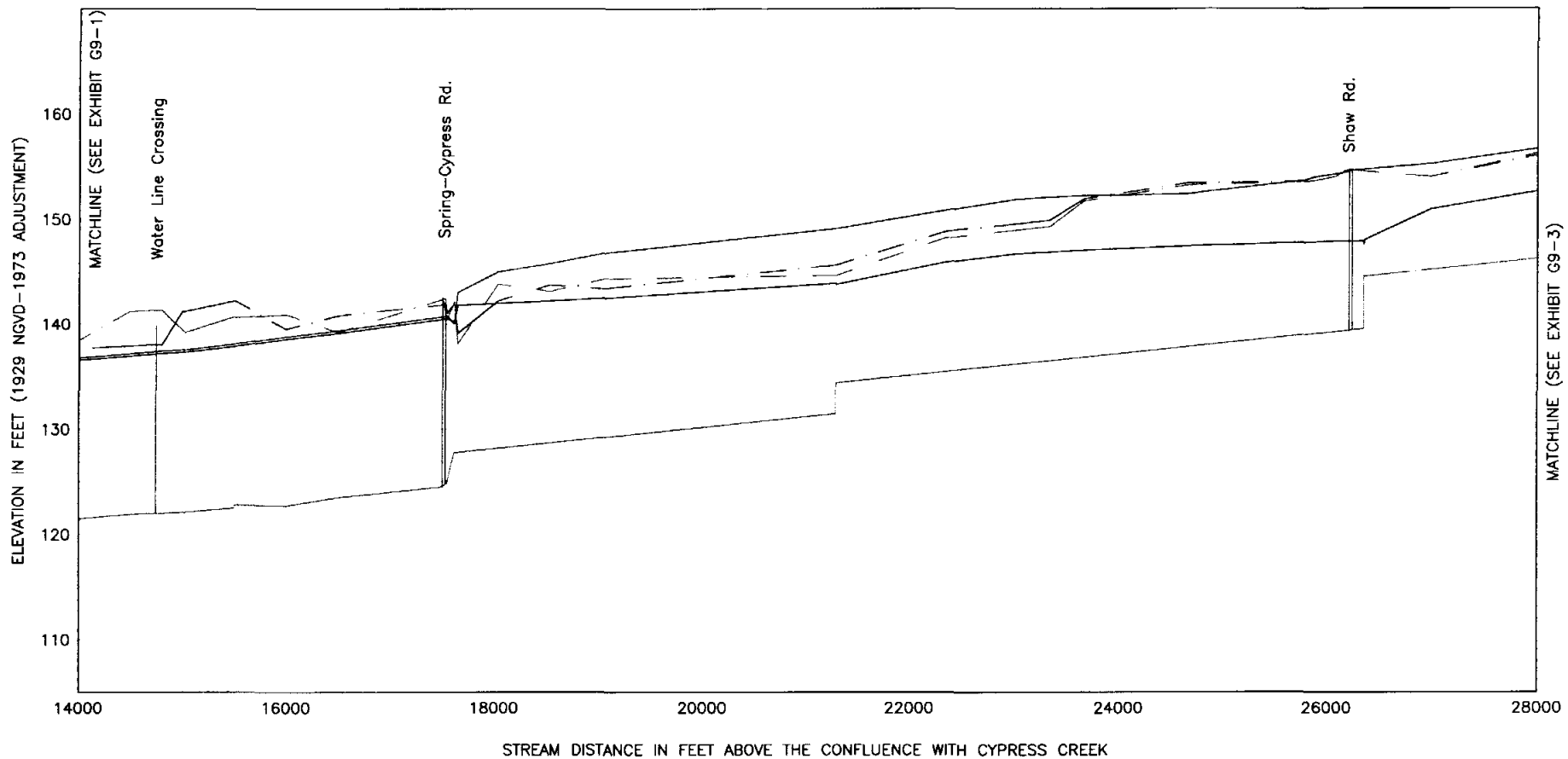
WATER SURFACE PROFILES
100-YEAR RECOMMENDED PLAN
100-YEAR BASELINE

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
100-YR WATER SURFACE PROFILE COMPARISON

FEBRUARY 2003	K142-00-00	EXHIBIT G8-1



LEGEND

FLOWLINE
LEFT BANK
RIGHT BANK
BRIDGES

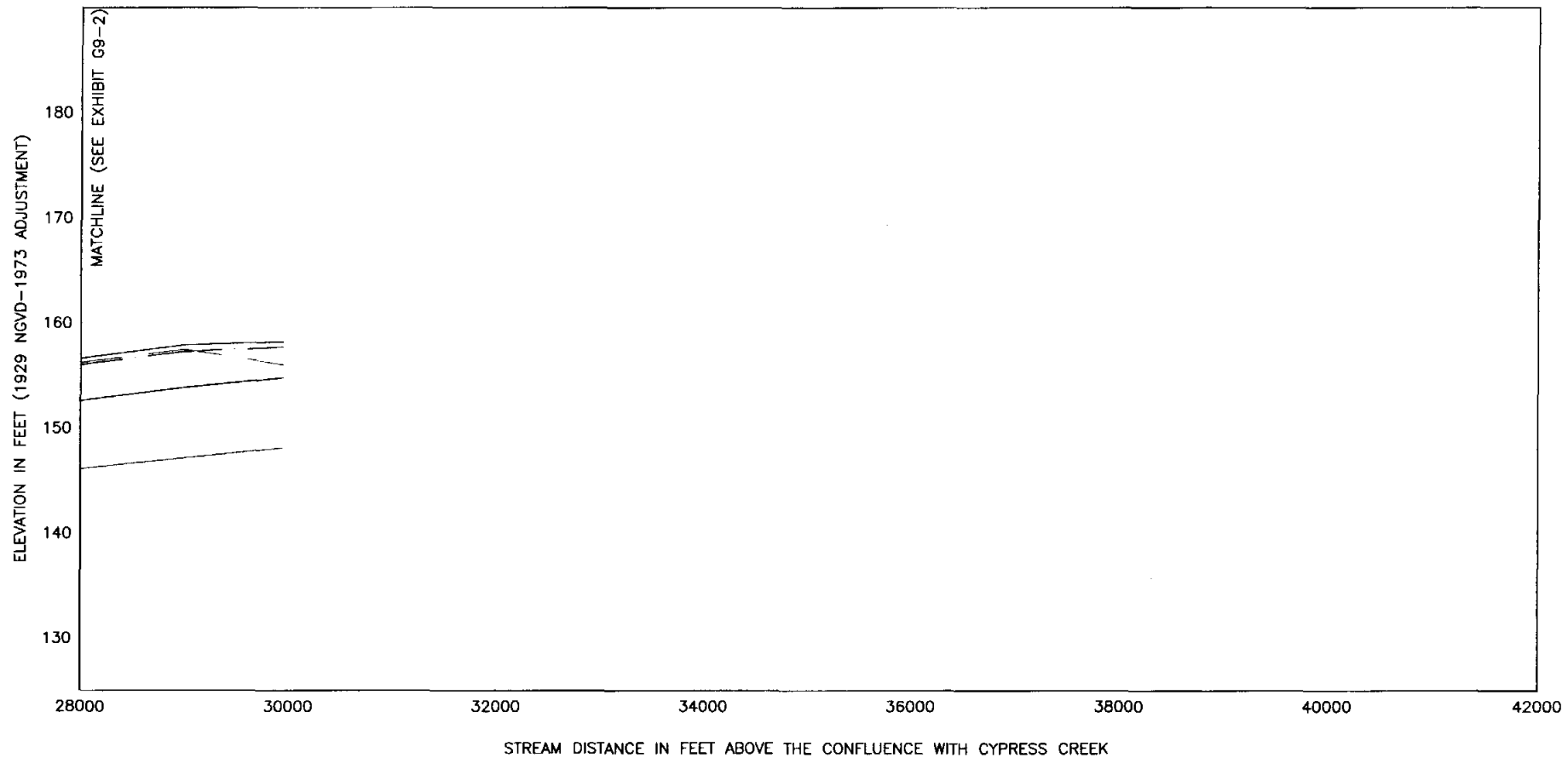
WATER SURFACE PROFILES
100-YEAR RECOMMENDED PLAN
100-YEAR BASELINE

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-336

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
100-YR WATER SURFACE PROFILE COMPARISON

FEBRUARY 2003 | K142-00-00 | EXHIBIT G9-2



LEGEND

FLOWLINE
LEFT BANK
RIGHT BANK
BRIDGES

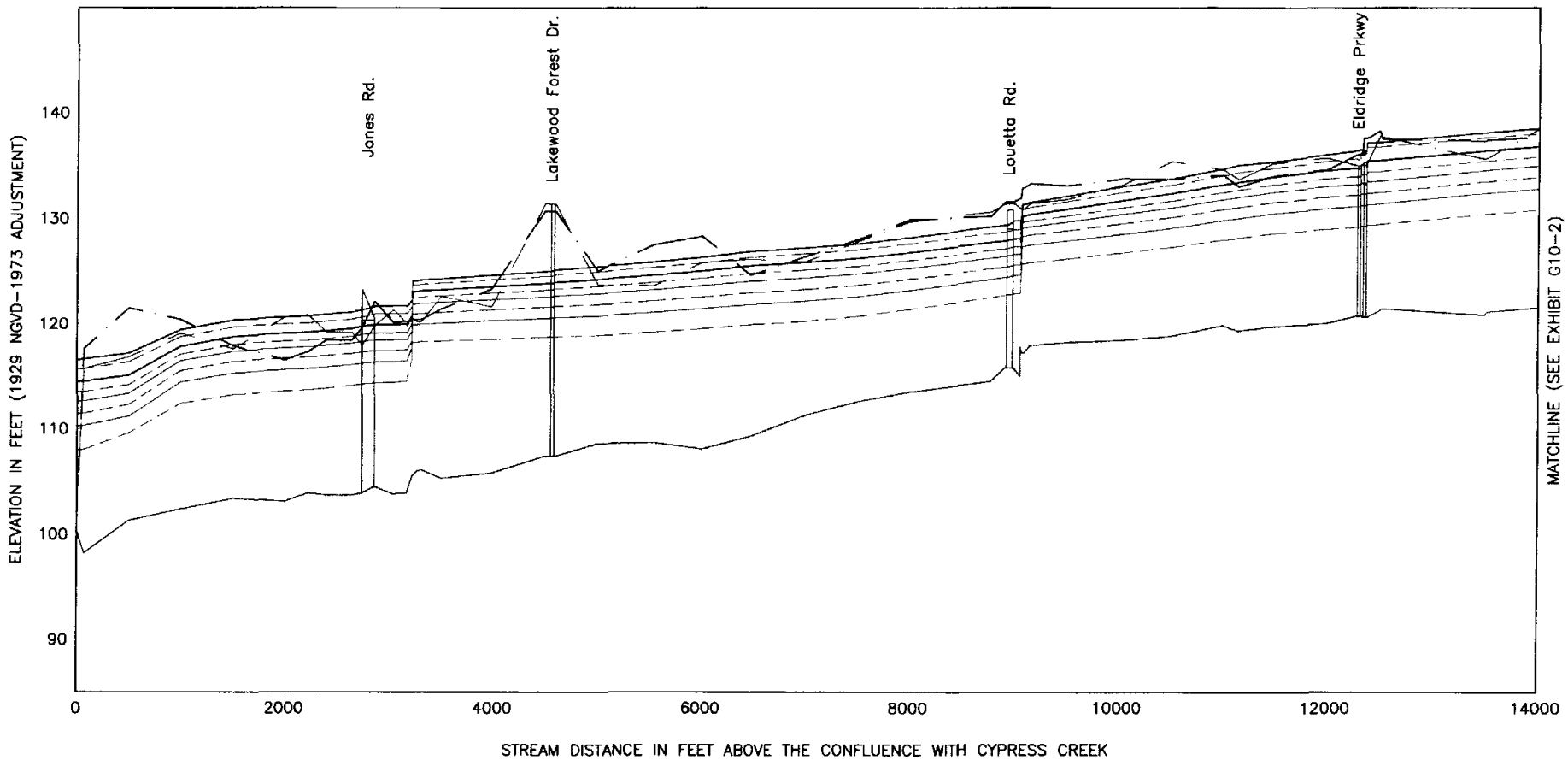
WATER SURFACE PROFILES
100-YEAR RECOMMENDED PLAN
100-YEAR BASELINE

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
100-YR WATER SURFACE PROFILE COMPARISON

FEBRUARY 2003 | K142-00-00 | EXHIBIT G9-3



LEGEND

- FLOWLINE
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

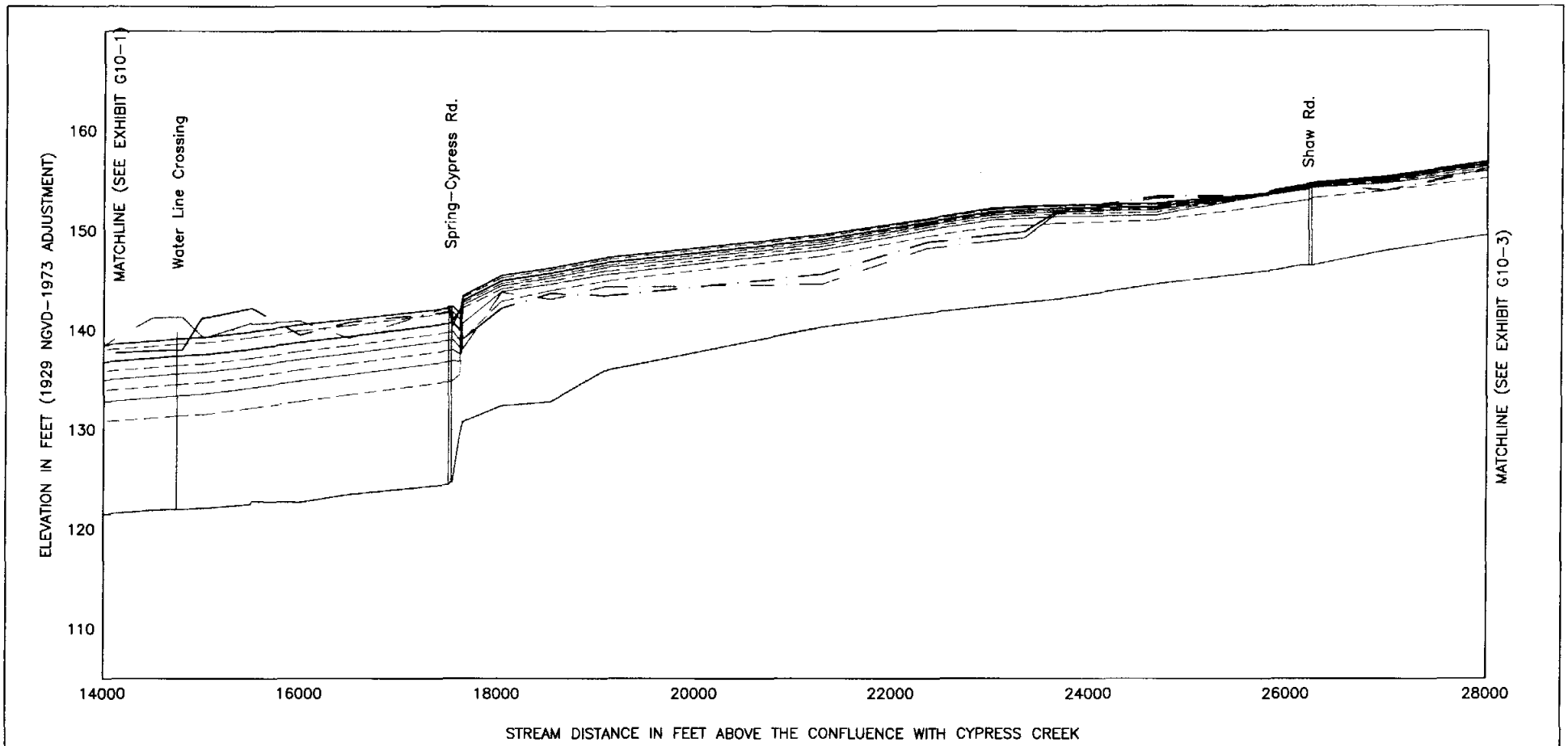
- 500-YEAR
- 250-YEAR
- 100-YEAR
- 50-YEAR
- 25-YEAR
- 10-YEAR
- 5-YEAR
- 2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
FAULKEY GULLY WATER SURFACE PROFILES
BASELINE CONDITION

FEBRUARY 2003 | K142-00-00 | EXHIBIT: G10-1



LEGEND

- FLOWLINE
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

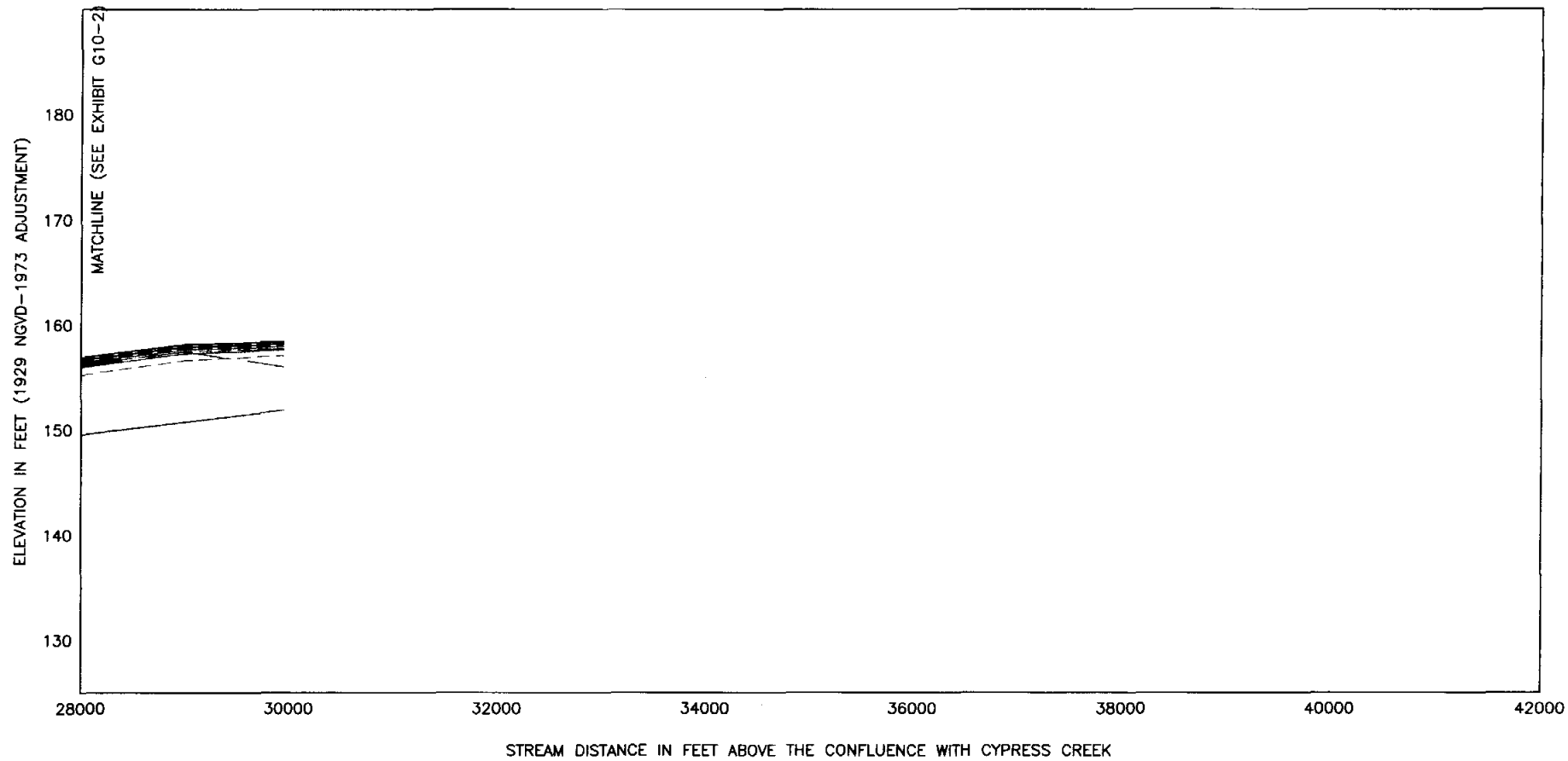
- 500-YEAR
- 250-YEAR
- 100-YEAR
- 50-YEAR
- 25-YEAR
- 10-YEAR
- 5-YEAR
- 2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
FAULKEY GULLY WATER SURFACE PROFILES
BASELINE CONDITION

FEBRUARY 2003	K142-00-00	EXHIBIT: G10-2



LEGEND

FLOWLINE
LEFT BANK
RIGHT BANK
BRIDGES

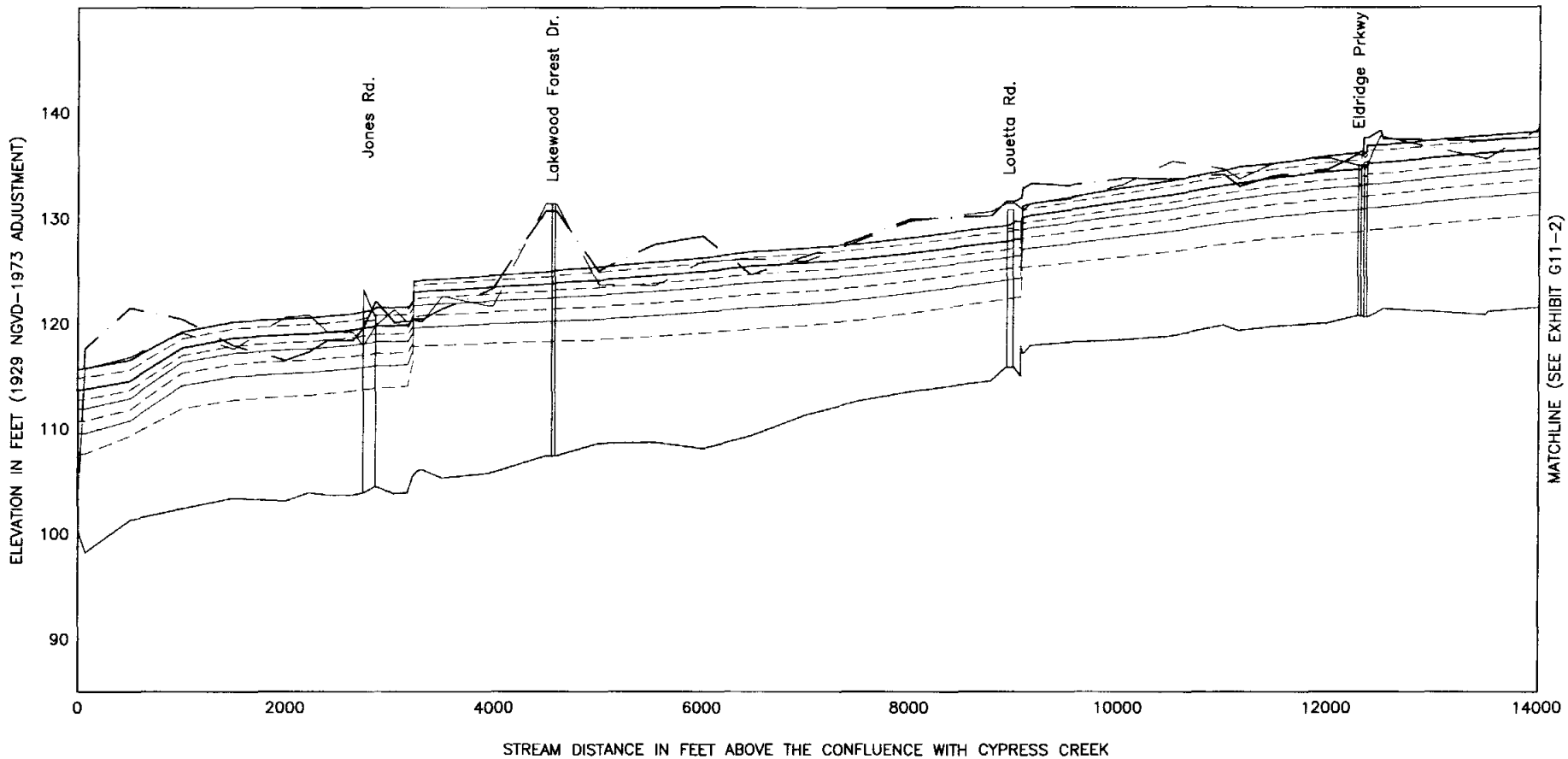
WATER SURFACE PROFILES
500-YEAR
250-YEAR
100-YEAR
50-YEAR
25-YEAR
10-YEAR
5-YEAR
2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
FAULKEY GULLY WATER SURFACE PROFILES
BASELINE CONDITION

