



**NOTICE OF WORKSHOP
OF THE WESLACO CITY COMMISSION
TUESDAY, JULY 24, 2018**

NOTICE IS HEREBY GIVEN THAT the City Commission of the City of Weslaco, Texas will hold a Workshop in the Legislative Chamber of City Hall, located at 255 South Kansas Avenue, on Tuesday, July 24, 2018 at 5:30 PM for the purpose of discussing the following items:

I. CALL TO ORDER

- A. Certification of Public Notice.
- B. Roll Call.

II. REPORT

- A. Presentation by State Representative Armando Martinez related to possible funding from the state on regional solutions under the Hazard Mitigation Grant Program.
- B. Report by Public Works on the cleaning of ditches and culverts.

III. NEW BUSINESS

- A. Discussion on short-term solutions to drainage issues. Attachment
- B. Discussion on social media communications.
- C. Discussion on changes to the Subdivision Ordinance.
- D. Discussion on pumps at levees.
- E. Discussion on location of Regional Detention Facilities.
- F. Discussion on issuance of Certificates of Obligation for drainage.
- G. Discussion on Republic Service Contract for Solid Waste Collection and Disposal Service through Emergency Management.
- H. Discussion on organizational structure of the Emergency Operations Center. Attachment

IV. ADJOURNMENT

I hereby certify this **Notice of a Workshop of the Weslaco City Commission** was posted in accordance with the Open Meetings Act on the outside bulletin board at City Hall of the City of Weslaco, located at the 255 South Kansas Avenue entrance, visible and accessible to the general public during and after regular working hours. This notice was posted on this 20th day of July, 2018 at 4:45 p.m. and will remain so posted continuously for at least 72-hours preceding the scheduled time of this meeting in accordance with Chapter 551 of the Texas Government Code.

/s/ Elizabeth M. Walker, City Secretary

NOTE: If during the course of the meeting, any discussion of any item on the agenda should be held in executive or closed session, the City Commission will convene in such executive or closed session whether or not such item is posted as an executive session item at any time during the meeting when authorized by the provisions of the Texas Open Meetings Act.

If any accommodation for a disability is required, please notify the City Secretary's Office at (956) 968-3181, Ext. 3100 prior to the meeting date.

Removed from Bulletin Board

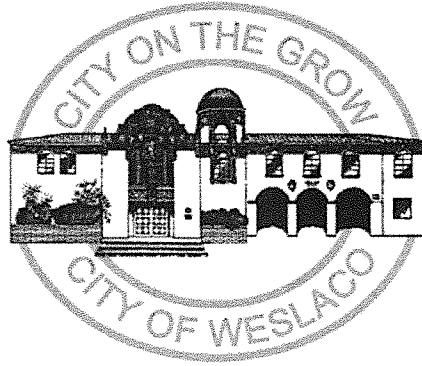
Date:

Initials:



Standardized Agenda Request Form

Date of Meeting: July 24, 2018		Agenda Item No. (to be assigned by CSO): 2018-1822	
From:			
Subject: Discussion on short-term solutions to drainage issues.			
Background:			
Funding Source (budget code, if applicable):			
Amount:	Term of Impact:	Identified in Current Budget:	
Additional Action Prompted:			
If item previously considered, provide date and action by Commission:			
If item requires Publication Notice, provide date and periodical of publication; indicate if comments received from letters mailed to property owners:			
Advisory Review, if any (name of board/committee, date of action, recommendation):			
Elizabeth Walker		Created/Initiated	
Mike Perez		Final Approval	
City Manager Comments: Approve.			
Staff Recommendation:			
Attachments, if any: 2015-01 Master Drainage Plan GDLG2			
Responsibilities upon Approval:			



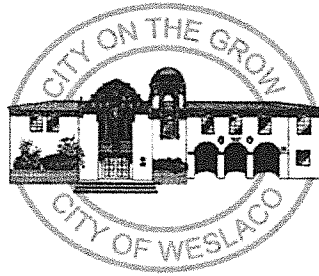
City of Weslaco Master Drainage Plan



Prepared by Gonzalez De La Garza and CFZ Group



Acknowledgements



The planning team would like to acknowledge the support and participation of the City of Weslaco, Hidalgo County, staff, business organizations, civic organizations and the residents of the City of Weslaco. The information and assistance provided was instrumental in the completion of Weslaco's Comprehensive Plan.

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Introduction



The purpose of this report is to document the hydrologic and hydraulic conditions for the streams in the City of Weslaco. The City of Weslaco is located in Hidalgo County in south Texas. The major cities close to Weslaco are City of McAllen, which is about 18 miles to the west and the City of Harlingen, which is about 20 miles to the east. The location map on Exhibit 1 shows the City of Weslaco. The streams that were studied for the purpose of the project are shown in Table 1. The study streams are shown on Exhibit 2.

Figure 1.1

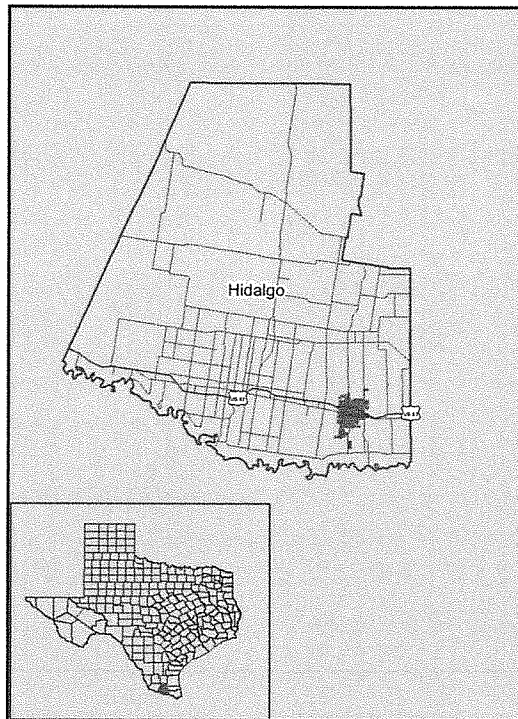


Exhibit 1. Location Map for City of Weslaco

Table 1.0 Study Streams

Stream Name	Study Length (Miles)
Drain 17B2 A1A	2.913
Drain A	1.474
Drain B 17B2	3.772
Drain 18B	4.439
Drain 18 B3	3.188
Drain 18B4	2.440
Drain 34	2.305
Drain 34A	1.000
Drain 35	2.678
Drain 35A	0.551
Drain 36	0.785
Drain 37	4.188
Drain 37A	1.153

Previous Studies



In 1996, Sigler, Winston, Greenwood & Associates Inc, performed a drainage study for the City of Weslaco. This drainage study identified the stream names that convey storm water runoff in the City of Weslaco. The watershed delineations were based on 5-foot contour data obtained from United States Geological Survey (USGS) quadrangle maps. This study performed the hydrologic analysis for a 9.5 year storm event using a runoff curves that were developed by Hidalgo County Drainage District. These curves represent a logarithmic plot between Runoff in cfs versus Drainage Area in acres / square miles. Two different curves were used to estimate peak discharges, one curve for urban areas and a second curve for undeveloped areas. The U.S Army Corps of Engineers' HEC-2 software was used for performing hydraulic analysis. This study aimed at evaluating the capacity of existing structures for a 9.5 year storm and recommendations were made in the study to upgrade structures to meet the 9.5 year capacity. Currently, no documentation exists on whether or not any proposed improvements were constructed since 1996 study was finished. Also, no documentation exists on how many new stream crossings were built since 1996 for all the development that has taken place in the City of Weslaco.

Data Collection



TOPOGRAPHIC DATA

LiDAR data and the 1-meter resolution Digital Elevation Models (DEMs) for the project were obtained from The Texas Natural Resources Information System (TNRIS) in September 2014. Using Geographic Information Systems (GIS) tools, 1-foot contour data was generated from the DEMs for the entire project area.

SURVEY DATA

Limited survey of all the structures for the study streams was performed by Gonzalez De-La-Garza Associates (GDA) in September 2014. At every crossing, the surveyors measured the structure dimensions, captured the downstream invert elevation and the top of road elevation on North American Vertical Datum (NAVD) 88 datum.

ORTHOPHOTOS

Orthophotos were used to assist visualization of the project area. The 2012 orthophotos were obtained from TNRIS. These images were used to help determine the location of drainage features and to assess potential project alternative locations.

SOILS DATABASE

Soil composition was taken from the Soil Survey Geographic (SSURGO) database for Hidalgo County, Texas. This data set is generally the most detailed level of soil geographic data developed by the National Cooperative Soil Survey. This database was completed in 2003 and was used to determine the hydrologic properties required for the development of runoff curve number for the project watersheds.

LANDUSE DATA

A GIS dataset reflecting Existing land use types was obtained from Hidalgo County. The land use dataset reflected development conditions as of 2014. This was the most recent year for which data was available. Due to the established nature of the neighborhoods in the project area, it is not anticipated that land use changed substantially between the compilation of the land use dataset and this project. This GIS dataset, was used to compute percentage impervious cover for study watersheds.

RAINFALL DATA

The rainfall totals developed for the City of Weslaco is based on the USGS report "Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas" (Scientific Investigations Report 2004-5041). Rainfall totals for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year events for durations of 15 minutes, 30 minutes; 1, 2, 3, 6, 12 and 24 hours; durations were read from the atlas maps provided in the USGS report.

The representative values were determined based on an interpretation of the

average rainfall total across City of Weslaco. These values were tabulated and then graphed for each recurrence interval event in the City of Weslaco. The resultant graphs provided an initial estimate of the IDF curves.

The initial IDF curve values were evaluated and revised as necessary in order to provide smooth curves for use in hydrologic modeling. The representative values determined from the atlas maps were adjusted as appropriate in order to smooth the curves. The 5-minute rainfall values called for in the Frequency Distribution hyetograph method are not available in the USGS report (15-minute is the smallest reported duration). The 5-minute values were developed under the assumption that the 5-minute rainfall total would be approximately 37% of the 30-minute total. This approach is based on the guidance provided in Table 3 in TP-40. The rainfall values are shown in Table 2.0.

Table 2.0 USGS Rainfall values for City of Weslaco, TX

Minutes	Rainfall Event					
	2-yr	5-yr	10-yr	50-yr	100-yr	500-yr
5	0.56	0.70	0.81	1.07	1.18	1.48
15	1.00	1.35	1.50	2.00	2.20	2.80
30	1.50	1.90	2.20	2.90	3.20	4.00
60	1.85	2.45	2.90	4.00	4.50	6.00
120	2.20	3.00	3.60	5.10	5.80	8.00
180	2.35	3.20	3.80	5.40	6.25	8.50
360	2.60	3.60	4.40	6.50	7.50	10.00
720	2.90	4.10	5.00	7.25	8.50	12.00
1440	3.30	4.50	5.50	8.00	9.50	13.00

WATERSHED DELINEATIONS

The watershed boundaries for the Existing Conditions were delineated with the 1-foot contours generated from the 2011 DEM data that was obtained from TNRIS and from site observations. The 1996 study contained locations of storm drains. This information was also used to delineate watershed boundaries in the urbanized areas of City of Weslaco. The watersheds were broken to have a target drainage area of 1.0 square-mile. Exhibit 3, in Appendix A illustrates the sub-watersheds as modeled.

TIME OF CONCENTRATION

Times of concentration was determined for each sub-watershed using methodologies outlined in the TR-55 manual. For larger watersheds, several plausible paths for runoff to travel through the sub-watersheds were delineated. These paths were broken up by the type of flow expected, which consisted of overland, shallow concentrated, or open channel flows. The overland flow was limited to 300 feet. The shallow concentrated flow was further broken into "Paved" vs "Unpaved". Using TR-55 to compute velocities through a "Paved" section of shallow concentrated flow produced extremely low velocities because of the nearly flat slopes that exist in the watershed. Therefore, a curb and gutter section was used in combination with Manning's equation to come up with

velocities within the “Paved” section of shallow concentrated flow. The velocities obtained using this methodology seems more reasonable. The velocity in the channel flow was initially assumed to be 4 feet per second. This assumptions were verified with hydraulic models that were developed for the study. The hydraulic models indicated velocities in the range of 3 feet per second in the channel reach. Therefore, channel velocities were adjusted from 4 feet per second to 3 feet per second. The attributes of the flow types were applied, and the travel time for each segment was calculated appropriately. Then the segment travel times for each path were summed, and the path with the longest travel time was chosen for each sub-watershed. The travel time of the selected sub-watershed was then assigned as the time of concentration. Smaller sub-watersheds had fewer paths to select from, and small, long, narrow sub-watersheds had only one potential path delineated.

CURVE NUMBERS

The NRCS Curve Number (CN) loss model was used to simulate surface storage and infiltration losses for hydrologic model. Hydrologic soil group (HSG) delineations were determined from the SSURGO 2003 database for Hidalgo County. Curve Numbers were computed in GIS using 1) hydrologic soil group, 2) type of land use and 3) antecedent moisture condition II. A good hydrologic condition was assumed for curve number computations. A straight row treatment was applied for agricultural areas because of the type of cultivation that was seen in these areas during site visits.

The watershed is comprised primarily of Hidalgo sandy clay loam content soils, which correspond to B soil group. The other type of soils that exist in the watersheds are Raymondville clay loam soils which correspond to C soil group. . Exhibit 4, in Appendix A illustrates the soil conditions of the watershed.

PERCENTAGE IMPERVIOUS COVER

Composite Impervious cover for the sub-basins was computed using GIS. The percentage impervious cover values were assigned to different land use categories as shown in Table 3. Exhibit 5, in Appendix A shows the land use designations for the watershed.

Table 3. Percentage Impervious Cover by Land Use		
Land use Category	Zoning District	Percentage Impervious Cover
1/8 Acre Residential Lots or Garden or Town Homes	R-4, R-5, RM-4, RM-5	65-85%
	TND/TOD use patterns	
1/4 Acre Residential Lots or Garden or Town Homes	R-6, RM-6	38%

1/3 Acre Residential Lots or Garden or Town Homes	R-15	30%
1/2 Acre Residential Lots or Garden or Town Homes	R-20	25%
1 Acre Residential Lots or Garden or Town Homes	RP, RE	20%
Industrial	L,I-1,I-2	72-85%
Business or Commercial	NC, O, C	85-95%
Densely developed apartments	MF	65-85%
Streets, Roads and Parking Areas		98%

CHANNEL ROUTING

The Muskingum-Cunge method of channel routing was used to route flows for various hydrographs, using 1-foot contours that were developed from the DEMs. The routing reach lengths were digitally measured in GIS. The summary of routing parameters used in the hydrologic model is presented in Table 5.

UNIT HYDROGRAPH

The existing hydrologic models of the study watersheds, were modeled using SCS unit hydrograph technique. The precipitation-runoff process for the entire watershed was modeled using US Army Corps of Engineers watershed program model, HEC-HMS. The Federal Emergency Management Agency (FEMA) accepts the HEC-HMS program for detailed analysis, and version 4.0 was used for this study.

Table 5. Routing Reach Parameters							
Routing Reach	Computational Time Step	Reach Length (feet)	Channel Slope (feet / feet)	Manning's Roughness Coefficient	Shape	Bottom Width (feet)	Side Slope (H:V)
R_Drain18B-2	5	14069	0.00087	0.055	Trapezoid	6	1.5
R_Drain17B2-2	5	6941	0.0004	0.045	Trapezoid	18	1
R_Drain 35-2	5	13418	0.00054	0.045	Trapezoid	16	0.5
R_17B2A1A-3	5	6890	0.00047	0.055	Trapezoid	15	1
R_Drain A	5	7736	0.00041	0.055	Trapezoid	5	1.5
R_Drain 37-2	5	8270	0.0004	0.05	Trapezoid	6	1.6
R_Drain 37-3	5	5484.2	0.0004	0.05	Trapezoid	13	1.5
R_Drain 37-4	5	4988	0.0001	0.05	Trapezoid	22	1
R_Drain 18B3-2	5	5515	0.001	0.045	Trapezoid	14	0.5
R_Drain 18B3-3	5	7439	0.0004	0.045	Trapezoid	20	1
R_Drain 18B4-3	5	5097	0.001	0.075	Trapezoid	13	1
R_Drain 18B3-4	5	3870	0.0008	0.065	Trapezoid	22	0.5

Hydrologic & Hydraulic Analysis



HYDROLOGIC ANALYSIS

For the purpose of this drainage study, 10-year rainfall event was simulated for Existing Conditions of the watershed. The results of the hydrologic analysis are displayed in Appendix B.

HYDRAULIC ANALYSIS

Enhanced Approximate Study

The hydraulic analysis of study streams was done using “Enhanced Approximate” methods as defined by Federal Emergency Management Agency (FEMA). Generating cross sections from topographic data and using approximate survey measurements for hydraulic structures constitutes an “Enhanced Approximate Study or Limited Detail Study” hydraulic analysis. The hydraulic structures in this type of study are surveyed using approximate survey methods. Appendix D contains all the approximate survey data. No ground survey is performed for obtaining stream cross-section data. The work maps containing stream cross sections are located in the Appendix A of this report.

Program Version

The Environmental Systems Research Institute (ESRI) ArcMap, Version 10.2, along with the HEC-GeoRAS Version 10.1 were used for the integration of geospatial data into the United States Army Corps of Engineers’ (USACE) Hydrologic Engineering Center River Analysis System (HEC-RAS), Version 4.1. HEC-RAS, accepted by FEMA for hydraulic analysis, performs one-dimensional hydraulic calculations to model the water surface elevations. HEC-GeoRAS along with the 3D Analyst and Spatial Analyst extensions was used to create the stream centerline and cross sections that were imported into HEC-RAS.

Cross Section Locations

The locations for cross sections were identified to capture the critical hydraulic features within a study reach. The spacing of cross sections was reduced as necessary to model significant hydraulic features. The location of the tributaries contributing to the study streams was also considered for choosing appropriate cross section locations. The guidelines outlined in the HEC-RAS technical manual were followed for locating cross sections for modeling bridges, culverts and road crossings. Cross Sections for the hydraulic model were from the DEMs using GIS-based tools, GeoRAS and Spatial Analyst. The guidelines outlined in the GeoRAS manual were followed for generating cross section data for import into HEC-RAS. Once generated, the cross sections obtained from GIS contained more points than required to represent the cross section. Therefore, the “Cross Section Points Filter” tool, available in HEC-RAS, was used to remove unnecessary points in the cross section.

Manning’s Roughness Coefficients

Manning’s roughness coefficients were determined from field visits and aerial photographs. The energy loss coefficients at cross sections, bridges and culverts were chosen as recommended in the HEC-RAS manual.

Flow Change Locations

Flow change locations in HEC-RAS were entered at one-half the channel

length upstream from the actual discharge computation point. Normal depth corresponding to the channel slope was used as the boundary condition for the hydraulic model.

Structure/Road Crossing Modeling

All existing bridges and culverts in the studied reaches were modeled in HEC-RAS in order to determine their effect on water surface profiles and the resulting floodplain. The culvert dimensions were obtained from field survey measurements. The Federal Highway Administration (FHWA) chart and scale numbers were appropriately chosen based on the observed culvert entrance designs from field visits. The upstream invert elevations and the hydraulic widths were obtained from the project DEMs. Bridges were also modeled using the information obtained from approximate surveys. The approximate bridge survey included obtaining pier shapes and dimensions, upstream invert elevations, deck thickness, channel top and bottom widths, distance between the toes of the abutments and the hydraulic widths. The road profile data for modeling hydraulic structures was also obtained from DEMs.

The effective flow areas were identified around the bridges and culverts by defining the limits of ineffective flow per the HEC-RAS modeling standards. Ineffective flow areas were delineated in HEC-RAS to identify areas of a cross section in which the flow of water is not effectively conveyed.

HYDRAULIC RESULTS

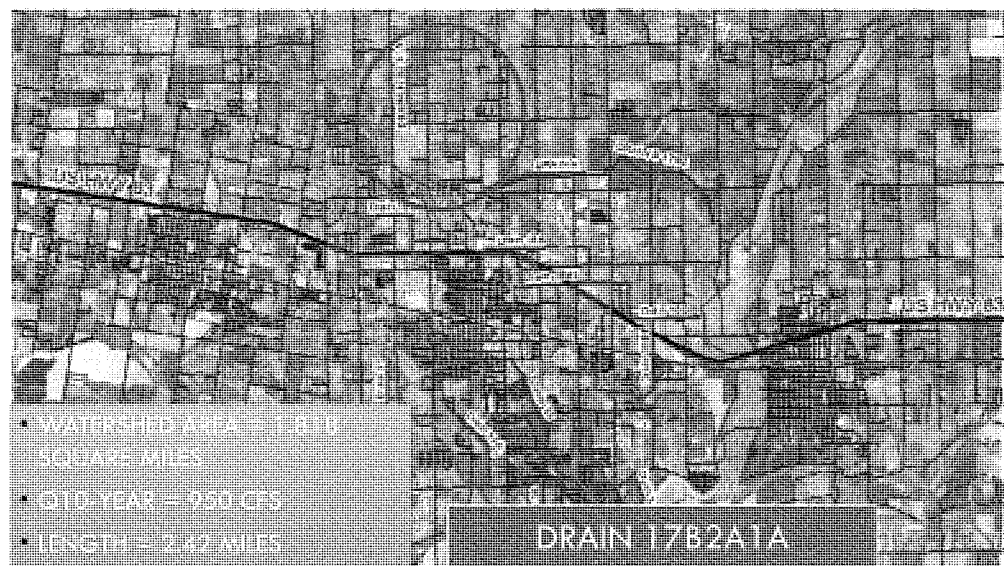
Drain 17B2 A1A

The Hydraulic results are included in Appendix C and the following section is a write-up of Existing and Proposed conditions hydraulics for all the study streams.

Existing

The Existing conditions hydraulic analysis indicates that the 10-year flow is not contained within the channel banks for most of its length, except for the very upstream reach, upstream of crossing Mile 5 ½. The hydraulic model indicates that all the three crossings are overtopped during a 10-year flood.

Figure 4.1



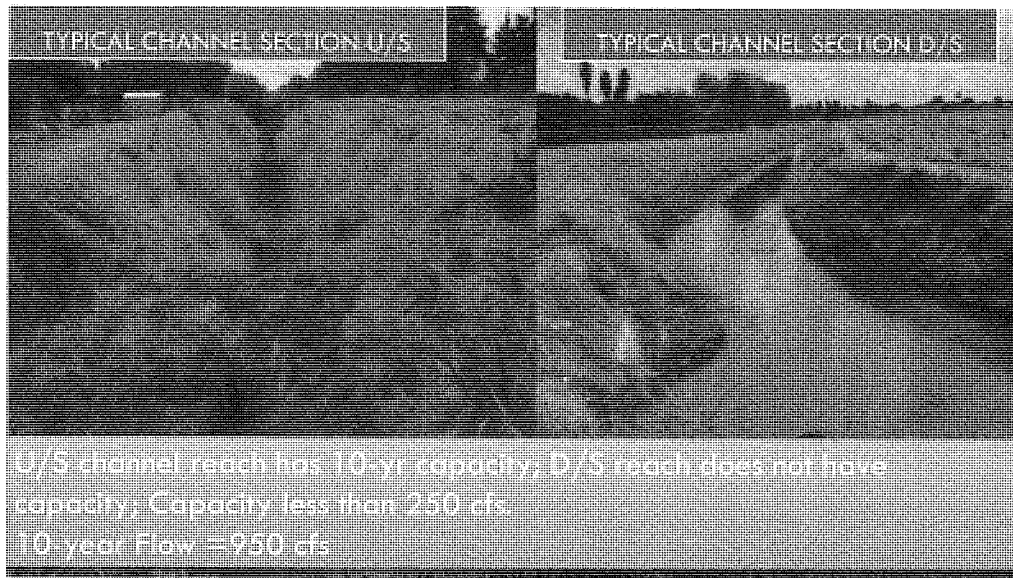


Figure 4.2

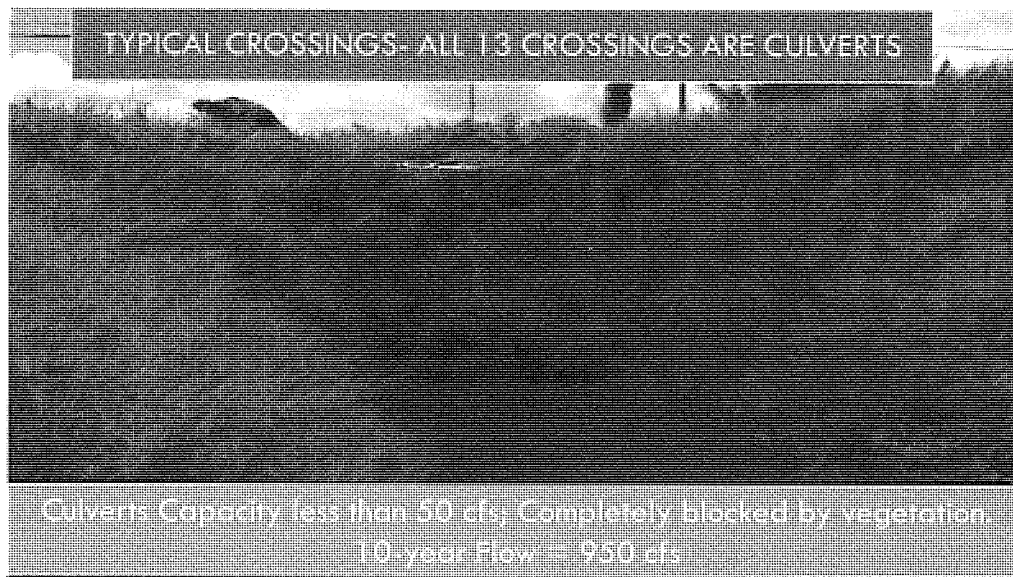


Figure 4.3

Proposed

The proposed solutions for Drain 17B2A1A include regional detention in sub-basin "17B2A1A-1" and sub-basin "17B2 A1A-2". It is recommended to capture almost all of the runoff volume generated from sub-basin "17B2 A1A-2" within the 36-acre footprint area identified for regional detention. This sub-basin produces a peak discharge of 757 cfs, and a runoff volume of 158 acre-feet for the 10-year

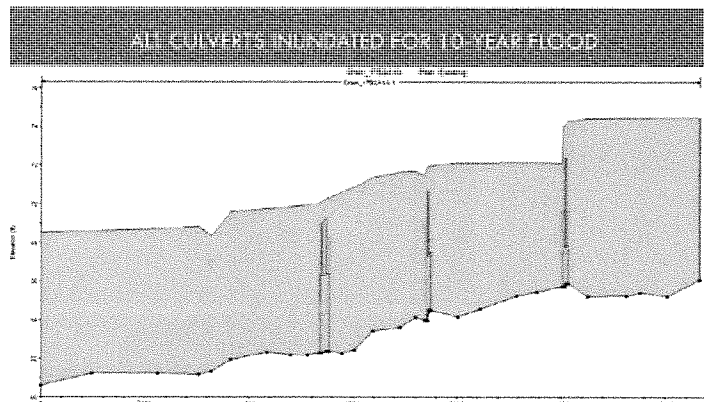


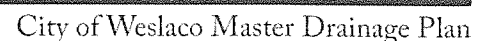
Figure 4.4

Figure 4.5



It was observed during site visits that Drain A was poorly maintained, characterized by growth of vegetation and trees in the channel. The 10-year flows overtop the channel banks and also the crossings.