FEBRUARY 2003	K142-00-00	EXHIBIT: G10-3



LEGEND

- FLOWLINE
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

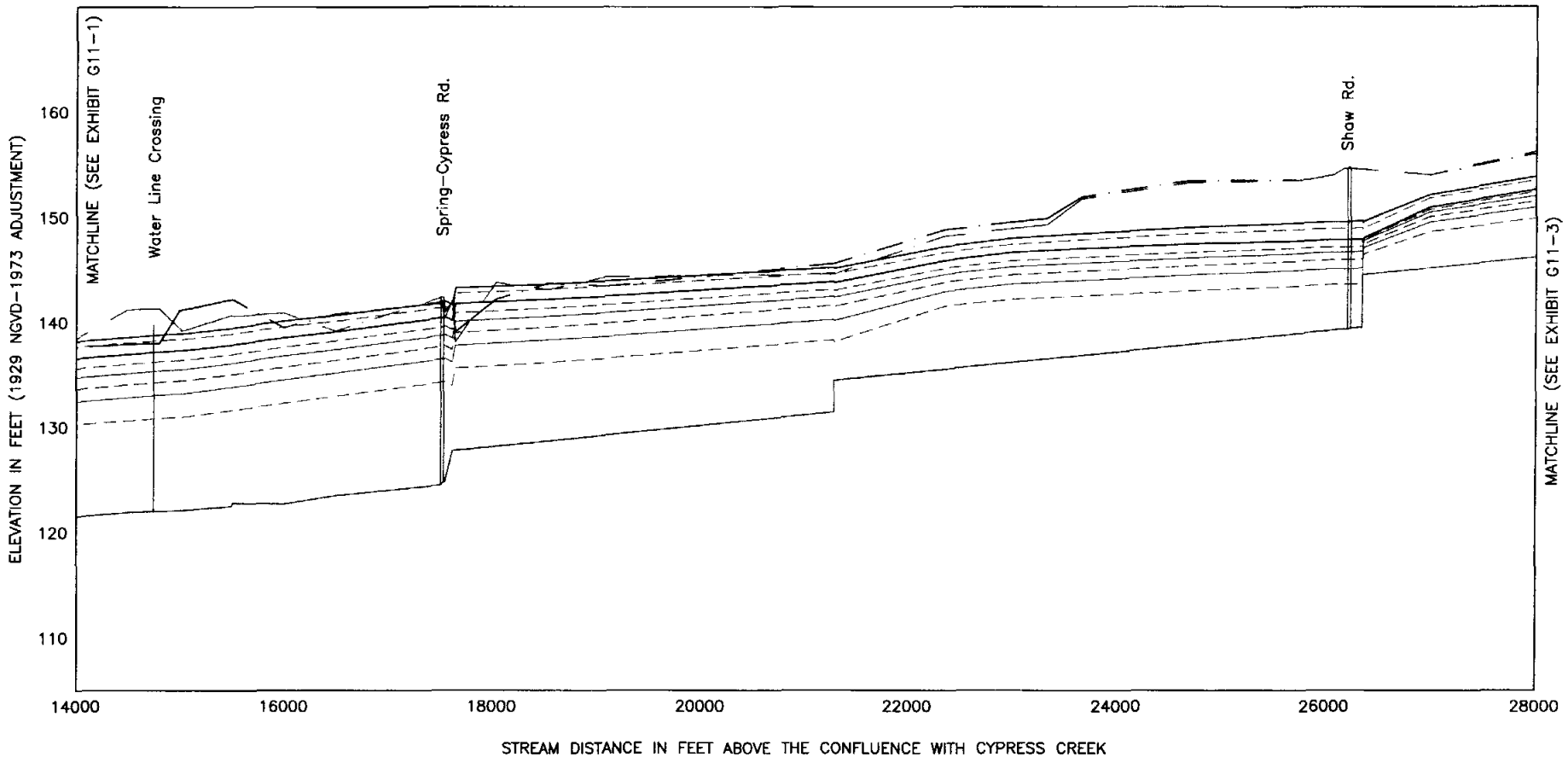
- 500-YEAR
- 250-YEAR
- 100-YEAR
- 50-YEAR
- 25-YEAR
- 10-YEAR
- 5-YEAR
- 2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-336

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
FAULKEY GULLY WATER SURFACE PROFILES
RECOMMENDED PLAN CONDITION

FEBRUARY 2003	K142-00-00	EXHIBIT G11-1



LEGEND

- FLOWLINE
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

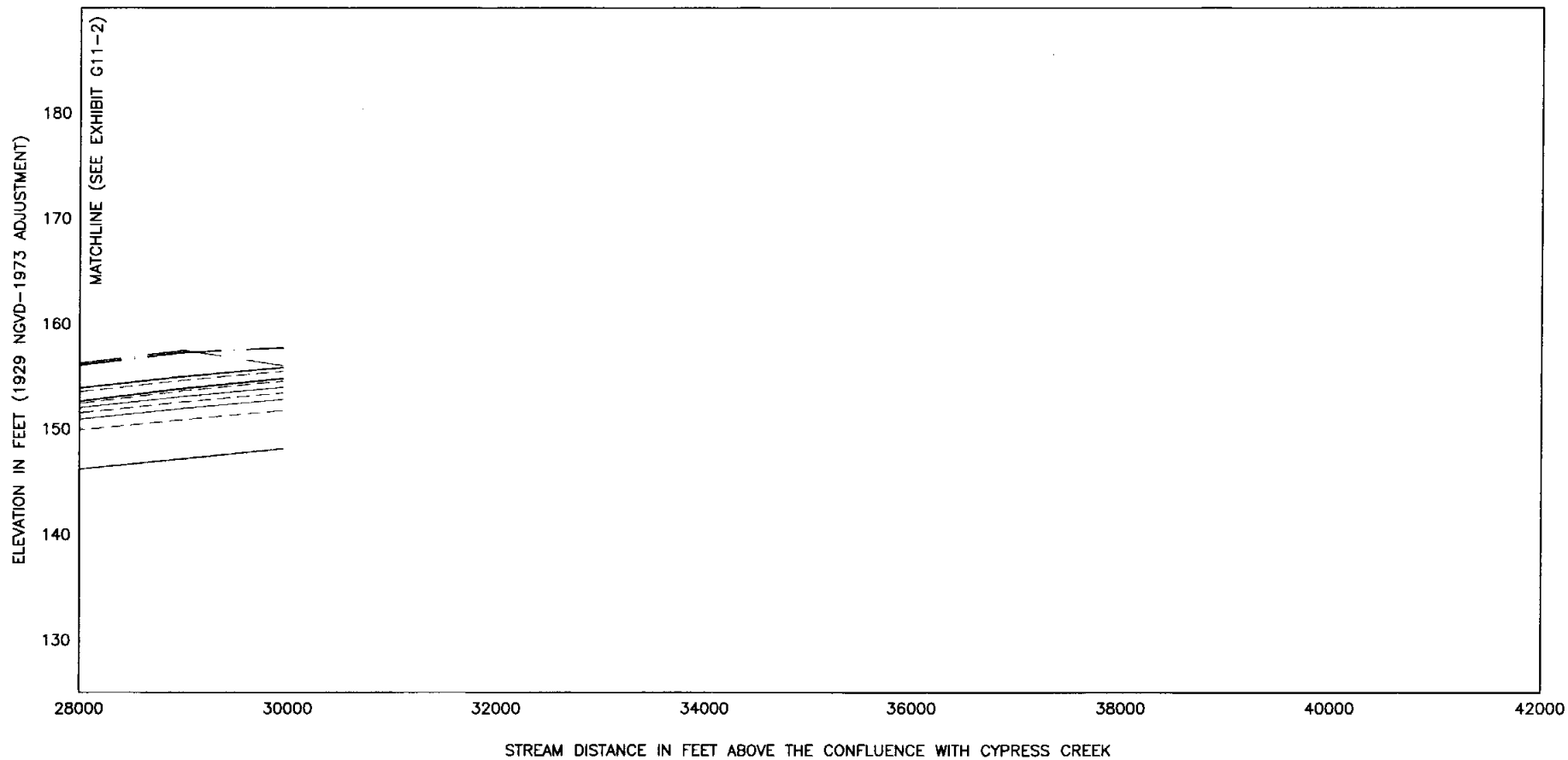
- 500-YEAR
- 250-YEAR
- 100-YEAR
- 50-YEAR
- 25-YEAR
- 10-YEAR
- 5-YEAR
- 2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO 2000-483-356

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
FAULKEY GULLY WATER SURFACE PROFILES
RECOMMENDED PLAN CONDITION

FEBRUARY 2003	K142-00-00	EXHIBIT G11-2



LEGEND

- FLOWLINE
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

- 500-YEAR
- 250-YEAR
- 100-YEAR
- 50-YEAR
- 25-YEAR
- 10-YEAR
- 5-YEAR
- 2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN REPORT
TWDB CONTRACT NO. 2000-483-356

FAULKEY GULLY WATERSHED
REGIONAL DRAINAGE PLAN REPORT
FAULKEY GULLY WATER SURFACE PROFILES
RECOMMENDED PLAN CONDITION

FEBRUARY 2003	K142-00-00	EXHIBIT G11-3

TABLE OF CONTENTS

EXHIBITS

TABLES

DEFINITIONS

Baseline Conditions or Baseline Model - Conditions identified for the watershed from which future planning efforts and the recommended plan will be compared to determine if the study goals and objectives will be met. This condition considers the watershed 100% developed, with new development after 1984 consistent with current HCFCD criteria for on-site storm water detention in the determination of the appropriate baseline hydrologic processes. Further, this condition considers the information identified in the environmental baseline report.

Plan Conditions or Plan Model - The baseline conditions model modified to reflect the land-use conditions and recommended plan elements identified for the recommended regional drainage plan for the watershed.

ELECTRONIC FILES

File Name:	Description
HEC-1 Models:	
K145B-2.ih1	Baseline Plan 2-year Flows
K145B-5.ih1	Baseline Plan 5-year Flows
K145B-10.ih1	Baseline Plan 10-year Flows
K145B-25.ih1	Baseline Plan 25-year Flows
K145B-50.ih1	Baseline Plan 50-year Flows
K145B100.ih1	Baseline Plan 100-year Flows
K145B250.ih1	Baseline Plan 250-year Flows
K145B500.ih1	Baseline Plan 500-year Flows
K145R-2.ih1	Recommended Plan 2-year Flows
K145R-5.ih1	Recommended Plan 5-year Flows
K145R-10.ih1	Recommended Plan 10-year Flows
K145R-25.ih1	Recommended Plan 25-year Flows
K145R-50.ih1	Recommended Plan 50-year Flows
K145R100.ih1	Recommended Plan 100-year Flows
K145R250.ih1	Recommended Plan 250-year Flows
K145R500.ih1	Recommended Plan 500-year Flows
HEC-RAS Models:	
K145.prj	Project File
K145.p01	Baseline and Recommended Plan Multiprofile Plan

1.0 INTRODUCTION

The information presented in this appendix report intends to document the process of developing the recommended regional drainage plan for the Pillot Gully watershed. The plan elements identified for the recommended plan are presented, along with the recommended funding and implementation strategies identified for the plan. All supporting regional-plan modeling information for the Dry Creek watershed is included in this report.

1.1 Project Location

The Dry Creek watershed is located in Northwest Harris County and is a sub watershed of the Cypress Creek watershed. The watershed is generally bounded by US 290 to the south, Fairfield Subdivision to the west, Cypress-Church Road to the north and Barker-Cypress Road to the east. The location of the watershed is shown on **Exhibit 1** in the main text report.

The Dry Creek watershed includes one main stem and four tributaries, and drains into Cypress Creek. As seen on **Exhibits H1** and **H2**, four unnamed tributaries: HCFC Units K145-01-00, K145-02-00, K145-03-00 and K145-05-00 outfall into Dry Creek (K145-00-00). K145-00-00 is the only Flood Insurance Study (FIS) stream in the Dry Creek watershed. The other four tributaries are designated Harris County Flood Control District ditches, but have not been part of a FIS.

1.2 Background Information

The HCFCD intends to prepare a storm water management and flood protection plan for nine tributary watersheds located within the Cypress Creek watershed. The Dry Creek watershed is one of the nine watersheds. Several studies have been conducted within the Dry Creek watershed at varying levels and are identified in Appendix H of the February 2002 *Regional Drainage Plan and Environmental Investigation for Major Tributaries in the Cypress Creek Watershed, Phase I – Hydrologic and Hydraulic Baseline Report.*

The baseline watershed boundary is shown on **Exhibit H1,** with the existing development conditions shown on **Exhibit H2**. The information identified on these exhibits was generated as part of the Phase I study efforts, and was used to assist in identification of the appropriate regional drainage plan for the Dry Creek watershed.

An assessment of the environmental baseline conditions of the Dry Creek watershed was prepared as part of the Phase II – Environmental Baseline Report study efforts. The information presented in this report was used to help identify the recommended regional drainage plan and appropriate plan elements for the watershed. The lower portions of the main stem of Dry Creek are identified as having good stream corridor habitat beneficial for wildlife and water quality. Further, scattered wetlands have been identified in the upper portions of the watershed. However, some of the wetlands and areas of high quality stream habitat have been replaced or impacted by

development since the Environmental Baseline Report was completed. Environmental considerations for the Dry Creek watershed are shown on **Exhibit H3**.

1.3 Flood Hazard

Flood hazards along Dry Creek for which existing model information was available were identified for the baseline conditions. These flood hazards were identified by modifying the current effective hydrologic models for the watershed to reflect appropriate baseline land-use conditions, with the resulting storm flows incorporated into the appropriate hydraulic model reflecting the current conditions of the channel system. The 1% storm flood profile information resulting from the hydraulic model was used in conjunction with an existing digital terrain model produced from LIDAR-obtained ground elevation information to produce a flood-hazard boundary map. The result of this mapping is shown on **Exhibit H4**.

1.4 Summary of Baseline Conditions

The results of the study efforts for identifying the baseline conditions indicate that the 1% storm flood boundary is different from the current effective Federal Emergency Management Agency regulatory flood boundary. This is predictable since updated information about the watershed and its studied streams has been used in the identification of the baseline conditions. The information prepared in the identification of the baseline conditions flood hazards and environmental baseline conditions is suitable for use in identifying the appropriate regional drainage plans.

2.0 REGIONAL DRAINAGE PLAN FORMULATION

The objectives of the Phase III study are to develop Regional Drainage Plans to guide future development of the watershed, address existing flooding issues, preserve and enhance stream habitat and water quality, provide opportunities for multi-use, reduce peak flows into Cypress Creek, and be implementable and acceptable to the public. The sections below detail the methodology of the plan formulation steps, the watershed resources and alternative plans developed for the Dry Creek watershed.

2.1 Methodology

The formulation of the recommended regional drainage plan used an approach that considered the information prepared as part of the Phase I and Phase II study efforts. Further, information concerning the proposed major roadway thoroughfare alignments was also used to help in the identification of recommended alignments for lateral channels that could serve as outfall drainage for these roadways. A series of public meetings and coordination through advisory committee meetings helped in providing direction for identifying a recommended plan.

Hydrologic and hydraulic models prepared as part of the baseline study effort were modified appropriately to reflect alternate plans for the watershed. Alternate plans were identified and the results measured against each other to determine which alternate represented the best plan for the watershed.

2.2 Watershed Description

The Dry Creek watershed as delineated in this study contains 7.89 square miles and has mild southerly overland slopes. The Dry Creek watershed has four tributaries that drain to the main stem of Dry Creek (K145-00-00). These unnamed tributaries are HCFC Units K145-01-00, K145-02-00, K145-03-00 and K145-05-00. As noted earlier however, only the main stem was the subject of the previous studies and is subject to these analyses.

The baseline condition model subbasins hydrologic parameters were modified to reflect alternative plan scenarios. In some instances, the baseline subbasins were further subdivided as shown on **Exhibit H5** to model particular plan elements and impact from development. The previously delineated subbasins STK-1, STK-2A and STK-3 were further subdivided into six smaller subbasins: STK-1A, STK-1B, STK-1C, STK-2A, STK-3 and STK-3A. The subbasins are described as follows:

- The area west of Mueschke Road, (155 acres – STK-1A);
- The area west of Mueschke Road, adjacent to Fairfield Subdivision, (211 acres – STK-1B);
- The area in the upper northwest corner of the Dry Creek watershed (669 acres – STK-1C);

- The area between Mueschke Road and Cypress-Rosehill (443 acres – STK-2A);
- The area in the central portion of the Dry Creek watershed (1120 acres – STK-2);
- The area north of Spring-Cypress Road and west of Cypress-Rosehill (1757 acres – STK-3A); and,
- The area south of Spring-Cypress near the confluence of K145-00-00 and the mouth (696 acres – STK-3).

Dry Creek discharges into Cypress Creek (HCFCD Unit K100-00-00) east of U.S. 290 just upstream of Barker-Cypress Road. **Exhibit H2** shows Dry Creek Watershed subareas with location and station of each routing node along with sub-basin names.

The topography of the basin is very flat, especially in the middle portion of the watershed. The upper and lower portions of the watershed have some limited slope, especially near the confluence with Cypress Creek, but all slopes are less than 20 feet per mile. The main stem has been rectified beginning upstream of Spring-Cypress Road and continuing approximately two miles upstream to Cypress-Chase Boulevard. An existing linear detention basin has been constructed on Dry Creek upstream from Cypress-Chase Boulevard as part of the Cypress Lakes development.

2.3 Basin Resource Inventory

Information was obtained for the watershed concerning existing and planned land use, structure values, environmental resources, etc. This information was used to help identify the value of the resources within the watershed and how best they should be considered in the overall planning efforts.

2.3.1 Stream Habitat Quality

The Environmental Baseline Report (EBR) qualitatively established stream habitat quality rankings based upon characteristics of the stream channel such as channelization, vegetation, and urban density. The ranking system is shown in the EBR and was based on color infrared aerial photos and local knowledge of the streams. The stream quality designations are shown on **Exhibit H3**. The goal of the regional drainage planning effort was to attempt to preserve areas of high stream quality in order to enhance the environmental benefits of the plan.

Areas of high quality stream habitat were identified within the Dry Creek watershed in the lower reaches of the main stem. Much of the middle and upper reaches have been rectified and are rated medium to low quality. The lower reach, south of Spring-Cypress Road, is in a mostly natural condition.

2.3.2 Land Uses in the Watershed

Exhibit H2 illustrates land uses within the watershed. The watershed is approximately 50 percent developed with 2,400 acres of undeveloped property. The majority of undeveloped land is located in the central and western portions of the Dry Creek watershed and is used for agricultural purposes. Development in the Dry Creek watershed is primarily a mix of higher density single-family residential developments with concrete curb and gutter streets, some commercial tracts, the Cypress Lakes golf course, and single-family large acre lots served by roadways with roadside ditch drainage.

2.3.3 Structure Inventory

An inventory of structures that might be affected by flooding along the main stem was performed. The purpose of the inventory was to identify and estimate the economic value or benefit if the structures were either removed or protected from flooding by the regional plans. In the Dry Creek watershed, a small number of structures located in Western Trails Subdivision were identified within the flood hazard area. The estimated value of these structures was obtained from the Harris County Appraisal District (HCAD) records. Approximately 30 structures were identified as having a possible risk of flooding in the baseline condition. The total structure (improvements) value was estimated to be approximately $3,600,000.

In order to determine whether these structures were at risk, slabs were visually inspected in the field since finish floor slab elevation data was not available in the Dry Creek watershed. Most slab elevations appeared to be constructed at or near adjacent natural ground and were determined to have a flood risk.

2.3.4 Economic Factors for the Watershed

The Dry Creek watershed is typical of many of the Cypress Creek tributary watersheds in that it is developing rapidly. Much of the middle portion of the watershed has been master planned for development and will be built away from the main stem of Dry Creek, but located near or along the unstudied tributary ditches in Dry Creek watershed. Land values in the watershed are rising due to this development pressure, especially in areas where outfall for drainage is present. As noted above, there are several structures currently located in flood-prone areas and current development regulations are written to ensure that new structures are provided adequate flood protection.

2.4 Problems and Opportunities Identification

The flood hazard information identified in the Phase I study efforts was used to determine the areas within the watershed most susceptible to out-of-bank flooding. Additionally, opportunities

for enhancement of the watershed through the reduction of existing flooding and preservation of environmental features in the design of the regional plans were identified.

2.4.1 Economic Flood Damage Analysis

Because few structures were identified in areas that may be subject to flooding, no formal economic analysis of flood damage was performed. The structures noted above total approximately $3,600,000. If approximately 50 percent of the value of the structure is added for the contents and vehicles, the total economic benefit from flood reduction planning in the area would be approximately $5,400,000 assuming the structures, contents, and vehicles would be completely lost in flooding. The cost for voluntary structural buyout would include land costs in addition to the structure cost noted above. The cost for voluntary structural buyout was estimated at 120 percent of the appraised land and structure value of $7,600,00 for a cost of $9,120,000.

2.4.2 Identification of Flood-Prone Areas

As shown on the floodplain map **Exhibit H4**, the baseline condition modeling identified areas along the lower reach of the main stem of Dry Creek both upstream and downstream of Spring-Cypress Road subject to out-of-bank flooding. The majority of flooded structures are located in the Western Trails Subdivision in the downstream reach of the main stem of Dry Creek. The main stem of Dry Creek upstream of Skinner to Cypress-Chase Boulevard is contained within the improved reach of the channel. The remainder of the Dry Creek main stem upstream of Cypress-Chase Boulevard has a large flood plain contained within the Cypress Lakes Golf Course and detention basin.

2.4.3 Summary of Public Comments Received

Three public meetings have been held to discuss this project, and public comment on existing drainage problems, plan alternates, and the recommended plan have been solicited. No comments were received for the Dry Creek watershed.

2.4.4 Summary of Repetitive Flood Loss Data

Data on structures that have experienced repetitive flood losses was collected for Harris County. This data included FEMA-related flood damage claims and did not include minor flooding that may have occurred throughout the watershed. Approximately 3000 properties were listed in the database of information obtained. One structure located in the Western Trails Subdivision was in the database.

2.4.5 Opportunities for Watershed Enhancement

There are several areas within the watershed that may be beneficial to preserve and enhance in order to benefit the community. As noted above, there are areas of high stream habitat quality in the lower reach of Dry Creek that are not under development pressure and can be preserved to enhance the environmental quality of the watershed. There are also a few undeveloped areas along the main channel that may be available for dual-use facilities such as parks and sports fields that could also serve as detention facilities. The area upstream from Spring-Cypress Road near the confluence with lateral K145-01-00 has a large area that could be used as a dual-use facility with sports fields and a detention facility.

A large area in the upper portion of the Dry Creek watershed near Mueschke could serve as a large regional detention facility. This area has the highest potential for future development and a regional facility could facilitate any future development west of Mueschke and additional major thoroughfares in the upper northwest portion of the Dry Creek watershed.

2.4.6 Identification of Major Thoroughfare Outfalls

Exhibit H4 shows the major roads through the watershed. Of the major roads shown, Mueschke, Jarvis, Cypress-Church, Spring-Cypress, Cypress-Rosehill and Cypresswood Boulevard are planned future major thoroughfares. Jarvis Road is currently undergoing an improvement project and will cross near the mouth of Dry Creek. Mueschke Road, Cypress-Church Road, Spring-Cypress Road, Cypress-Rosehill Road and Cypresswood Boulevard do not have any current plans for improvements. The major thoroughfare plan includes a new alignment for Cypress-Church Road, Mueschke Road and Cypresswood Boulevard that will ultimately cross Dry Creek. Because these future improvements are near the unimproved upstream portion of Dry Creek, future channel improvements will be required to provide outfall depth at these crossings.