Figure 4.6



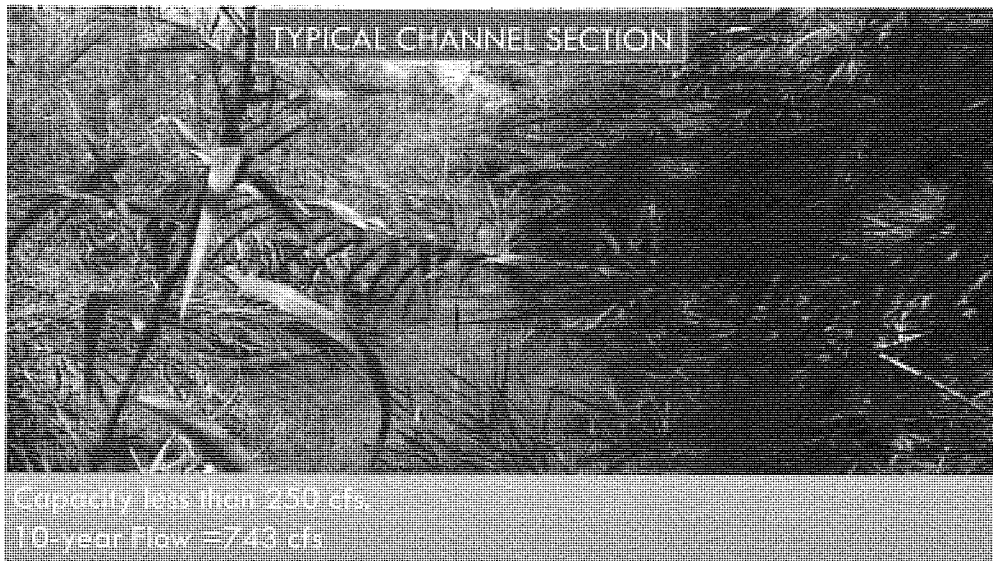


Figure 4.7

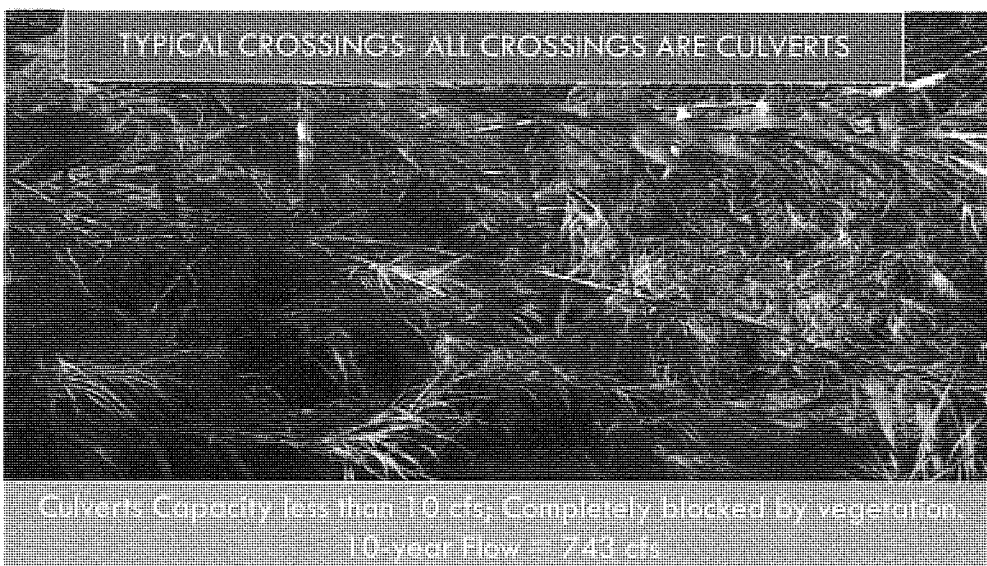


Figure 4.8

Proposed

The proposed solutions include regular maintenance of the channel that would reflect a Manning's roughness coefficient of 0.035. Since Drain 17B2A1A feeds into Drain A, solutions proposed for Drain 17B2 A1A would also help reduce flooding on Drain A. Also, it is recommended that the structures at Mile 4 ½ and Mile 4 be replaced to a single 10' x 6' box culverts to carry the 10-year flow and also to reduce the backwater caused by smaller sized structures that exist at these crossings. In spite of these proposed improvements, the hydraulic model shows that the 10-year flow still overtops the left channel banks for about 1000-feet upstream of crossing at

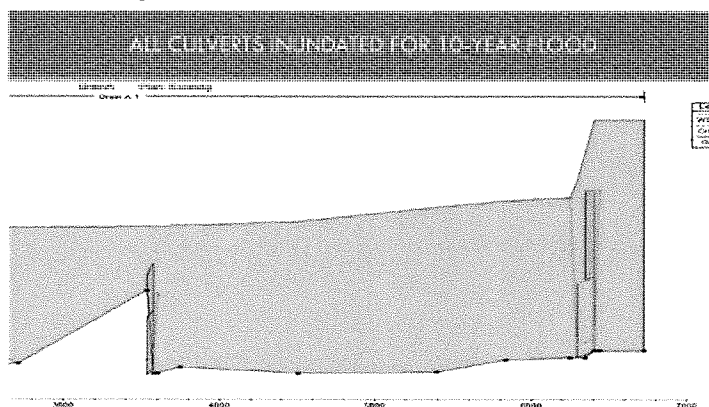
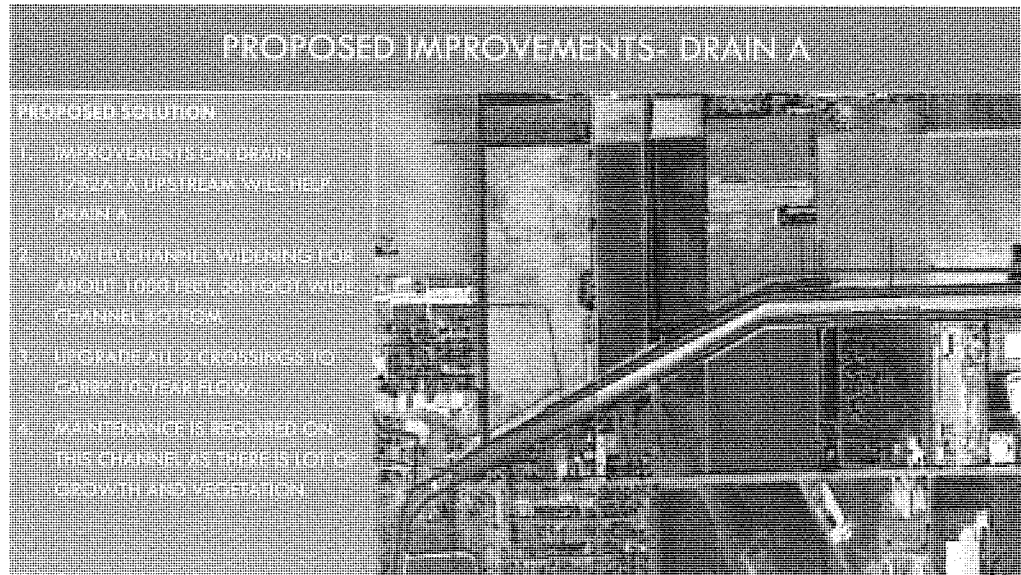


Figure 4.9

Mile 4. Therefore, it is proposed that the channel be widened to a 50-foot bottom width, 3:1 side slopes, for this 1000-foot stretch to contain the 10-year flows.

Figure 4.10

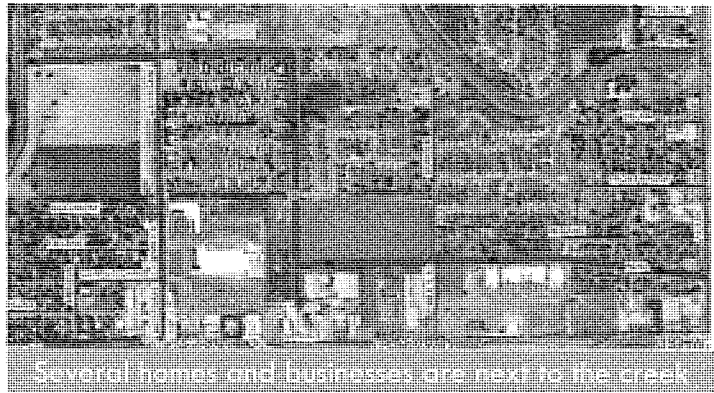


Drain 18B

Existing

The results from the HEC-RAS model for Drain 18B for the 10-year storm indicates that this drain is significantly undersized. Although, a hydraulic analysis for this drain was performed using a 1-dimensional steady state HEC-RAS software, it is highly recommended that this drain be studied in detail using a 2-dimensional modeling software, because of interaction between overland flow and storm sewer flow. This drain goes underground for more than a mile between Border Avenue and Paso Del Norte (Crossing downstream of Bridge Avenue). Within this stretch of the drain, there are several inlets that feed to this drain and site visits during a rain event indicate significant street flooding. The long underground culvert has dimensions of 7' x 3' on the upstream end at Border Avenue and where it outfalls at Paso Del Norte, the culvert dimensions are 7.5' x 7.5'. Therefore, for modeling purposes in HEC-RAS, a conservative approach was taken and it was assumed that the culvert had dimensions of 7' x 3' for its entire length. The 1996 study indicates that this drain makes a sharp right turn after flowing through the airport property and merges into Drain 18B3. However, field visits in September 2014 indicate that this drain makes a sharp left turn and flows north and merges with Drain B 17B2.

Figure 4.11



The Existing condition analysis indicates that the channel does not have enough capacity and all the structures on this drain are inundated during a 10-year flood.

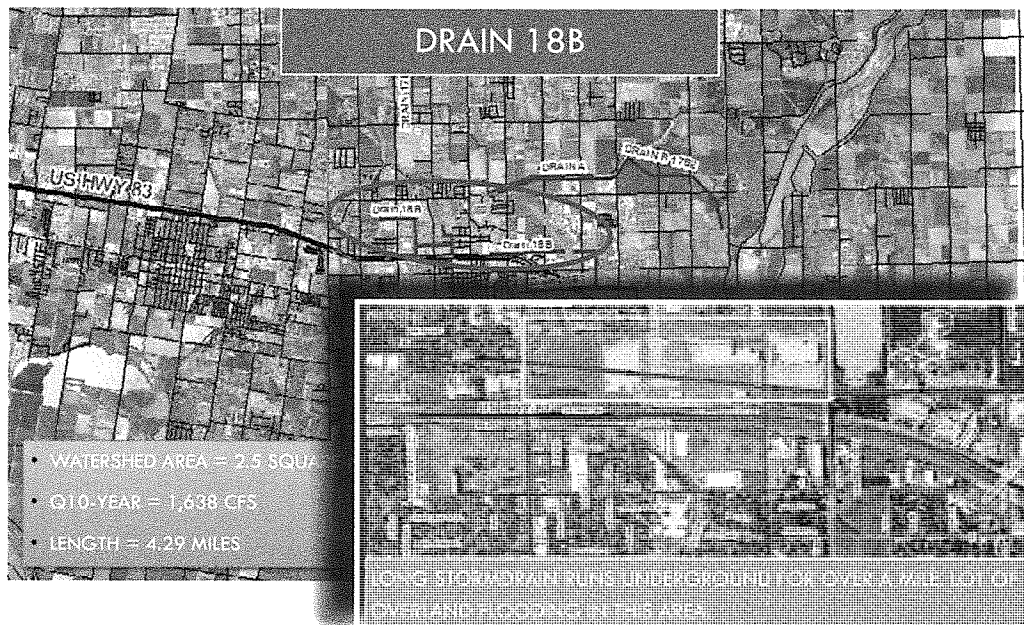


Figure 4.12



Figure 4.13

Figure 4.14

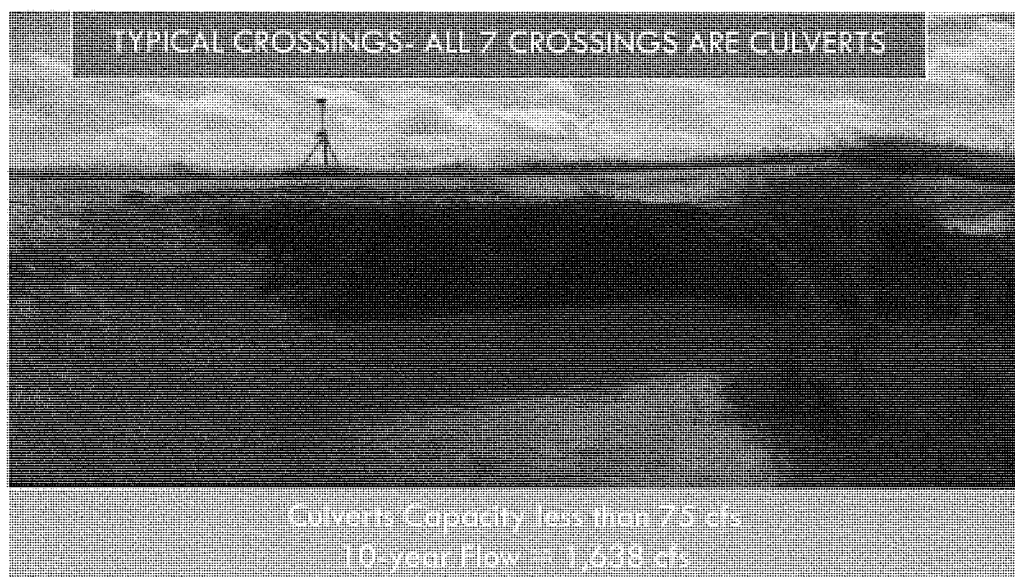
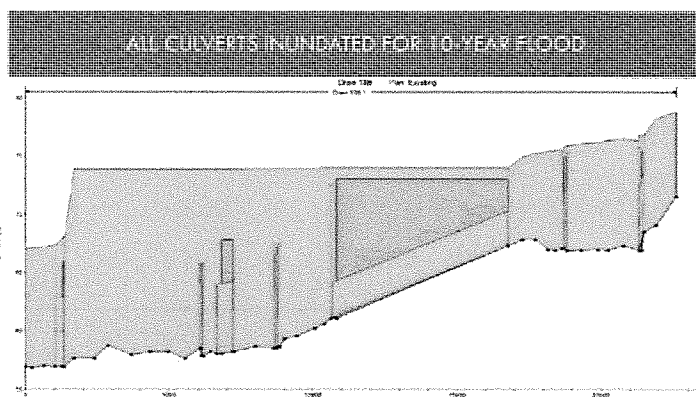


Figure 4.15

Proposed

The proposed solutions include widening the channel to a 100-foot bottom width, grass lined trapezoidal channel, with 3:1 side slopes from its confluence with Drain B 17B2 to approximately Airport Drive. From Airport Drive to its head waters,



a 50-foot bottom width with 3:1 side slopes is proposed. All structures for drain 18B need to be replaced to handle 10-year flows. Normal depth analysis indicates that a single 10' x 10' box culvert at a slope of 0.0003 ft/ft carries about 350 cfs. In order to handle 10-year flows of 1634 cfs, five box culverts would be required. The proposed improvements would result in increases peak discharges downstream from 1634 to 1934 cfs. In order to offset these adverse impacts, hydrograph peak shaving analysis was done to capture flows over 1634 cfs and it was determined that a storage of 15 acre-feet would offset increases in peak discharges.

In order to offset increases in peak discharge, three sites were identified for detention along Drain 18B. Two sites lie west of Mile 5 ½ Road and the third site was identified just west of International Boulevard. These three site together provide foot print area of 105 acres for detention. This is significantly lot more area than what would be required to offset increases in peak discharges downstream. Any additional detention that can be obtained in these areas will reduce the size of proposed improvements on Drain 18B and would also help in capturing storms larger than a 10-year storm. It should also be noted that Drain 18B discharges into

Drain B 17B2. Any additional detention that can be obtained in these detention ponds can also significantly reduce the size of proposed improvements on Drain B 17B.

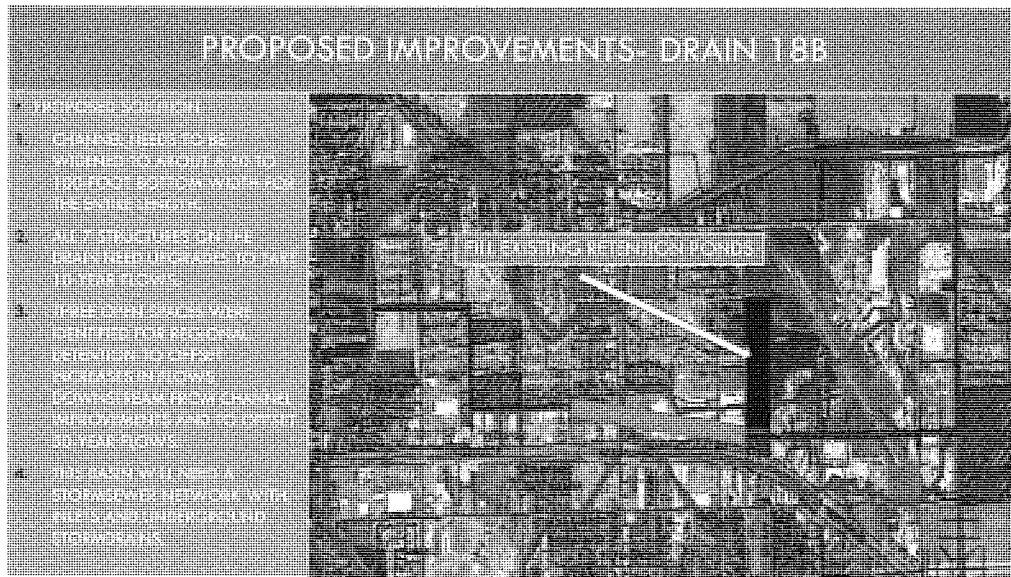


Figure 4.16

Drain B 17B2

Existing

The results from the HEC-RAS model for Drain B 17B2 for the 10-year storm indicates that this drain is significantly undersized. The 10-year flow spills the channel banks and also all the structures on this drain are overtopped.

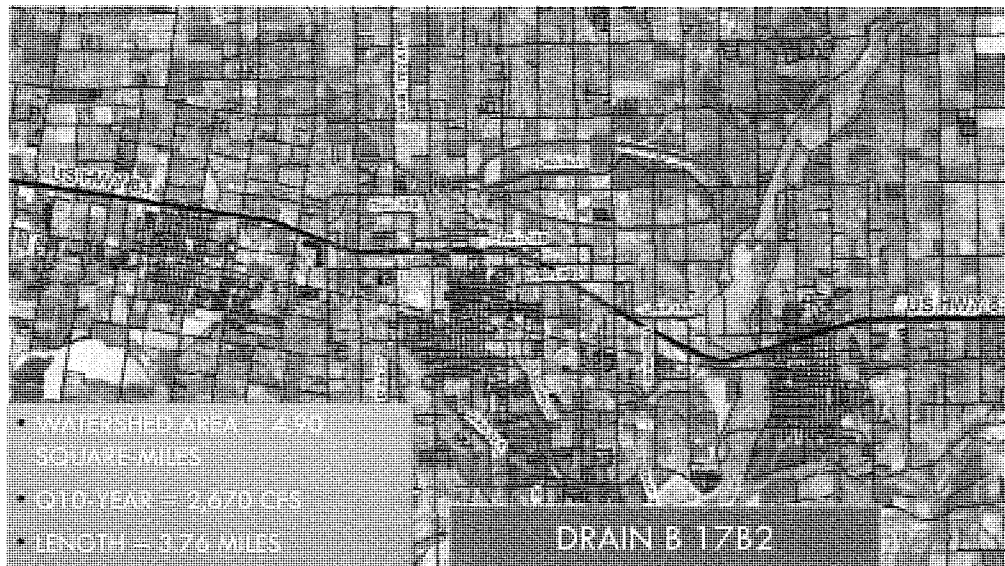


Figure 4.17

Figure 4.18



Figure 4.19

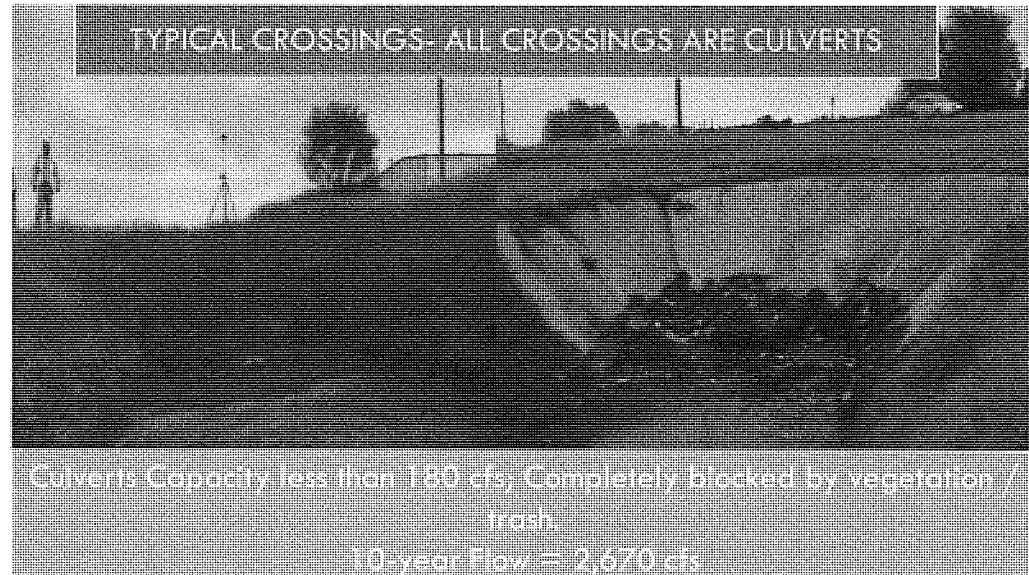
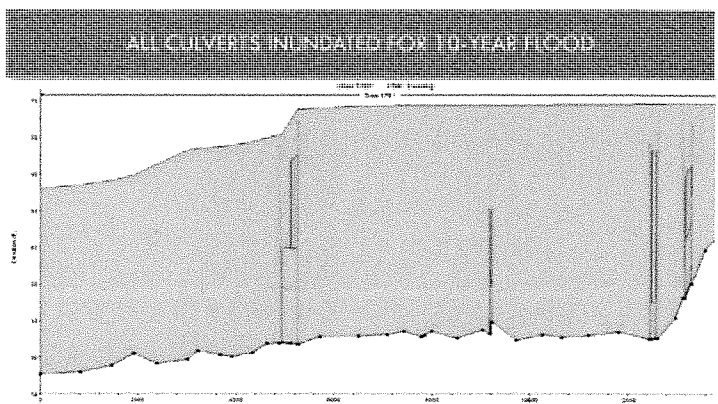


Figure 4.20

Proposed

At the confluence of Drain 18B and Drain B 17B2, it should be noted that a flow of 1638 cfs from Drain 18B combines with a flow of 873 cfs from Drain B 17B2 to produce a flow of 2,390 cfs. The detention site identified next to Drain 18B, just west of International Boulevard should be utilized to its maximum capacity in order



to reduce flows on Drain B 17B2. If this 75-acre detention pond were to be 6 foot deep, it can provide a storage of 450 acre feet. This large amount of regional detention would result in reducing the peak discharge from 1638 cfs to about 150 cfs. If this much amount of detention can be attained, normal depth analysis indicates a proposed grass lined trapezoidal channel with a bottom width of 50 feet and 3:1 side slopes would be sufficient to convey 10-year flows on Drain B 17B2. If this detention cannot be achieved, the proposed channel improvements that would be needed for Drain B 17B2 below its confluence with Drain 18B would be a 100-foot bottom width, grass lined trapezoidal channel with 3:1 side slopes. The channel upstream of the confluence with Drain 18B would need to be a 50-foot channel bottom with 3:1 side slopes irrespective of the storage that could be attained on Drain 18B. It is also proposed that all crossings on Drain B 17B2 need to be replaced. Normal depth analysis indicates that 4 boxes with dimensions 10' x 8' are needed to convey a flow of 873 cfs on Drain B 17B2 upstream of the confluence with Drain 18B. If maximum detention as planned on Drain 18B could be attained, then on Drain B 17B2 downstream of the confluence with Drain 18B would require five 10' x 8' box culverts at all crossings. If this planned detention cannot be fully attained, it would be economical to replace crossings on Drain B 17B2 downstream of the confluence with Drain 18B with bridges.