2.4.7 Storm Water Quality Issues

As part of new regulations enacted by Harris County in October 2001, all new development that outfalls into Dry Creek will be required to provide storm water quality protection for the outfall drainage. This includes roadway projects, subdivisions and other development of five acres or more. The regional plans evaluated as part of this project are planned to provide general water quality benefits, but do not specifically address individual developments or roadway projects. Additional storm water quality features will have to be designed for these projects, in order to comply with the new regulations.

2.5 Alternate Drainage Plan Formulation

A series of alternate drainage plans were identified for the watershed. Each plan was prepared in consideration of the goals and objectives identified early on for the study effort. As mentioned above, the alternate plans were developed by considering channelization alternates, detention alternates, and non-structural and "no-action" alternates.

As mentioned in Section 2.2, the baseline subbasins were further subdivided in order to more accurately model particular plan elements. The additional subdivision created a model slightly different than the one included in the Phase I report. The addition of subareas to the model caused peak flows to increase slightly in the baseline models used in this study. **Table H2** of this report presents the updated watershed parameters resulting from this modification of subareas. The peak flows resulting from this subdivision are identified in the following sections describing the plan alternates.

The models used to simulate the plan alternatives are based on the revised modeling efforts that define an updated baseline condition. For the simulation of the Dry Creek watershed, the watershed parameters are identified in **Table H2**. Additional storage volume resulting from alternative plan features were incorporated into the models, and the peak flow values along appropriate reaches were determined.

Each of the alternate plans presented below are combinations of these elements. Although the alternates differ somewhat in their features, there are common elements to all the plans presented in this study.

2.5.1 Common Features to Alternate Plans

In keeping with the goals of the program, outfall depth and flood reduction were emphasized in each of the plans. Emphasis was also placed on preserving areas of high-quality stream habitat where possible. Where new channels (or channel extensions) have been recommended, the channel design is based on a wide section that has flat side slopes and benches for vegetation. This type of section (illustrated in **Figure 1**) provides more opportunities for multiple uses and is less susceptible to erosion. The locations and number of channels provided for future outfalls were also not changed between alternates, unless otherwise noted. The current regulations requiring storm water detention to serve new development are assumed to remain in place for this analysis, unless otherwise noted. The plans described below provide benefits in addition to the on-site requirements. **Exhibit H6** shows the locations of all features for the watershed, including those common to the alternate plans.

2.5.2 Alternate 1 Features and Benefits

Alternate 1 features are shown on **Exhibit H6**. Alternate 1 includes one area of high-quality stream habitat protection in the lower reach of Dry Creek, voluntary structural buyout of flood-prone structures, and a multiple-use detention/recreation facility (K145#B1) upstream of Spring-Cypress Road. A typical layout of the type of detention/amenity facility is shown on **Figure 2** in the main report.

This plan reduces peak flows downstream of the proposed detention basin. The table shown below lists the peak flows at each hydrologic computational node in the baseline and alternate condition.

Alternate 1 Benefits (100 Year Flows)				
Node	**Location**	**Baseline Flow (cfs)**	**Alt Flow* (cfs)**	**Benefit (cfs)**
STK-1	Mueschke Road	516	516	0
STK-2A	Cypress-Chase Blvd.	1182	1182	0
STK-2	Cypress-Rosehill Road	1583	1583	0
STK-3	Mouth	2851	2649	-202

* The flow has been prorated by the percent difference between the baseline and revised subdivided baseline models as noted in Part 2.2 of this report.

The alternate reduces flows at Cypress Creek by approximately 7 percent. The estimated cost for implementing Alternate 1 is $3,320,000 plus $9,120,000 for voluntary structural buyout and $400,000 for a stream habitat protection corridor. The total estimated cost for implementing Alternate 1 is $12,840,000.

2.5.3 Alternate 2 Features and Benefits

Alternate 2 features are shown on **Exhibit H6**. Alternate 2 includes one area of high-quality stream habitat protection in the lower reach of Dry Creek, voluntary structural buyout of flood-prone structures, and a lateral channel extension (K145#C1) to provide outfall depth in the upstream portion of the watershed.

This plan provides additional benefits in reducing peak flows in Dry Creek. The table below lists the peak flows at each hydrologic computational node in the baseline and alternate condition.

Alternate 2 Benefits (100 Year Flows)				
Node	**Location**	**Baseline Flow (cfs)**	**Alt Flow (cfs)**	**Benefit (cfs)**
STK-1	Mueschke Road	516	459	-57
STK-2A	Cypress-Chase Blvd.	1182	1109	-73
STK-2	Cypress-Rosehill Road	1583	1464	-119
STK-3	Mouth	2851	2737	-114

* The flow has been prorated by the percent difference between the baseline and revised subdivided baseline models as noted in Part 2.2 of this report.

The channel extension reduces flows in the upper reach by approximately 11 percent and by approximately 4 percent at Cypress Creek. The estimated cost for implementing Alternate 2 is $1,980,000 plus $9,120,000 for voluntary structural buyout and $400,000 for a stream habitat protection corridor. The total estimated cost for implementing Alternate 2 is $11,500,000.

2.5.4 Alternate 3 Features and Benefit

Alternate 3 features are shown on **Exhibit H6**. Alternate 3 is a combination of features from Alternates 1 and 2. Alternate 3 includes one area of high-quality stream habitat protection in the lower reach of Dry Creek, voluntary buyout of flood-prone structures, a multiple-use detention facility (K145#B1) upstream of Spring-Cypress Road and a lateral channel extension (K145#C1) to provide outfall depth for future Mueschke Road.

The following table shows the peak flows at each hydrologic computational node in the baseline and alternate condition. The combination of channel detention in the upper reach and the additional volume provided by the detention basin in the lower reach has the effect of reducing flows at Cypress Creek by approximately 10 percent. The estimated cost for implementing Alternate 3 is $5,300,000 plus $9,120,000 for voluntary structural buyout and $400,000 for a stream habitat protection corridor. The total estimated cost for implementing Alternate 3 is $14,820,000.

Alternate 3 Benefits (100 Year Flows)				
Node	**Location**	**Baseline Flow (cfs)**	**Alt Flow* (cfs)**	**Benefit (cfs)**
STK-1	Mueschke Road	516	442	-74
STK-2A	Cypress-Chase Blvd.	1182	1104	-78
STK-2	Cypress-Rosehill Road	1583	1484	-99
STK-3	Mouth	2851	2572	-279

* The flow has been prorated by the percent difference between the baseline and revised subdivided baseline models as noted in Part 2.2 of this report.

2.5.5 Alternate 4 Features and Benefits

Alternate 4 features are shown on **Exhibit H6**. Alternate 4 includes one area of high-quality stream habitat protection in the lower portion of the watershed, voluntary structural buyout of flood-prone structures, and a large regional detention basin in the upper portion of the watershed. This plan provides benefits in reducing peak flows at each of the nodes to account for full development of the upper reach without on-site detention. The watershed parameters to model full development were revised (DCI and DLU = 100 percent) and the associated increase in runoff was mitigated in the regional basin. The detention basin volume was

increased to reduce the flows and corresponding 100-year water surface elevations in the lower reach.

The following table shows the peak flows at each hydrologic computational node in the baseline and alternate condition. The regional detention basin reduces flows in the upper reach near Mueschke Road by approximately 50 percent and reduces flows at Cypress Creek by 16 percent. The estimated cost for implementing Alternate 4 is $11,750,000, however, a drainage impact fee of $4,000 per acre would lower this cost to $7,630,000. The impact fee would be assessed on approximately 1,030 acres in the upper portion of Dry Creek served by the regional basin. The estimated cost for implementing Alternate 4 is $7,630,000 plus $9,120,000 for voluntary structural buyout and $400,000 for a stream habitat protection corridor. The total estimated cost for implementing Alternate 4 is $17,150,000.

Alternate 4 Benefits (100 Year Flows)				
Node	**Location**	**Baseline Flow (cfs)**	**Alt Flow* (cfs)**	**Benefit (cfs)**
STK-1	Mueschke Road	516	261	-255
STK-2A	Cypress-Chase Blvd.	1182	474	-708
STK-2	Cypress-Rosehill Road	1583	1050	-533
STK-3	Mouth	2851	2404	-447

* The flow has been prorated by the percent difference between the baseline and revised subdivided baseline models as noted in Part 2.2 of this report.

2.5.6 Alternate 5 Features and Benefits

Alternate 5 features are shown on **Exhibit H6**. Alternate 5 includes one area of high-quality stream habitat protection in the lower reach of Dry Creek, voluntary structural buyout of flood-prone structures, a multiple-use detention facility (K145#B1) upstream of Spring-Cypress Road, and a lateral channel extension (K145#C1) to provide outfall depth for future Mueschke Road. This plan provides benefits in reducing peak flows at each of the nodes to account for full development of the upper reach without on-site detention. The watershed parameters to model full development were revised (DCI and DLU = 100 percent) and the associated increase in runoff was mitigated in the regional basin. The detention basin volume was increased to reduce the flows and corresponding 100-year water surface elevations in the lower reach.

The following table shows the peak flows at each hydrologic computational node in the baseline and alternate condition. Regional detention in the upper reach (K145#C1) reduces flows by 16 percent and along with detention near Spring-Cypress (K145#B1) reduces flows at Cypress Creek by 16 percent. The estimated cost for implementing Alternate 5 is $8,710,000, however, a drainage impact fee of $4,000 per acre would lower this cost to $4,590,000. The impact fee would be assessed on approximately 1,030 acres in the upper portion of Dry Creek served by the regional basin. The estimated cost for implementing

Alternate 5 is $4,590,000 plus $9,120,000 for voluntary structural buyout and $400,000 for a stream habitat protection corridor. The total estimated cost for implementing Alternate 5 is $14,110,000.

Alternate 5 Benefits (100 Year Flows)				
Node	**Location**	**Baseline Flow (cfs)**	**Alt Flow (cfs)**	**Benefit (cfs)**
STK-1	Mueschke Road	516	432	-84
STK-2A	Cypress-Chase Blvd.	1182	723	-459
STK-2	Cypress-Rosehill Road	1583	1256	-327
STK-3	Mouth	2851	2394	-457

* The flow has been prorated by the percent difference between the baseline and revised subdivided baseline models as noted in Part 2.2 of this report.

2.5.7 Public Input on Alternate Plans

On October 8, 2002, a public meeting was held to describe the planning progress and to inform the public regarding the alternate plans being proposed for the watershed. No public comments were received at the meeting for Dry Creek, which is likely due to the few flooding concerns within the watershed.

2.5.8 Screening of Alternates

The following criteria matrix was used when evaluating the alternative plans identified for each watershed.

Table H1 - Screening Matrix for Dry Creek						
Criteria	**Weight**	**Plan**				
		ALT 1	**ALT 2**	**ALT 3**	**ALT 4**	**ALT 5**
Minimal Construction Cost	0.2	6	8	4	2	4
Provides Aesthetics	0.5	7	6	8	9	9
Ease of Implementation	0.8	7	7	6	2	2
Flood Protection within Tributary Watershed	1	4	3	5	6	6
Ability to Accommodate Multiple Uses	0.5	7	6	8	10	8
Preserves/Enhances Water Quality	0.8	6	7	6	8	8
Preserves/Enhances Stream Habitat Quality	0.5	9	9	9	10	10
Ease of Maintenance	0.8	9	9	9	5	6
Reduction of Peak Flows into Cypress Creek	1	6	6	7	8	8
Outfalls for Future Roadways/Development	0.8	0	8	8	8	8
Acceptable to the Public	0.8	7	8	8	6	7
TOTAL	-----	**68**	**77**	**78**	**74**	**76**
WEIGHTED TOTAL	**77 (max)**	**45.9**	**52.3**	**54.9**	**52.1**	**53.1**

The ability of the plan alternative to meet each criteria was ranked from 0 to 10, with 0 indicating that the criteria is not met, and 10 indicating that the criteria is met to the best of its ability. Relative weights were then set for each of the criteria as shown above based on the stated goals of the study.

2.6 Recommended Plan and Identification of Elements

Based on this criteria noted, a plan was recommended that met the needs of the watershed as noted in this report. The recommended plan is described in detail below in the following section. None of the alternates eliminated the flood plain in the lower portion of Dry Creek since much of the flood plain is deep through the Western Trails Subdivision. Options to remove the flood plain would require detention volumes far in excess of those recommended, or channel rectification of the high-quality stream habitat in the lower reach of Dry Creek. Neither of these options were desirable and were therefore removed from consideration.

2.6.1 Determination of Recommended Plan

Alternate 3 was chosen as the recommended plan primarily due to the fact that it met all the criteria of the study, provided a reduction in flows to Cypress Creek, and is more likely to be implemented when compared to regional detention Alternatives 4 and 5. As shown in the screening matrix, Alternate 3 received the highest score. The regional plans reflected in Alternates 4 and 5 scored lower because of the difficulty in implementing an impact fee for the relatively small contributing area, constructing regional facilities in advance of development, and possible public acceptance problems associated with the larger regional basins.

2.6.2 Recommended Plan Features

The recommended plan consists of features that preserve areas of good quality stream habitat, obtain structures in flood-prone areas through the voluntary buyout program, provide outfall drainage for future development, and slightly lower flood plain elevations. The features of the plan, beginning at the mouth, consist of the elements described below.

The lower 5800 feet of main channel stream quality and habitat will be preserved in a corridor with an average width of approximately 300 feet. A detention/recreation/water quality basin will reduce flow to Cypress Creek and enhance water quality entering the high-quality area. Basin K145#B1 will comprise approximately 36 acres of land with dimensions consisting of 1200' by 1300' and side slopes of 4:1 with a nominal depth of 12 feet. K145B#1 should be designed as a "wet basin" in order to address the common pollutants found in Cypress Creek and tributary streams. Upstream of Spring-Cypress Road and through Cypress-Chase Boulevard, the channel has been rectified and has sufficient capacity to handle the design storms. No additional work is planned in this reach. Upstream of Cypress-Chase Boulevard,

an existing detention basin mitigates impacts of development from the Cypress-Lakes Golf Course and subdivision. Upstream from the detention basin, a multiple-use "frontier" channel within a 300-foot wide drainage corridor (K145#C1) near the confluence of Dry Creek and Mueschke Road will provide outfall depth.

2.6.3 Recommended Plan Benefits

Taken together, these elements make up the recommended plan for Dry Creek and satisfy the criteria for this study while providing quantifiable benefits to the watershed. Some recreational elements will be necessary to add to the plan features to fully meet the desired goal for multiple-use facilities which include a continuous hike and bike trail system. The system could begin near the mouth of Dry Creek and extend as far northwestward as the planned regional detention basin near Mueschke Road. The trail system would offer benefits for recreation, and would be accessible to all residents in the Dry Creek watershed. Additionally, developments served by the proposed channel extension would be encouraged to construct trails along the lateral channel as a recreational amenity for the development.

Hydrologic benefits due to the plan elements were summarized in the alternate plan formulation section of this report. In order to maintain consistency with the Phase I report, the flows calculated as a result of the more detailed modeling were compared with the revised baseline flows, then the prorated decrease (or increase) resulting from the modeling of the recommended plan was applied to the original baseline flows to create an adjusted plan flow. The adjusted plan flows were used as the basis for the HEC-RAS modeling and floodplain mapping for the recommended plan. The revised Tc and R parameters for the recommended plan compared to the baseline are shown in **Table H2**. The resulting 100-year flows comparing the baseline conditions to the recommended plan conditions are presented in **Table H3** of this report. **Table H4** of this report presents the HEC-1 peak flows resulting from the recommended plan for various storm frequencies. The 100-year baseline and 100-year recommended plan profiles are shown on **Exhibit H9-1** and **Exhibit H9-2**. The eight frequency storm event profiles for the baseline and recommended plan are shown on **Exhibit H10-1** and **Exhibit H10-2**, and **Exhibit H11-1** and **Exhibit H11-2**, respectively.

The plan reduces 100-year peak flows downstream of channel K145#C1 by 74 cfs and flows entering into Cypress Creek 279 cfs. Water surface elevations are slightly lower as a result of the lower flows. As shown in **Table H5,** the 100-year water surface elevations decrease along Dry Creek by about 0.35 feet. Upstream from the dual 66-inch restrictor located upstream from Cypress-Chase Boulevard, channel improvements are proposed which lower the water surface elevations by about 2.30 feet. As noted earlier, the goal of this plan was not to bring all areas of out-of-bank flooding to within the banks. The goal was to preserve some areas of out-of-bank flooding that occurs in areas that are beneficial to the watershed and to address out-of-bank flooding in areas where it causes existing or projected flooding problems outside

of the stream corridor areas. Finally, the plan provides environmental benefits by preserving identified areas of good quality stream habitat as well as preserving some naturally flood-prone areas, as noted above.

Table H2: Watershed Physical Characteristics (Baseline & Recommended Plan Conditions)

Subarea Name	Drainage Area		Watershed Length	Length to Centroid	Channel Slope	Overland Slope	Urban Dev. *	Watershed Dev. *	Channel Imp.	Channel Conv.	Ponding
	(Acre)	(Sq.Mi)	(mi)	(mi)	(ft/mi)	(ft/mi)	(%)	(%)	(%)	(%)	(%)
Baseline Condition											
STK-1	563	0.88	KINEMATIC WAVE EQUATION								
STK-2A	915	1.43	2.44	1.34	2.64	<20	1.9	90.9	100	100	0
STK-2	1120	1.75	2.71	0.83	3.14	<20	2.6	89.7	25	79	0
STK-3	2451	3.83	3.81	1.78	4.70	<20	8.8	73.4	87	74	0
Recommended Plan											
STK-1A	155	0.24	0.91	0.74	1.42	<20	0.0	100.0	0	100	0
STK-1B	211	0.33	0.95	0.64	17.00	<20	0.4	98.9	0	100	0
STK-1C	669	1.05	2.22	1.47	9.90	<20	6.0	78.9	0	100	0
STK-2A	443	0.69	1.63	0.97	4.24	<20	0.0	100.0	40	100	0
STK-2	1120	1.75	2.71	0.83	3.14	<20	2.6	90.0	25	79	0
STK-3A	1757	2.75	2.88	1.40	4.35	<20	11.7	66.0	87	74	0
STK-3	696	1.09	1.78	0.81	4.67	<20	1.5	92.3	87	74	0

* % based on development in place prior to implementation of HCFCD on-site detention policy (1984)

Baseline & Recommended Plan Conditions

Subarea Name	TC	R	RTIMP
	(hrs)	(hrs)	(%)
Baseline Condition			
STK-1	KINEMATIC WAVE EQUATION		
STK-2A	1.13	8.53	31.8
STK-2	0.62	9.17	31.4
STK-3	1.21	9.59	25.7
Recommended Plan			
STK-1A	1.49	4.51	35.0
STK-1B	0.34	2.23	34.6
STK-1C	1.09	4.58	27.6
STK-2A	0.92	5.23	35.0
STK-2	0.98	8.81	31.5
STK-3A	0.97	8.14	23.1
STK-3	0.54	5.78	32.3

Table H3: 100-Year Flow Comparison Table (Baseline vs. Recommended Plan)

HEC-1 Analysis Point	Baseline Condition (cfs)	Recommended Condition (cfs)*	Baseline vs. Recommended Plan	
			Difference (cfs)	% Change
STK-1A	n/a	145	n/a	n/a
STK-1B	n/a	318	n/a	n/a
STK-1C	n/a	657	n/a	n/a
STK-1	516	442	74	14
STK-2A	1182	1104	78	7
STK-2	1583	1484	99	6
STK-3A	n/a	2672	n/a	n/a
STK-3	2851	2572	279	10

* The flow from the recommended plan model prorated as identified in part 2.6.3 of this report.

Table H4: HEC-1 Peak Flow Rates for Recommended Plan Conditions*

HEC-1 Analysis Point	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	250-Year	500-Year
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
STK-1A	47	74	92	111	128	145	167	184
STK-1B	111	170	208	248	283	318	365	400
STK-1C	211	335	417	504	576	657	758	834
STK-1	63	140	207	283	355	442	561	652
STK-2A	253	449	597	771	927	1104	1331	1506
STK-2	400	766	912	1116	1333	1484	1698	1865
STK-3A	756	1258	1635	2007	2351	2672	3053	3346
STK-3	728	1211	1574	1932	2263	2572	2939	3221

* The flows prorated as identified in part 2.6.3 of this report.

Table H5: Comparison of Water Surface Elevations (100-Year)

		Baseline Condition		Recommended Plan		Delta
SECNO	Location	Flow	WSEL	Flow	WSEL	(ft)
170410	Mouth	2900	133.15	2570	132.55	-0.60
15.23		2900	140.20	2570	139.87	-0.37
17.23		2900	140.74	2570	140.45	-0.34
18.23		2900	140.97	2570	140.68	-0.34
19.04		2900	141.11	2570	140.82	-0.35
19.42	Jarvis Rd.	2900	141.31	2570	141.13	-0.25
20.25		2900	141.30	2570	141.12	-0.24
22.25		2900	141.39	2570	141.21	-0.24
24.25		2900	141.80	2570	141.63	-0.25
41.78		2900	144.20	2570	144.02	-0.24
56.04		2450	145.35	2270	145.14	-0.24
61.85		2450	145.75	2270	145.58	-0.21
62.24		2450	146.11	2270	145.99	-0.11
62.63	Spring-Cypress Rd.	2270	146.20	2120	146.09	-0.12
83.08		2270	146.63	2120	146.51	-0.14
98.35		2270	147.03	2120	146.91	-0.13
99.67	Dry Creek Rd.	2270	148.26	2120	147.97	-0.29
101.56		2270	148.30	2120	148.02	-0.29
103		2270	148.35	2120	148.07	-0.29
104		2270	148.38	2120	148.08	-0.31
105		2270	148.41	2120	148.13	-0.28
106		2270	148.44	2120	148.16	-0.28
107.02		2270	148.47	2120	148.19	-0.28
107.68		1900	148.48	1790	148.20	-0.28
107.98		1900	148.37	1790	148.07	-0.30
108.42	Skinner Rd.	1900	148.53	1790	148.19	-0.33
108.69		1900	148.68	1790	148.38	-0.31
109.29		1900	148.79	1790	148.49	-0.31
110.29		1900	148.85	1790	148.56	-0.30
111.29		1900	148.89	1790	148.60	-0.30
112.29		1900	148.91	1790	148.63	-0.30
113.29		1900	148.93	1790	148.65	-0.29
114.29		1900	148.95	1790	148.67	-0.30
120		1900	149.07	1790	148.78	-0.30
124.23		1900	149.19	1790	148.91	-0.29
126.93		1900	149.28	1790	148.99	-0.30
129		1900	149.35	1790	149.06	-0.31
133.5		1900	149.51	1790	149.21	-0.31
137.97		1900	149.66	1790	149.36	-0.31
145.49	Node STK-2	1650	149.93	1550	149.63	-0.31
145.99		1650	149.94	1550	149.64	-0.31
146.34	Cypress-Rosehill Rd.	1650	149.97	1550	149.65	-0.33
170.64	Node STK-2A	1650	150.74	1480	150.39	-0.36
191.84		1200	150.91	1120	150.54	-0.37

Table H5: Comparison of Water Surface Elevations (100-Year) *continued*

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
191.95		1200	150.92	1130	150.55	-0.38
192.95	Cypress-Chase Blvd.	1200	150.96	1120	150.59	-0.38
192.96		1200	150.93	1120	150.56	-0.38
193.55		1200	150.33	1120	149.85	-0.49
193.97	Dual 66-inch Restrictor	1200	149.54	1120	149.29	-0.25
194.68		1200	154.32	1120	153.77	-0.55
196.4		1200	154.33	1120	153.78	-0.55
197.93		1200	154.34	1120	153.78	-0.56
198.82		1200	154.35	1120	153.79	-0.56
199.61		1200	154.36	1120	153.79	-0.57
201.86		1200	154.37	1120	153.80	-0.57
202.64		1200	154.38	1120	153.80	-0.58
203.83		1200	154.39	1120	153.80	-0.59
204.21		1200	154.40	1120	153.81	-0.59
205.53		950	154.41	930	153.81	-0.60
207.4		950	154.42	930	153.82	-0.60
208.37		950	154.43	930	153.82	-0.61
209.38		950	154.44	930	153.82	-0.62
210.8		950	154.45	930	153.83	-0.62
211.52		950	154.46	930	153.83	-0.63
212.58		950	154.47	930	153.84	-0.63
213.46		950	154.48	930	153.84	-0.64
215.47		950	154.49	930	153.87	-0.62
216.77		950	154.50	930	153.89	-0.61
219.08		950	154.51	930	153.92	-0.59
220.93		790	154.52	760	153.93	-0.59
222.87		790	154.53	760	153.94	-0.59
225.09		790	154.53	760	153.95	-0.59
225.9		790	154.54	760	153.96	-0.59
227.17		790	154.55	760	153.98	-0.58
228.93		790	154.56	760	153.99	-0.58
231.2		790	154.57	760	154.00	-0.58
232.2		790	154.58	760	154.01	-0.58
233.25		790	154.59	760	154.02	-0.58
235.32		790	154.60	760	154.03	-0.57
240.57		790	154.61	760	153.97	-0.64
245.82	Limit of Study	550	154.84	510	154.68	-0.18

3.0 PLAN IMPLEMENTATION AND MANAGEMENT STRATEGIES

Since the Dry Creek watershed is quickly developing, the features identified as part of the recommended plan should be implemented ahead of development, while remaining acreage is available. As new development continues, mitigation for anticipated increases in storm water runoff can be implemented.