Figure 4.21

Drain 18B4

Existing

The results from the HEC-RAS model for Drain 18B4 for the 10-year storm indicates that this drain is significantly undersized. The 10-year flow spills the channel banks and also all the structures on this drain are overtopped. A hydraulic model without any structures reduces the 10-year water surface elevation in the range of 2.5 – 5.0 feet, indicating that the structures are significantly undersized. The undersized structures cause significant backwater in the channel. The hydraulic model also indicates that in spite of eliminating the backwater from the structures, the 10-year flow would still not be contained in the channel banks.

Figure 4.22

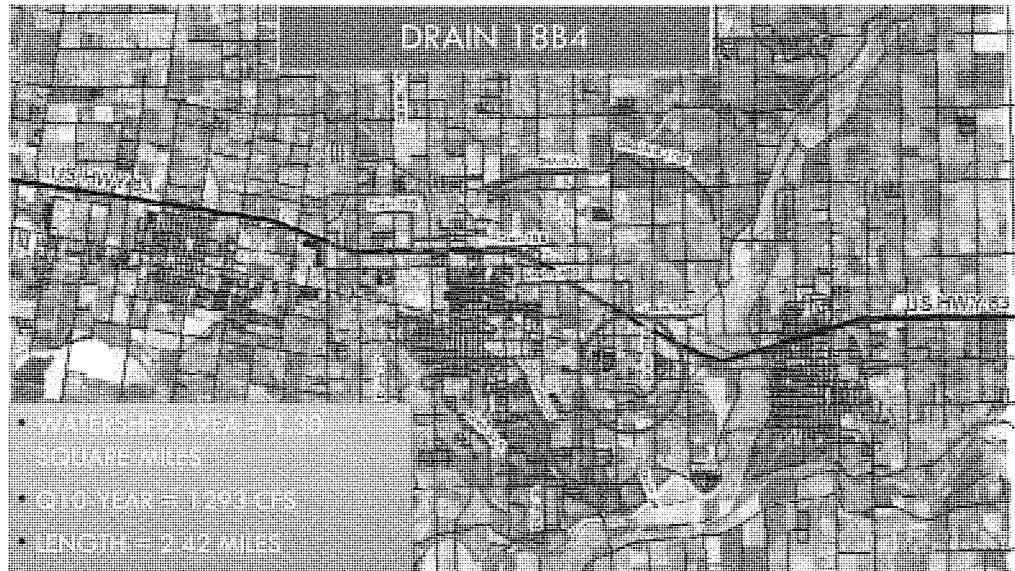


Figure 4.23

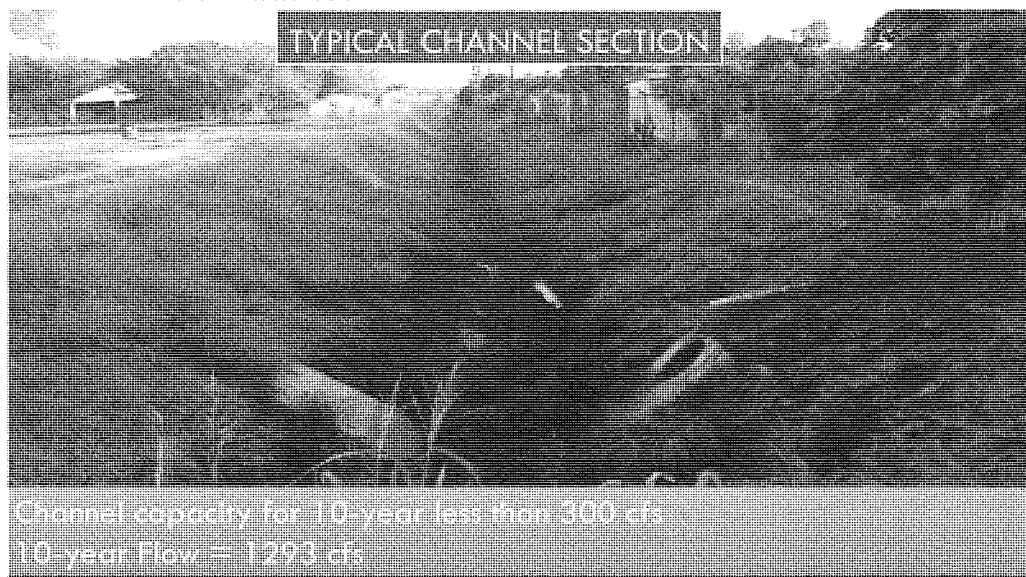
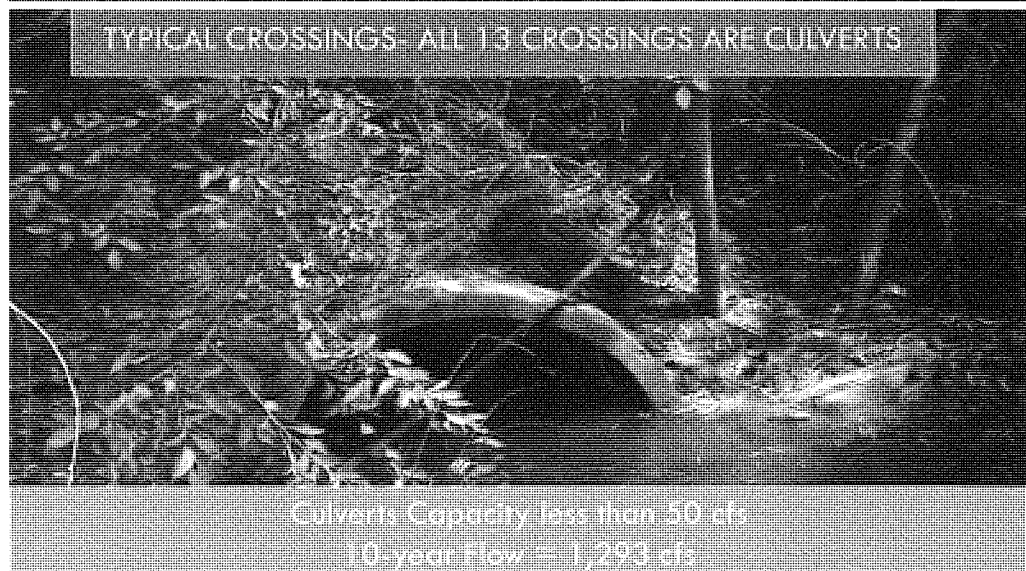


Figure 4.24



Proposed

It is proposed that all structures on Drain 18B4 be replaced to eliminate the back water and also the channel needs to be widened to a 25-foot bottom width with 3:1 side slopes to contain the 10-year flows. The proposed grass lined trapezoidal channel would be about

6 – 8 feet depth. Normal depth analysis indicates that the all crossings including State Highway 374 and downstream need four 8' x 7' box culverts. For all crossing upstream of State Highway 374, the proposed improvements at crossings would include three 8' x 5' box culverts.

The proposed improvements would increase the peak discharges at the outfall of Drain 18B4 from 1,294 cfs to 1,374 cfs. In order to mitigate increases in peak discharges downstream, peak flow shaving analysis of the hydrograph was done and it was determined that a storage of about 2 acre-feet would be required. A vacant land east of Mile 3 Road was identified for regional detention. The footprint area of this proposed detention pond is approximately 42 acres. This site could be planned for detention of storm events larger than a 10-year storm.

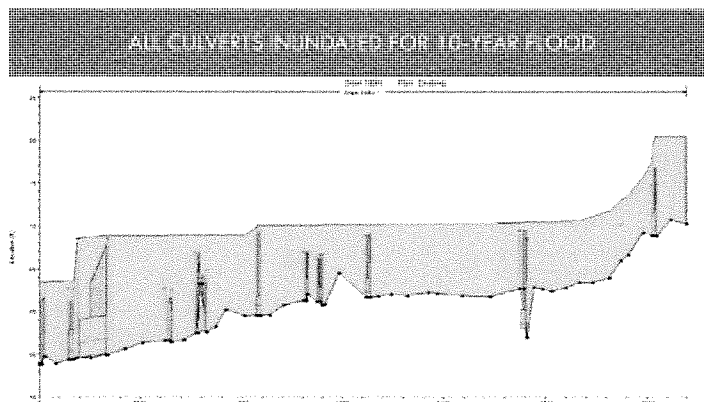


Figure 4.25



Figure 4.26

Drain 18B3

Existing

The results from the HEC-RAS model for Drain 18B3 for the 10-year storm indicates that this drain has enough capacity for the 10-year storm in the reach upstream of Mile 3 Road, if backwater from the structures is eliminated.

Figure 4.27

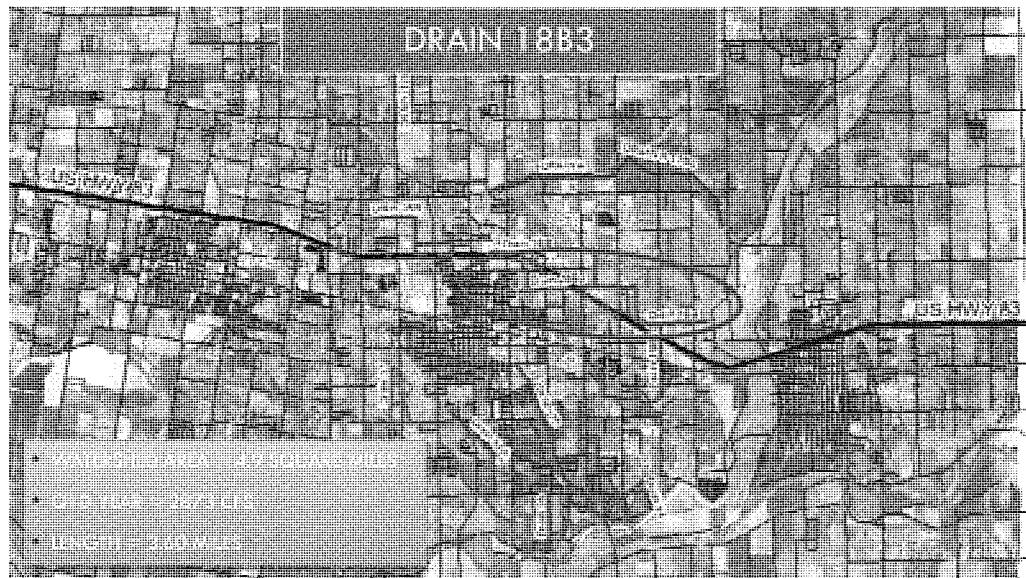


Figure 4.28

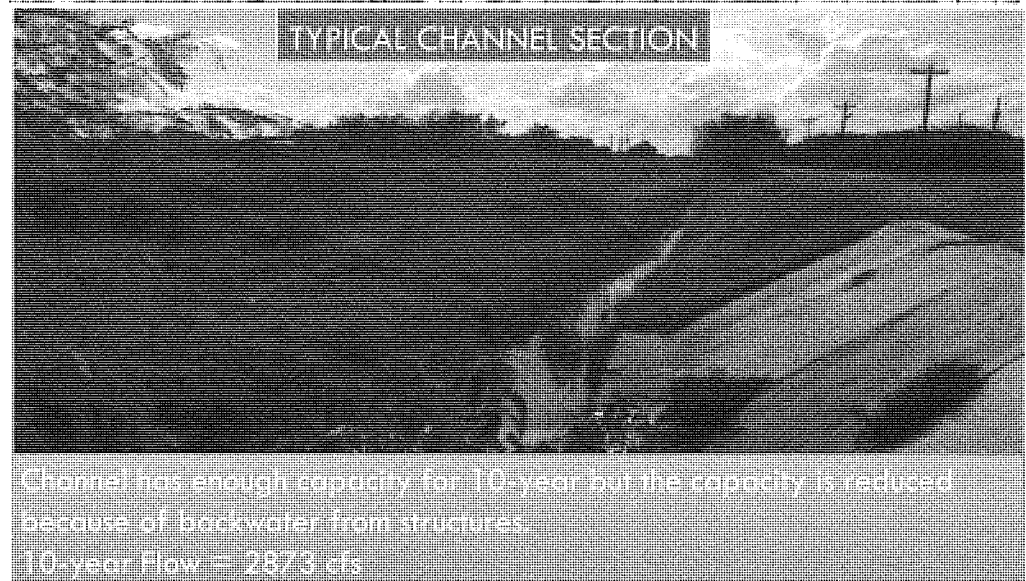
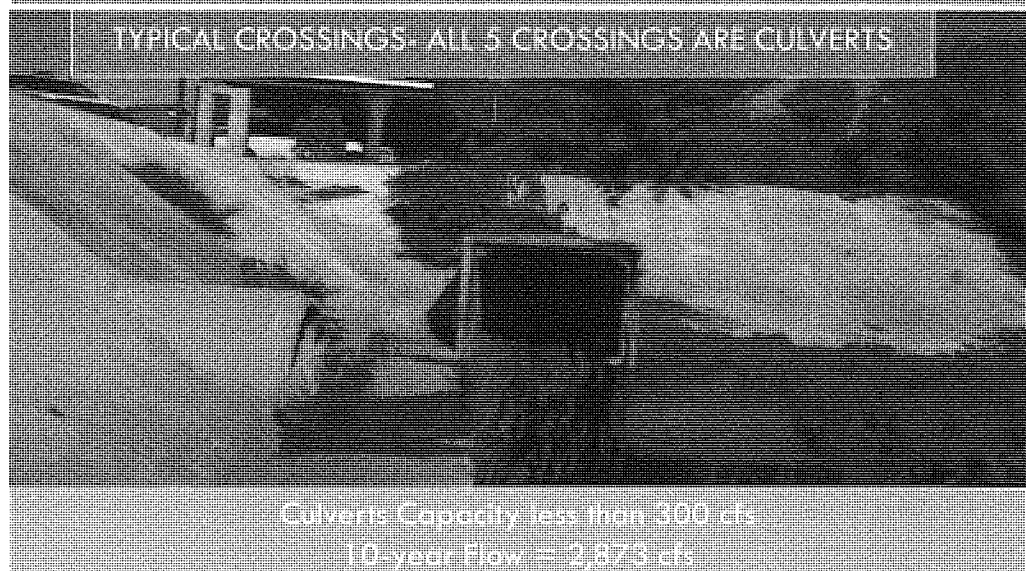


Figure 4.29



Proposed

It is recommended to upgrade all the crossings to accommodate the 10-year flows. Normal depth analysis indicates that a single 10' x 8' box carries about 500 cfs at a slope of 0.001 ft/ft. At Airport Drive two 10' x 8' box culverts are proposed.

At US Highway 83

and International Boulevard, four 10' x 7' box culverts are proposed at the slope of 0.001 ft/ft to carry 10-year flow of 1679 cfs. At Mile 2 ½ crossing four 10' x 8' box culverts are proposed. It should be noted that Drain 18B4 flows into Drain 18B3. At the confluence of these two drains, a flow of about 3,029 cfs exists in the channel. The channel downstream can handle only about 1,400 cfs. Therefore, regional detention is recommended on Drain 18B3 to capture almost all of the 10-year year flow, before it conflues with Drain 18B4. The most feasible location identified for regional detention sits at the northwest corner of Mile 8 and International Boulevard. This site is approximately 75 acres and a 10-foot deep offline detention pond can capture most of the 10-year runoff volume from Drain 18B3. In the event this site has limited storage capacity, a second site, 43 acres in area, was identified west to Airport Drive and south of Drain 18B3 for regional detention. Channel improvements are also proposed between cross sections 3949 and 6470. The proposed channel improvements between these sections consists of a grass lined trapezoidal channel with bottom width of 100-foot and 3:1 side slopes.

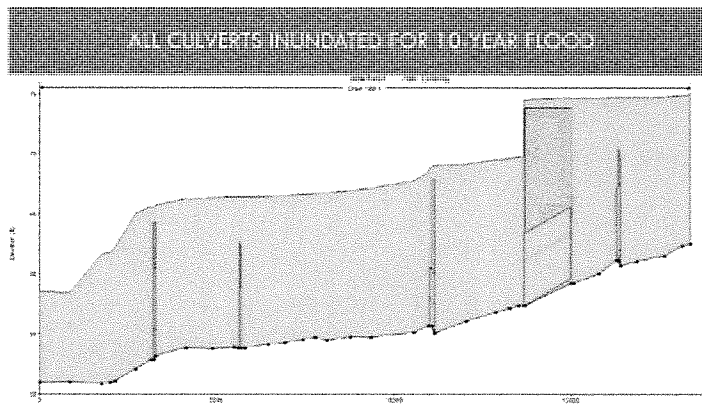


Figure 4.30

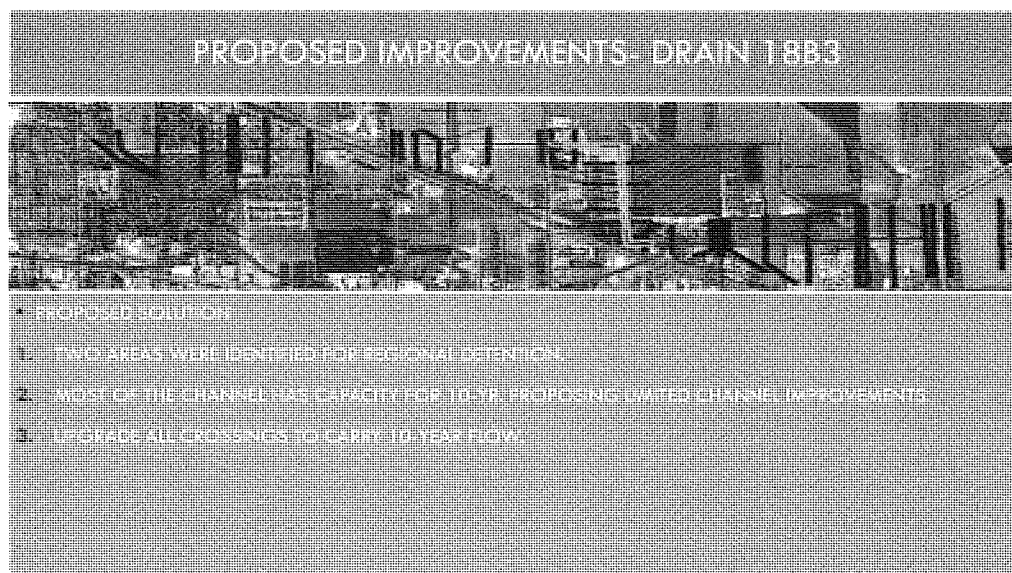


Figure 4.31

Drain 34

Existing

The profile of the existing channel is almost flat with a slope of 0.00002 ft / ft. The results from the HEC-RAS model for Drain 34 for the 10-year storm indicates that this drain is significantly undersized. The 10-year flow spills the channel banks and also all structures on this drain are overtopped. In order to evaluate if back water from structures was reducing the capacity of the channel, a separate hydraulic model was run without any structures and the resulting 10-year water surface elevations were compared against the 10-year water surface elevations of the hydraulic model that included structures. These two models produced nearly similar results indicating that the existing channel is undersized and cannot handle the 10-year flows.

Figure 4.32

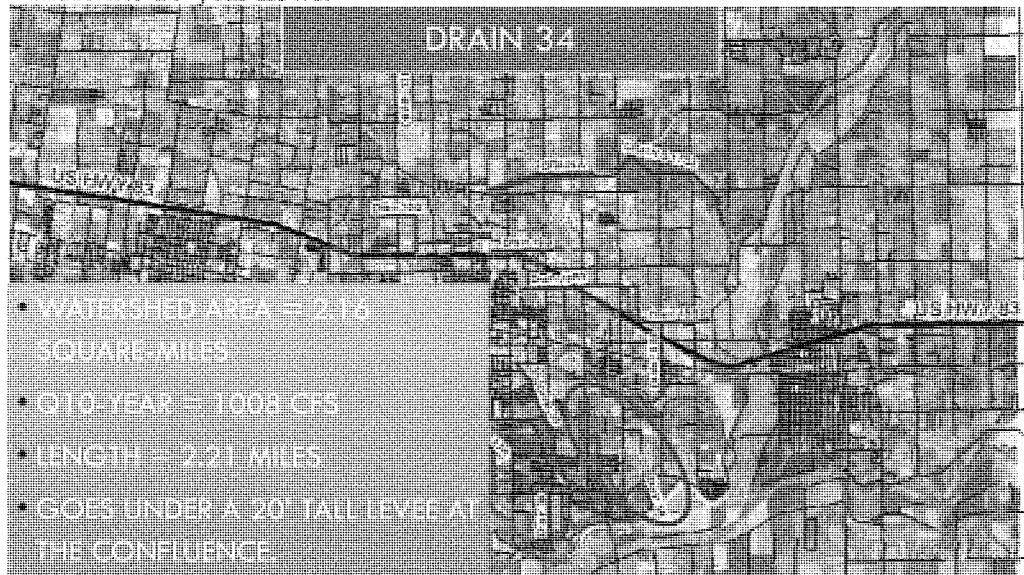


Figure 4.33





Figure 4.34

Proposed

Channel improvements are proposed for the entire reach. It is recommended to lower the channel bottom by about 3-feet on the average and design a channel with a slope of 0.0006 ft / ft, starting from its outfall and projecting this slope all the way till the most upstream cross section of the hydraulic model.

The proposed grass lined trapezoidal channel would vary in bottom width from 10 feet to 20 feet; and 3:1 side slopes in the lower reach below Mile 3 ½ road crossing, as this reach of Drain 34 would approximately be 10 – 15 feet deep with proposed improvements. In the reach above Mile 3 ½ crossing, as the proposed channel is only about 5-feet deep, a 60-foot bottom width with 3:1 side slopes would be required to convey 10-year flow. In spite of these proposed improvements, cross sections in the vicinity of 18th street and upstream still would not contain the flow within the channel banks. Therefore, regional detention is proposed on Drain 34 to capture as much as flows as possible to reduce the amount of channel improvements and to offset increases in discharges from proposed improvements. Two such areas were identified for detention. The first detention area of approximately 31 acres, lies in the head waters just west of Mile 3 ½ road and the second detention area, 11.20 acres, that was identified lies just downstream of Mile 3 ½ crossing on the right over bank. Using a combination of detention and channel improvements, the 10-year flows could be contained within the channel.

It is proposed that all crossing including and downstream of Mile 3 ½ be replaced with three 10' x 8' box culverts and the crossing upstream on 18th Street be replaced with four 10' x 4' box culverts.