This information identifies ultimate drainage corridor rights-of-way needed to implement the recommended plan features. Further, this identification of right-of-way will help local agencies in their coordination with new development to ensure that the appropriate considerations for drainage are being implemented. The following sections outline a suggested approach for implementing the recommended plan and identify recommended management strategies for the watershed.

3.1 Preservation of Stream Habitat Corridors

The recommended plan identifies one area of high quality stream habitat that is to be managed without any structural flood reduction project. The area is from the mouth at the confluence of Cypress Creek upstream to Spring-Cypress Road. In this area, the channel of Dry Creek has a good natural stream habitat corridor that is beneficial to maintain in its existing condition.

The area contained within this corridor consists of an existing 80-foot right-of-way width. A recommended right-of-way of 300-foot was determined based on the extents of mature tree cover as well as the limits of areas of out-of-bank flooding. Because a majority of this right-of-way represents floodplain, it is anticipated that development consisting of homes and the placement of fill material will not occur as quickly within these areas. Any development in these corridors will require substantial mitigation and coordination with the appropriate regulatory/governmental agencies. Future development within the floodplain adjacent to this corridor will require mitigation for fill in the floodplain. In order to implement this plan element, it is necessary to reserve the right-of-way in some fashion in order to limit or restrict development within the extents of these corridors.

One alternative for implementing this plan element is to request the appropriate easements from the landowner as development occurs in the adjacent area. Another alternate would be to have the appropriate entity such as the Harris County Flood Control District acquire the appropriate right-of-way through fee title, easement, or setback. However, fee title or easement would severely tax the funding source of the district if implemented on a wide basis. Another alternative would be to allow adjacent developments to construct mitigation facilities such as detention basins and water quality basins (that are a requirement of the development process) within these corridors, and to have the use of the corridors for recreational features such as hiking trails. No other portions of the development would be allowed within the corridors.

Requirements would have to be placed on the construction of these facilities so that they did not overly disturb the stream habitat that is meant to be preserved in the corridors.

3.2 New Lateral Channels/Channel Extensions

There is one new channel proposed in the recommended plan, a new lateral channel (K145#C1). The plan suggests a right-of-way width sufficient to incorporate a channel that has terraced sections and allows for multiple uses (see **Figure 1**). The recommended implementation of this channel corridor would consist of having the Harris County Flood Control District prioritize (as best as possible) the immediate need for these channels, and proceed with the acquisition of a portion of the right-of-way along the proposed lateral channel alignments. This portion of the right-of-way would be the minimum (approximately 140 feet) necessary to implement a typical trapezoidal channel with the appropriate depth for outfall. Additional right-of-way and construction of the channel would be provided by adjacent properties of new development as they occur. Alternative right-of-way acquisition strategies are similar to those already discussed in the previous section and consist of requiring dedication of larger easements, purchasing the land outright, or entering into an agreement with the proposed development to share the land. The ultimate configuration of the facility would require a 300-foot right-of-way width.

3.3 Detention Facilities

One detention facility is identified for the Dry Creek watershed recommended plan. It should be noted that the recommended plan includes the use of on-site detention as a requirement of development. The facility K145#B1 proposed as part of the recommended plan is for further reduction of flows in the watershed. Therefore, it will not be feasible to allow developers to mitigate individual developments by excavating in the regional facility. Implementation of the detention facility element of the recommended plan will consist of the purchase of the land and construction of the facility by public agencies such as the HCFCD.

3.4 Channel Crossings

As noted earlier, several major thoroughfares cross the channels in the Dry Creek watershed. Of the major thoroughfares shown on the exhibits, only Jarvis Road currently has immediate plans for improvements. The plan for improvements to Jarvis Road calls for a single span structure to accommodate two lanes of traffic in both directions.

The current bridge opening beneath Jarvis is 237 square feet. The recommended plan would require a new structure designed to pass the recommended plan 100-year flows (approximately 2570 cfs) with a minimal (less than 0.5') amount of head losses. An opening of approximately 460 square feet will be required for the recommended plan.

Spring-Cypress is a two lane road that does not currently have plans to be widened. The existing bridge opening beneath Spring-Cypress is 296 square feet. If a new structure is designed to pass the recommended plan 100-year flows (approximately 2270 cfs) with a minimal (less than 0.5') amount of head losses, an opening of approximately 400 square feet will be necessary. If a future improvement is made at Spring-Cypress to accommodate the recommended opening, the additional release of flow downstream will require mitigation. There is no plan for channel improvements downstream from Spring-Cypress because of the recommended stream habitat protection corridor.

Cypresswood Boulevard is a divided two lane road that has been improved up to Dry Creek that will need to be extended at sometime in the future. A crossing does not currently exist over the main channel of Dry Creek. If the new structure is designed to pass the recommended plan 100-year flows (approximately 510 cfs) with a minimal (less than 0.5') amount of head losses, an opening of approximately 90 square feet will be necessary.

A future alignment for Cypress-Church Road is proposed as part of the major thoroughfare plan. This new alignment crosses K145#C1 near Mueschke Road and Dry Creek. If the new structure is designed to pass the 100-year flows in the tributary channel (approximately 657 cfs) with a minimal (less than 0.5') amount of head losses, an opening of approximately 120 square feet will be necessary.

Upstream from Cypress-Chase Boulevard is an existing dual 66-inch control structure and detention pond. The recommended plan will require the control structure to be lowered approximately 3.25' to provide outfall depth upstream at future lateral channel K145C#1. The recommended plan section will extend approximately 5,000 feet upstream from the lowered dual culverts within a 360-foot wide of right-of-way.

There may be crossings that are constructed as part of developments or as revisions to the major thoroughfare plan. Channel crossings must be considered in light of the goals for the "frontier program" in each of these watersheds. For example, a new bridge spanning an area of high-quality habitat protection, such as the lower portion of the watershed, would need to be built to preserve the habitat quality of the area. This would include longer spans or additional spans to clear more of the conveyance area of the channel, limited clearing of trees along the right-of-way and storm water quality features at any outfalls proposed with the crossing. Proposed crossings of the channel extension or new tributary channel included in the recommended plan could be designed in a more conventional manner however, care must be taken to ensure that the storage of the channel is not impacted by the construction of a too-narrow structure.

3.5 Cost Analysis

Costs were identified for implementation of the recommended plan. These costs consider acquisition of right-of-way, engineering, and construction of the plan elements. It should be noted that the bridge crossing information included above was not included in the recommended plan cost because the crossings were not implemented as part of the recommended plan, but as part of the county's transportation plan. The table below shows each plan element, the identified right-of-way, the unit costs and total costs for the project.

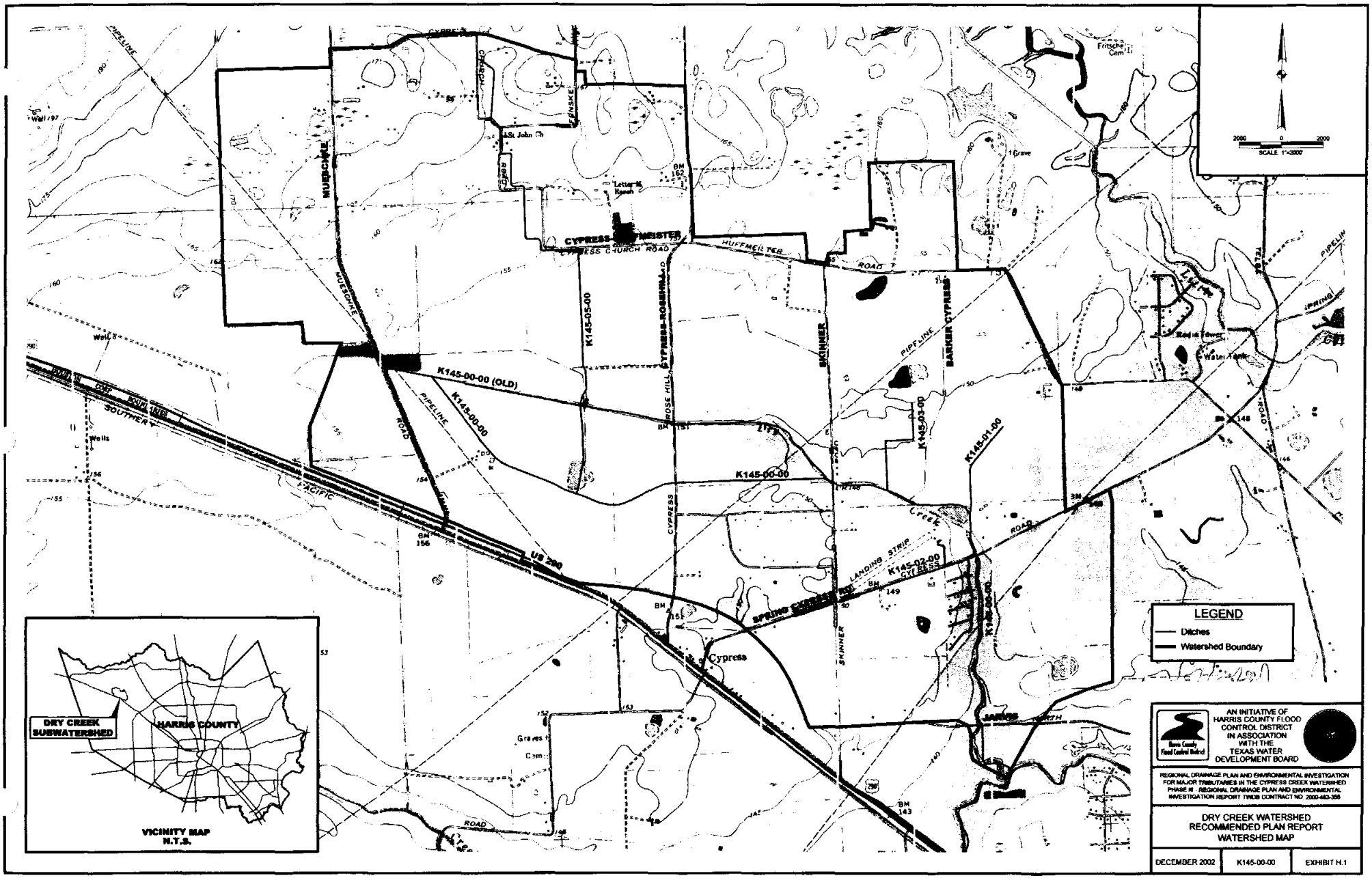
Table H6 - Estimated Recommended Plan Costs for Dry Creek

Description	Unit	Quantity	Unit Cost	Cost
1. Mobilization	Each	4	$10,000	$40,000
2. Clearing & Grubbing	Acre	68.8	$1,500	$103,200
3. Excavation & Haul	Ac-Ft	570.4	$5,000	$2,852,000
4. Bridge Installation	S.F.	0	$60	$0
5. Culvert Installation	EA	0	$75	$0
6. Drop/Control Structures	L.S.	2	$100,000	$200,000
7. Backslope Drains	Each	22	$3,000	$66,000
8. Utilities Relocation	Each	0	$100,000	$0
9. Right-of-Way	Acre	68.8	$15,000	$688,000
10. Seeding & Mulching	Acre	68.8	$1,000	$68,800
11. Tree/Shrub Planting	Acre	17.2	$10,000	$172,000
SUB TOTAL				$4,290,000
Contingencies (15%)				$643,500
Engineering and Administration (10%)				$493,350
SUBTOTAL CONSTRUCTION COST				$5,426,850
VOLUNTARY STRUCTURAL BUYOUT				$9,120,000
STREAM HABITAT PRESERVATION CORRRIDOR				$400,000
TOTAL				**$14,946,850**

The total cost when fully implemented is approximately $14.82 million, with the bulk of the cost in voluntary structural buyout, land acquisition and excavation costs.

3.6 Implementation Phasing

Implementation of the recommended plan features is suggested to occur in phases so that the appropriate funding can be identified for each fiscal year. First priority should be given to implementing projects that result in flood reduction benefits to existing flood-prone structures. In the Dry Creek watershed, detention basin K145#B1 fits this category and will slightly reduce flood levels in the Western Trails Subdivision. Second priority should be given to acquiring right-of-way ahead of new development, to ensure that future drainage projects can be implemented accordingly. This acquisition will also coincide with future major roadway thoroughfare projects. The proposed channel K145#C1 fits this category. Final priority should be placed on an ongoing land acquisition program to purchase right-of-way for stream corridor

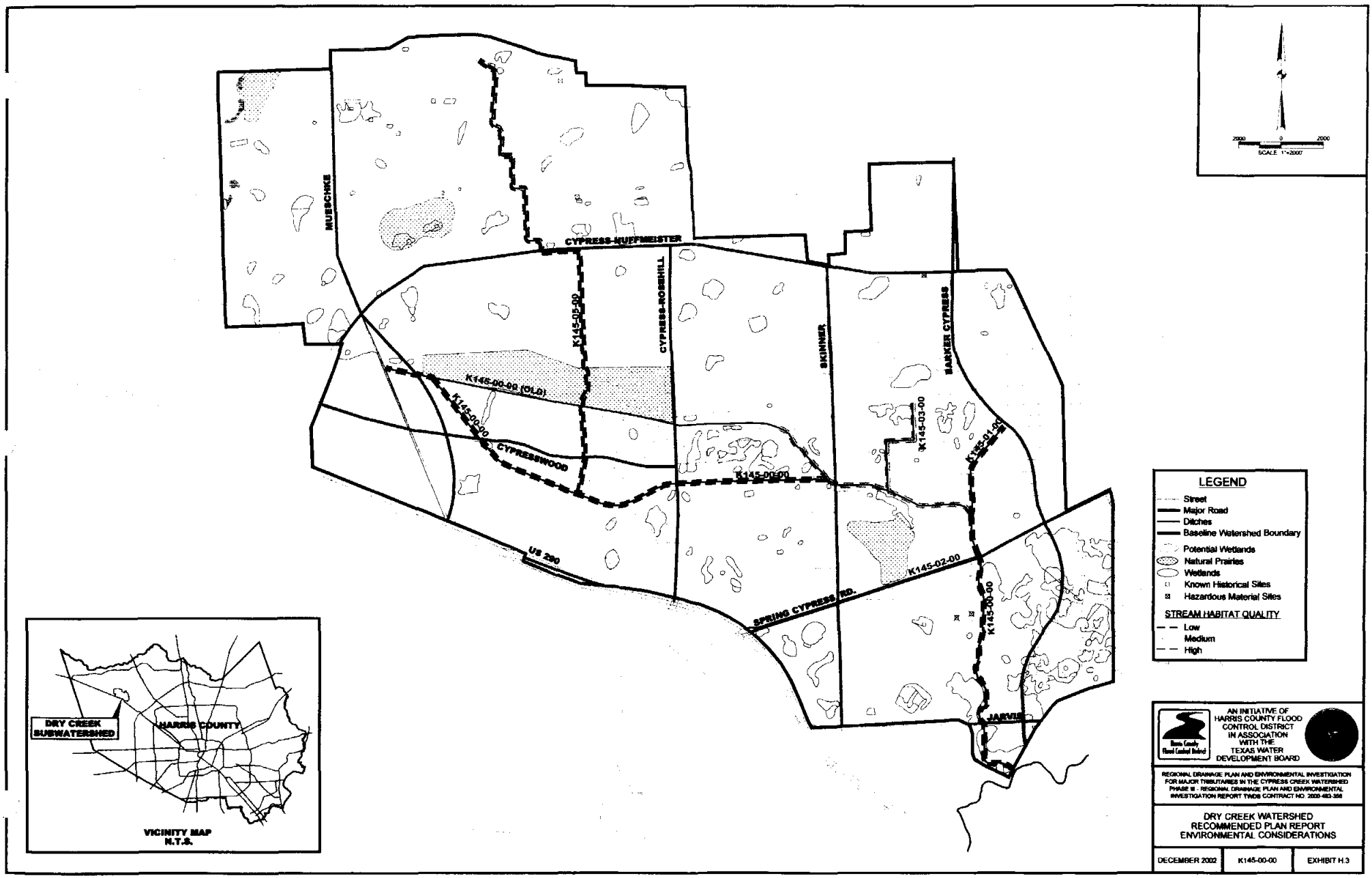

SCALE 1"=2000'
K145-00-00 (OLD)
K145-00-00
K145-05-00
K145-03-00
K145-01-00
K145-02-00
K130-00-00
CYPRESS-HUFFMEISTER ROAD
HUFFMEISTER ROAD
BARKER CYPRESS ROAD
SKINNER ROAD
ROSE HILL CYPRESS-ROSEHILL ROAD
MUSCHINE ROAD
SPRING CYPRESS ROAD
LANDING STRIP ROAD
US 290
Cypress
Creek
LEGEND
Ditches
Watershed Boundary
DRY CREEK SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-358
DRY CREEK WATERSHED
RECOMMENDED PLAN REPORT
WATERSHED MAP
DECEMBER 2002
K145-00-00
EXHIBIT H.1

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-356

DRY CREEK WATERSHED RECOMMENDED PLAN REPORT 1999 AERIAL WATERSHED MAP

DECEMBER 2002	K145-00-00	EXHIBIT H.2

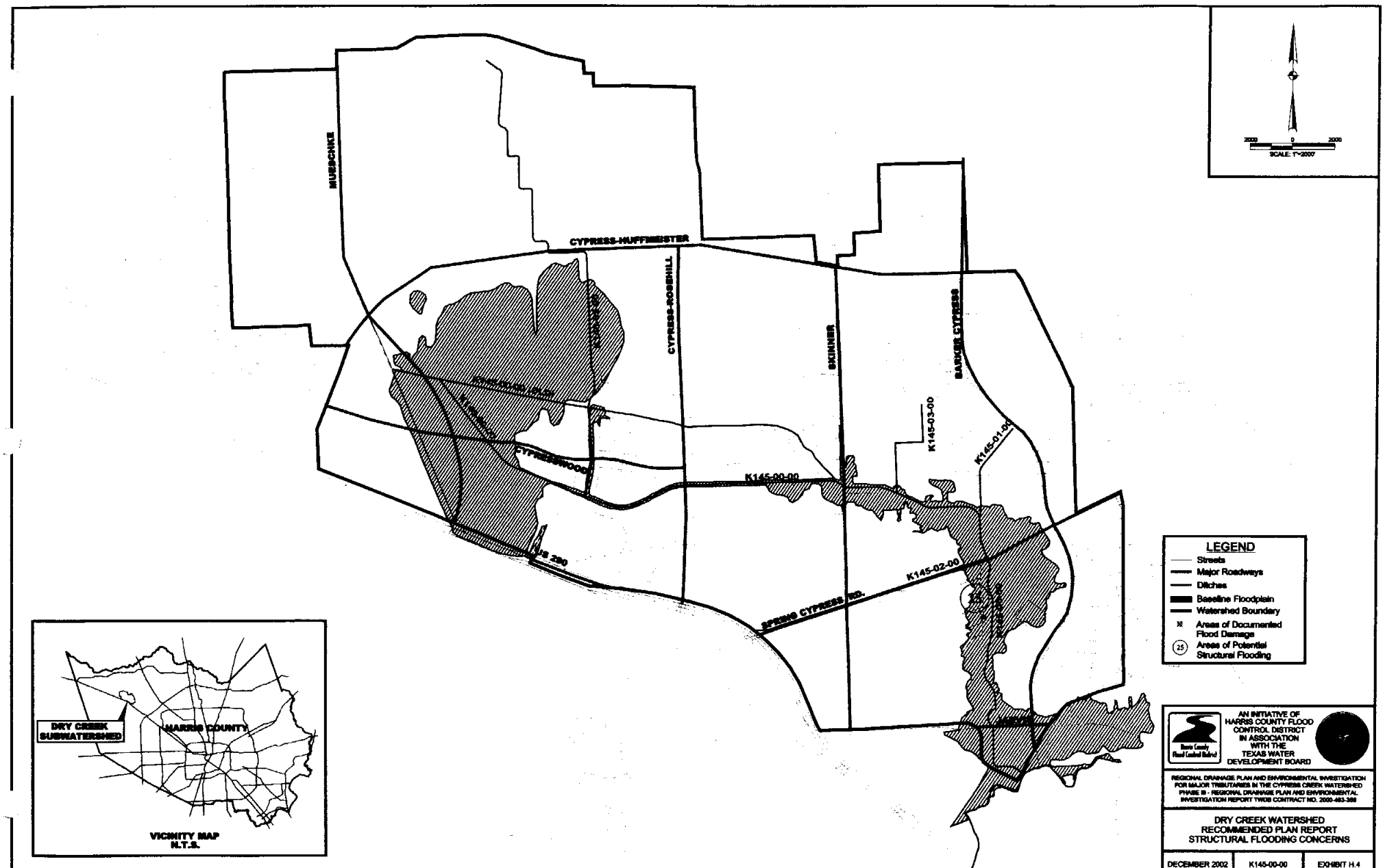


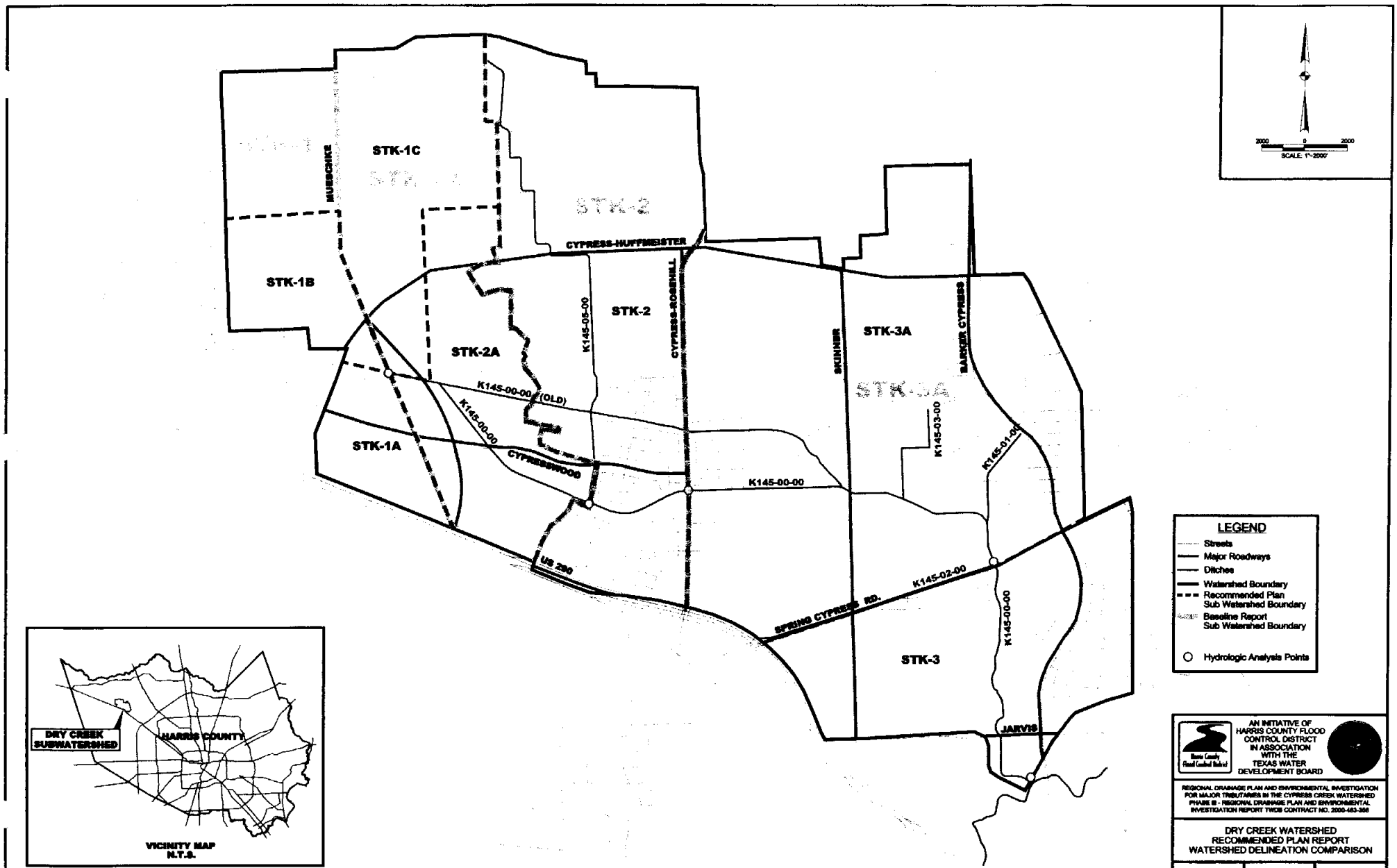
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-356