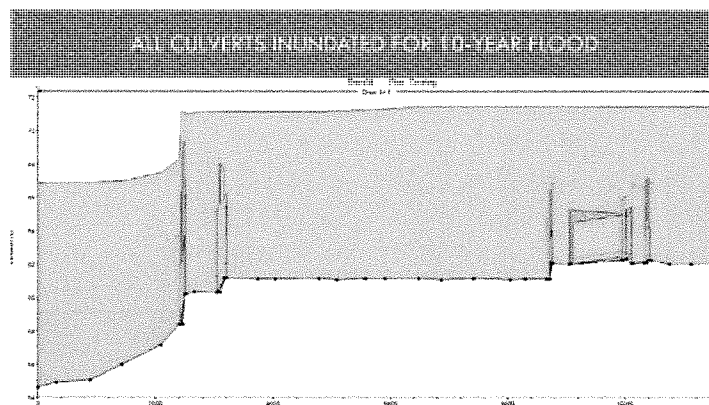
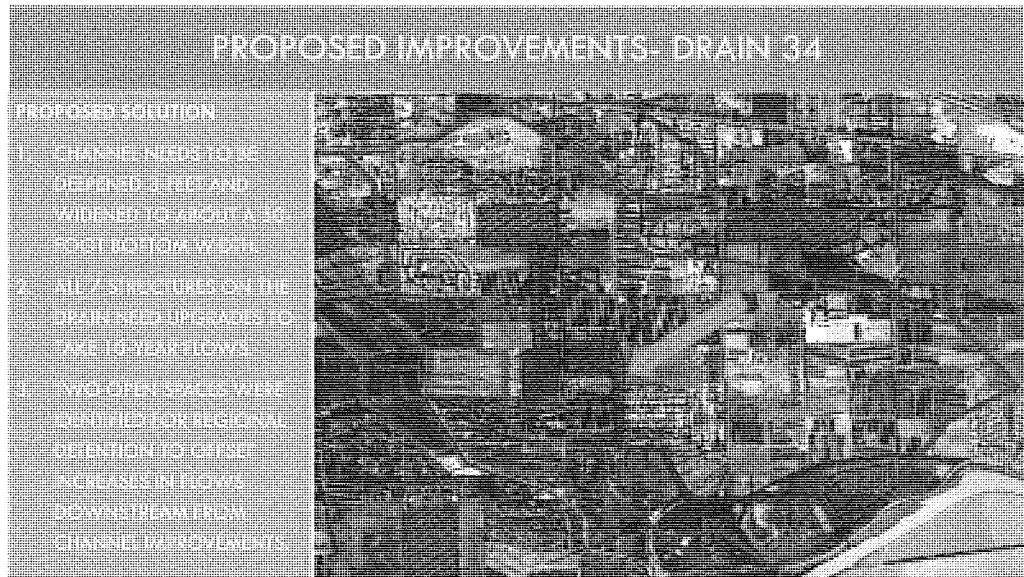


Figure 4.35

Figure 4.36



Drain 34A

Existing

Drain 34A drains into Drain 34. The only creek crossing is at International Boulevard, which is a low water crossing. The undersized structure and the zigzag nature of the creek at the crossing results in significant head losses, thereby inundating the structure. The channel has enough capacity for a 10-year storm.

Proposed

International Boulevard sags at the creek crossing. Based on alternatives looked at to improve the creek crossing, high water detection systems are proposed on this crossing. Improvements to alleviate the flooding at this crossing would have to include a long bridge of more than 1000 feet, which would be very costly and therefore not recommended in this study.

Drain 35A and Drain 35

Existing

Drain 35A flows from south to north and then goes underground through a 36-inch Reinforced Concrete Pipe (RCP) at Academy Drive for about 2000 feet, then outfalls into Drain 35 at 10th Street via a single 8' x 7' box culvert. The 1-meter resolution DEM data indicates that the slope between where Drain 35A goes underground and where it outfalls into Drain 35, is 0.0013 feet / feet. A normal depth analysis indicates that this 36-inch RCP would carry a flow of about 20 cfs. The 10-year flow of 834 cfs was computed for Drain 35A. This indicates that all the excess flow that cannot be handled by the 36-inch RCP will be overtopped at Academy Drive and floods the neighborhood between 8th and 10th street and east of Iowa Avenue. It was also noticed during site visits that there were City signs in this neighborhood that indicated frequent flooding. The HEC-RAS model for Drain 35A indicates spilling of 10-year flows outside the channel banks and inundation of existing crossing. This drain flows through a

cemetery and no homes seem to be affected from undersized channel and drain crossings.

Drain 35 is the only drain within the study streams that has bridge crossings. The existing conditions model for Drain 35 indicates that most of the channel on the downstream reach below 18th street has enough capacity to handle the 10-year flow. The crossing at 18th street appears to be a low water crossing with four 5-foot diameter RCPs. The other two remaining structures on this drain are bridge crossings. The results from the hydraulic model indicates that the bridge crossings handle the 10-year flows and the crossing at 18th street is inundated by about 2.65 feet of water during a 10-year storm. Also, the existing channel cannot handle 10-year flows between 10th Street and 18th Street. There are several home adjacent to the channel between 10th and 18th street that would be flooded during a 10-year storm.

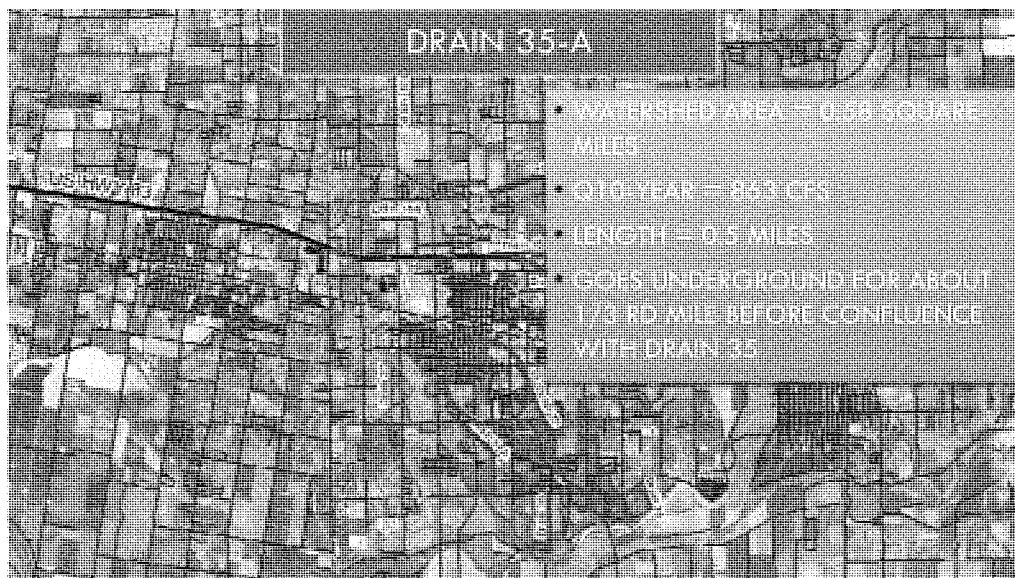


Figure 4.37

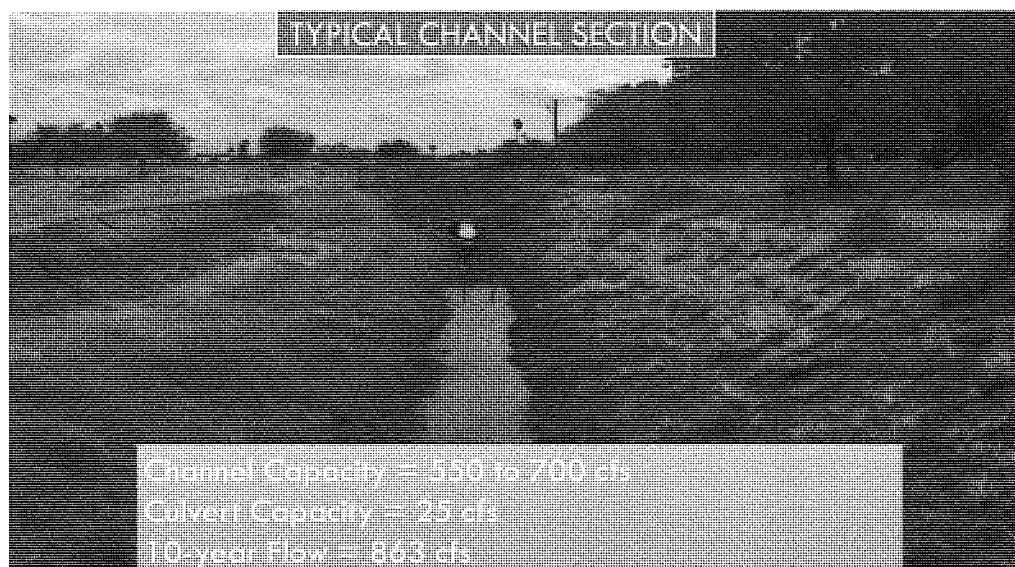


Figure 4.38

Figure 4.39



Figure 4.40

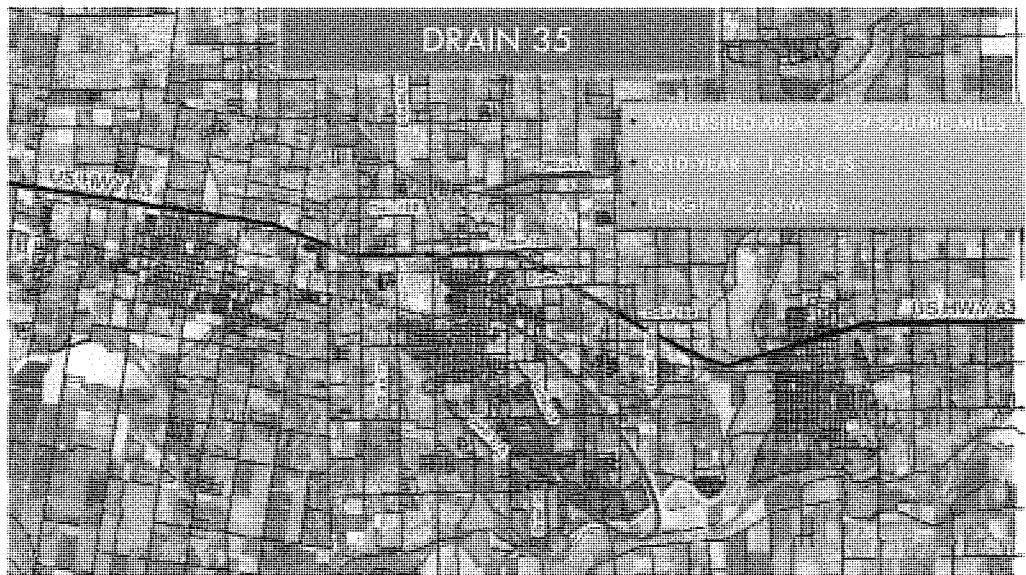


Figure 4.41

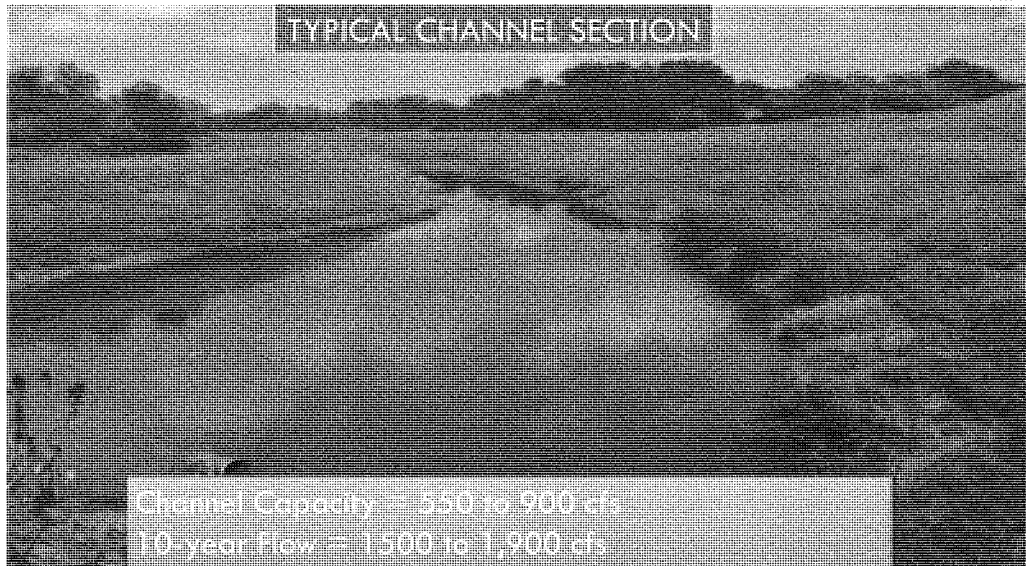




Figure 4.42

Proposed

Since Drain 35A flows into Drain 35, these two drains were analyzed holistically in order to propose solutions to the existing flooding problems. Because Drain 35A flows through a cemetery and no homes seem to be affected from undersized channel and drain crossings,

no improvements are recommended for the channel or the crossing because the cost to relocate a cemetery would be significantly expensive. However, it is recommended that the homes that lie between

8th and 10th street and east of Iowa Avenue should be considered for potential buy-outs. Buying these homes out would avoid repetitive losses to these property owners from frequent flooding.

On Drain 35, where there is significant flooding in the neighborhood between 10th and 18th streets, several alternatives were looked at to eliminate flooding. As these homes are located very close to the channel banks, a feasible solution could not be achieved to contain the 10-year flows within the channel. It is therefore

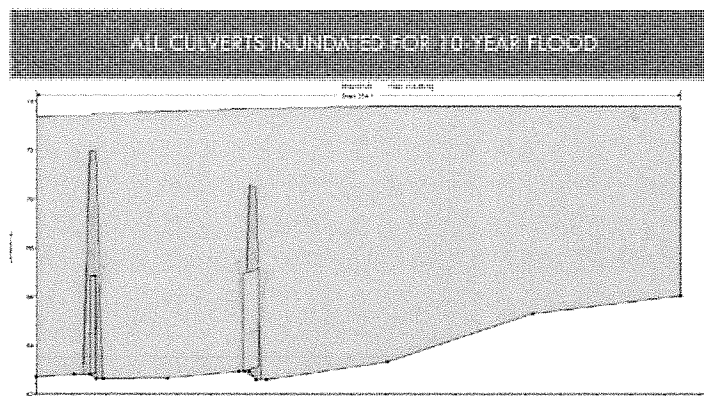


Figure 4.43

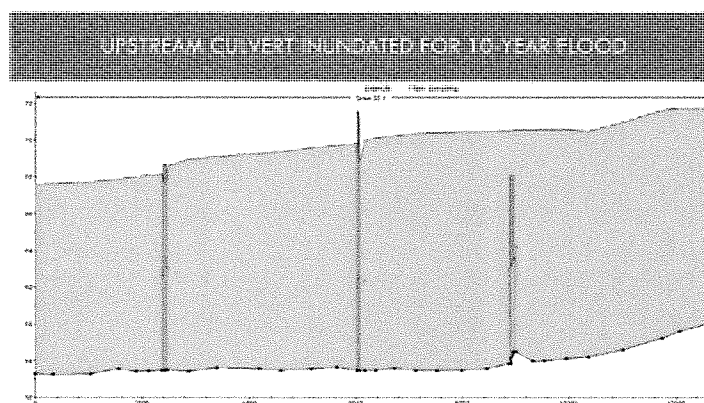


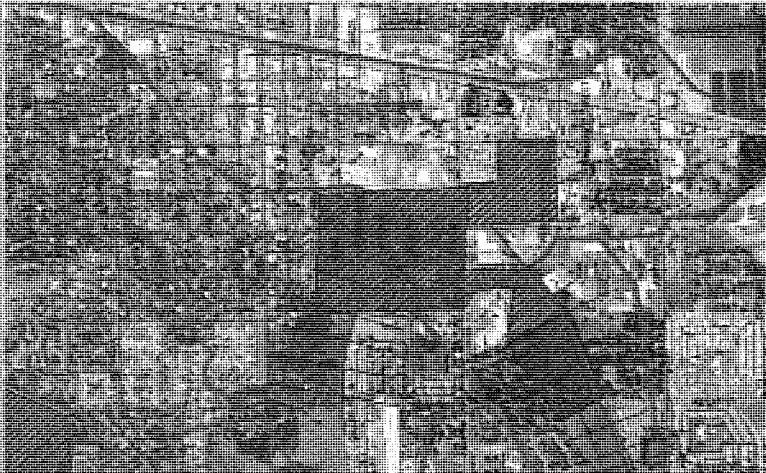
Figure 4.44

The area that would be available after buy-outs of properties along Drain35A and Drain 35 could be used as a regional park / detention to capture flows above a 10-year storm.

PROPOSED IMPROVEMENTS: DRAIN 35A, DRAIN 35

PROPOSED SOLUTION

1. REMOVE OLD HOME DOWNSTREAM OF CEMENT ON DRAIN 35, DISCONNECT TO DRAIN 20 AND FACTORY
2. USE BRICK AND CONCRETE TO PUT A NEW FLEX REGIONAL DETENTION
3. CHISEL THE WEST LUTHERAN STRUCTURE ON DRAIN 35 AND THE ONE BRICK LANE WASHED OFF ALL THE NEEDS TO BE REPLACED TO GARY TO GET FISH
4. STORMWATER CONNECTING DRAIN 35A AND DRAIN 35 NEEDS TO GO INTO PROPOSED DETENTION POND / PARK



Existing

Figure 4.46

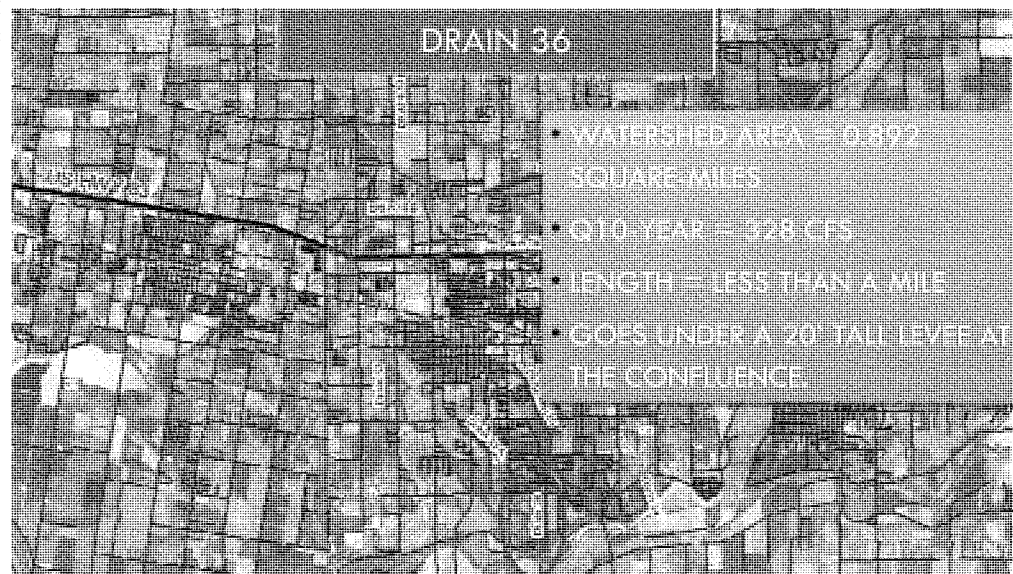




Figure 4.47

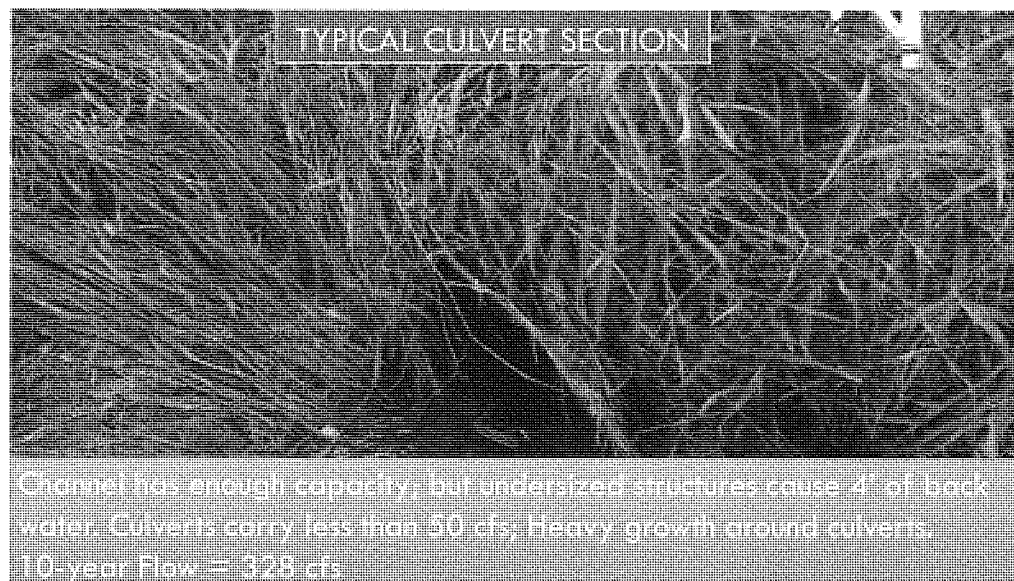


Figure 4.48

Proposed

It is proposed to upgrade all crossings to a single 8' x 6' box culvert. This upgrade would eliminate the backwater caused by existing structures and will convey the 10-year flows within the channel banks. One detention area, about 34 acres, was identified on the left over bank of Drain 36, downstream of Mile 5 crossing. This potential detention area lies between cross sections where lateral spill occurs on the left over

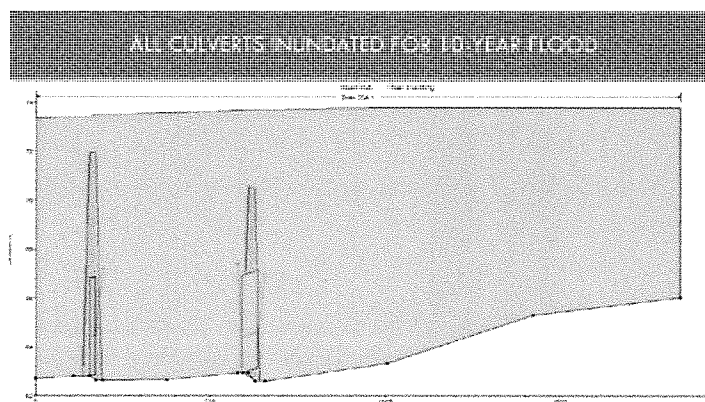


Figure 4.49

back. Offline regional detention needs can be achieved within this detention area for storms larger than 10-year storm.

Figure 4.50



Drain 37

Existing

The Existing conditions hydraulic analysis indicates that all crossing on Drain 37 are overtopped during a 10-year flood. A separate hydraulic model was developed without any structures to see if there was any backwater effect from structures. The results indicate that even without any structures modeled, the channel do not have any capacity to handle 10-year flows. There are several homes between 18th street and Texas Boulevard that are very close to the channel banks. There is a greater risk of these homes getting inundated from a 10-year storm. It also appears from aerial images that the natural flow of the stream between Border Avenue and 18th Street may have been altered to accommodate residential development. Currently, the drain in this section flows in a zigzag fashion and it should be noted that during a flood, the floodwaters do not follow zigzag path. It appears from the topographic data and existing hydraulic analysis that during a flood, Drain 37 overtops its 18th Street and flows more in a south easterly direction between 18th street and Texas Boulevard, inundating several home in between.