DRY CREEK WATERSHED RECOMMENDED PLAN REPORT ENVIRONMENTAL CONSIDERATIONS

DECEMBER 2002	K145-00-00	EXHIBIT H.3


MUSE-CHKE
CYPRESS-HUFFMEISTER
CYPRESS-ROSEHILL
SKINNER
BARKER CYPRESS
K145-04-00
K145-03-00
K145-01-00
K145-00-00
K145-02-00
CYPRESSWOOD
US 290
SPRING CYPRESS RD.
SCALE: 1"=2000'
LEGEND
Streets
Major Roadways
Ditches
Baseline Floodplain
Watershed Boundary
Areas of Documented Flood Damage
Areas of Potential Structural Flooding
DRY CREEK SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-398
DRY CREEK WATERSHED
RECOMMENDED PLAN REPORT
STRUCTURAL FLOODING CONCERNS
DECEMBER 2002
K145-00-00
EXHIBIT H.4

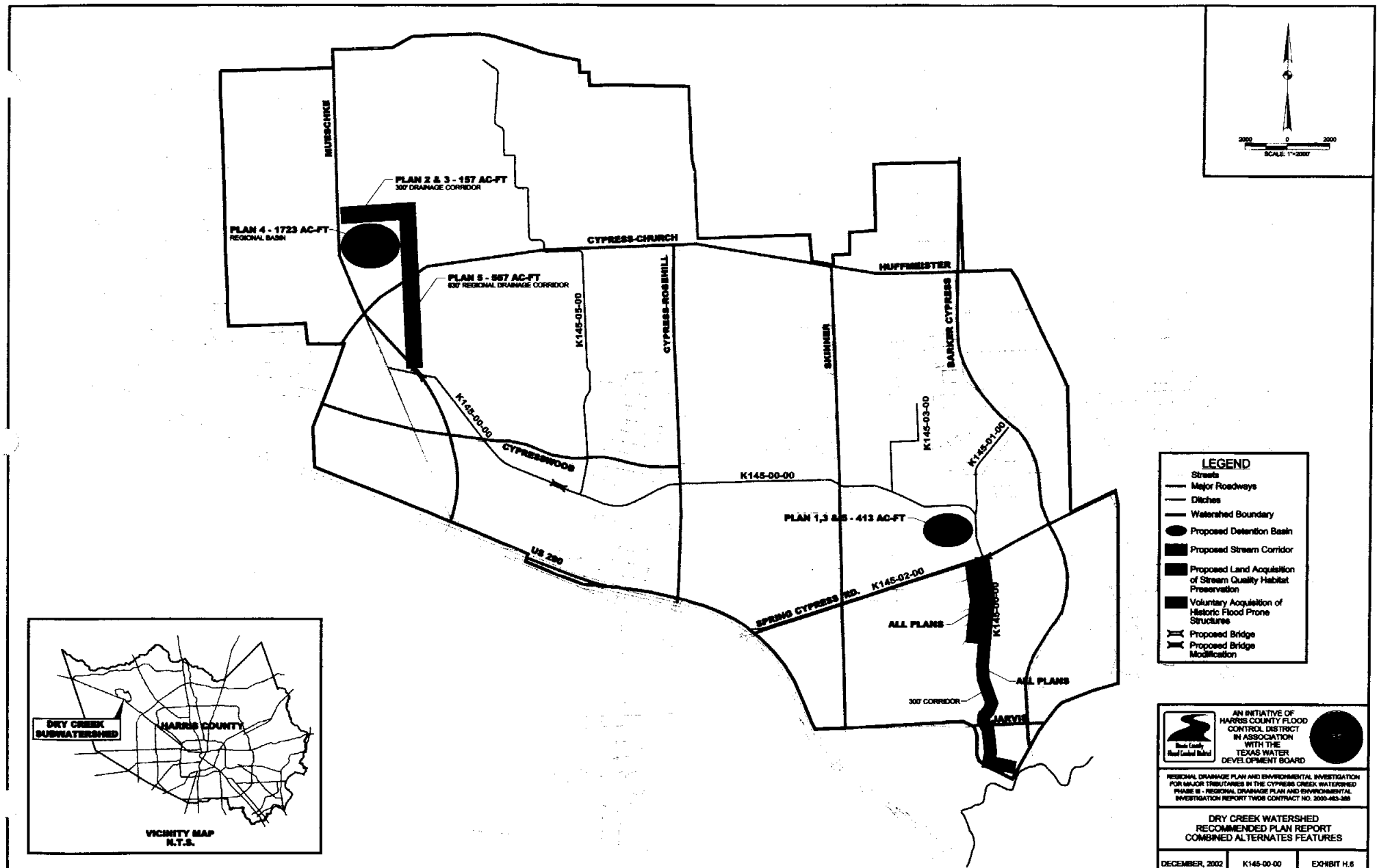


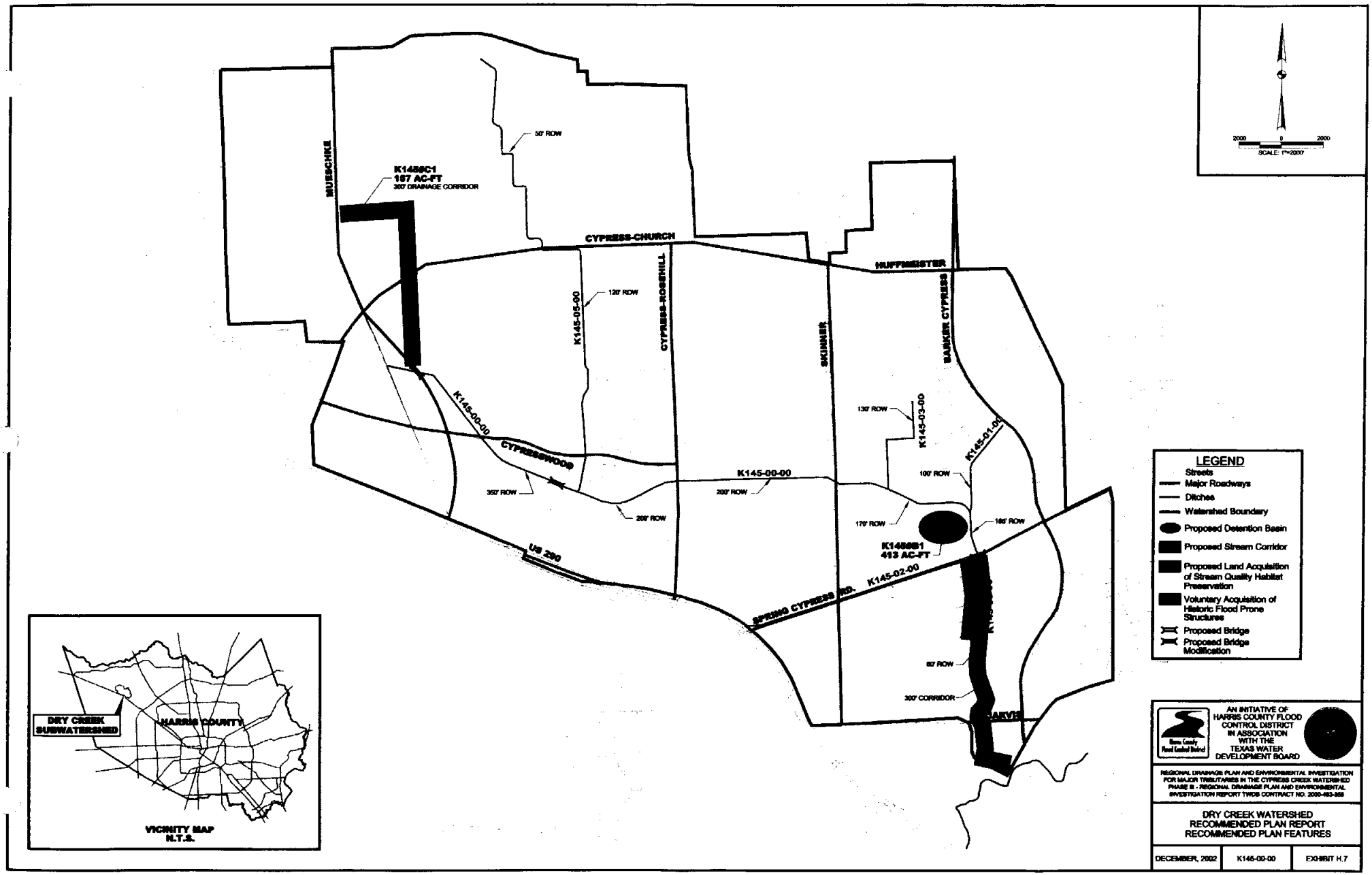
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

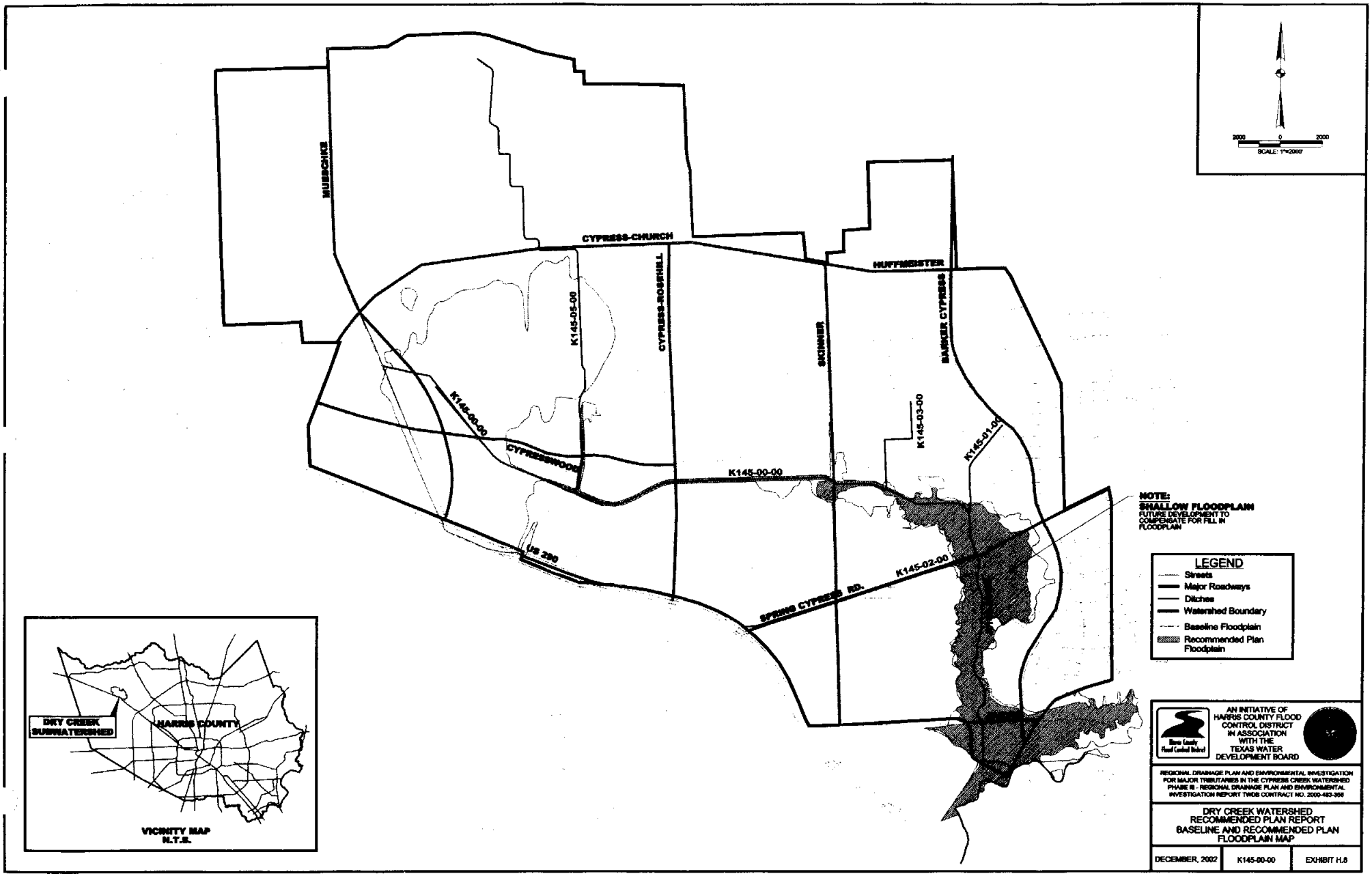
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-366

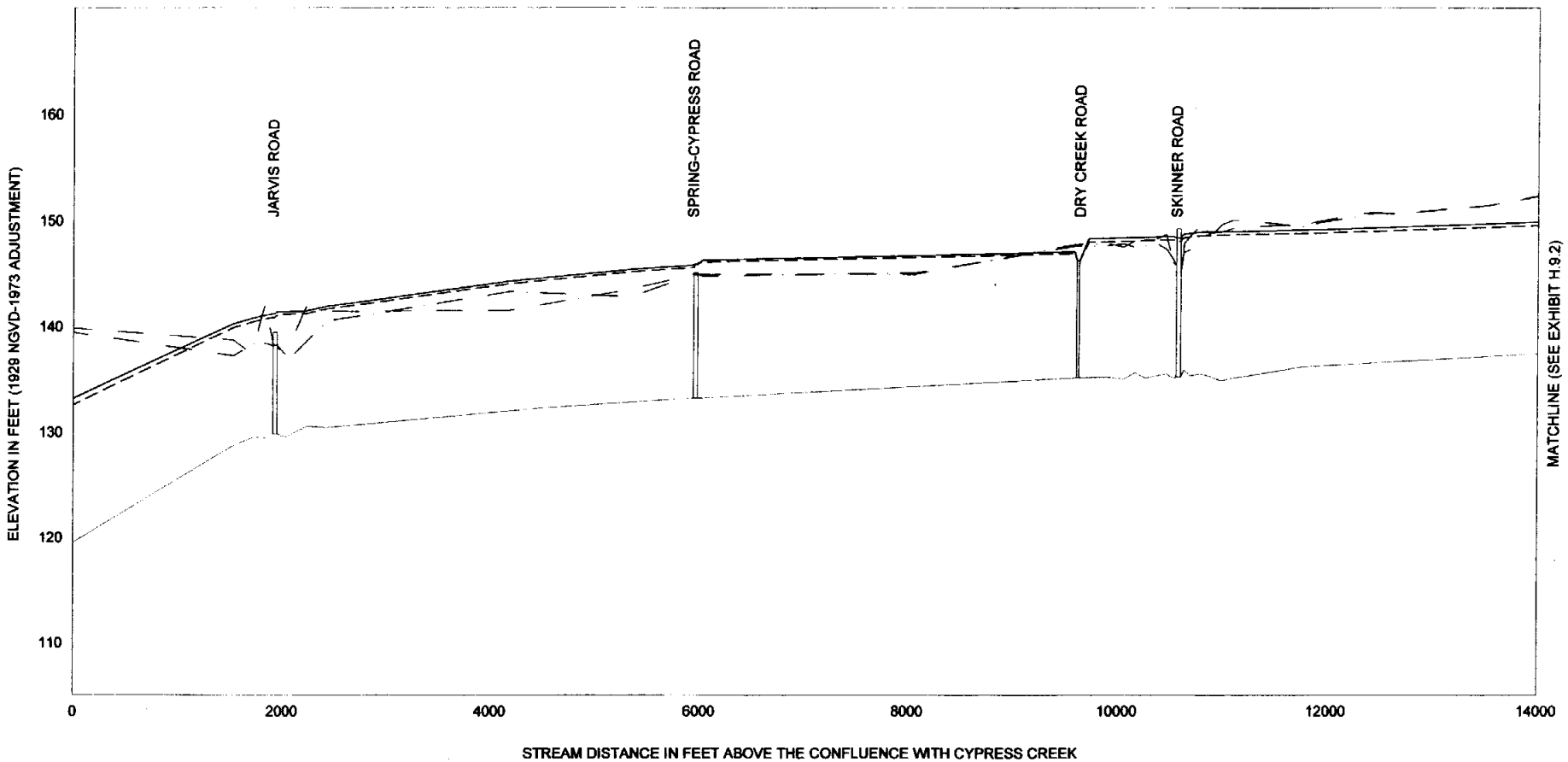
DRY CREEK WATERSHED RECOMMENDED PLAN REPORT WATERSHED DELINEATION COMPARISON

DECEMBER 2002	K145-00-00	EXHIBIT H.5


MUESCHKE
PLAN 2 & 3 - 157 AC-FT
300' DRAINAGE CORRIDOR
PLAN 4 - 1723 AC-FT
REGIONAL BASIN
CYPRESS-CHURCH
HUFFMEISTER
PLAN 5 - 567 AC-FT
630' REGIONAL DRAINAGE CORRIDOR
K145-05-00
CYPRESS-ROSEHILL
SKINNER
BARKER CYPRESS
K145-03-00
K145-01-00
K145-00-00
CYPRESSWOOD
K145-00-00
PLAN 1,3 & 5 - 413 AC-FT
US 290
SPRING CYPRESS RD.
K145-02-00
K145-04-00
ALL PLANS
ALL PLANS
300' CORRIDOR
HARVIS
2000 0 2000
SCALE: 1"=2000'
LEGEND
Streets
Major Roadways
Ditches
Watershed Boundary
Proposed Detention Basin
Proposed Stream Corridor
Proposed Land Acquisition of Stream Quality Habitat Preservation
Voluntary Acquisition of Historic Flood Prone Structures
Proposed Bridge
Proposed Bridge Modification
DRY CREEK SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-388
DRY CREEK WATERSHED
RECOMMENDED PLAN REPORT
COMBINED ALTERNATES FEATURES
DECEMBER, 2002
K145-00-00
EXHIBIT H.6


2000 0 2000
SCALE: 1"=2000'
MUSSCHKE
K145C1
157 AC-FT
300' DRAINAGE CORRIDOR
50' ROW
CYPRESS-CHURCH
HUFFMEISTER
K145-05-00
120' ROW
CYPRESS-ROSEHILL
SKINNER
BARKER CYPRESS
K145-00-00
CYPRESSWOOD
357' ROW
200' ROW
K145-00-00
200' ROW
137' ROW
K145-03-00
K145-01-00
100' ROW
170' ROW
160' ROW
K145B1
413 AC-FT
US 290
K145-02-00
SPRING CYPRESS RD.
80' ROW
300' CORRIDOR
DRY CREEK SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
LEGEND
Streets
Major Roadways
Ditches
Watershed Boundary
Proposed Detention Basin
Proposed Stream Corridor
Proposed Land Acquisition of Stream Quality Habitat Preservation
Voluntary Acquisition of Historic Flood Prone Structures
Proposed Bridge
Proposed Bridge Modification
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-358
DRY CREEK WATERSHED
RECOMMENDED PLAN REPORT
RECOMMENDED PLAN FEATURES
DECEMBER, 2002
K145-00-00
EXHIBIT H.7


MUSSCHIKE
CYPRESS-CHURCH
HUFFMEISTER
CYPRESS-ROSEHILL
SKINNER
BARKER CYPRESS
K145-05-00
K145-00-00
K145-03-00
K145-01-00
CYPRESSWOOD
K145-00-00
US 290
K145-02-00
SPRING CYPRESS RD.
2000 0 2000
SCALE: 1"=2000'
NOTE:
SHALLOW FLOODPLAIN
FUTURE DEVELOPMENT TO COMPENSATE FOR FILL IN FLOODPLAIN
LEGEND
Streets
Major Roadways
Ditches
Watershed Boundary
Baseline Floodplain
Recommended Plan Floodplain
DRY CREEK SUBWATERSHED
HARRIS COUNTY
VICINITY MAP
N.T.S.
AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD
REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION REPORT TWDB CONTRACT NO. 2000-483-366
DRY CREEK WATERSHED
RECOMMENDED PLAN REPORT
BASELINE AND RECOMMENDED PLAN
FLOODPLAIN MAP
DECEMBER, 2002
K145-00-00
EXHIBIT H.8



LEGEND

- FLOWLINE
- FLOWLINE (RECOMMENDED PLAN)
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

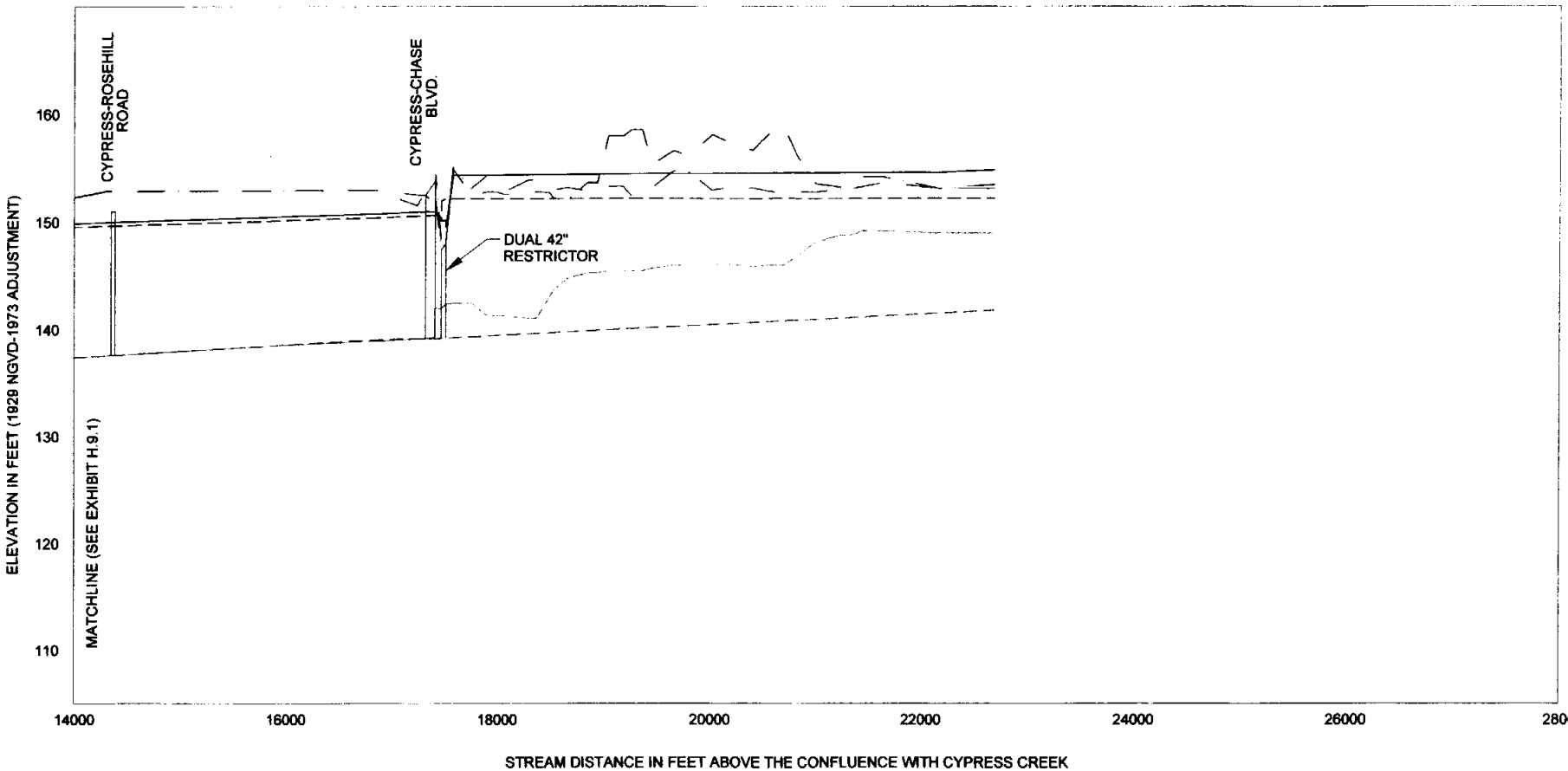
- 100-YEAR (BASELINE)
- 100-YEAR (RECOMMENDED PLAN)

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - HYDROLOGIC AND HYDRAULIC BASELINE REPORT TWDB CONTRACT NO. 2000-483-358

DRY CREEK 100-YEAR
WATER SURFACE PROFILES
(BASELINE vs. RECOMMENDED PLAN)

DECEMBER 2002	K146-00-00	EXHIBIT H.9.1



LEGEND

- FLOWLINE
- FLOWLINE (RECOMMENDED PLAN)
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

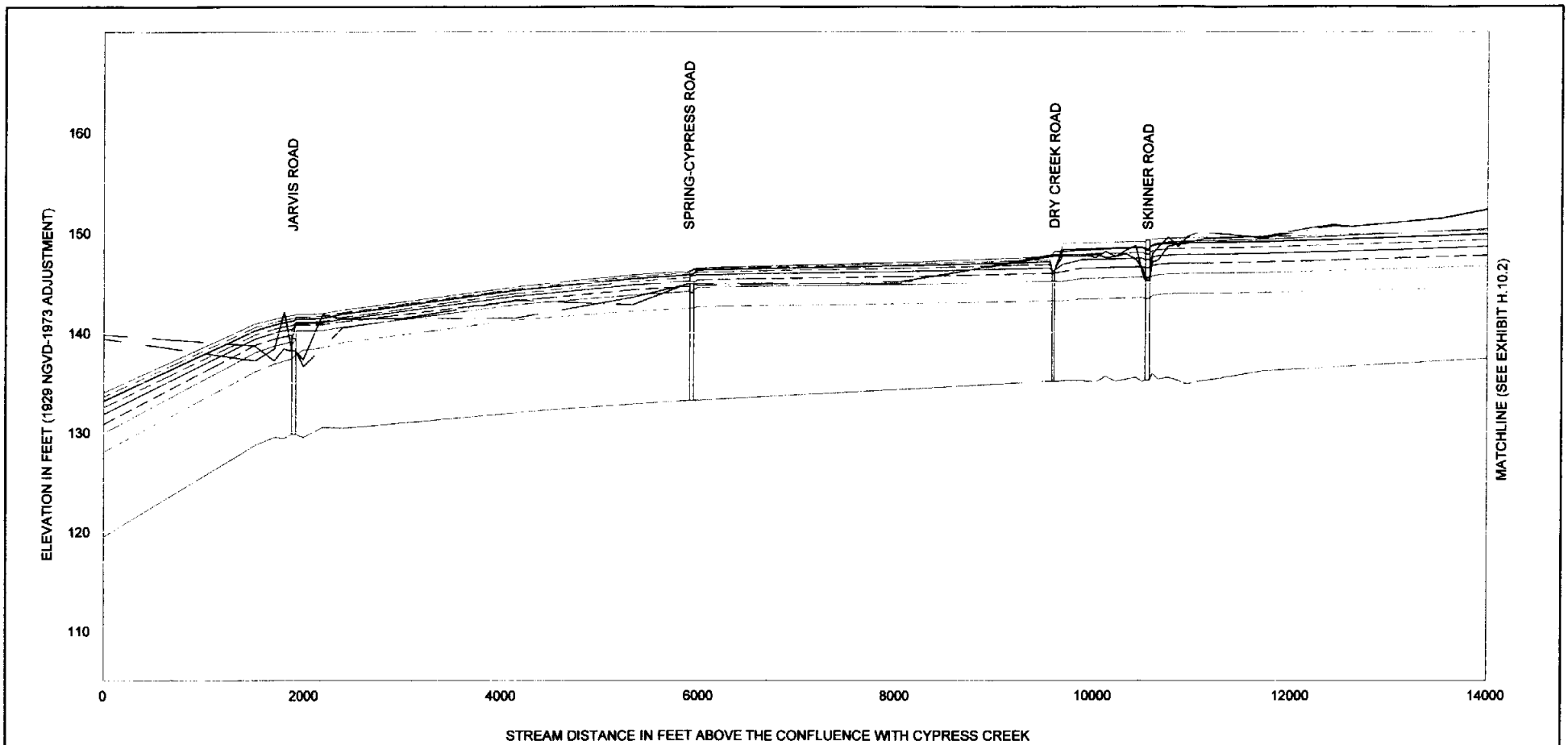
- 100-YEAR (BASELINE)
- 100-YEAR (RECOMMENDED PLAN)

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - HYDROLOGIC AND HYDRAULIC BASELINE REPORT TWDB CONTRACT NO. 2000-483-356

DRY CREEK 100-YEAR
WATER SURFACE PROFILES
(BASELINE vs. RECOMMENDED PLAN)

DECEMBER 2002	K145-00-00	EXHIBIT H.9.2



LEGEND

FLOWLINE
LEFT BANK
RIGHT BANK
BRIDGES

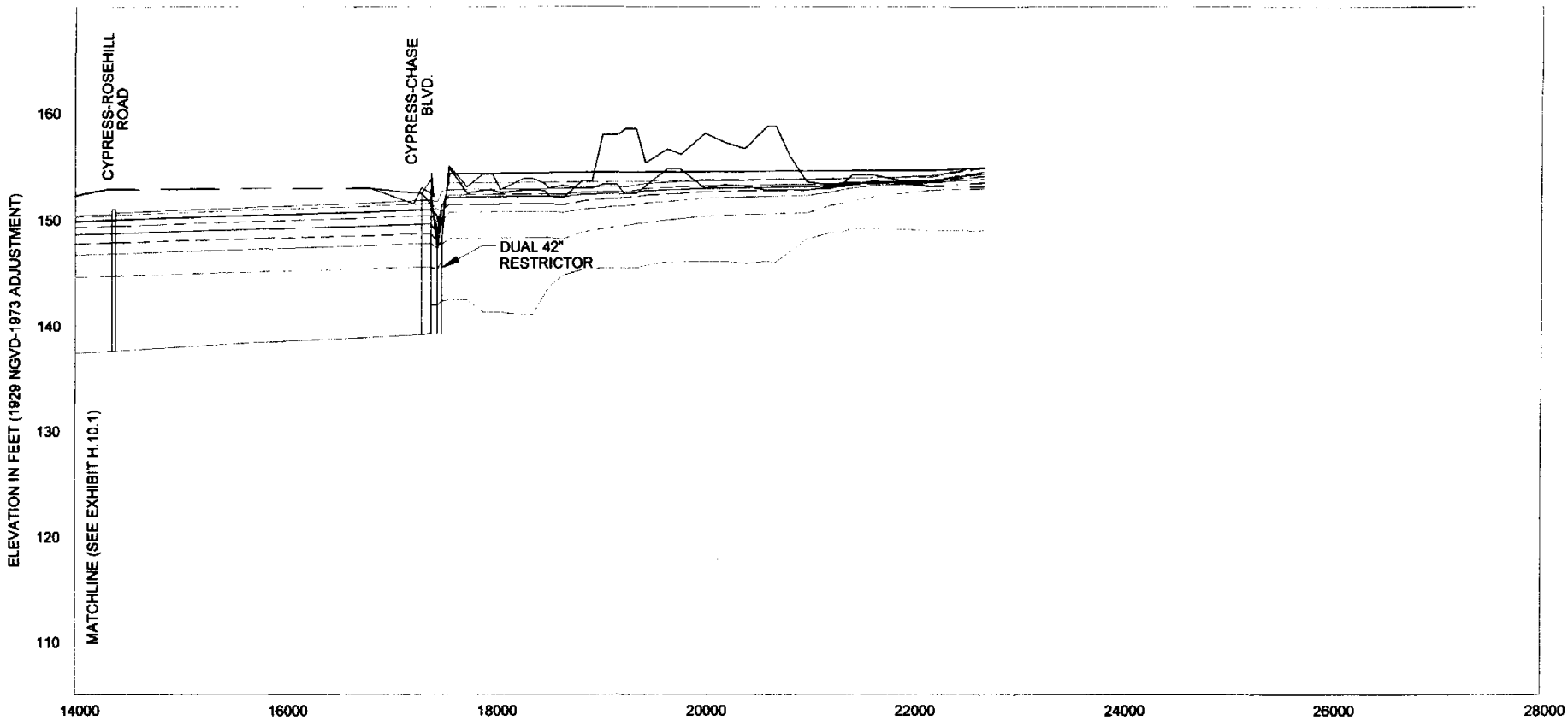
WATER SURFACE PROFILES
500-YEAR
250-YEAR
100-YEAR
50-YEAR
25-YEAR
10-YEAR
5-YEAR
2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED
PHASE III - HYDROLOGIC AND HYDRAULIC BASELINE REPORT
TWDB CONTRACT NO. 2000-483-358

DRY CREEK
WATER SURFACE PROFILES
(BASELINE)

DECEMBER 2002 | K145-00-00 | EXHIBIT H.10.1



LEGEND

FLOWLINE
LEFT BANK
RIGHT BANK
BRIDGES

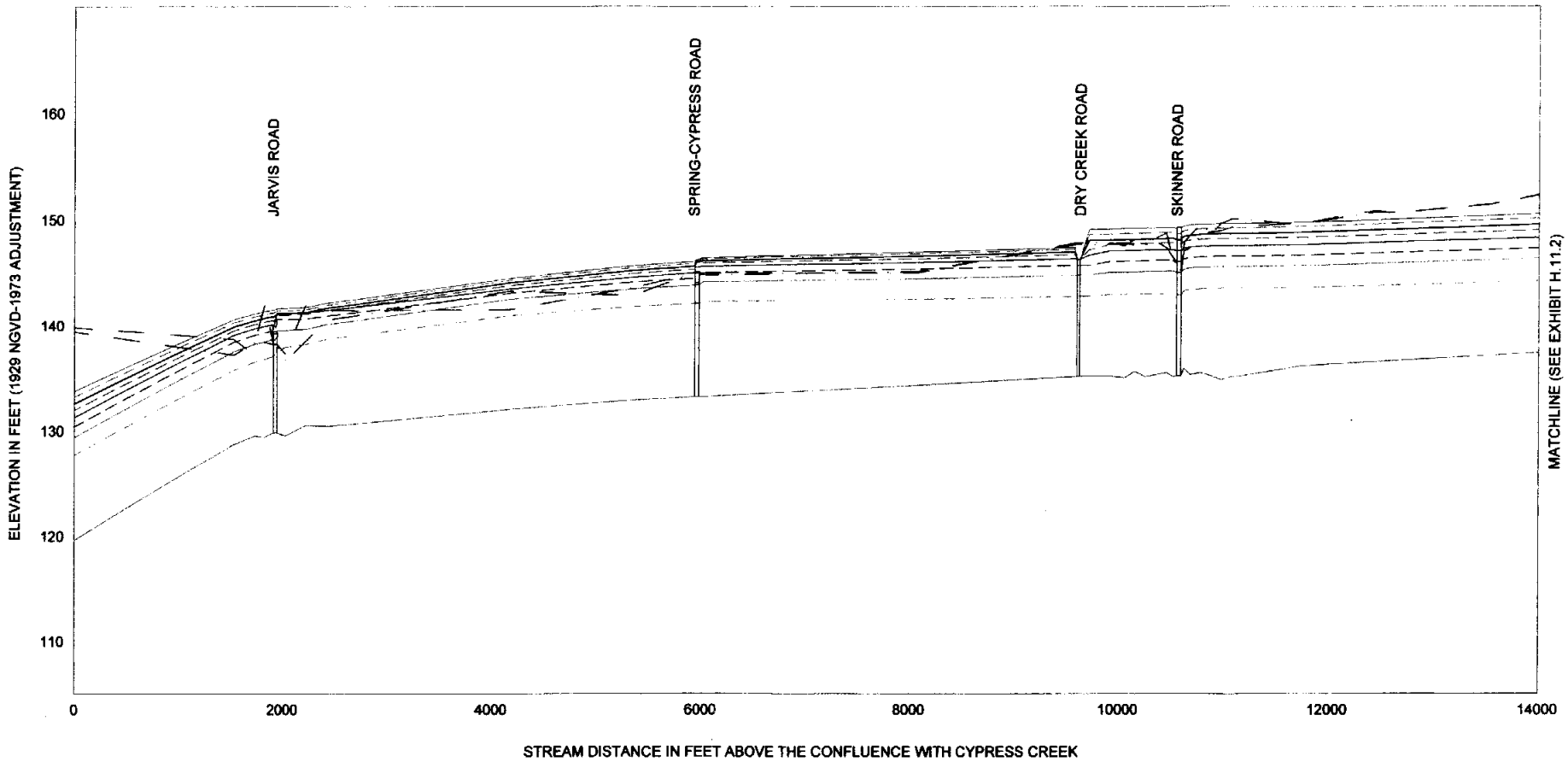
WATER SURFACE PROFILES
500-YEAR
250-YEAR
100-YEAR
50-YEAR
25-YEAR
10-YEAR
5-YEAR
2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - HYDROLOGIC AND HYDRAULIC BASELINE REPORT TWDB CONTRACT NO. 2000-483-386

DRY CREEK
WATER SURFACE PROFILES
(BASELINE)

DECEMBER 2002 | K145-00-00 | EXHIBIT H 10.2



LEGEND

FLOWLINE
LEFT BANK
RIGHT BANK
BRIDGES

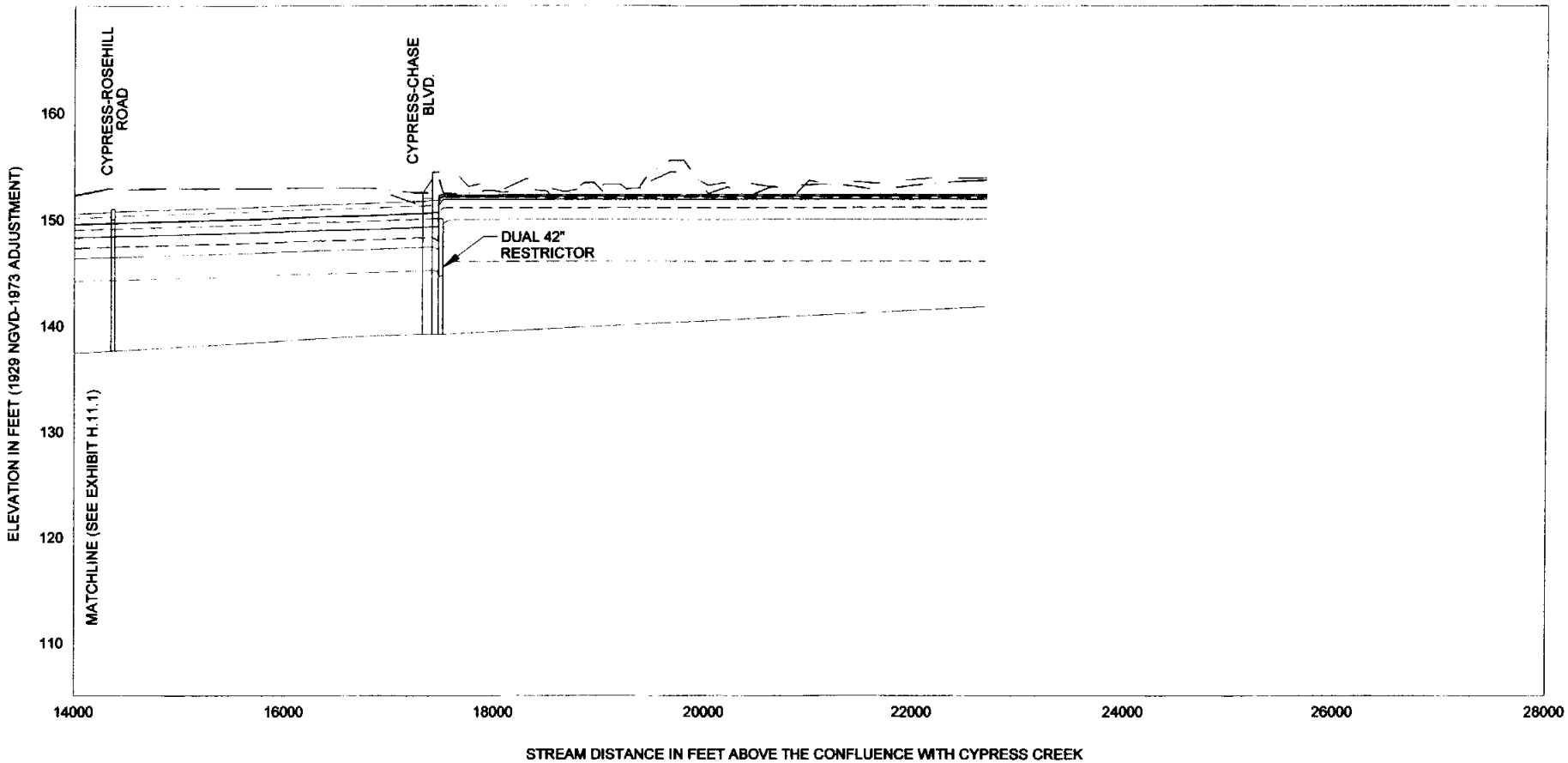
WATER SURFACE PROFILES
500-YEAR
250-YEAR
100-YEAR
50-YEAR
25-YEAR
10-YEAR
5-YEAR
2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - HYDROLOGIC AND HYDRAULIC BASELINE REPORT TWDB CONTRACT NO. 2000-483-359

DRY CREEK
WATER SURFACE PROFILES
(RECOMMENDED PLAN)

DECEMBER 2002	K145-00-00	EXHIBIT H.11.1



LEGEND

- FLOWLINE
- LEFT BANK
- RIGHT BANK
- BRIDGES

WATER SURFACE PROFILES

- 500-YEAR
- 250-YEAR
- 100-YEAR
- 50-YEAR
- 25-YEAR
- 10-YEAR
- 5-YEAR
- 2-YEAR

AN INITIATIVE OF HARRIS COUNTY FLOOD CONTROL DISTRICT IN ASSOCIATION WITH THE TEXAS WATER DEVELOPMENT BOARD

REGIONAL DRAINAGE PLAN AND ENVIRONMENTAL INVESTIGATION FOR MAJOR TRIBUTARIES IN THE CYPRESS CREEK WATERSHED PHASE III - HYDROLOGIC AND HYDRAULIC BASELINE REPORT
TWDB CONTRACT NO. 2000-483-358

DRY CREEK
WATER SURFACE PROFILES
(RECOMMENDED PLAN)

DECEMBER 2002	K145-00-00	EXHIBIT H.11.2

TABLE OF CONTENTS

EXHIBITS

TABLES

DEFINITIONS

Baseline Conditions or Baseline Model - Conditions identified for the watershed from which future planning efforts and the recommended plan will be compared to determine if the study goals and objectives will be met. This condition considers the watershed 100% developed, with new development after 1984 consistent with current HCFCD criteria for on-site storm water detention in the determination of the appropriate baseline hydrologic processes. Further, this condition considers the information identified in the environmental baseline report.

Plan Conditions or Plan Model - The baseline conditions model modified to reflect the land-use conditions and recommended plan elements identified for the recommended regional drainage plan for the watershed.

ELECTRONIC FILES

File Name:	Description
HEC-1 Models:	
K166B-2.ih1	Baseline Plan 2-year Flows
K166B-5.ih1	Baseline Plan 5-year Flows
K166B-10.ih1	Baseline Plan 10-year Flows
K166B-25.ih1	Baseline Plan 25-year Flows
K166B-50.ih1	Baseline Plan 50-year Flows
K166B100.ih1	Baseline Plan 100-year Flows
K166B250.ih1	Baseline Plan 250-year Flows
K166B500.ih1	Baseline Plan 500-year Flows
K166R-2.ih1	Recommended Plan 2-year Flows
K166R-5.ih1	Recommended Plan 5-year Flows

ELECTRONIC FILES *(continued)*

File Name:	Description
HEC-1 Models:	
K166R-10.ih1	Recommended Plan 10-year Flows
K166R-25.ih1	Recommended Plan 25-year Flows
K166R-50.ih1	Recommended Plan 50-year Flows
K166R100.ih1	Recommended Plan 100-year Flows
K166R250.ih1	Recommended Plan 250-year Flows
K166R500.ih1	Recommended Plan 500-year Flows
HEC-RAS Models:	
K16600, 01, 02, 03, 04, 05, 06baseline.prj	Project File – Baseline
K16600, 01, 02, 03, 04, 05, 06baseline.p01	Baseline Plan File
K16600, 01, 02, 03, 04, 05, 06.prj	Project File
K16600, 01, 02, 03, 04, 05, 06.p01	Recommended Plan Multiprofile Plan

1.0 INTRODUCTION

The information presented in this appendix report intends to document the process of developing the recommended regional drainage plan for the Mound Creek watershed. The plan elements identified for the recommended plan are presented, along with the recommended funding and implementation strategies identified for the plan. All supporting regional plan modeling information for the Mound Creek watershed is included in this report.

1.1 Project Location

The Mound Creek watershed is located in Northwest Harris County and Eastern Waller County and is a sub watershed of the Cypress Creek watershed comprising 36 square miles. The watershed is generally subdivided by US 290 from East to West, and the Harris/Waller County line from North to South. The location of the watershed is shown on **Exhibit 1** in the main text report.

The Mound Creek watershed includes one main stem and six tributaries, and drains into Cypress Creek. As shown on **Exhibits I1.1**, **I1.2**, **I2.1** and **I2.2**, the six tributaries drain to the main stem as described below. Little Mound Creek (K166-02-00) drains the eastern portion of the watershed. Kx166-01-00, or Tributary 7.62, drains the eastern central area. East Fork Mound Creek (Kx166-03-00 or Tributary 8.18) drains roughly the eastern half of the City of Waller. Middle Fork Mound Creek (Kx166-04-00) drains the western half of the City of Waller. West Fork Mound Creek (Kx166-05-00) drains the north-central portion of the watershed, and South Fork Mound Creek (Kx166-06-00) drains a relatively small area on the western side of the watershed. All of the streams have been studied as part of a Flood Insurance Study (FIS).

1.2 Background Information

HCFCD intends to prepare a storm water management and flood protection plan for nine tributary watersheds located within the Cypress Creek watershed. The Mound Creek watershed is one of the nine watersheds. Several studies have been conducted within the Faulkey Gully watershed at varying levels and are identified in Appendix I of the February 2002 *Regional Drainage Plan and Environmental Investigation for Major Tributaries in the Cypress Creek Watershed, Phase I – Hydrologic and Hydraulic Baseline Report.*

The baseline watershed boundary is shown on **Exhibits I1.1** and **I1.2,** with the existing development conditions shown on **Exhibits I2.1** and **I2.2**. The information identified on these exhibits was generated as part of the Phase I study efforts, and was used to assist in identification of the appropriate regional drainage plan for the Mound Creek watershed.