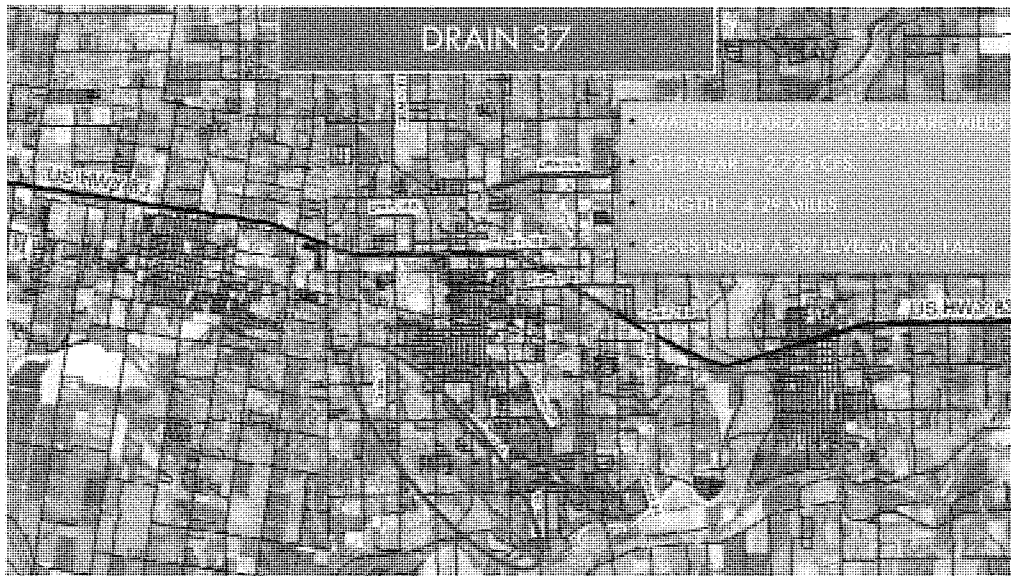


Figure 4.51



Figure 4.52

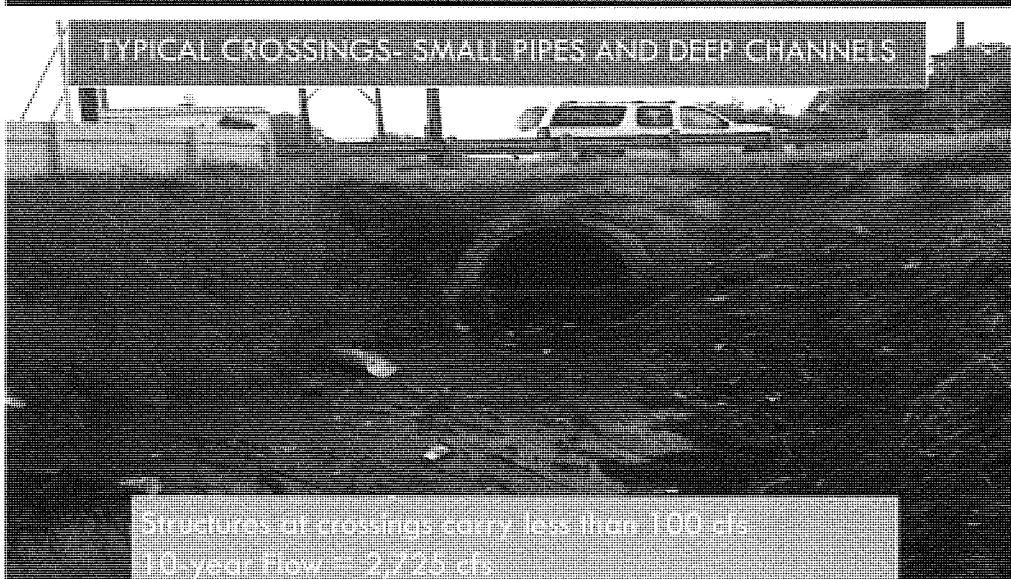


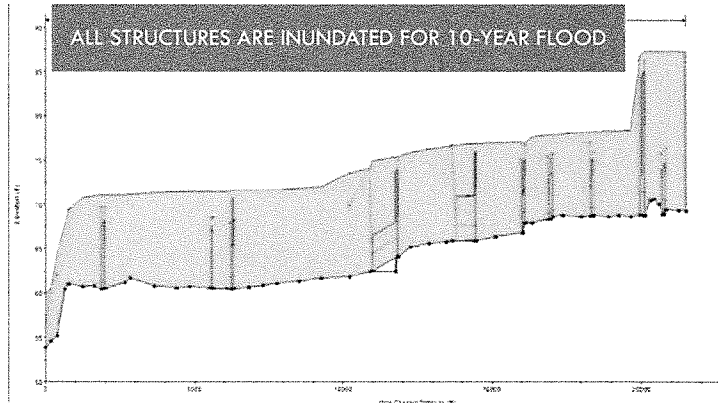
Figure 4.53

Figure 4.54

Proposed

In order to contain the 10-year flow within the channel, a 100-foot bottom width, grass lined trapezoidal channel, approximately eight foot deep, with the same slope as the existing channel is proposed with 3:1 side slopes. It is

recommended that the zigzag nature of the existing drain be modified to allow the stream to flow in south easterly direction between 18th Street and Texas Boulevard. Several homes next to Drain 37 between 18th Street and Texas Boulevard need to be considered for buyouts in order to accommodate the proposed improvements. All crossings on Drain 37 need to be replaced to carry the 10-year flows. It is proposed to replace crossing at Bridge Avenue with seven 10'x 9' box culverts and Texas Boulevard with six 10'x 9' box culverts at the existing slope of 0.0006 feet / feet. It is also proposed to replace the crossings at Border Avenue and 18th Street be replaced with five 10'x 9' box culverts. For all crossings upstream of 18th street, it is proposed to replace existing structures with six 10' x 7' box culverts.



The proposed conditions HEC-HMS model indicates that the proposed channel improvements do not cause any adverse impacts downstream because of additional channel storage that becomes available from proposed improvements. Additionally, an area approximately 83 acres was identified in the northwest corner of Border Avenue and 18th Street for regional detention. Approximately, 2.87 square miles drain to this potential detention site, with a 10-year peak discharge of approximately 2,000 cfs and a runoff volume of 533 acre-feet. If this potential detention area could capture most of the runoff volume draining to it during a 10-year storm or greater, it would reduce the magnitude of proposed improvements on Drain 37.



Figure 4.55

Drain 37A

Existing

An irrigation canal crosses Drain 37A approximately 2,200 feet downstream of Texas Boulevard. Drain 37A is conveyed under the irrigation canal by a single 30-inch RCP. The results from the hydraulic modeling indicate that the existing channel downstream of the canal crossing has enough capacity to handle the 10-year flows. However, the channel upstream of the canal does not have enough capacity. Additionally, the undersized structure at the canal crossing causes significant backwater upstream. The other crossing at Texas Boulevard is also undersized. There are several homes between Texas Boulevard and Canal crossing that are at risk of flooding from a 10-year storm.

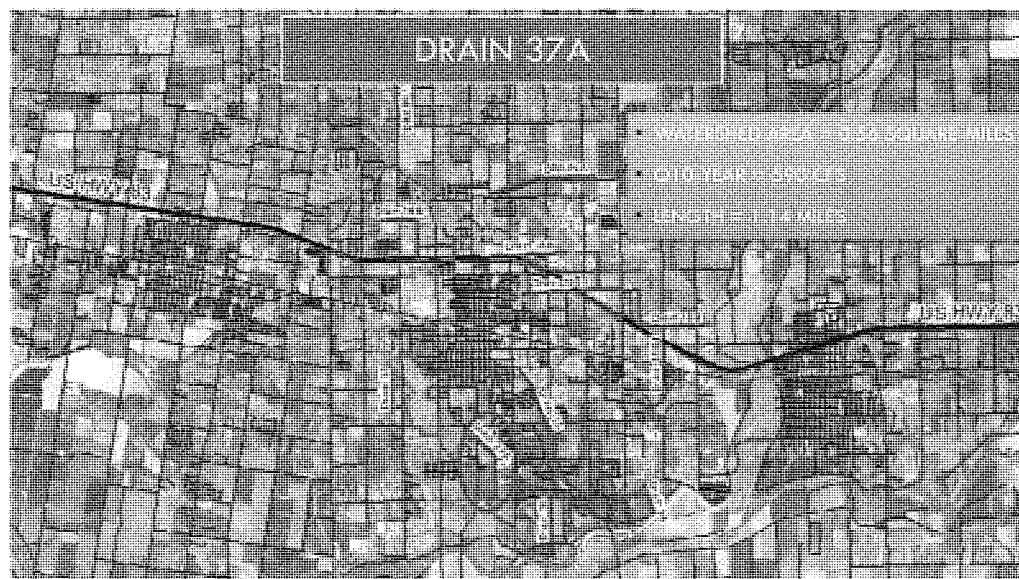


Figure 4.56

Figure 4.57

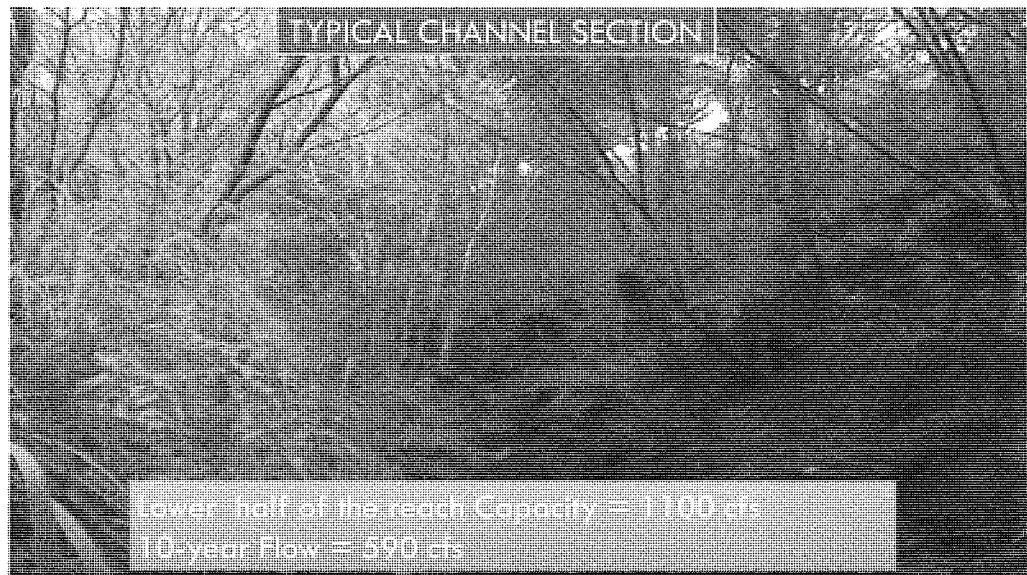


Figure 4.58

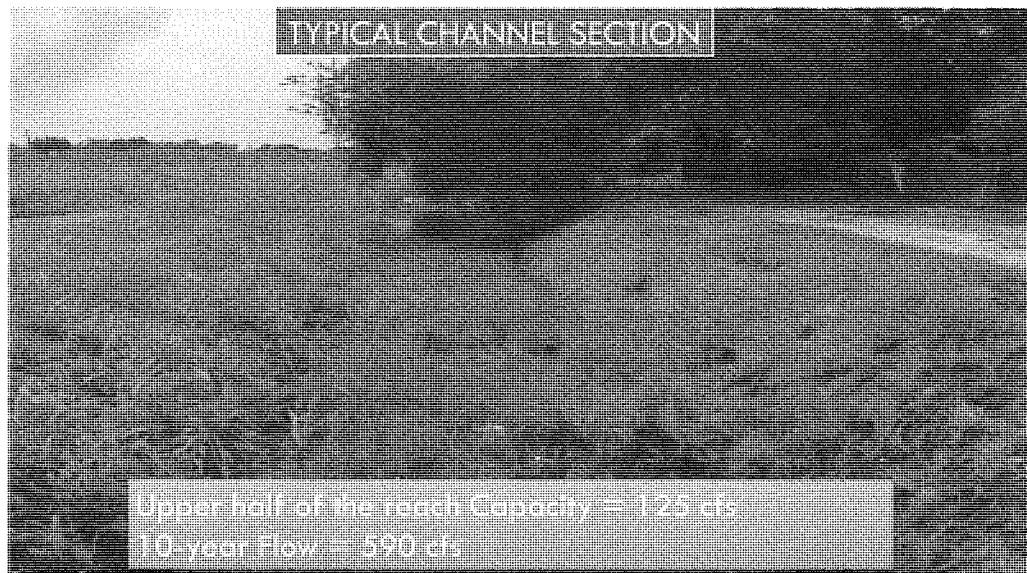
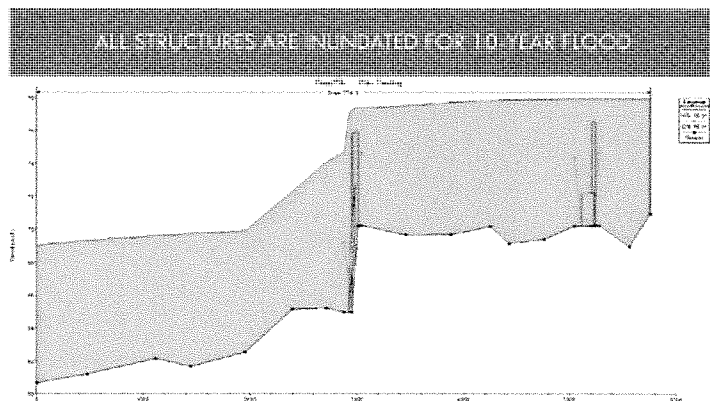


Figure 4.59

Proposed

It is proposed that the crossing under the canal be replaced with a dual 10' x 8' box culvert and the crossing at Texas Boulevard be upgraded to a single 10' x 8' box culvert to eliminate backwater. Also, channel improvements are proposed from the canal crossing all the way upstream.

There appears to be 5-foot drop in channel profile through the existing canal structure. Therefore, it is proposed to lower the channel bottom by about 5-feet upstream of canal crossing and construct a new grass lined trapezoidal



channel with a 50-foot bottom width and 3:1 side slopes. It may be necessary to buy some trailer home properties on the left over bank between Texas Boulevard and canal crossing to accommodate proposed channel improvements.

Finally, it should also be noted that all drains from Weslaco outfall into floodways which exist on the south and east side of Weslaco. The floodways have levees on both side that are about 20-feet tall and have a small structure such as a single 4' x 4' box culvert where any of the study stream outfalls into the floodway. The presence of significantly undersized structures under levees causes significant backwater for all the study streams. Therefore, it is recommended that all structures under levees be upgraded to a bigger structure with flap gates that would be capable of handling the 10-year flow and at the same time prevent backwater from the floodways.



Figure 4.60

The inventory of Existing and Proposed structures along with opinion of probable construction costs are shown in Appendix D-1.

Reccomendations & Conculsions



It is recommended that this study be used as a planning tool to assess the drainage infrastructure needs for the City of Weslaco. It should be noted that hydraulic analysis was performed using “Enhanced Approximate” methods. As such, detailed analysis is recommended for all the study streams that would include on the ground survey of stream cross sections, bridges and culverts. It should also be noted that the presence of significantly undersized structures for all the study streams creates lot of storage behind them. These undersized structures create an interconnected pond like situations. This storage has been best modeled in HEC-HMS using Muskingum-Cunge method. During detailed analysis, it is recommended that the available storage behind structures be verified with the use of a 2-dimensional software for at least couple of streams to make sure the storage was not under / overestimated in HEC-HMS.

It is further recommended that the City take the initiative to regulate new development such that the new development does not create further drainage problems. The steps that the City could take include developing a risk map for the community that would map floodplains for different storm events. Having these maps will help the community identify the risk of flooding for their property. These risk maps will in turn encourage the community to buy flood insurance. The City also needs to establish a regulatory floodplain and a drainage ordinance that would prevent people from encroaching into the regulatory floodplain.

Additionally, the City needs to either adopt a Low Impact Development (LID) implementation plan from other cities in South Texas such as San Antonio or Austin to encourage sustainable development or develop their own implementation plan. LID techniques could be implemented for new development, re-development and also for capital improvement projects. Rain gardens, pervious pavements, bio-swales, bio-retention ponds, rain barrels and cisterns, open space preservation are some of the LID features that can be implemented in Weslaco.

Finally, any flood control project the City wants to initiate, should begin with a preliminary engineering study of the entire stream from a holistic view to identify the drainage, environmental, traffic, geotechnical and structural needs for a project with refined cost estimates.

Appendices



○ Appendix A

○

○



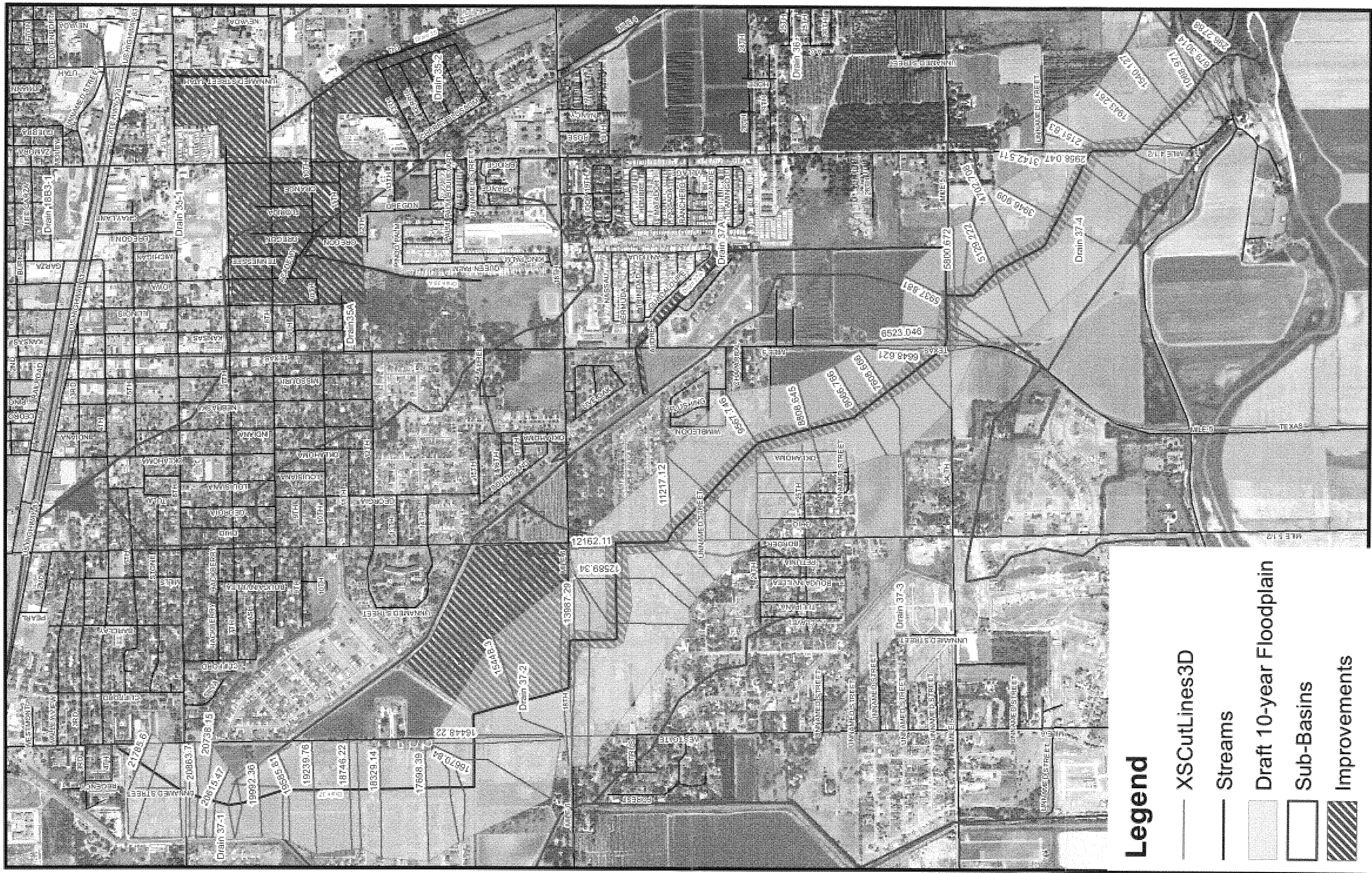
Legend

- XSCutLines3D
- Streams
- Draft 10-year Floodplain
- Sub-Basins



Exhibit 6L. Workmap of Drain 34A

1 inch = 500 feet



Legend

— XSCutLines3D

— Streams

■ Draft 10-year Floodplain

□ Sub-Basins

▨ Improvements



Exhibit 6K. Workmap of Drain 37

1 inch = 1,200 feet



Legend

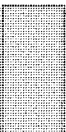
- XSCutLines3D
- - - Streams
-  Draft 10-year Floodplain
-  Sub-Basins
-  Improvements

Exhibit 6I. Workmap of Drain 36

1 inch = 290 feet

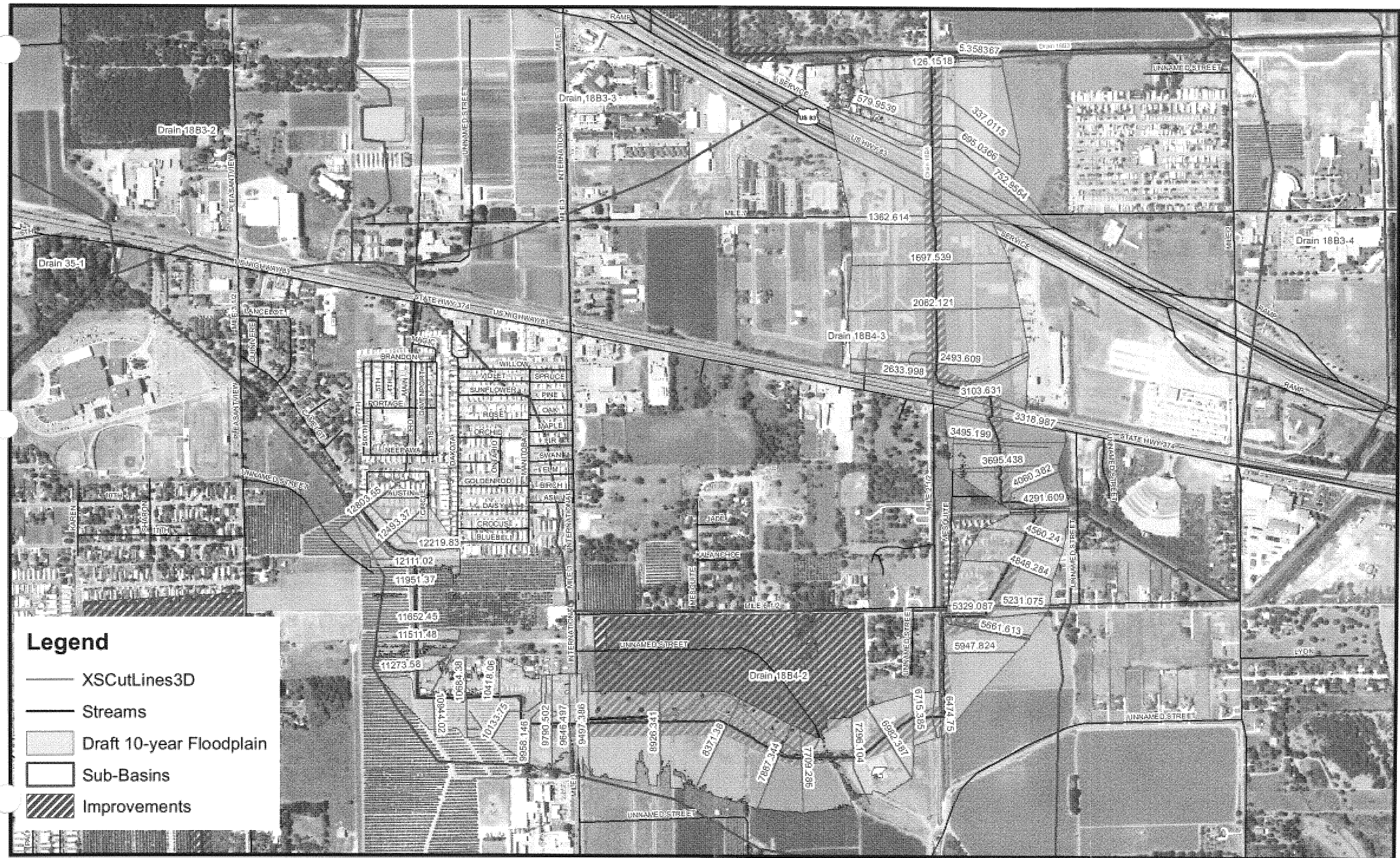


Exhibit 6F. Workmap of Drain 18B4

1 inch = 700 feet

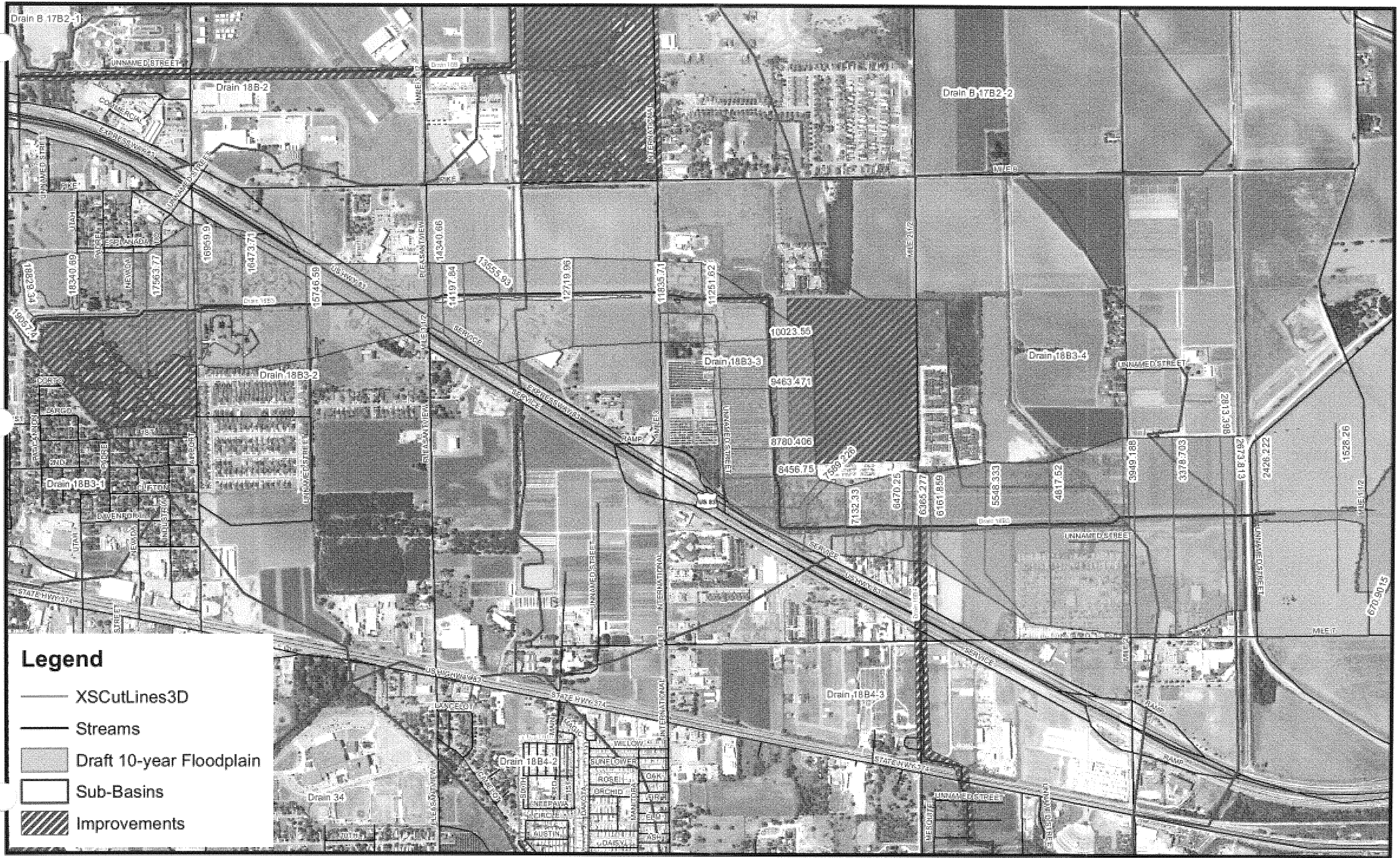


Exhibit 6E. Workmap of Drain 18B3

1 inch = 1,000 feet

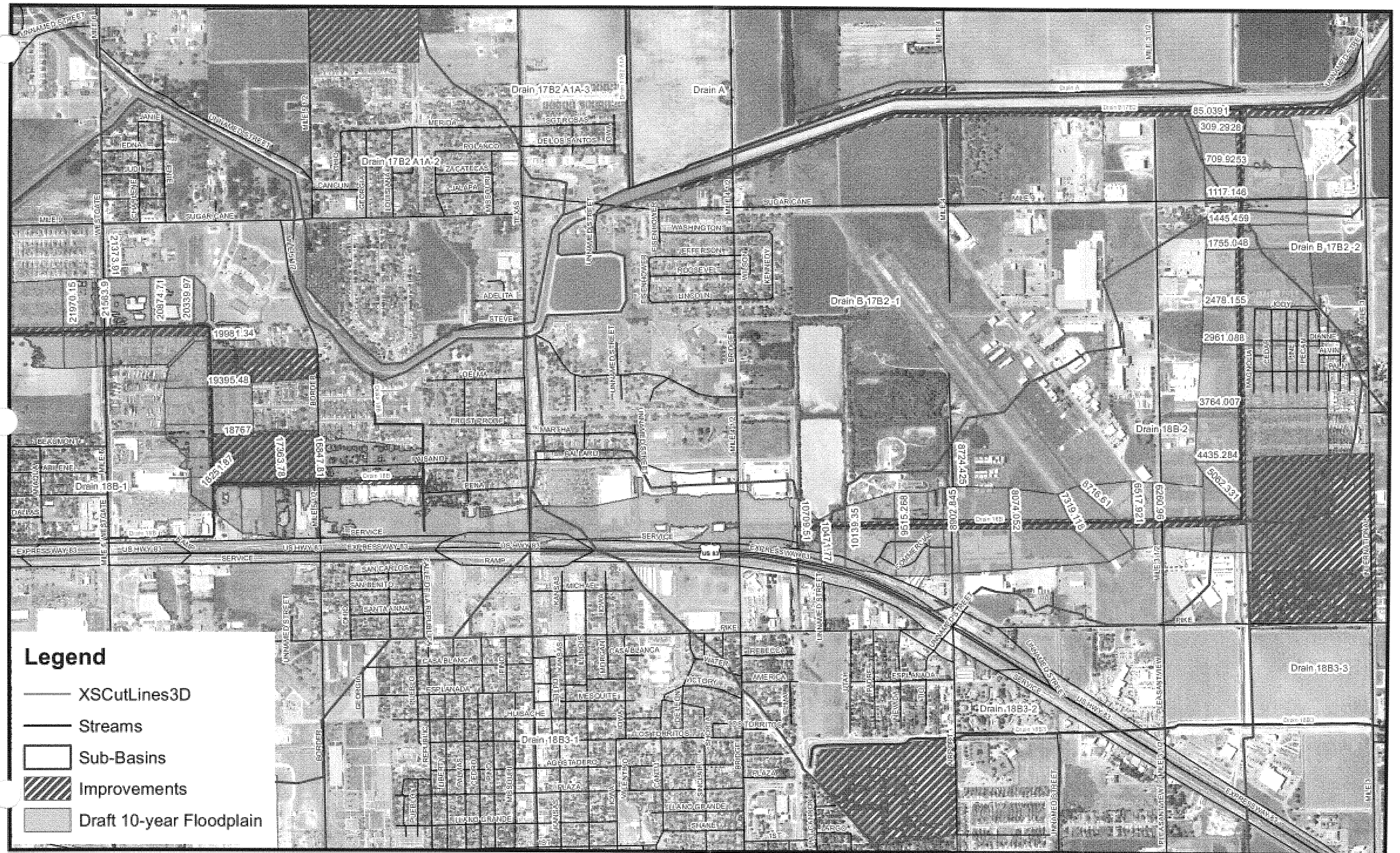


Exhibit 6D. Workmap of Drain 18B

1 inch = 1,100 feet



Exhibit 6C. Workmap of Drain B 17B2

1 inch = 800 feet



Exhibit 6B. Workmap of Drain A

1 inch = 800 feet

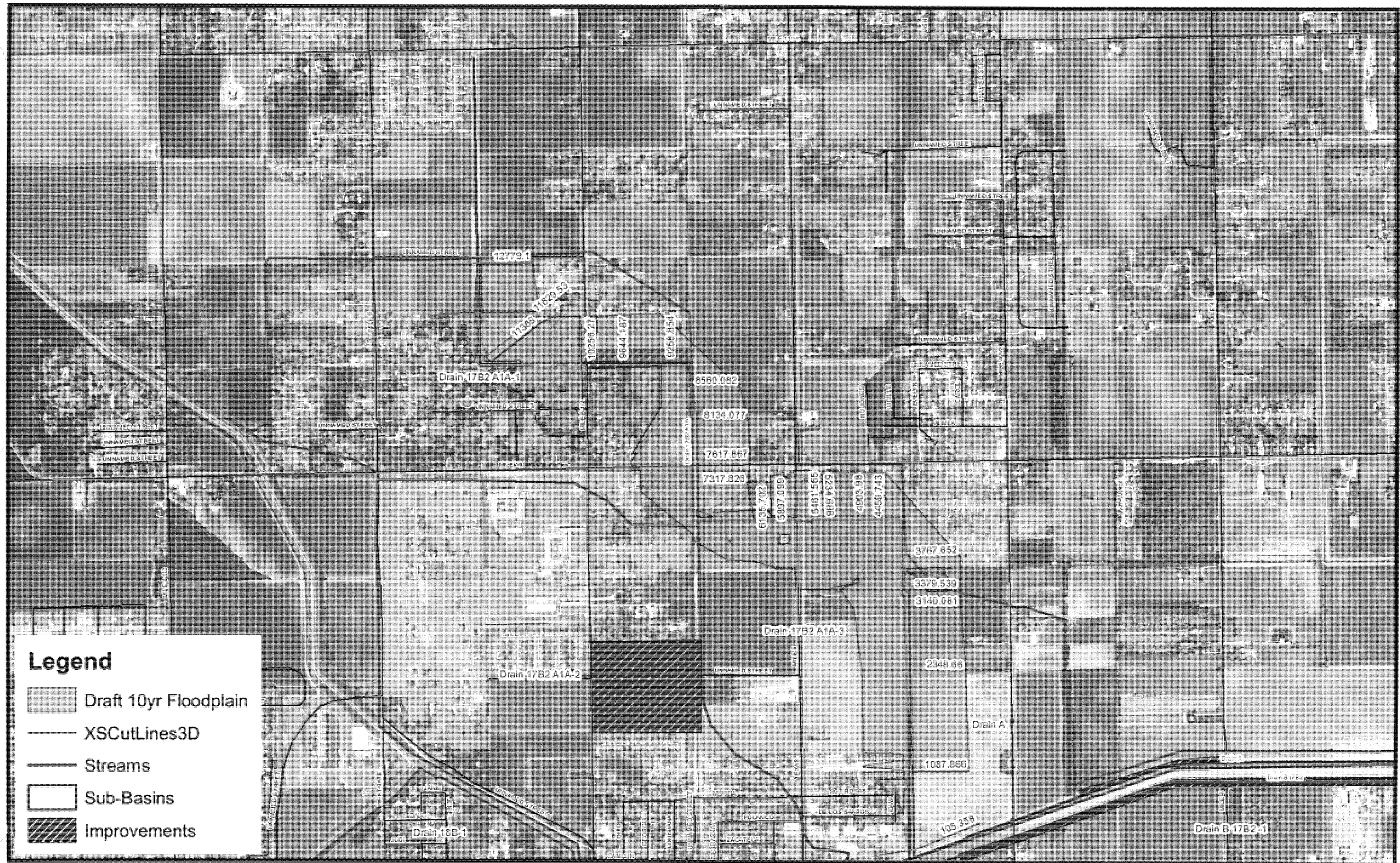


Exhibit 6A Workmap of Drain 17B2A1A

0 0.1 0.2 0.4 Miles





Exhibit 5. Landuse Map

0 0.4 0.8 1.6 Miles

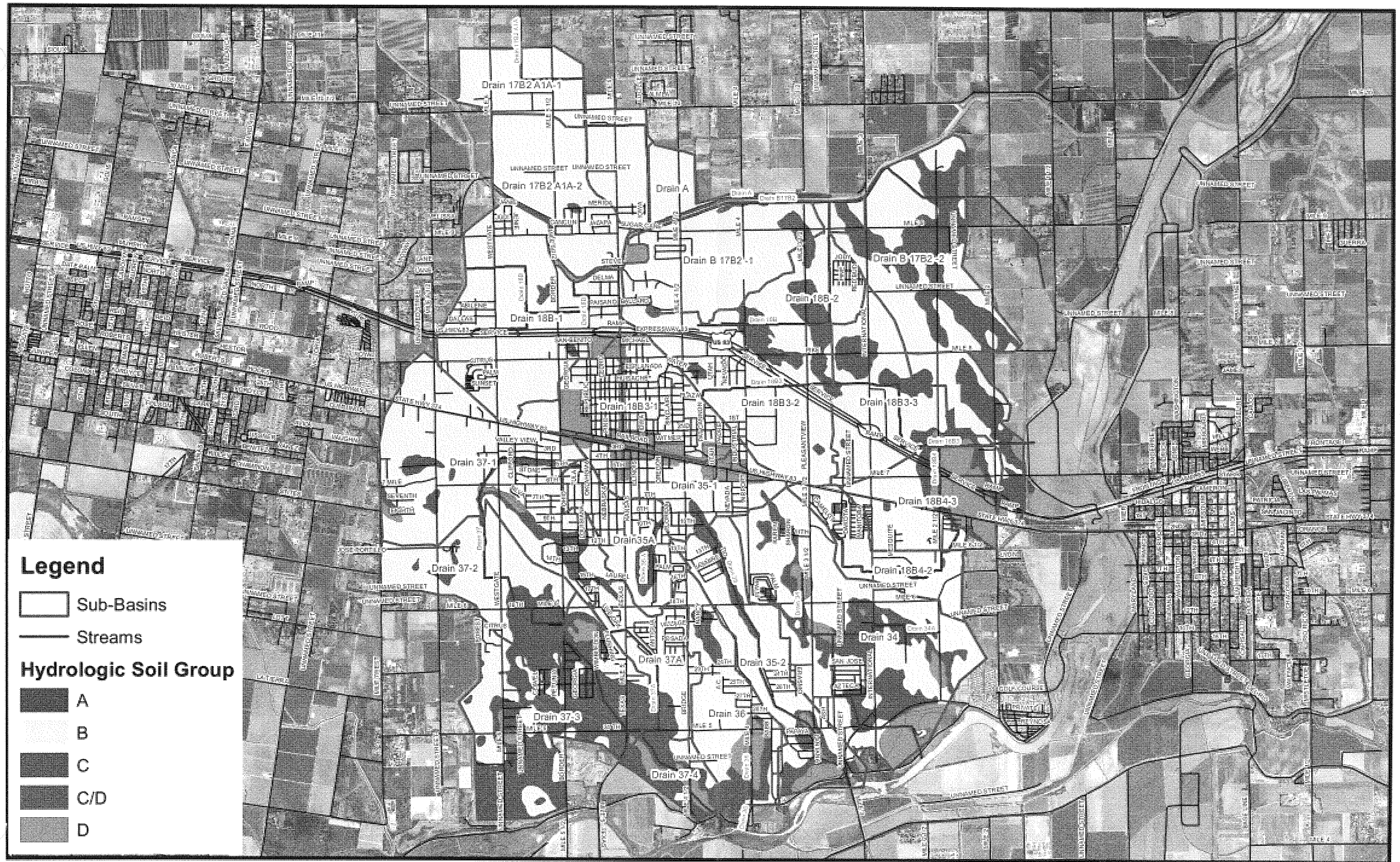


Exhibit 4. Soils Map

0 0.4 0.8 1.6 Miles

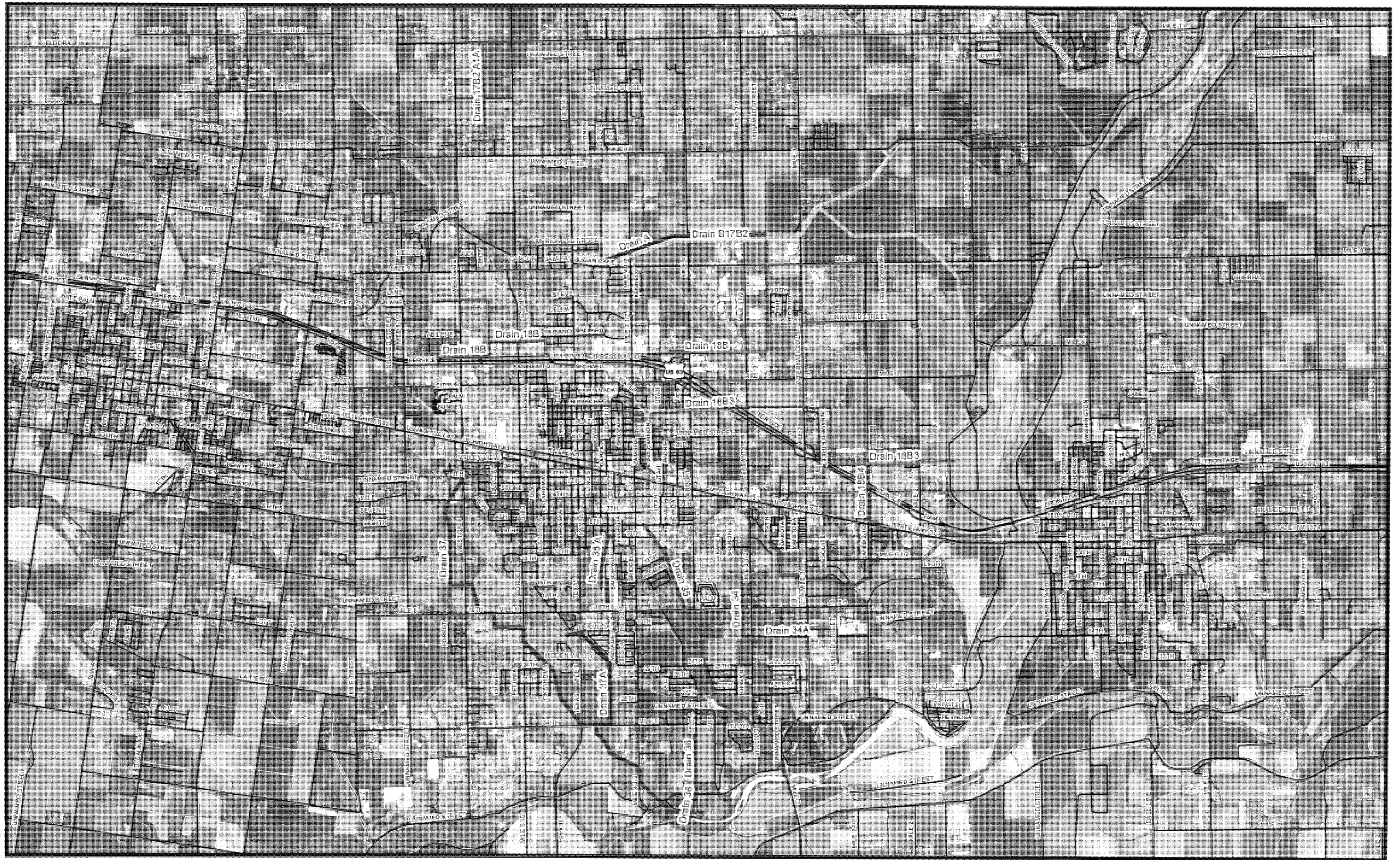
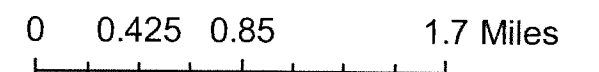


Exhibit 2. Study Streams



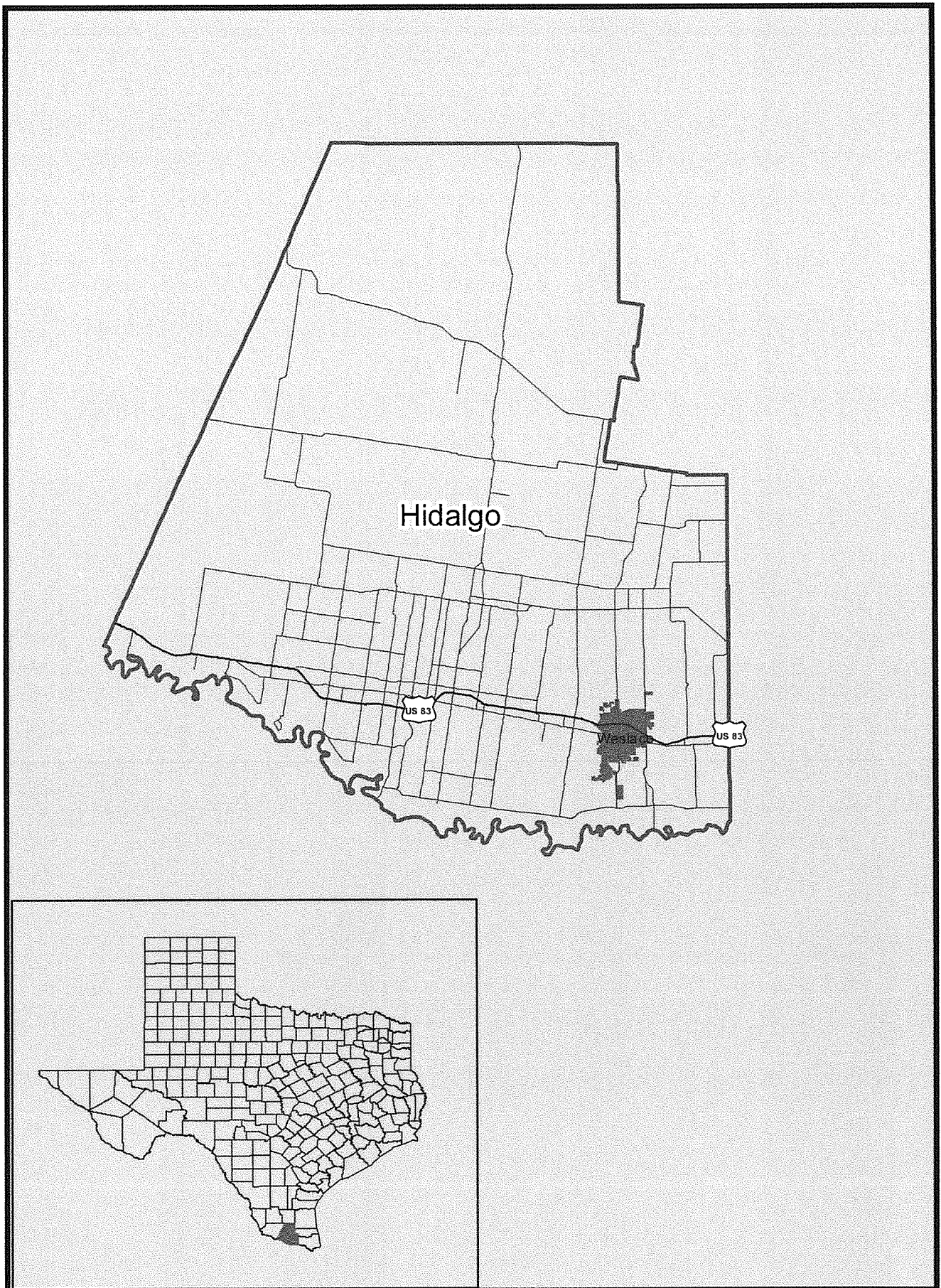


Exhibit 1. Location Map for City of Weslaco

Appendix B

Project: Weslaco_Drainage Simulation Run: 10yr

Start of Run: 09Sep2014, 00:00

Basin Model: Existing Conditions

End of Run: 10Sep2014, 00:00

Meteorologic Model: 10-yr

Compute Time: 03Dec2014, 20:24:35

Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Drain 18B-1	1.6033	1688.0	09Sep2014, 13:00	333.2
R_Drain18B-2	1.6033	1082.4	09Sep2014, 14:00	316.9
Drain 18B-2	0.9044	575.2	09Sep2014, 14:25	216.3
J_Drain 18B-2	2.5077	1638.5	09Sep2014, 14:05	533.2
Drain B 17B2-1	1.0197	873.8	09Sep2014, 13:30	224.8
J_17B2-1	3.5274	2390.3	09Sep2014, 13:50	758.0
R_Drain17B2-2	3.5274	1937.8	09Sep2014, 14:10	731.7
Drain B 17B2-2	1.3809	736.9	09Sep2014, 14:05	226.5
J_Drain B 17B2-2	4.9083	2670.5	09Sep2014, 14:10	958.2
Drain 35-1	0.7111	1055.0	09Sep2014, 12:50	180.1
Drain 35A	0.5862	863.6	09Sep2014, 12:45	137.2
J_Drain 35A-35-1	1.2973	1916.7	09Sep2014, 12:45	317.4
R_Drain 35-2	1.2973	900.2	09Sep2014, 13:15	283.2
Drain 35-2	0.9989	641.4	09Sep2014, 13:30	158.5
J_Drain 35-2	2.2962	1533.8	09Sep2014, 13:25	441.7
Drain 34	2.1693	1008.9	09Sep2014, 14:30	360.3
J_Drain 34	2.1693	1008.9	09Sep2014, 14:30	360.3
Drain 17B2A1A-2	0.8430	757.6	09Sep2014, 13:10	158.6
Drain 17B2 A1A-1	0.5302	385.9	09Sep2014, 13:35	101.9
J_17B2A1A-2	1.3732	1107.8	09Sep2014, 13:15	260.5
R_17B2A1A-3	1.3732	757.3	09Sep2014, 13:35	246.0
Drain 17B2A1A-3	0.4449	222.6	09Sep2014, 14:20	75.5
J_17B2A1A-3	1.8181	950.0	09Sep2014, 13:45	321.4
R_Drain A	1.8181	697.7	09Sep2014, 14:35	305.8
Drain A	0.2412	149.5	09Sep2014, 13:05	27.9
J_Drain-A	2.0593	743.7	09Sep2014, 14:25	333.7
Drain 37-1	1.8920	1825.1	09Sep2014, 13:05	367.1