An assessment of the environmental baseline conditions of the Mound Creek watershed was prepared as part of the Phase II – Environmental Baseline Report study efforts. The information presented in this report was used to help identify the recommended regional drainage plan and

appropriate plan elements for the watershed. Mound Creek and its tributaries have a mix of high and medium quality stream corridor habitat beneficial for wildlife and water quality. Further, scattered wetlands have been identified throughout the watershed. Environmental considerations for the Mound Creek watershed are shown on **Exhibits I3.1** and **I3.2**.

1.3 Flood Hazard

Flood hazards along Mound Creek and its tributaries for which existing model information was available were identified for the baseline conditions. These flood hazards were identified by modifying the current effective hydrologic and hydraulic models for the watershed to reflect appropriate baseline land-use conditions, with the resulting storm flows incorporated into the appropriate hydraulic model reflecting the current conditions of the channel system. The 1% storm flood profile information resulting from the hydraulic model was used in conjunction with an existing digital terrain model produced from USGS Digital Elevation Model data to produce a flood-hazard boundary map. The flood hazard boundary is shown on **Exhibits I4.1** and **I4.2**.

1.4 Summary of Baseline Conditions

The results of the study efforts for identifying the baseline conditions indicate that the 1% storm flood boundary is different from the current effective Federal Emergency Management Agency regulatory flood boundary. This is predictable since updated information about the watershed and its studied streams has been used in the identification of the baseline conditions. The information prepared in the identification of the baseline conditions flood hazards and environmental baseline conditions is suitable for use in identifying the appropriate regional drainage plans.

2.0 REGIONAL DRAINAGE PLAN FORMULATION

The objective of this Phase III study was to develop Regional Drainage Plans to guide future development of the watershed, address existing flooding issues, preserve and enhance stream habitat and water quality, provide opportunities for multiple-use facilities, reduce peak flows into Cypress Creek, be implementable and have public acceptance. The various plan elements were evaluated based on a matrix of criteria and the recommended plan was defined that best met these criteria. The sections below detail the methodology of the plan formulation steps, the watershed resources, and alternative plans developed for the Mound Creek watershed.

2.1 Methodology

The formulation of the recommended regional drainage plan used an approach that considered the information prepared as part of the Phase I and Phase II study efforts. Further, information concerning the proposed major roadway thoroughfare alignments was also used to help in the identification of recommended alignments for lateral channels that could serve as outfall drainage for these roadways. A series of public meetings and coordination through advisory committee meetings helped in providing direction for identifying a recommended plan.

Hydrologic and hydraulic models prepared as part of the baseline study effort were modified appropriately to reflect alternate plans for the watershed. Alternate plans were identified and the results measured against each other to determine which alternate represented the best plan for the watershed.

2.2 Watershed Description

The Mound Creek watershed has a drainage area of approximately 35.5 square miles. Topography generally falls from north to south, and streams are aligned north to south. The City of Waller comprises 1.5 square miles and is located in the northern part of the watershed. The remainder of the watershed is characterized by gently rolling farmland and open pasture. United State Highway 290 (Business) runs through the City of Waller, and US290 (Bypass) runs north of the City of Waller.

The baseline condition model subbasin hydrologic parameters were modified to reflect alternative plan scenarios. In some instances, the baseline subbasins were further subdivided as shown on **Exhibits I5.1** and **I5.2** to model particular plan elements and impact from development. The previously delineated subbasins K166A1, K166A2, K166B, K158A, K166D1, K166D2, K166D3, K166C, K100A, K166E and K100B were further subdivided into a total of 27 subbasins as described as follows:

- K166A1 – The upper most subbasin for the main stem of Mound Creek (2940 acres) further subdivided into four subareas: K166A1A, K166A1B, K166A1C and K166A1D.
- K166B – The upper north subbasin of the watershed drained by the West Fork (3835 acres) further subdivided into six subareas: K166B1, K166B2, K166B3, K166B4, K166B5 and K166B6.
- K158A – The upper north-central subbasin and the western portion of the City of Waller drained by the Middle Fork (1887 acres) further subdivided into three subareas: K158A1, K158A2 and K158A3.
- K166D1 – The upper north-eastern subbasin and the eastern portion of the City of Waller drained by the East Fork (1536 acres) further subdivided into three subareas: K166D1A, K166D1B and K166B1C.
- K166D3 – The central portion of the watershed drained by Tributary 7.62 (1347 acres) further subdivided into three subareas: K166D3A, K166D3B and K166D3C.
- K166A2 – The western portion of the watershed drained by the South Fork (787 acres) remains unchanged.
- K166C – The western-central portion of the watershed (908 acres) remains unchanged.
- K166D2 – The western-central portion of the watershed (1409 acres) remains unchanged.
- K100A – The eastern portion of the watershed drained by Little Mound Creek (3433 acres) further subdivided into five subareas: K100A1, K100A2, K100A3, K100A4 and K100A5.
- K166E – The lower western portion of the watershed (2058 acres) remains unchanged, and
- K100B – The lower portion of the watershed (2621 acres) remains unchanged.

Mound Creek discharges into Cypress Creek (HCFCD Unit K100-00-00) at Cypress Creek node number K100#2. **Exhibits I2.1** and **I2.2** show Mound Creek Watershed subareas with the location and station of each routing node along with subbasin names.

The topography of the basin consists of moderate overland slopes with an average slope of 40 feet per mile. The main stem remains in its natural state and has not been rectified as part of any drainage improvements, and there are few improved lateral channels.

2.3 Basin Resource Inventory

Information was obtained for the watershed concerning existing and planned land use, structure values and environmental resources. This information was used to help identify the value of the resources within the watershed and how best they should be considered in the overall planning efforts.

2.3.1 Stream Habitat Quality

The Environmental Baseline Report (EBR) qualitatively established stream habitat quality rankings based upon characteristics of the stream channel such as channelization, vegetation,

and urban density. The ranking system is shown in the EBR and was based on color infrared aerial photos and local knowledge of the streams. The stream quality designations are shown on **Exhibits I3.1** and **I3.2**. One of the goals of the regional drainage planning effort is to preserve areas of high stream quality in order to enhance the environmental benefits of the plan.

Areas of high quality stream habitat were identified throughout the Mound Creek watershed. Approximately 55 percent of the Mound Creek main stem was identified as having high stream quality with the remainder identified as medium quality stream corridors that are beneficial to wildlife and water quality. The majority of tributaries to Mound Creek have medium quality stream habitat corridors. There is little channel rectification in the lateral channels, with the exception of two laterals that pass through the City of Waller. These channels, Kx166-03-00 and Kx166-04-00, are rated as medium to poor quality.

2.3.2 Land Uses in the Watershed

Exhibits I2.1 and **I2.2** illustrate land use within the watershed. The watershed is approximately 13 percent developed with the majority of development in or near the City of Waller. The remainder of the watershed is characterized by gently rolling farmland and open pasture.

2.3.3 Structure Inventory

An inventory of structures that might be affected by flooding was performed. The purpose of the inventory was to identify and estimate the economic value or benefit if the structures were either removed or protected from flooding by the regional plans. In the Mound Creek watershed, a number of structures were identified within the flood hazard area as shown on **Exhibits I4.1** and **I4.2**. Of an estimated 147 potential structures, 102 are in or near the City of Waller. The estimated value of these structures was obtained from the Waller County Appraisal District records. The total structure (improvements) value was estimated to be $9,260,000.

In order to determine whether these structures were at risk, slabs were visually inspected in the field since finish floor slab elevation data was not available in the Mound Creek watershed. Most slab elevations appeared to be constructed at or near the same elevation as the adjacent natural ground and were determined to have a flood risk.

2.3.4 Economic Factors for the Watershed

Unlike many tributaries within the Cypress Creek watershed, Mound Creek has not experienced significant development pressure in the last several decades. The US290 bypass was constructed around the City of Waller several years ago, which has reduced traffic and

business in the City. As shown on **Exhibits I2.1** and **I2.2**, limited development has occurred in the watershed since 1984.

2.4 Problems and Opportunities Identification

The flood hazard information identified in the Phase I study efforts was used to determine the areas within the watershed most susceptible to out-of-bank flooding. Additionally, opportunities for enhancement of the watershed through the reduction of existing flooding and preservation of environmental features in the design of the regional plans were identified.

2.4.1 Economic Flood Damage Analysis

Because detailed slab elevations were not available and hydraulic models did not extend into the City of Waller, a formal economic analysis of flood damage was not performed. The structural value noted above total approximately $9,260,000. If 50 percent of the value of the structure were added for contents and vehicles, the total economic benefit from flood reduction planning would be $13,900,000 assuming the structures, contents and vehicles would be completely lost in flooding.

2.4.2 Identification of Flood-Prone Areas

As shown on the floodplain map **Exhibits I4.1** and **I4.2**, the baseline condition modeling identified areas throughout the main stem and tributaries subject to out-of-bank flooding. The floodplain is typically 2000 to 3000 feet wide along the main stem. The majority of potentially flood-prone structures are located in the City of Waller. The East Fork and Middle Fork tributaries that drain Waller have floodplains up to 1000 feet wide. Middle Fork does not show a floodplain north of Hempstead Highway since the hydraulic model does not continue beyond the highway. Assessment of existing drainage facility capacity along Middle Fork through the City of Waller, however, indicates the system is inadequate to convey the 1% storm. Much of the remaining flood-prone area south of the City of Waller is located through undeveloped farmland.

2.4.3 Summary of Public Comments Received

Three public meetings have been held to discuss this project, and public comment on existing drainage problems, plan alternates, and the recommended plan have been solicited. No comments were received concerning the Mound Creek planning area.

2.4.4 Summary of Repetitive Flood Loss Data

Data on structures that have experienced repetitive flood losses was collected for Harris County. This data includes FEMA-related flood damage claims and did not include minor

flooding that may have occurred throughout the watershed. Approximately 3000 properties are listed in the database of information obtained. None of the listed properties are within the Mound Creek watershed.

2.4.5 Opportunities for Watershed Enhancement

There are several areas within the watershed that may be beneficial to preserve and to enhance in order to benefit the community. As noted previously, there are areas of high quality stream habitat throughout the Mound Creek watershed that are not under development pressure and can be preserved to enhance the environmental quality of the watershed. There are also large open areas near the main channel that may be available for detention facilities and could also multiple uses such as parks and sports fields.

2.4.6 Identification of Major Thoroughfare Outfalls

Exhibits I4.1 and **I4.2** show the major roads through the watershed. With the exception of portions of US290 which has some storm sewer systems, roads are typically drained via adjacent roadside ditches. As the area develops, however, outfall depth and capacity for storm sewer and ditch systems serving the major roads will be needed.

2.4.7 Storm Water Quality Issues

As part of new regulations enacted by Harris County in October 2001, all new development that outfalls into Mound Creek and its tributaries within Harris County will be required to provide stormwater quality protection for the outfall drainage. This includes roadway projects, subdivisions, and other developments larger than five acres. It is anticipated that in the near future, these new regulations will be mandatory for counties surrounding Harris County. As such, the regional plans evaluated as part of this project are planned to provide general water quality benefits, but do not specifically address individual developments or roadway projects. Additional stormwater quality features will have to be designed for these projects in order to comply with the new regulations.

2.5 Alternate Drainage Plan Formulation

A series of alternate drainage plans were identified for the watershed. Each plan was prepared in consideration of the goals and objectives identified early on for the study effort. As mentioned above, the alternate plans were developed by considering channelization alternates, detention alternates, and non-structural or "no-action" alternates.

As mentioned in Section 2.2, the baseline subbasins were further subdivided in order to more accurately model particular plan elements. The additional subdivision created a model slightly

different than the one included in the Phase I report. The addition of subareas to the model caused peak flows to increase slightly in the baseline models used in this study. **Table I2** of this report presents the updated watershed parameters resulting from this modification of subareas. The peak flows resulting from this subdivision are identified in the following sections describing the plan alternates.

The models used to simulate the plan alternatives are based on the revised modeling efforts that define an updated baseline condition. For the simulation of the Mound Creek watershed, the watershed parameters did not change and are the same as that identified in **Table I2**. Additional storage volume resulting from alternative plan features were incorporated into the models, and the peak flow values along appropriate reaches were determined.

Each of the alternate plans presented below are combinations of these elements. Although the alternates differ somewhat in their features, there are common elements to all the plans presented in this study.

2.5.1 Common Features to Alternate Plans

In keeping with the goals of the program, environmental benefits were emphasized in each of the plans. Emphasis was placed on preserving areas of high quality stream habitat. Voluntary structural buyout of approximately 40 structures adjacent to high quality stream corridors was common to all plans. Where new channels (or channel extensions) have been recommended, the channel design is based on a wide section that has flat side slopes and benches for vegetation. This type of section (illustrated in **Figure 1**) provides more opportunities for multiple uses and is less susceptible to erosion.

The current regulations requiring stormwater detention to serve new development within Harris County, and the requirement that no adverse impact will result from upstream development in Waller County is assumed to remain in place for Alternate 1 and 3 Plan features. A regional approach is considered in Alternates 2 and 4, however, whereby development impact would be mitigated in regional detention basins. **Exhibits I6.1** and **I6.2** show the locations of all plan features within the watershed, including those common to the alternate plans.

2.5.2 Alternate 1 Features and Benefits

Alternate 1 features are shown on **Exhibits I6.1** and **I6.2**. Alternate 1 includes high quality stream habitat protection for much of the main stem of Mound Creek from the confluence with Cypress Creek to Middle Fork, or approximately eight miles. Because of the rural nature of the watershed, tributaries to Mound Creek lack adequate depth and capacity to serve major roadways and future developed areas, therefore numerous channel extensions are proposed to

provide adequate depth and channel capacity. Linear detention will be provided within the channels to reduce flows to the main stem of Mound Creek and Cypress Creek to below baseline levels.

The table shown below lists the peak flows at each hydrologic computational node in the baseline and alternate condition.

Alternate 1 Benefits (100-Year Flows)				
Node	**Location**	**Revised Baseline Flow (cfs)**	**Alt Flow (cfs)**	**Benefit (cfs)**
K166#1	South Fork	5,237	4,138	-1,099
K166#2	West Fork	9,695	8,071	-1,624
K166#3	Middle Fork	9,921	8,780	-1,141
K166#4	Tributary 8.18	12,541	11,303	-1,238
K166#5	Tributary 7.62	12,320	11,314	-1,006
K100#1	Little Mound Creek	12,003	11,531	-472
K100#2	Mouth of Cypress Creek	13,604	13,050	-554

* The flow from the baseline model with subbasins revised as noted in Part 2.2 of this report.

The alternative reduces flows at Cypress Creek by approximately 4 percent. The estimated cost for implementing Alternate 1 is $67,000,000.

2.5.3 Alternate 2 Features and Benefits

Alternate 2 features are shown on **Exhibits I6.1** and **I6.2**. Alternate 2 includes high quality stream habitat protection for much of the main stem of Mound Creek as described in Alternate 1. The watershed parameter representing the percentage of land urbanization (DLU) was revised to 100% to reflect regional rather than on-site detention. Numerous channel extensions are proposed to provide outfall depth for future roadways and development similar to Alternate 1. In most cases the width of the stream corridor is larger to convey the higher full development flows. Three regional detention basins have been identified along the main stem of Mound Creek to reduce flows to baseline levels. The baseline floodplain will be removed in the tributaries to Mound Creek, but a residual floodplain will remain on the main stem through the high quality stream habitat corridor. Preservation of habitat and floodplain will be accomplished through implementation strategies discussed later, and the floodplain area beyond the corridor boundaries will be managed by developers.

The table shown below lists the peak flows at each hydrologic computational mode in the baseline and alternate condition.

Alternate 2 Benefits (100-Year Flows)				
Node	**Location**	**Revised Baseline Flow (cfs)**	**Alt Flow (cfs)**	**Benefit (cfs)**
K166#1	South Fork	5,237	5,267	30
K166#2	West Fork	9,695	9,311	-384
K166#3	Middle Fork	9,921	9,146	-775
K166#4	Tributary 8.18	12,541	11,353	-1,188
K166#5	Tributary 7.62	12,320	10,697	-1,623
K100#1	Little Mound Creek	12,003	12,452	449
K100#2	Mouth of Cypress Creek	13,604	13,535	-69

* The flow from the baseline model with subbasins revised as noted in Part 2.2 of this report.

The alternative reduces flows at Cypress Creek by approximately 0.5 percent. The estimated cost for implementing Alternative 2 is $201,000,000.

2.5.4 Alternate 3 Features and Benefit

Alternate 3 features are shown on **Exhibits I6.1** and **I6.2**. Alternate 3 is a variation of Alternate 1. The high quality stream habitat is protected on the main stem, numerous channels are extended, and on-site detention is provided as in Alternate 1. Additionally, detention basins are located upstream of the City of Waller to reduce flows through the City and minimize out of bank flooding. This is in contrast to Alternate 1 where a wide stream corridor is proposed through the City with replacement of all crossings. In Alternate 3 the existing channels through Waller would not be improved.

The table shown below lists the peak flows at each hydrologic computational mode in the baseline and alternate condition.

Alternate 3 Benefits (100-Year Flows)				
Node	**Location**	**Revised Baseline Flow (cfs)**	**Alt Flow (cfs)**	**Benefit (cfs)**
K166#1	South Fork	5,237	4,139	-1,098
K166#2	West Fork	9,695	8,072	-1,623
K166#3	Middle Fork	9,921	8,368	-1,553
K166#4	Tributary 8.18	12,541	10,243	-2,298
K166#5	Tributary 7.62	12,320	11,494	-826
K100#1	Little Mound Creek	12,003	11,077	-926
K100#2	Mouth of Cypress Creek	13,604	12,552	-1,052

* The flow from the baseline model with subbasins revised as noted in Part 2.2 of this report.

The alternative reduces flows at Cypress Creek by approximately 8 percent. The estimated const for implementing Alternate 3 is $71,000,000.

2.5.5 Alternate 4 Features and Benefits

Alternate 4 features are shown on **Exhibits I6.1** and **I6.2**. Alternate 4 is a variation of Alternate 2. The high quality stream habitat is protected on the main stem, numerous channels are extended, and regional detention is provided as in Alternate 2. Additionally, detention basis are located upstream of the City of Waller to reduce flows through the City and minimize out-of-bank flooding. This is in contrast to Alternate 2 where a wide stream corridor is proposed through the City with replacement of crossings to convey fully developed flows. In Alternate 4 the existing channels through Waller would not be improved.

The table shown below lists the peak flows at each hydrologic computational mode in the baseline and alternate condition.

Alternate 4 Benefits (100-Year Flows)				
Node	**Location**	**Revised Baseline Flow (cfs)**	**Alt Flow (cfs)**	**Benefit (cfs)**
K166#1	South Fork	5,237	5,623	386
K166#2	West Fork	9,695	9,800	105
K166#3	Middle Fork	9,921	9,299	-622
K166#4	Tributary 8.18	12,541	11,277	-1,264
K166#5	Tributary 7.62	12,320	11,030	-1,290
K100#1	Little Mound Creek	12,003	12,660	657
K100#2	Mouth of Cypress Creek	13,604	13,514	-90

* The flow from the baseline model with subbasins revised as noted in Part 2.2 of this report.

The alternate reduces flows at Cypress Creek by approximately 0.6 percent. The estimated cost for implementing Alternate 4 is $170,000,000.

2.5.6 Public Input on Alternate Plans

On October 8, 2002, a public meeting was held to describe the progress of the project and to inform the public regarding the alternate plans being proposed for the watershed. No public comments were received at the meeting for Mound Creek.

2.5.7 Screening of Alternates

The following criteria matrix was used when evaluating the alternative plans identified for each watershed. The ability of the plan alternative to meet each criteria was ranked from 0 to 10, with 0 indicating that the criteria is not met, and 10 indicating that the criteria is met to the best of its ability. Relative weights were then set for each of the criteria as shown below based on the stated goals of the study.

Table I1 - Screening Matrix for Mound Creek					
Criteria	**Weight**	**Plan**			
		ALT 1	**ALT 2**	**ALT 3**	**ALT 4**
Minimal Construction Cost	0.2	8	5	7	8
Provides Aesthetics	0.5	7	8	5	6
Ease of Implementation	0.8	6	5	8	7
Flood Protection within Tributary Watershed	1	8	8	7	8
Ability to Accommodate Multiple Uses	0.5	6	8	5	7
Preserves/Enhances Water Quality	0.8	7	8	6	7
Preserves/Enhances Stream Habitat Quality	0.5	7	9	7	8
Ease of Maintenance	0.8	6	9	6	8
Reduction of Peak Flows into Cypress Creek	1	9	8	10	8
Outfalls for Future Roadways/Development	0.8	10	10	9	9
Acceptable to the Public	0.8	6	6	9	10
TOTAL	-----	**80**	**84**	**79**	**86**
WEIGHTED TOTAL	**77 (max)**	**56.6**	**59.9**	**57.3**	**60.9**

2.6 Recommended Plan and Identification of Elements

Based on the criteria noted above, a plan was recommended that met the needs of the watershed as noted in this report. The recommended plan is described in detail below and shown on **Exhibits I7.1** and **I7.2**. All of the alternatives maintained the floodplain along the main stem of Mound Creek from Middle Fork to the confluence with Cypress Creek to protect the high quality stream habitat. Options to remove the floodplain would require detention volumes far in excess of those recommended, or channel rectification and loss of the habitat. Neither of these options was desirable and was therefore removed from consideration.

2.6.1 Determination of Recommended Plan

Alternate 4 was chosen as the recommended plan primarily because regionalization should be easier to implement for the rural watershed as development occurs over the next several decades. An impact fee would be established to pay for part or all of the program. Construction of regional detention facilities upstream of the City of Waller was viewed as a desirable alternative when compared to condemnation of developed areas through the City to accommodate channel improvements. As shown on the screening matrix, Alternate 4 received the highest score. The on-site detention plans reflected in Alternatives 1 and 3 scored lower primarily because of potential public acceptance problems associated with a lack of proactive management of the watershed, difficulty in maintaining multiple small on-site facilities, and ability to accommodate multiple uses such as park and trails.

2.6.2 Recommended Plan Features

The recommended plan consists of features that preserve areas of high quality stream habitat, obtain structures in flood-prone areas through a voluntary buyout program, provide outfall drainage for future development, and slightly reduce flows to Cypress Creek. The features of the plan, beginning at the mouth, consist of the elements described below.

The lower eight miles of main stem stream quality and habitat will be preserved in a 300-foot wide corridor. Three regional detention basins will be located along the main stem near the confluences of K166-02-00, Kx166-01-00 and Kx166-04-00. The basins will reduce peak flows along Mound Creek, enhance water quality through the high quality corridor, and provide opportunities for multiple-use facilities. The basin areas are 215 acres, 291 acres and 181 acres with an average depth of ten feet. Numerous tributary channel and bridge improvements are proposed to convey fully developed flows. Voluntary structural buyout of approximately 40 structures in the floodplain of the main stem of Mound Creek is proposed. Two detention basins are proposed north of the City of Waller. One basin will be located on Kx166-04-00 (Middle Fork) and one on Kx166-03-00 (East Fork) to over-detain upstream flood flows to a level that removes the floodplain through the City of Waller.

2.6.3 Recommended Plan Benefits

Taken together, these elements make up the recommended plan for Mound Creek and satisfy the criteria for this study while providing quantifiable benefits to the watershed. Some recreational elements will be necessary to add to the plan features to fully meet the desired goal for multiple-use facilities, which include a continuous hike and bike trail system. The system could begin near the mouth of Mound Creek and extend along numerous tributaries for recreation, and would be accessible to all residents in the Mound Creek watershed. Additionally, developments served by the proposed channels would be encouraged to construct trails along the lateral channel as a recreational amenity for the development.

Hydrologic benefits due to the plan elements were summarized in the alternate plan formulation section of this report. The revised Tc and R parameters for the recommended plan compared to the baseline are shown in **Table I2**. The resulting 100-year flows comparing the revised baseline conditions to the recommended plan conditions are presented in **Table I3** of this report. **Table I4** of this report presents the HEC-1 peak flows resulting from the recommended plan for various storm frequencies. The 100-year baseline and 100-year recommended plan profiles are shown on **Exhibit I9-1** through **I9-11**. The eight frequency storm event profiles for the baseline and recommended plan are shown on **Exhibits I10-1** through **I10-11**, and **Exhibits I11-1** through **I11-11**, respectively.

The plan reduces peak flows at the confluence with Cypress Creek by 90 cfs. Tributary water surface elevations are significantly lower as a result of proposed drainage corridors. As shown in **Table I5**, the 100-year water surface elevations decrease significantly along tributaries to Mound Creek. As noted earlier, the goal of this plan was not to bring all areas of out-of-bank flooding to within the banks. The goal was to preserve some areas of out-of-bank flooding that occurs in areas that are beneficial to the watershed and to address out-of-bank flooding in areas where it causes existing or projected flooding problems outside of the stream corridor areas. Finally, the plan provides environmental benefits by preserving identified areas of high quality stream habitat as well as preserving some naturally flood-prone areas.

Table I2: Watershed Physical Characteristics (Baseline & Recommended Plan Conditions)

Subarea Name	Drainage Area		Watershed Length	Length to Centroid	Channel Slope	Overland Slope	Urban Dev. *	Watershed Dev. *	Channel Imp.	Channel Conv.	Ponding
	(Acre)	(Sq.Mi)	(mi)	(mi)	(ft/mi)	(ft/mi)	(%)	(%)	(%)	(%)	(%)
Baseline Plan											
K166A1	2940	4.59	4.73	2.56	11.8	35	5.7	91	0	100	0
K166A2	787	1.23	1.89	1.04	15.5	24	9.3	77	0	100	0
K166B	3835	5.99	6.63	3.98	12.5	31	4.4	97	0	100	0
K166C	908	1.42	2.39	0.81	22.0	26	1.4	97	0	100	0
K158A	1887	2.95	3.79	2.27	14.0	38	28.3	101	0	100	0
K166D1	1536	2.40	3.79	2.65	20.0	50	21.2	90	0	100	0
K166D2	1409	2.20	2.08	1.23	18.0	47	4.6	88	0	100	0
K166D3	1347	2.11	2.73	1.55	24.0	58	13.5	92	0	100	0
K166E	2058	3.22	3.60	1.89	20.0	60	2.2	95	0	100	0
K100A	3423	5.35	5.87	3.13	14.8	24	5.0	100	0	100	0
K100B	2621	4.10	6.25	3.56	9.0	50	1.5	96	0	100	0
Recommended Plan											
K166A1A	1036	1.62	2.08	1.08	10.1	20	100	100	100	100	0
K166A1B	697	1.09	1.25	0.47	20.0	33	100	100	100	100	0
K166A1C	339	0.53	1.08	0.28	30.6	29	100	100	100	100	0
K166A1D	869	1.36	1.89	1.08	18.5	33	100	100	100	100	0
K166A2	787	1.23	1.89	1.04	15.5	24	100	100	100	100	0
K166B1	1083	1.69	2.65	0.91	13.2	19	100	100	100	100	0
K166B2	682	1.07	1.72	0.72	17.4	29	100	100	100	100	0
K166B3	513	0.80	1.48	0.85	24.8	50	100	100	100	100	0
K166B4	472	0.74	1.21	0.85	22.3	38	100	100	100	100	0
K166B5	669	1.05	1.23	0.68	24.4	54	100	100	100	100	0
K166B6	417	0.65	1.46	0.76	29.5	66	100	100	100	100	0
K166C	908	1.42	2.39	0.81	22.0	26	100	100	100	100	0
K158A1	671	1.05	1.64	0.85	13.4	38	100	100	100	100	0
K158A2	689	1.08	1.40	0.72	14.3	38	100	100	100	100	0
K158A3	527	0.82	2.03	0.97	21.2	47	100	100	100	100	0
K166D1A	689	1.08	1.89	1.50	5.3	19	100	100	100	100	0
K166D1B	470	0.74	1.21	0.78	25.6	70	100	100	100	100	0
K166D1C	377	0.59	1.80	0.97	25.0	88	100	100	100	100	0
K166D2	1409	2.20	2.08	1.23	18.0	47	100	100	100	100	0
K166D3A	160	0.25	0.61	0.28	13.2	33	100	100	100	100	0
K166D3B	846	1.32	1.89	0.80	23.8	56	100	100	100	100	0
K166D3C	341	0.53	1.67	1.25	21.0	101	100	100	100	100	0
K166E	2058	3.22	3.60	1.89	20.0	60	100	100	100	100	0
K100A1	560	0.88	0.95	0.66	12.6	20	100	100	100	100	0
K100A2	851	1.33	1.97	1.08	15.2	18	100	100	100	100	0
K100A3	493	0.77	1.40	0.80	23.6	33	100	100	100	100	0
K100A4	723	1.13	1.33	0.70	23.3	44	100	100	100	100	0
K100A5	796	1.24	2.35	1.53	19.1	67	100	100	100	100	0
K100B	2621	4.10	6.25	3.56	9.0	50	100	100	100	100	0

* % in the Baseline Plan based on development in place prior to implementation of HCFCD on-site detention policy (1984)

Table I2 (cont.): Baseline & Recommended Plan Conditions

Subarea Name	TC (hrs)	R (hrs)	RTIMP (%)
Baseline Plan			
K166A1	2.75	2.83	31.7
K166A2	0.91	1.01	26.9
K166B	4.26	4.26	33.9
K166C	0.59	0.66	34.1
K158A	2.11	2.31	35.3
K166D1	2.82	3.04	31.5
K166D2	1.37	1.49	31.0
K166D3	1.47	1.63	32.2
K166E	2.05	2.17	33.1
K100A	3.02	3.09	35.0
K100B	6.12	6.07	33.7
Recommended Plan			
K166A1A	0.30	1.34	35.0
K166A1B	0.13	0.76	35.0
K166A1C	0.06	0.63	35.0
K166A1D	0.33	0.90	35.0
K166A2	0.35	0.96	35.0
K166B1	0.22	1.55	35.0
K166B2	0.22	0.95	35.0
K166B3	0.30	0.64	35.0
K166B4	0.23	0.61	35.0
K166B5	0.24	0.59	35.0
K166B6	0.24	0.63	35.0
K166C	0.22	1.14	35.0
K158A1	0.31	0.94	35.3
K158A2	0.25	0.84	35.3
K158A3	0.37	0.86	35.3
K166D1A	0.59	1.32	35.0
K166D1B	0.27	0.53	35.0
K166D1C	0.34	0.73	35.0
K166D2	0.52	0.81	35.0
K166D3A	0.10	0.53	35.0
K166D3B	0.29	0.84	35.0
K166D3C	0.49	0.59	35.0
K166E	0.78	1.11	35.0
K100A1	0.24	0.63	35.1
K100A2	0.24	1.12	35.1
K100A3	0.21	0.70	35.1
K100A4	0.25	0.64	35.1
K100A5	0.64	0.78	35.1
K100B	2.33	1.37	35.0

Table I3: 100-Year Flow Comparison Table (Revised Baseline vs. Recommended Plan)

HEC-1 Analysis Point	Revised Baseline Condition (cfs)	Recommended Condition (cfs)*	Revised Baseline vs. Recommended Plan	
			Difference (cfs)	% Change
Mound Creek (K166-00-00)				
K166#1A	1199	1534	335	27.9
K166#1B	2332	2874	542	23.2
K166#1C	2959	3604	645	21.8
K166#1	5237	5623	386	7.4
K166#2	7768	9800	2032	26.2
K166#3	9921	9299	-622	-6.3
K166#4	12541	11277	-1264	-10.1
K166#5	12320	11030	-1290	-10.5
K100#1	12003	12660	657	5.5
K100#2	13604	13514	-90	-0.7
Trib. 7.62 to Mound Creek (Kx166-01-00)				
K166#5A	338	360	22	6.5
K166#5B	1612	2869	1257	78.0
K166#5	2171	4027	1856	85.5
Little Mound Creek (K166-02-00)				
K100#1A	1038	1587	549	52.9
K100#1B	2140	2943	803	37.5
K100#1C	2989	3383	394	13.2
K100#1D	4290	4320	30	0.7
K100#1	5262	5835	573	10.9
Trib. 8.18 to Mound Creek (Kx166-03-00)				
K166#4A	863	389	-474	-54.9
K166#4B	1776	1926	150	8.4
K166#4	2456	3011	555	22.6
Middle Fork of Mound Creek (Kx166-04-00)				
K166#3A	1247	534	-713	-57.2
K166#3B	2607	2428	-179	-6.9
K166#3	3604	3907	303	8.4
West Fork of Mound Creek (Kx166-05-00)				
K166#2A	1152	1800	648	56.3
K166#2B	2130	2765	635	29.8
K166#2C	3906	4826	920	23.6
K166#2D	5165	5110	-55	-1.1
K166#2E	889	1691	802	90.2
K166#2	5915	5163	-752	-12.7
South Fork of Mound Creek (Kx166-06-00)				
K166#1	1096	2232	1136	103.6

Table I4: HEC-1 Peak Flow Rates for Recommended Plan Conditions

HEC-1 Analysis Point	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	250-Year	500-Year
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
Mound Creek (K166-00-00)								
K166#1A	525	808	999	1193	1327	1534	1761	1930
K166#1B	1046	1560	1903	2247	2440	2874	3299	3620
K166#1C	1305	1961	2399	2833	3041	3604	4140	4534
K166#1	1950	2986	3683	4377	4757	5623	6460	7088
K166#2	3095	4888	6146	7447	8450	9800	11355	12528
K166#3	3208	4927	6048	7078	7644	9299	10917	12129
K166#4	3897	5945	7363	8586	9179	11277	13255	14746
K166#5	3797	5800	7133	8601	9143	11030	12744	14167
K100#1	4227	6495	8052	9767	10323	12660	14614	16111
K100#2	4491	6912	8582	10405	11054	13514	15618	17243
Trib. 7.62 to Mound Creek (Kx166-01-00)								
K166#5A	136	201	243	284	288	360	413	452
K166#5B	1114	1619	1957	2283	2225	2869	3272	3565
K166#5	1574	2280	2752	3210	3044	4027	4591	5001
Little Mound Creek (K166-02-00)								
K100#1A	609	892	1080	1266	1276	1587	1815	1979
K100#1B	1073	1609	1971	2315	2497	2943	3369	3681
K100#1C	1193	1818	2238	2643	2898	3383	3883	4250
K100#1D	1505	2303	2836	3366	3712	4320	4957	5428
K100#1	1991	3086	3884	4570	4834	5835	6687	7317
Trib. 8.18 to Mound Creek (Kx166-03-00)								
K166#4A	128	198	245	296	333	389	449	495
K166#4B	743	1076	1293	1531	1376	1926	2201	2403
K166#4	1167	1681	2036	2380	2316	3011	3446	3753
Middle Fork of Mound Creek (Kx166-04-00)								
K166#3A	173	268	334	407	462	534	616	679
K166#3B	909	1339	1625	1916	1924	2428	2776	3033
K166#3	1466	2159	2614	3091	3111	3907	4463	4877
West Fork of Mound Creek (Kx166-05-00)								
K166#2A	628	956	1180	1400	1559	1800	2067	2265
K166#2B	967	1471	1811	2150	2399	2765	3173	3474
K166#2C	1766	2632	3206	3784	3987	4826	5524	6049
K166#2D	1772	2709	3334	3975	4392	5110	5869	6439
K166#2E	675	966	1157	1356	1156	1691	1928	2098
K166#2	1741	3696	3341	3999	4369	5163	5943	6525
South Fork of Mound Creek (Kx166-06-00)								
K166#1	862	1255	1520	1773	1751	2232	2548	2779

Table I5: Comparison of Water Surface Elevations (100-Year)

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
Mound Creek (K166-00-00)						
100	Mouth	13500	184.51	13500	184.51	0.00
1550		13500	187.08	12600	187.04	-0.04
2700		13500	188.38	12600	188.27	-0.11
4178		13500	191.07	12600	190.92	-0.15
5578		13500	192.59	12600	192.42	-0.17
7478		13500	193.11	12600	192.91	-0.20
9590		13500	193.46	12600	193.22	-0.24
11068		13500	195.13	12600	195.00	-0.13
12494		13500	197.54	12600	197.39	-0.15
14394		13500	199.21	12600	199.06	-0.15
16394		13500	200.08	12600	199.91	-0.17
18444		13500	201.38	12600	201.19	-0.19
20292		13500	202.73	12600	202.55	-0.18
21876		13500	203.77	12600	203.58	-0.19
23882		13500	204.77	12600	204.57	-0.20
25994		13500	205.75	12600	205.56	-0.19
26627		13500	206.01	12600	205.83	-0.18
28852		13500	208.10	12600	207.96	-0.14
29412		13500	209.16	12600	208.99	-0.17
29422	Mathis Rd.	13500	209.22	12600	209.07	-0.15
29445	Road	13500	209.78	12600	209.64	-0.14
29455		13500	209.80	12600	209.66	-0.14
32555		13500	212.44	12600	212.24	-0.20
34139		13500	213.20	12600	213.00	-0.20
35723		13500	215.64	12600	215.46	-0.18
37307		13500	217.54	12600	217.39	-0.15
39155		13500	218.19	12600	218.02	-0.17
40955		11500	218.98	11300	218.81	-0.17
42803		11500	220.14	11300	220.04	-0.10
8.18		10500	221.13	11000	221.10	-0.03
8.2	Penick	10200	221.31	11000	221.29	-0.02
8.21	Road	10200	221.72	11000	221.79	0.07
8.23		10200	221.75	11000	221.82	0.07
8.38		10200	222.33	11000	222.46	0.13
8.68		10000	223.82	11000	224.05	0.23
8.9		10000	224.91	11000	225.17	0.26
9		10000	225.72	10000	225.95	0.23
9.1	FM 362	9400	225.97	10000	226.26	0.29
9.11	FM 362	9400	229.57	10000	229.67	0.10
9.13		9400	229.75	10000	229.86	0.11
9.23		9200	230.06	9600	230.19	0.13
9.6		9000	230.76	9600	230.92	0.16
9.629		9000	230.81	9600	230.96	0.15
9.913		8800	231.05	9600	231.21	0.16

Table I5: Comparison of Water Surface Elevations (100-Year)

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
Mound Creek (K166-00-00) cont.						
10.178		8600	231.67	9600	231.86	0.19
10.709		8400	235.19	9200	235.39	0.20
11.239		6200	238.77	7500	239.05	0.28
11.694		4600	240.76	5700	241.18	0.42
11.769		4600	241.10	5700	241.51	0.41
11.786	Blinka	4600	241.38	5700	241.77	0.39
11.792	Road	4600	241.41	5700	241.83	0.42
11.798		4600	241.49	5700	241.90	0.41
12.158		3000	244.83	3100	245.03	0.20
12.707	Limit of Study	2600	249.31	2800	249.32	0.01
Trib. 7.62 to Mound Creek (Kx166-01-00)						
210	Mouth	1340	213.34	3044	209.96	-3.38
2005		1200	217.34	3044	212.59	-4.75
2006		-	-	2225	212.54	-
2007		-	-	2225	215.56	-
3325		970	219.58	2225	215.83	-3.75
4223		710	220.63	2225	216.62	-4.01
5121	Limit of Study	710	225.6	2225	218.46	-7.14
Little Mound Creek (K166-02-00)						
264	Mouth	2880	205.49	5835	204.02	-1.47
265				4320	204.71	-
1964		2700	207.29	4320	204.83	-2.46
2914		2700	207.76	4320	205.02	-2.74
4914		2500	212.83	4320	205.21	-7.62
4915		-	-	4320	205.76	-
4916		-	-	4320	208.91	-
6498		2500	214.62	4320	209.08	-5.54
8135		2500	218.12	4320	209.59	-8.53
8136		-	-	4320	213.96	-
8137		-	-	4320	217.86	-
8798		2500	219.96	4320	217.89	-2.07
8808	Betkard	2500	220.16	4320	217.9	-2.26
8835	Road	2500	220.17	4320	217.92	-2.25
8885		-	-	3383	217.93	-
10285		2100	223.93	3383	218.12	-5.81
10286		-	-	3383	217.84	-
10287		-	-	3383	221.77	-
11735		2100	227.4	3383	221.92	-5.48
13604		-	-	3383	222.89	-
13605	Limit of Study	1900	232.89	3383	229.03	-3.86

Table I5: Comparison of Water Surface Elevations (100-Year)

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
Trib. 8.18 to Mound Creek (Kx166-03-00)						
0.086	Mouth	1330	220.94	3011	220.20	-0.74
0.115	Private	1290	221.51	3011	220.68	-0.83
0.119	Drive #1	1290	221.71	3011	222.09	0.38
0.147	Charter	1290	221.85	3011	222.24	0.39
0.154	Lane	1290	221.92	3011	222.39	0.47
0.260		1290	222.33	3011	223.00	0.67
0.380		1290	222.46	3011	223.17	0.71
0.382		1290	222.47	3011	223.18	0.71
0.435	Private	1290	222.70	3011	223.36	0.66
0.438	Drive #2	1290	222.77	3011	223.51	0.74
0.442	Private	1290	222.80	3011	223.53	0.73
0.446	Drive #3	1290	222.85	3011	223.55	0.70
0.468	Private	1290	223.00	3011	223.61	0.61
0.476	Drive #4	1290	223.03	3011	223.73	0.70
0.501	Private	1290	223.31	3011	223.88	0.57
0.508	Drive #5	1290	224.27	3011	224.10	-0.17
0.517	Private	1290	224.31	3011	224.15	-0.16
0.524	Drive #6	1290	224.36	3011	222.84	-1.52
0.660		1290	226.01	3011	228.67	2.66
0.670	Private	1290	226.55	3011	228.68	2.13
0.678	Drive #7	1290	226.52	3011	228.73	2.21
0.820		1290	228.46	3011	228.88	0.42
0.970		1210	230.59	1829	229.27	-1.32
0.9702		-	-	1829	229.19	-
1.040	Ross	1210	232.11	1829	229.56	-2.55
1.043	Road	1210	232.30	1829	229.57	-2.73
1.120		1210	233.99	1829	230.13	-3.86
1.340		1090	237.39	389	231.86	-5.53
1.560		1090	239.73	389	232.27	-7.46
1.670		1090	242.21	389	233.27	-8.94
1.671	Old Washington	1090	242.22	389	233.16	-9.06
1.674	Road	1090	245.22	389	234.60	-10.62
1.680	Rail Road	1090	245.23	389	234.88	-10.35
1.686	Crossing	1090	247.58	389	234.89	-12.69
1.693		1090	247.59	389	234.92	-12.67
1.700	Business	1090	247.60	389	234.95	-12.65
1.712	290	1090	247.61	389	235.02	-12.59
1.730	Covered	1090	247.62	389	235.12	-12.50
1.740	Foot Bridge	1090	247.65	389	235.15	-12.50
1.750	Mills	1090	247.66	389	235.17	-12.49
1.754	Street	1090	247.66	389	235.52	-12.14
1.780		1090	247.67	389	235.90	-11.77
1.810		1090	247.68	389	235.99	-11.69
1.811	Main	1090	247.68	389	235.99	-11.69

Table I5: Comparison of Water Surface Elevations (100-Year)

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
Trib. 8.18 to Mound Creek (Kx166-03-00) cont.						
1.813	Street	1090	247.69	389	236.34	-11.35
1.814		1090	247.70	389	236.42	-11.28
1.820		1090	247.70	389	236.63	-11.07
1.870		1090	247.71	389	236.93	-10.78
1.920		1090	247.76	389	237.23	-10.53
1.9202		-	-	389	237.73	-
1.921	Taylor	1090	247.77	389	237.83	-9.94
1.923	Street	1090	250.10	389	241.42	-8.68
1.924		1090	250.11	389	241.66	-8.45
1.940		1090	250.11	389	241.71	-8.40
2.060		1090	250.22	389	242.67	-7.55
2.080		1090	250.61	389	243.35	-7.26
2.0815	Field Store	1090	250.68	389	243.26	-7.42
2.0835	Road	1090	253.21	389	248.24	-4.97
2.085		1090	253.21	389	248.53	-4.68
2.100		900	253.26	389	248.77	-4.49
2.110		900	253.27	389	249.24	-4.03
2.150		740	253.33	389	250.29	-3.04
2.210		740	253.48	389	252.03	-1.45
2.260		740	254.18	389	253.57	-0.61
2.310		740	255.64	389	254.86	-0.78
2.323	Ironwood	740	255.97	389	256.20	0.23
2.336	Drive	740	257.15	389	256.82	-0.33
2.350		740	257.65	389	257.18	-0.47
2.400		740	259.98	389	259.61	-0.37
2.450	US 290	740	262.96	389	263.70	0.74
2.540		740	264.36	389	263.25	-1.11
2.550		740	265.34	389	264.96	-0.38
2.730	Limit of Study	740	271.18	389	270.73	-0.45
Middle Fork of Mound Creek (Kx166-04-00)						
0	Mouth	1850	224.72	3907	225.66	0.94
0.157	Private	1850	226.82	2374	227.09	0.27
0.163	Crossing	1850	227.04	2374	227.25	0.21
0.24		1850	227.29	2374	227.50	0.21
0.37		1850	227.66	2374	227.81	0.15
0.5		1850	228.75	2374	228.47	-0.28
0.55		1850	229.64	2374	229.28	-0.36
0.688		1850	231.18	2374	230.27	-0.91
0.707		1850	231.86	2374	230.50	-1.36
0.709	Old County	1850	234.9	2374	230.52	-4.38
0.715	Road	1850	234.92	2374	230.65	-4.27
0.717		1850	234.92	2374	230.68	-4.24
0.736		1850	234.92	2374	230.84	-4.08
0.9		1850	235.01	2374	231.95	-3.06

Table I5: Comparison of Water Surface Elevations (100-Year)

SECNO	Location	Baseline Condition		Recommended Plan		Delta
		Flow	WSEL	Flow	WSEL	(ft)
Middle Fork of Mound Creek (Kx166-04-00) cont.						
0.97		1550	235.17	534	232.58	-2.59
1		1550	235.25	534	232.59	-2.66
1.04		1550	235.37	534	232.60	-2.77
1.197	Limit of Study	1550	237.62	534	232.68	-4.94
West Fork of Mound Creek (Kx166-05-00)						
0	Mouth	3900	229.26	5163	224.82	-4.44
0.321		3900	230.33	5163	225.62	-4.71
0.322	Old County	3900	230.35	5163	225.66	-4.69
0.323	Road	3900	230.39	5163	225.71	-4.68
0.324		3900	230.43	5163	225.77	-4.66
0.44		3900	231.58	5163	226.03	-5.55
0.4402		-	-	5163	230.57	-
0.64		3900	237.25	5163	234.57	-2.68
0.83		3700	238.56	4501	234.62	-3.94
0.8302		-	-	4501	234.62	-
0.832		3700	238.58	4501	234.62	-3.96
0.833		3700	238.60	4501	234.62	-3.98
0.834		3700	239.10	4501	234.62	-4.48
0.88		3700	239.32	4501	234.63	-4.69
0.92		3700	239.32	4501	234.64	-4.68
1.04		3700	239.33	4501	234.64	-4.69
1.081		3700	241.24	4501	234.65	-6.59
1.0812		-	-	4501	234.66	-
1.082	Old Washington	3700	241.93	4501	234.66	-7.27
1.083	Road	3700	241.97	4501	234.67	-7.30
1.09		3700	242.04	4501	234.67	-7.37
1.101	Railroad	3700	242.16	4501	234.68	-7.48
1.103	Crossing	3700	242.17	4501	234.68	-7.49
1.122		3700	242.30	4501	234.69	-7.61
1.123	Hempstead	3700	242.30	4501	234.70	-7.60
1.124	Highway	3700	242.32	4501	234.70	-7.62
1.125		3700	243.88	4501	234.70	-9.18
1.14		3700	244.03	4501	234.71	-9.32
1.23	Limit of Study	3700	244.17	4501	234.80	-9.37
South Fork of Mound Creek (Kx166-06-00)						
0	Mouth	1225	232.35	2232	228.88	-3.47
0.002		-	-	2232	229.33	-
0.004		-	-	2232	230.82	-
0.28		1100	236.91	2232	231.29	-5.62
0.2802		-	-	2232	232.33	-
0.2804		-	-	2232	235.32	-
0.57		1100	243.24	2232	235.39	-7.85
0.5702		-	-	2232	238.03	-