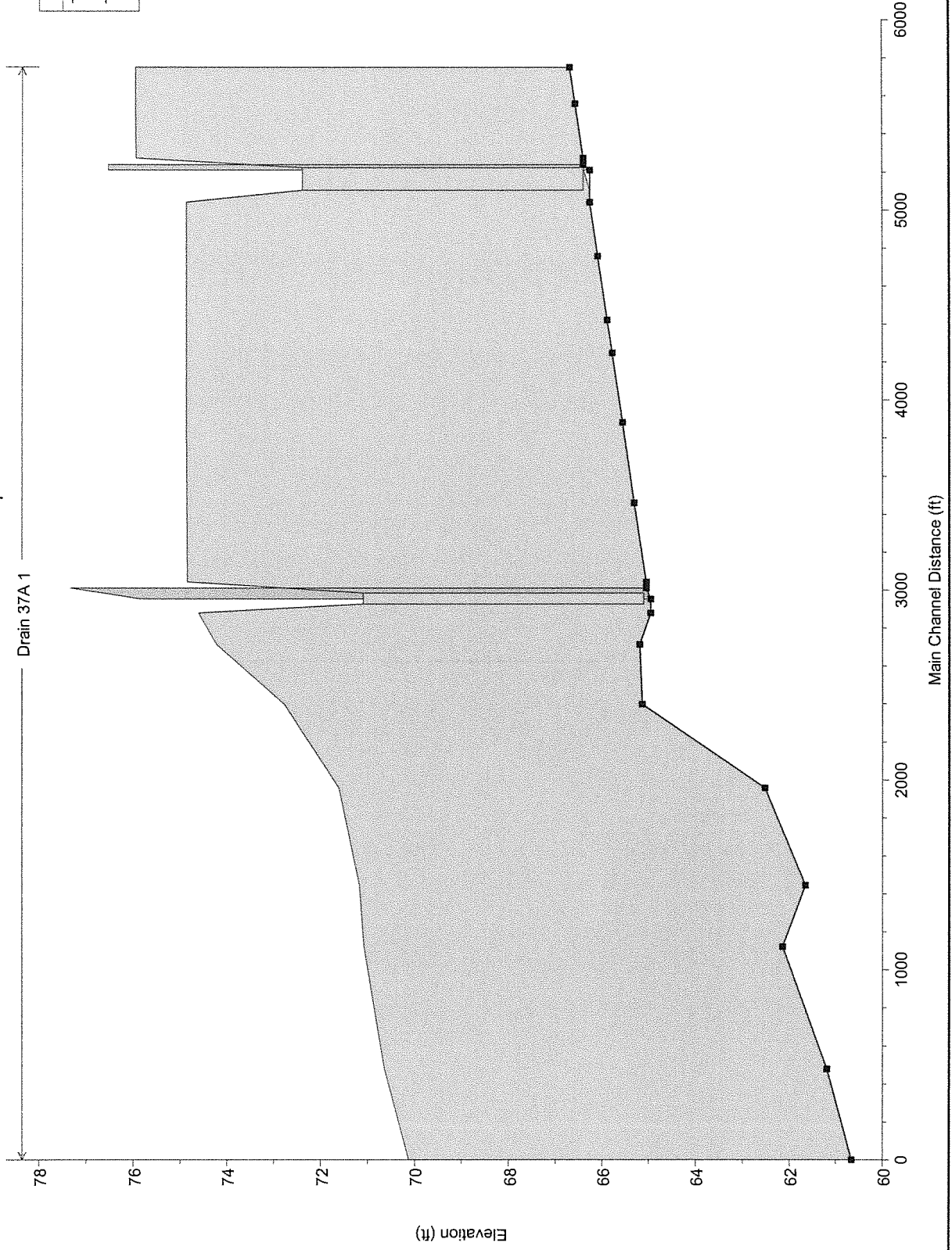
Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
R_Drain 37-2	1.8920	1140.4	09Sep2014, 13:20	347.9
Drain 37-2	0.9791	769.6	09Sep2014, 13:25	186.7
J_Drain 37-2	2.8711	1909.6	09Sep2014, 13:25	534.7
R_Drain 37-3	2.8711	1483.3	09Sep2014, 13:40	517.2
Drain 37-3	1.5514	911.7	09Sep2014, 14:05	295.9
J_Drain 37-3	4.4225	2356.0	09Sep2014, 13:50	813.2
Drain 37A	0.5656	590.0	09Sep2014, 13:05	123.5
J_Drain 37-37A	4.9881	2757.5	09Sep2014, 13:35	936.7
R_Drain 37-4	4.9881	2507.4	09Sep2014, 13:35	874.9
Drain 37-4	0.3253	415.8	09Sep2014, 12:50	66.2
J_Drain 37-4	5.3134	2725.3	09Sep2014, 13:30	941.1
Drain 36	0.8292	328.8	09Sep2014, 15:05	139.8
J_Drain 36	0.8292	328.8	09Sep2014, 15:05	139.8
Drain 18B3-2	1.0633	1117.1	09Sep2014, 13:00	216.0
Drain 18B3-1	1.0220	967.9	09Sep2014, 13:40	272.3
R_Drain 18B3-2	1.0220	892.3	09Sep2014, 14:00	267.9
J_Drain18B3-2	2.0853	1679.7	09Sep2014, 13:15	483.9
R_Drain 18B3-3	2.0853	1252.0	09Sep2014, 13:45	462.3
Drain 18B3-3	0.9773	677.2	09Sep2014, 13:25	164.7
J_Drain 18B3-3	3.0626	1906.2	09Sep2014, 13:35	627.0
Drain 18B4-3	0.8319	1080.6	09Sep2014, 12:55	198.0
Drain 18B4-2	0.5311	486.8	09Sep2014, 13:10	101.8
J_Drain18B4-2	0.5311	486.8	09Sep2014, 13:10	101.8
R_Drain 18B4-3	0.5311	376.1	09Sep2014, 13:40	97.9
J_Drain 18B4-3	1.3630	1293.9	09Sep2014, 13:00	295.9
J_Drain 18B4_18B3	4.4256	3029.4	09Sep2014, 13:15	922.9
R_Drain 18B3-4	4.4256	2639.6	09Sep2014, 13:30	904.1
Drain 18B3-4	0.4782	237.4	09Sep2014, 13:20	51.0
J_Drain 18B3-4	4.9038	2873.5	09Sep2014, 13:30	955.2

Appendix C

Drain37A Plan: Proposed

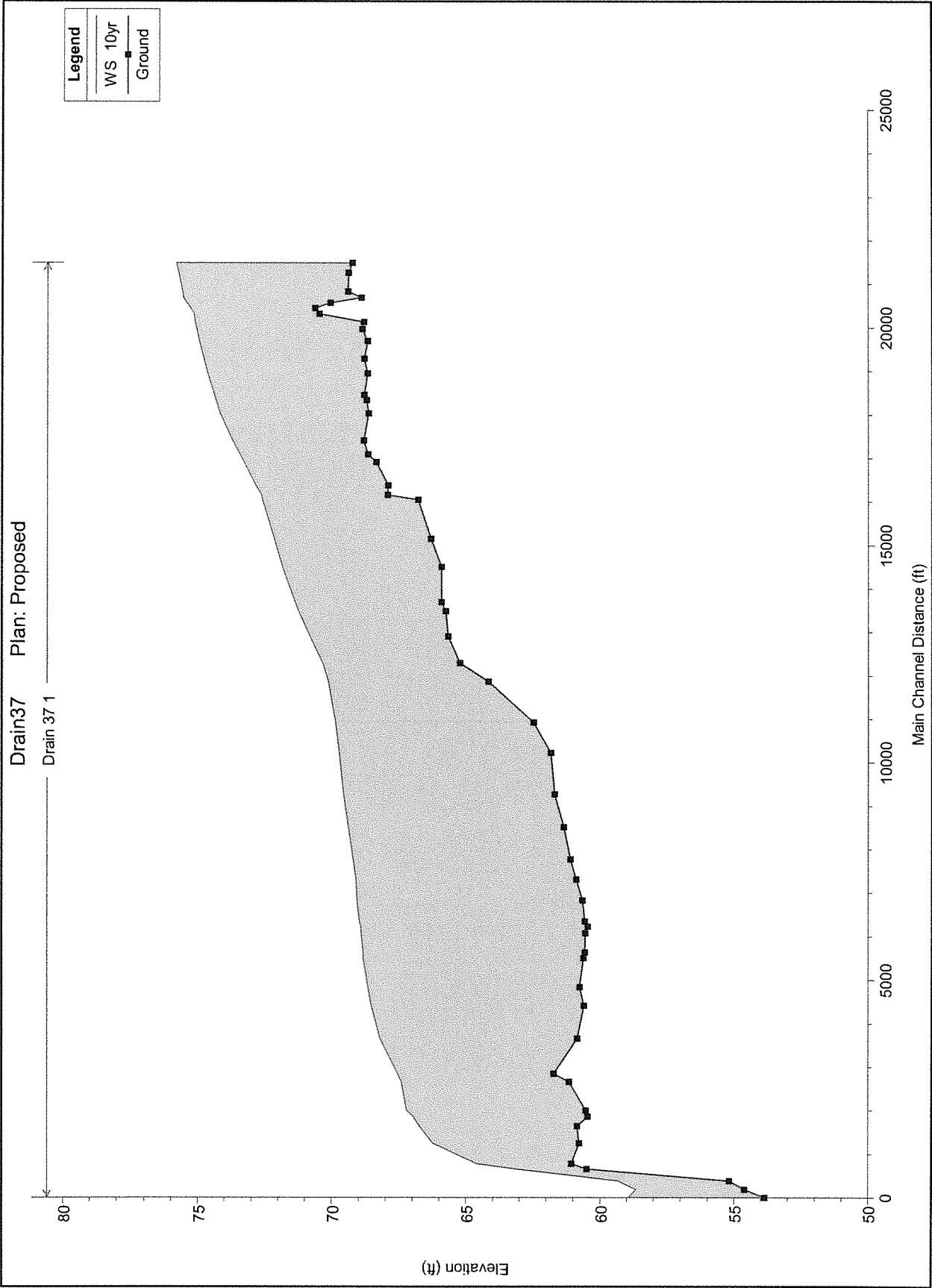
Drain 37A 1

Legend	
WS 10-yr	
Ground	



HEC-RAS Plan: Proposed River Drain 37A Reach: 1 Profile: 10-yr

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	297.42	10-yr	590.00	60.66	70.13	64.78	70.25	0.001102	2.87	215.61	901.63	0.21
1	774.30	10-yr	590.00	61.18	70.64		70.76	0.001040	2.80	211.17	38.66	0.20
1	1418.75	10-yr	590.00	62.13	71.08		71.11	0.000303	1.55	597.87	434.51	0.11
1	1743.43	10-yr	590.00	61.64	71.18		71.26	0.000615	2.29	257.28	40.66	0.16
1	2253.57	10-yr	590.00	62.51	71.61		71.81	0.001989	3.64	162.10	29.89	0.28
1	2695.01	10-yr	590.00	65.12	72.77		73.16	0.004744	5.05	116.81	25.23	0.41
1	3010.76	10-yr	590.00	65.18	74.22		74.56	0.004118	4.70	125.65	26.06	0.38
1	3175.39	10-yr	300.00	64.94	74.61	66.07	74.61	0.000013	0.71	424.32	107.99	0.04
1	3264.25 Under Canal		Culvert									
1	3339.04	10-yr	300.00	65.04	74.84	66.41	74.85	0.000023	0.93	321.34	83.83	0.05
1	3756.90	10-yr	300.00	65.29	74.86		74.86	0.000007	0.40	752.83	107.38	0.03
1	4179.90	10-yr	300.00	65.54	74.86		74.86	0.000008	0.41	735.44	138.19	0.03
1	4546.04	10-yr	300.00	65.76	74.86		74.87	0.000008	0.42	732.05	145.02	0.03
1	4718.00	10-yr	300.00	65.87	74.86		74.87	0.000008	0.43	706.49	131.37	0.03
1	5054.76	10-yr	300.00	66.07	74.87		74.87	0.000008	0.42	742.45	150.59	0.03
1	5337.60	10-yr	300.00	66.24	74.86	67.55	74.88	0.000030	0.99	304.53	101.72	0.06
1	5471.53 Texas		Culvert									
1	5570.80	10-yr	300.00	66.38	75.94	67.97	75.95	0.000007	0.40	763.39	175.12	0.03
1	5855.71	10-yr	300.00	66.55	75.95		75.95	0.000007	0.41	762.50	193.90	0.03
1	6048.28	10-yr	300.00	66.67	75.95		75.95	0.000007	0.41	819.25	751.42	0.03



HEC-RAS Plan: Proposed River: Drain 37 Reach: 1 Profile: 10yr

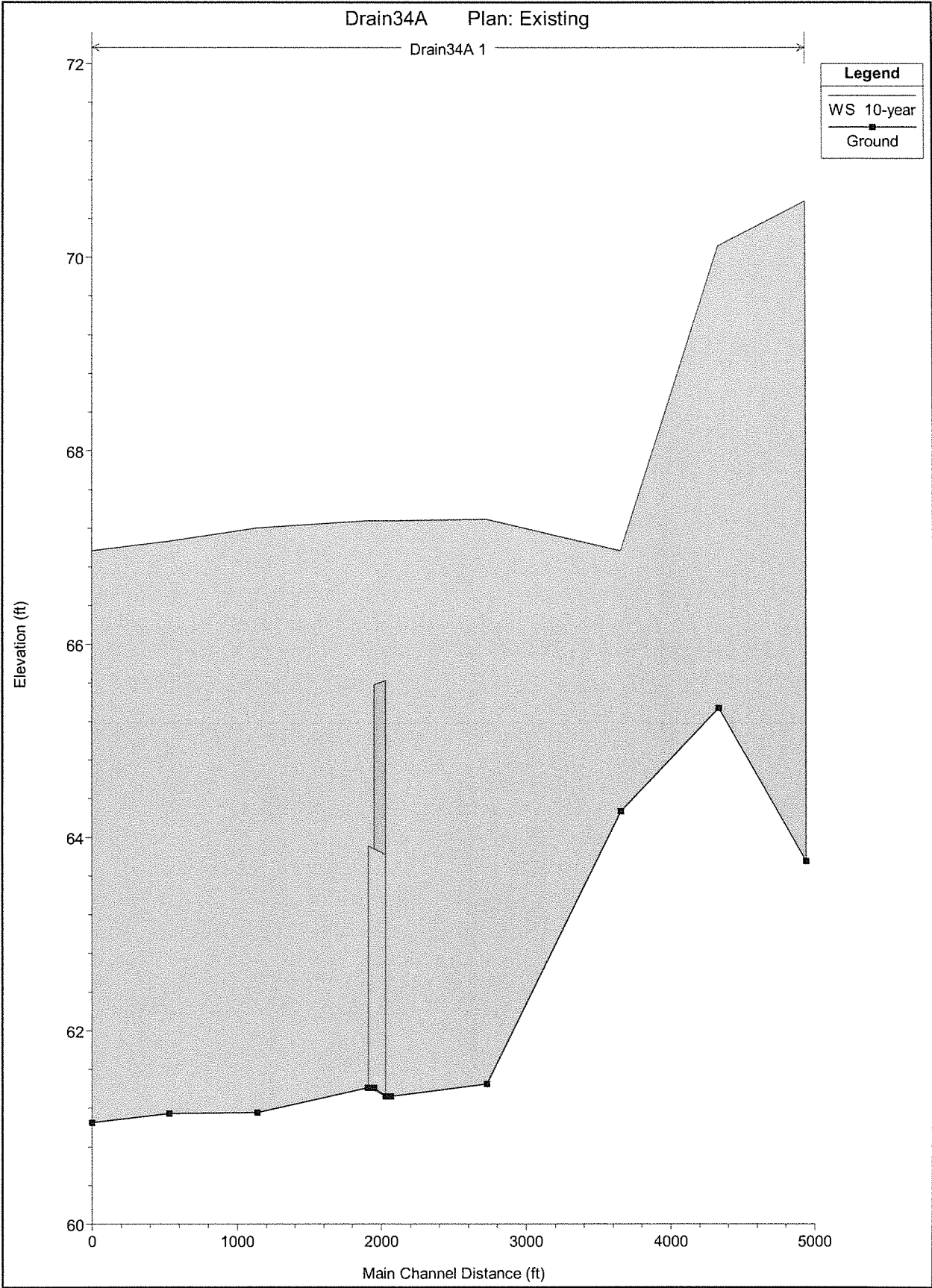
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	296.28	10yr	2725.00	53.86	58.95	55.90	58.97	0.000170	1.50	2503.08	727.78	0.12
1	485.33	10yr	2725.00	54.61	58.67		59.20	0.003486	5.91	481.21	174.86	0.54
1	679.30	10yr	2725.00	55.17	59.33		59.86	0.003270	5.82	468.52	124.99	0.53
1	948.68	10yr	2725.00	60.50	63.14	63.14	64.30	0.013287	8.87	326.65	145.58	1.00
1	1068.97	10yr	2725.00	61.06	64.59	63.82	65.35	0.005736	6.97	390.76	121.19	0.68
1	1540.13	10yr	2725.00	60.77	66.23		66.51	0.001289	4.29	635.10	132.74	0.35
1	1943.26	10yr	2725.00	60.84	66.73		66.97	0.000989	3.93	693.28	135.35	0.31
1	2151.83	10yr	2725.00	60.46	66.97		67.16	0.000700	3.50	777.83	139.05	0.26
1	2298.79	10yr	2725.00	60.53	67.21		67.28	0.000317	2.40	1600.90	495.86	0.18
1	2958.05	10yr	2757.00	61.15	67.41		67.62	0.000819	3.71	743.73	137.56	0.28
1	3142.51	10yr	2757.00	61.72	67.56		67.81	0.001047	4.02	685.70	135.02	0.31
1	3946.91	10yr	2757.00	60.84	68.20		68.35	0.000457	3.06	917.21	180.12	0.21
1	4702.71	10yr	2757.00	60.60	68.53		68.62	0.000283	2.57	1449.95	718.79	0.17
1	5129.22	10yr	2757.00	60.75	68.66		68.74	0.000257	2.46	1749.40	1294.36	0.16
1	5800.67	10yr	2356.00	60.62	68.82		68.86	0.000119	1.70	2523.17	1425.15	0.11
1	5937.88	10yr	2356.00	60.57	68.83		68.89	0.000186	2.08	1575.49	1153.21	0.14
1	6371.54	10yr	2356.00	60.55	68.90		68.96	0.000181	2.09	1479.75	946.33	0.14
1	6523.05	10yr	2356.00	60.46	68.92		68.99	0.000193	2.19	1208.49	592.25	0.14
1	6848.62	10yr	2356.00	60.57	68.97		69.02	0.000166	2.01	1754.32	1073.07	0.13
1	7131.82	10yr	2356.00	60.66	69.05		69.09	0.000119	1.73	2307.49	1150.95	0.11
1	7608.67	10yr	2356.00	60.88	69.10		69.18	0.000214	2.26	1161.45	407.26	0.15
1	8066.77	10yr	2356.00	61.09	69.20		69.29	0.000239	2.33	1048.60	559.88	0.16
1	8808.64	10yr	2356.00	61.35	69.38		69.46	0.000235	2.32	1087.82	312.94	0.16
1	9567.75	10yr	1909.00	61.68	69.56		69.62	0.000176	1.96	974.27	147.27	0.13
1	10519.35	10yr	1909.00	61.82	69.73		69.79	0.000173	1.95	978.21	147.45	0.13
1	11217.12	10yr	1909.00	62.47	69.86		69.93	0.000220	2.12	902.46	144.33	0.15
1	12162.11	10yr	1909.00	64.15	70.13		70.24	0.000462	2.71	704.83	135.87	0.21
1	12589.34	10yr	1909.00	65.23	70.35		70.51	0.000791	3.23	590.11	130.69	0.27
1	13200.01	10yr	1909.00	65.66	70.83		70.98	0.000766	3.20	596.54	130.99	0.26
1	13784.91	10yr	1909.00	65.75	71.25		71.39	0.000617	2.98	640.51	132.98	0.24
1	13987.29	10yr	1909.00	65.92	71.37		71.51	0.000634	3.01	634.60	132.72	0.24
1	14801.17	10yr	1909.00	65.91	71.85		71.96	0.000472	2.73	699.62	135.62	0.21
1	15448.30	10yr	1909.00	66.31	72.16		72.28	0.000498	2.78	687.57	135.10	0.22
1	16337.55	10yr	1825.00	66.79	72.60		72.71	0.000466	2.68	682.11	134.85	0.21
1	16448.22	10yr	1825.00	67.93	72.64		72.82	0.000964	3.40	537.14	128.25	0.29
1	16670.84	10yr	1825.00	67.91	72.85		73.01	0.000814	3.21	567.70	129.65	0.27
1	17211.46	10yr	1825.00	68.35	73.29		73.45	0.000814	3.21	567.72	129.66	0.27
1	17382.03	10yr	1825.00	68.65	73.43		73.61	0.000911	3.34	547.12	128.71	0.29

HEC-RAS Plan: Proposed River: Drain 37 Reach: 1 Profile: 10yr (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	17698.39	10yr	1825.00	68.81	73.72		73.88	0.000814	3.20	592.00	175.08	0.27
1	18329.14	10yr	1825.00	68.63	74.18		74.30	0.000547	2.82	647.10	133.30	0.23
1	18625.46	10yr	1825.00	68.70	74.34		74.46	0.000516	2.77	659.52	133.84	0.22
1	18746.22	10yr	1825.00	68.79	74.40		74.52	0.000525	2.78	655.82	133.68	0.22
1	19239.76	10yr	1825.00	68.67	74.65		74.76	0.000419	2.58	723.17	313.46	0.20
1	19585.81	10yr	1825.00	68.80	74.80		74.90	0.000410	2.56	756.47	349.82	0.20
1	19992.36	10yr	1825.00	68.67	74.96		75.05	0.000339	2.42	801.79	261.40	0.18
1	20258.29	10yr	1825.00	68.87	75.05		75.15	0.000375	2.49	733.04	137.10	0.19
1	20426.76	10yr	1825.00	68.81	75.12		75.21	0.000349	2.43	750.41	137.85	0.18
1	20615.47	10yr	1825.00	70.47	75.16		75.34	0.000975	3.41	535.17	128.15	0.29
1	20738.15	10yr	1825.00	70.63	75.28		75.46	0.000989	3.45	533.35	150.18	0.30
1	20863.70	10yr	1825.00	70.06	75.43		75.56	0.000582	2.90	671.12	283.80	0.23
1	20978.49	10yr	1825.00	68.90	75.55		75.62	0.000260	2.22	967.73	504.58	0.16
1	21125.82	10yr	1825.00	69.40	75.58		75.68	0.000374	2.48	749.56	226.09	0.19
1	21555.71	10yr	1825.00	69.38	75.74		75.83	0.000340	2.41	757.49	138.17	0.18
1	21785.60	10yr	1825.00	69.25	75.82		75.91	0.000303	2.32	786.86	147.34	0.17

HEC-RAS Plan: Proposed River: Drain 36 Reach: 1 Profile: 10-yr

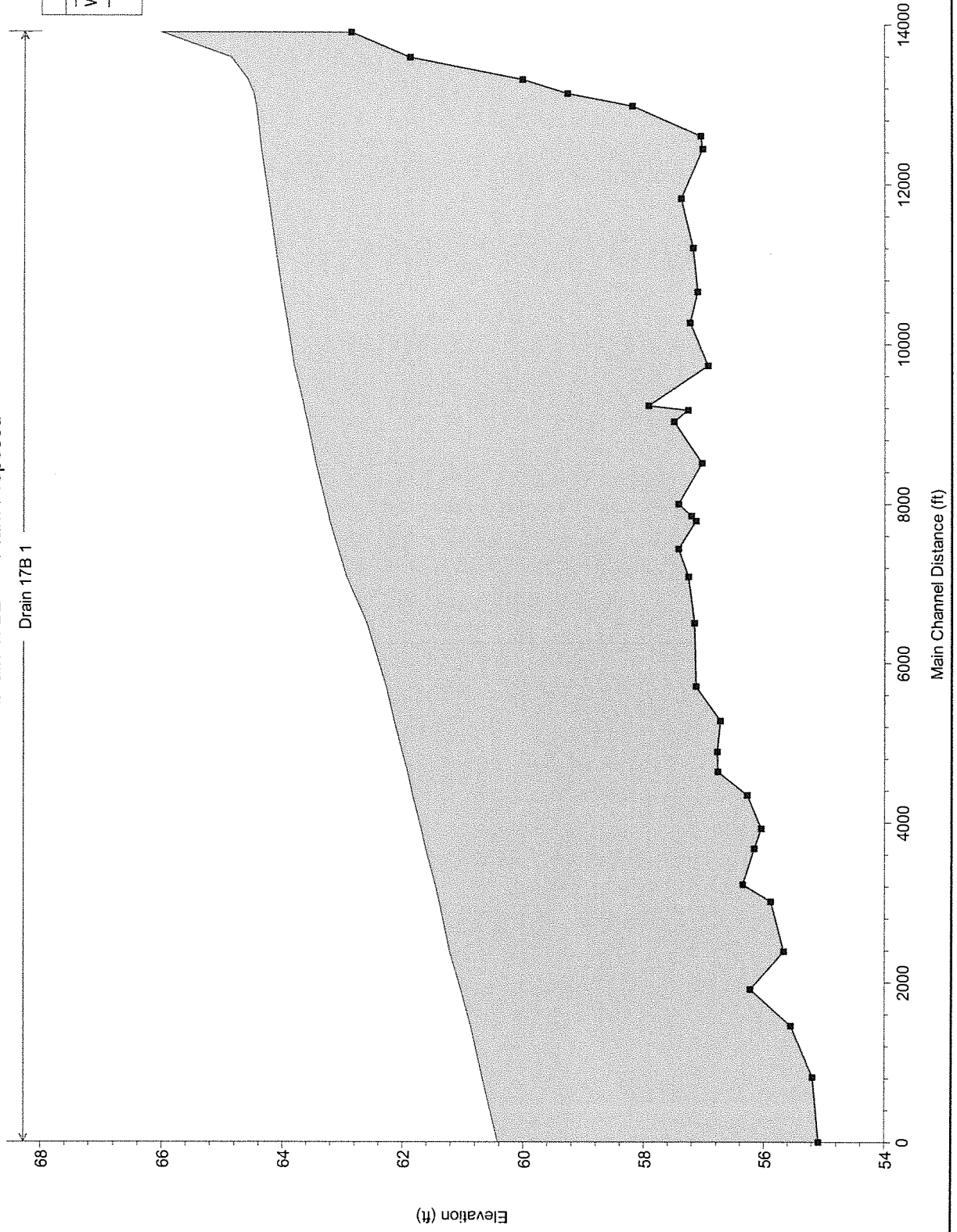
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	237.49	10-yr	328.00	57.49	63.54	61.11	63.72	0.003504	3.44	95.41	27.26	0.32
1	655.32	10-yr	328.00	59.02	64.90		65.08	0.003046	3.42	95.91	23.83	0.30
1	1002.84	10-yr	328.00	60.19	65.66	62.62	65.74	0.001251	2.24	146.22	38.24	0.20
1	1247.73	10-yr	328.00	59.40	65.78	61.46	65.79	0.000063	0.61	743.69	197.39	0.05
1	1442.04	10-yr	328.00	59.68	65.73	62.56	65.86	0.001941	2.83	115.92	28.14	0.25
1	1488.23	Drive Way	Culvert									
1	1521.83	10-yr	328.00	59.70	66.84	62.56	66.90	0.000846	2.03	161.59	35.49	0.17
1	1623.56	10-yr	328.00	59.65	66.92		66.99	0.000773	2.01	163.24	32.84	0.16
1	1750.25	10-yr	328.00	61.20	67.05	63.81	67.16	0.002522	2.72	120.76	29.79	0.24
1	1793.21	Drive Way	Culvert									
1	1838.40	10-yr	328.00	60.12	68.20	63.03	68.25	0.001058	1.87	175.77	41.35	0.16
1	1908.88	10-yr	328.00	60.14	68.27		68.33	0.001012	1.90	172.55	35.82	0.15
1	2408.15	10-yr	328.00	60.14	68.62		68.64	0.000413	1.20	476.19	1278.91	0.10
1	2901.71	10-yr	328.00	60.09	68.68		68.69	0.000041	0.42	1098.41	1315.59	0.03
1	3657.38	10-yr	328.00	61.03	68.71		68.71	0.000035	0.34	1036.99	545.39	0.03
1	4157.48	10-yr	328.00	60.67	68.73		68.73	0.000053	0.44	932.86	616.01	0.04
1	4293.19	10-yr	328.00	61.31	68.74		68.74	0.000084	0.53	786.36	556.49	0.04



Drain 17B2 Plan: Proposed

Drain 17B 1

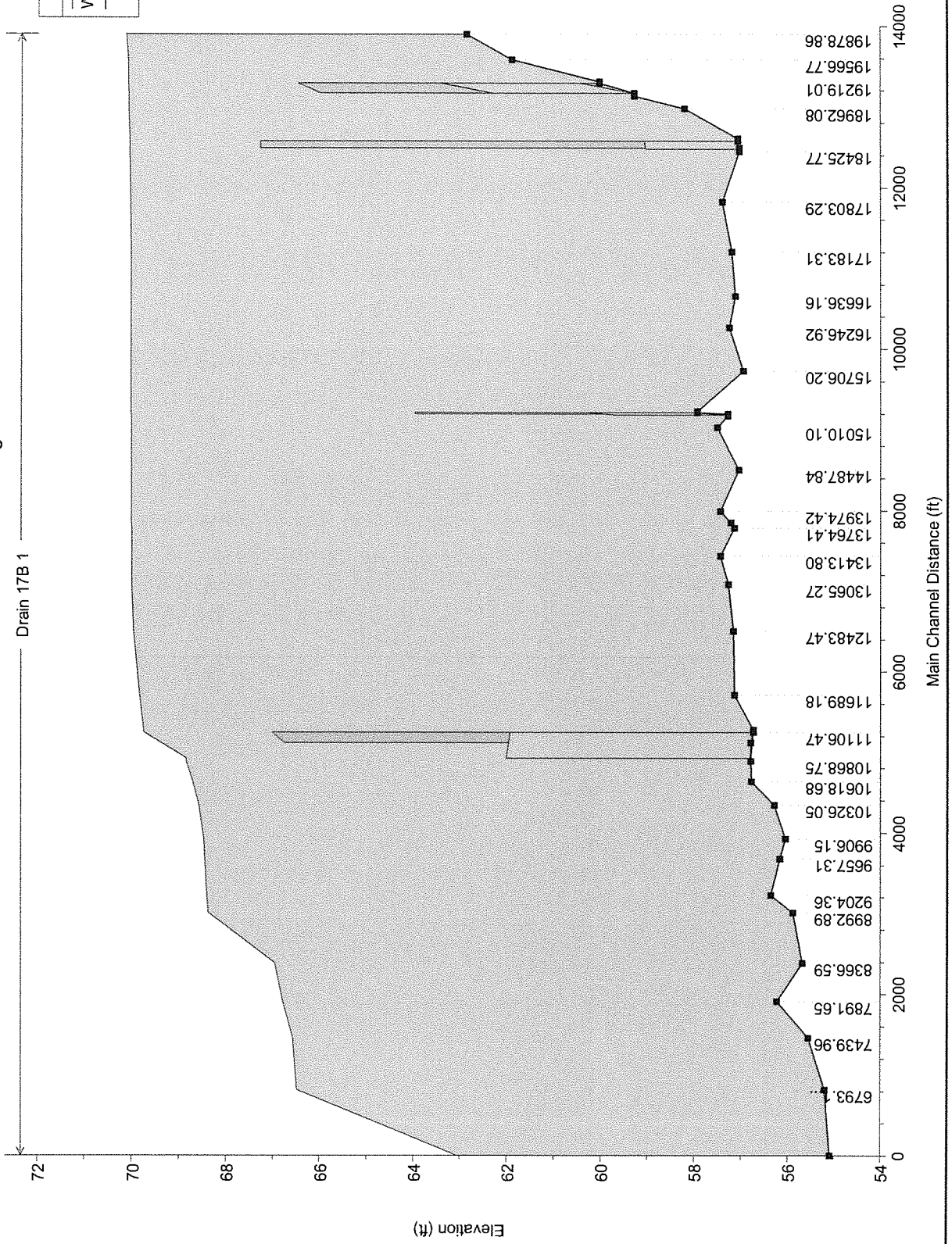
Legend	
WS proposed	
Ground	



Drain 17B2 Plan: Existing

Drain 17B 1

Legend	
WS 10-year	—
Ground	■

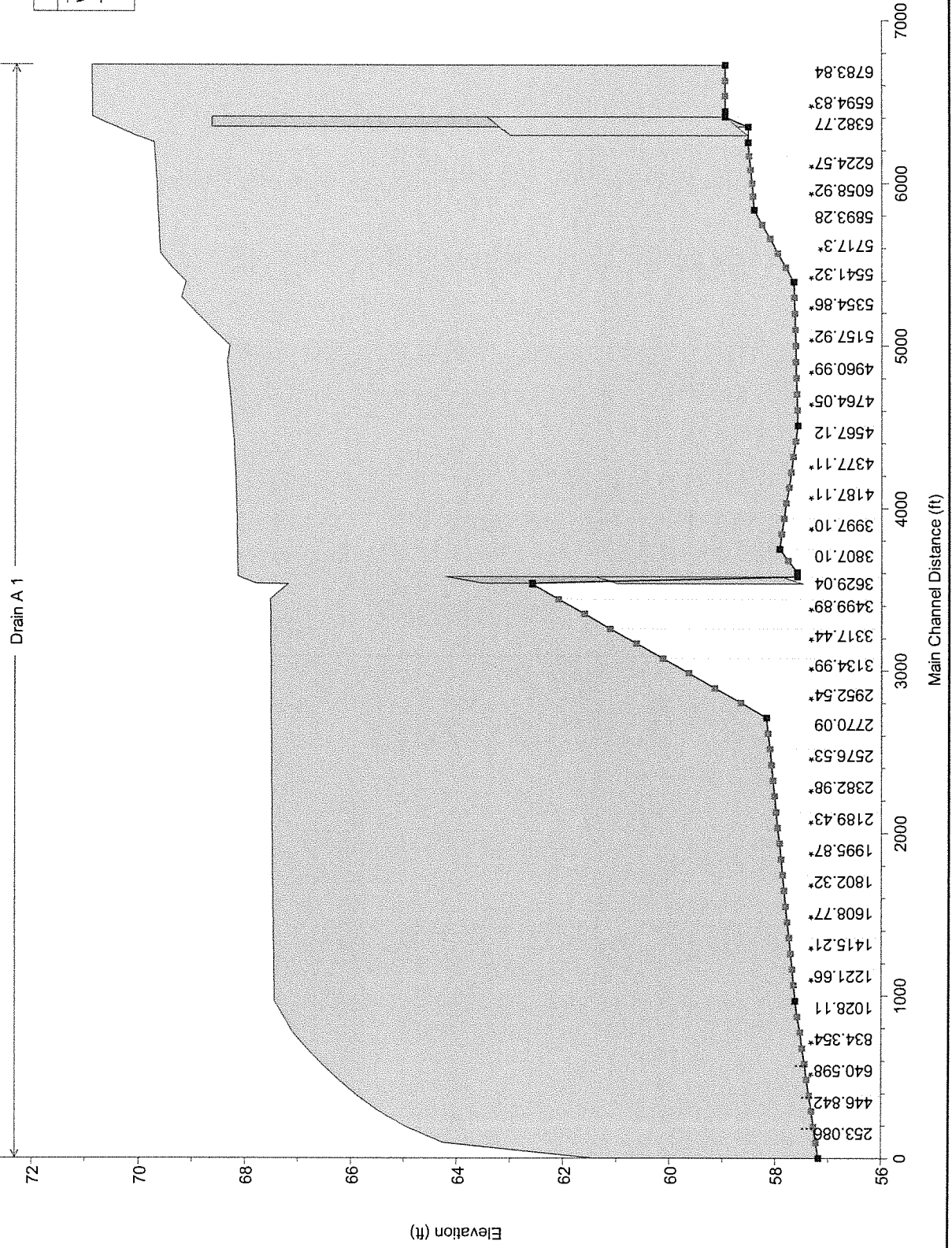


HEC-RAS Plan: Proposed River: Drain 17B Reach: 1 Profile: proposed

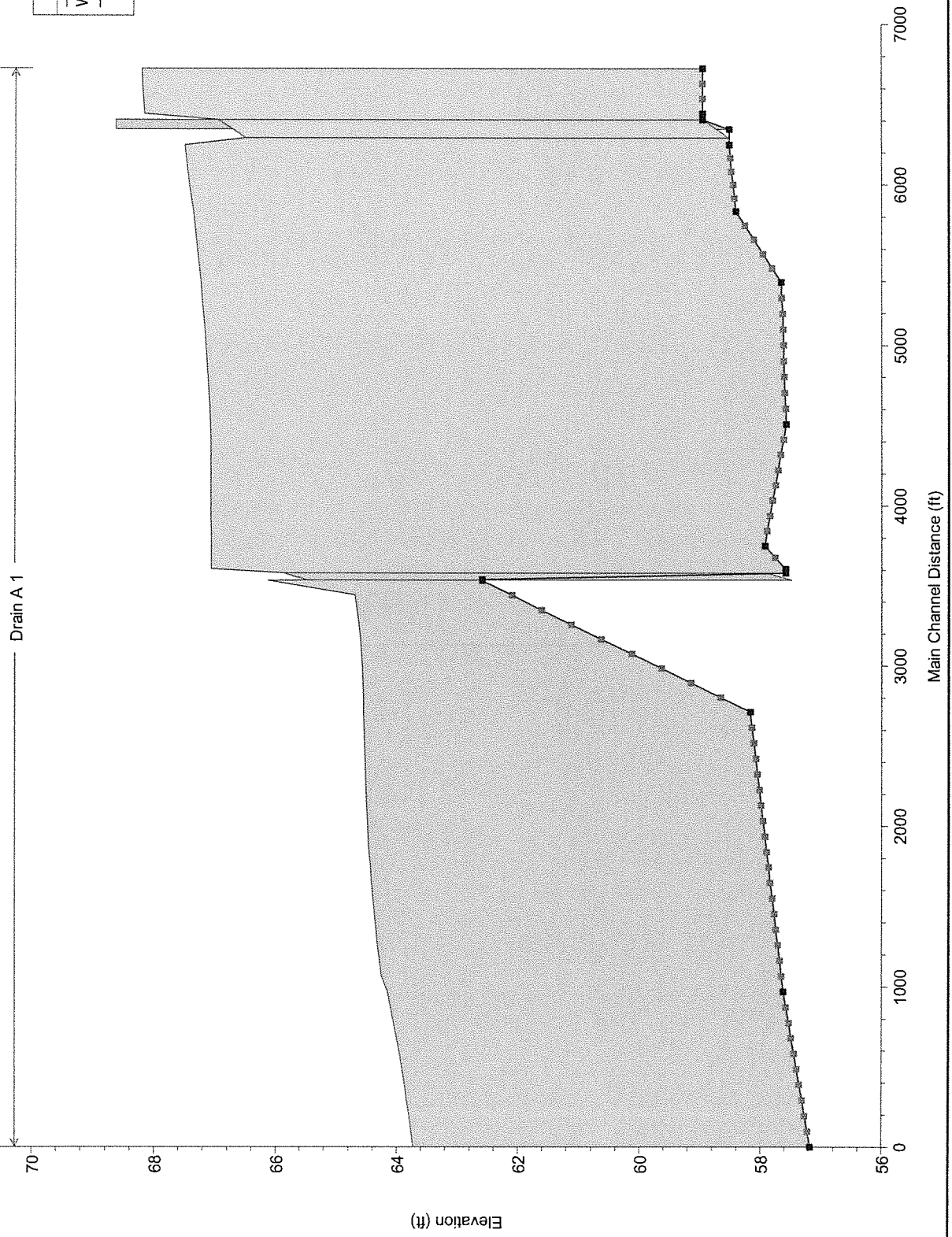
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	5980.00	proposed	1023.00	55.09	60.43	56.54	60.47	0.000320	1.65	618.98	132.00	0.13
1	6793.17	proposed	1023.00	55.19	60.68		60.72	0.000291	1.60	639.04	132.93	0.13
1	7439.96	proposed	1023.00	55.55	60.87		60.92	0.000324	1.66	617.30	131.93	0.14
1	7891.65	proposed	1023.00	56.22	61.04		61.09	0.000455	1.86	551.40	128.91	0.16
1	8366.59	proposed	1023.00	55.67	61.22		61.26	0.000279	1.58	647.53	133.32	0.13
1	8992.89	proposed	1023.00	55.88	61.40		61.44	0.000285	1.59	643.03	133.10	0.13
1	9204.36	proposed	1023.00	56.35	61.46		61.51	0.000372	1.74	589.39	130.66	0.14
1	9657.31	proposed	1023.00	56.16	61.62		61.66	0.000300	1.61	635.27	132.75	0.13
1	9906.15	proposed	1023.00	56.04	61.69		61.74	0.000341	1.78	573.20	109.90	0.14
1	10326.05	proposed	1023.00	56.27	61.83		61.87	0.000275	1.59	642.72	127.28	0.12
1	10618.68	proposed	1023.00	56.76	61.92		61.97	0.000363	1.75	583.98	122.62	0.14
1	10868.75	proposed	1023.00	56.77	62.01		62.05	0.000341	1.69	606.33	131.43	0.14
1	11258.85	proposed	1023.00	56.72	62.14		62.18	0.000300	1.62	629.84	131.68	0.13
1	11689.18	proposed	1023.00	57.13	62.28		62.32	0.000362	1.72	594.14	130.89	0.14
1	12483.47	proposed	1023.00	57.15	62.60		62.72	0.000640	2.83	361.32	82.68	0.24
1	13065.27	proposed	873.00	57.25	62.94		63.02	0.000398	2.29	381.56	84.14	0.19
1	13413.80	proposed	873.00	57.42	63.08		63.16	0.000406	2.30	378.97	83.94	0.19
1	13764.41	proposed	873.00	57.13	63.22		63.29	0.000311	2.10	415.61	86.53	0.17
1	13829.17	proposed	873.00	57.20	63.24		63.31	0.000321	2.12	411.22	86.22	0.17
1	13974.42	proposed	873.00	57.42	63.28		63.36	0.000357	2.20	396.57	90.18	0.18
1	14487.84	proposed	873.00	57.03	63.45		63.51	0.000256	1.96	445.01	88.54	0.15
1	15010.10	proposed	873.00	57.49	63.59		63.66	0.000308	2.09	417.18	93.60	0.17
1	15152.15	proposed	873.00	57.26	63.64		63.70	0.000262	1.98	441.51	88.31	0.16
1	15208.26	proposed	873.00	57.92	63.65		63.73	0.000387	2.27	385.21	84.40	0.19
1	15706.20	proposed	873.00	56.93	63.82		63.87	0.000198	1.79	486.84	91.33	0.14
1	16246.92	proposed	873.00	57.23	63.93		63.98	0.000219	1.86	470.15	107.76	0.14
1	16636.16	proposed	873.00	57.10	64.01		64.06	0.000195	1.78	489.17	91.49	0.14
1	17183.31	proposed	873.00	57.18	64.12		64.17	0.000192	1.78	491.57	91.65	0.14
1	17803.29	proposed	873.00	57.38	64.24		64.29	0.000201	1.80	484.34	91.17	0.14
1	18425.77	proposed	873.00	57.02	64.36		64.40	0.000156	1.65	528.86	94.06	0.12
1	18587.84	proposed	873.00	57.05	64.39		64.43	0.000157	1.65	528.44	94.04	0.12
1	18962.08	proposed	873.00	58.19	64.45		64.51	0.000281	2.03	430.52	87.56	0.16
1	19114.08	proposed	873.00	59.27	64.49		64.59	0.000544	2.55	342.65	81.31	0.22
1	19290.87	proposed	873.00	60.02	64.59		64.73	0.000875	3.00	291.17	77.43	0.27
1	19566.77	proposed	873.00	61.88	64.86		65.25	0.003910	4.96	175.97	67.91	0.54
1	19878.86	proposed	873.00	62.86	66.02		66.36	0.003201	4.64	188.06	68.97	0.50

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	5980.00	10-year	2800.00	55.09	63.05	63.05	65.95	0.020052	13.64	205.22	35.53	1.00
1	6793.17	10-year	2800.00	55.19	66.48	63.21	66.49	0.000090	1.12	383.76	1112.63	0.07
1	7439.96	10-year	2800.00	55.55	66.57	63.43	66.60	0.000373	2.32	2053.10	727.83	0.15
1	7891.65	10-year	2800.00	56.22	66.78	64.10	66.88	0.000929	3.30	1329.76	507.06	0.23
1	8366.59	10-year	2800.00	55.67	66.96	63.54	68.03	0.005175	8.31	337.42	45.69	0.53
1	8992.89	10-year	2800.00	55.88	68.37	64.23	68.39	0.000135	1.45	3538.57	1295.65	0.09
1	9204.36	10-year	2800.00	56.35	68.40	65.24	68.41	0.000132	1.33	3587.36	1283.48	0.09
1	9657.31	10-year	2800.00	56.16	68.45	62.99	68.46	0.000138	1.48	3087.08	939.71	0.09
1	9906.15	10-year	2800.00	56.04	68.47	63.69	68.49	0.000223	1.79	2478.59	778.09	0.11
1	10326.05	10-year	2800.00	56.27	68.57	65.20	68.63	0.000519	2.75	1635.62	533.96	0.17
1	10618.68	10-year	2800.00	56.76	68.71	64.36	68.75	0.000359	2.38	1832.65	535.54	0.15
1	10868.75	10-year	2800.00	56.77	68.84	67.51	68.88	0.000383	2.68	2121.71	861.37	0.15
1	11106.47 Mile 3	Culvert										
1	11258.85	10-year	2800.00	56.72	69.75	68.80	69.78	0.000179	1.91	2290.39	564.46	0.11
1	11689.18	10-year	2800.00	57.13	69.83	64.67	69.87	0.000207	1.94	2131.59	499.63	0.11
1	12483.47	10-year	2800.00	57.15	69.96	65.04	69.98	0.000100	1.38	2812.19	556.12	0.08
1	13065.27	10-year	873.00	57.25	70.00		70.00	0.000009	0.44	2963.24	623.67	0.02
1	13413.80	10-year	873.00	57.42	70.01		70.01	0.000010	0.47	2934.00	656.12	0.03
1	13764.41	10-year	873.00	57.13	70.01		70.01	0.000014	0.50	2666.06	653.82	0.03
1	13829.17	10-year	873.00	57.20	70.01		70.01	0.000007	0.37	3270.61	648.94	0.02
1	13974.42	10-year	873.00	57.42	70.01		70.01	0.000007	0.38	3336.12	673.59	0.02
1	14487.84	10-year	873.00	57.03	70.01		70.02	0.000005	0.31	4010.59	767.75	0.02
1	15010.10	10-year	873.00	57.49	70.02		70.02	0.000004	0.31	3922.46	701.73	0.02
1	15152.15	10-year	873.00	57.26	70.02	64.08	70.02	0.000007	0.41	3316.63	708.83	0.02
1	15179.98 27+60	Culvert										
1	15208.26	10-year	873.00	57.92	70.02	64.08	70.02	0.000005	0.32	3790.28	706.85	0.02
1	15706.20	10-year	873.00	56.93	70.02		70.02	0.000004	0.28	4232.22	710.99	0.02
1	16246.92	10-year	873.00	57.23	70.03		70.03	0.000004	0.28	4309.40	763.54	0.02
1	16636.16	10-year	873.00	57.10	70.03		70.03	0.000006	0.35	3743.31	742.32	0.02
1	17183.31	10-year	873.00	57.18	70.03		70.03	0.000010	0.45	3015.02	717.36	0.03
1	17803.29	10-year	873.00	57.38	70.04		70.04	0.000023	0.60	2283.92	657.48	0.04
1	18425.77	10-year	873.00	57.02	70.06	67.59	70.06	0.000035	0.76	1904.36	610.98	0.05
1	18516.68 7+50	Culvert										
1	18587.84	10-year	873.00	57.05	70.06	68.20	70.07	0.000058	0.81	1677.85	604.56	0.05
1	18962.08	10-year	873.00	58.19	70.08		70.08	0.000020	0.56	2298.97	588.39	0.03
1	19114.08	10-year	873.00	59.27	70.08	68.00	70.08	0.000033	0.64	1994.15	589.82	0.04
1	19219.01 Mile 4.5	Culvert										
1	19290.87	10-year	873.00	60.02	70.08	68.66	70.09	0.000032	0.63	1913.47	515.58	0.04
1	19566.77	10-year	873.00	61.88	70.10		70.10	0.000085	0.98	1328.07	440.55	0.07
1	19878.86	10-year	873.00	62.86	70.13		70.14	0.000181	1.25	960.06	336.75	0.10

DrainA Plan: Existing



DrainA Plan: Proposed_50ft

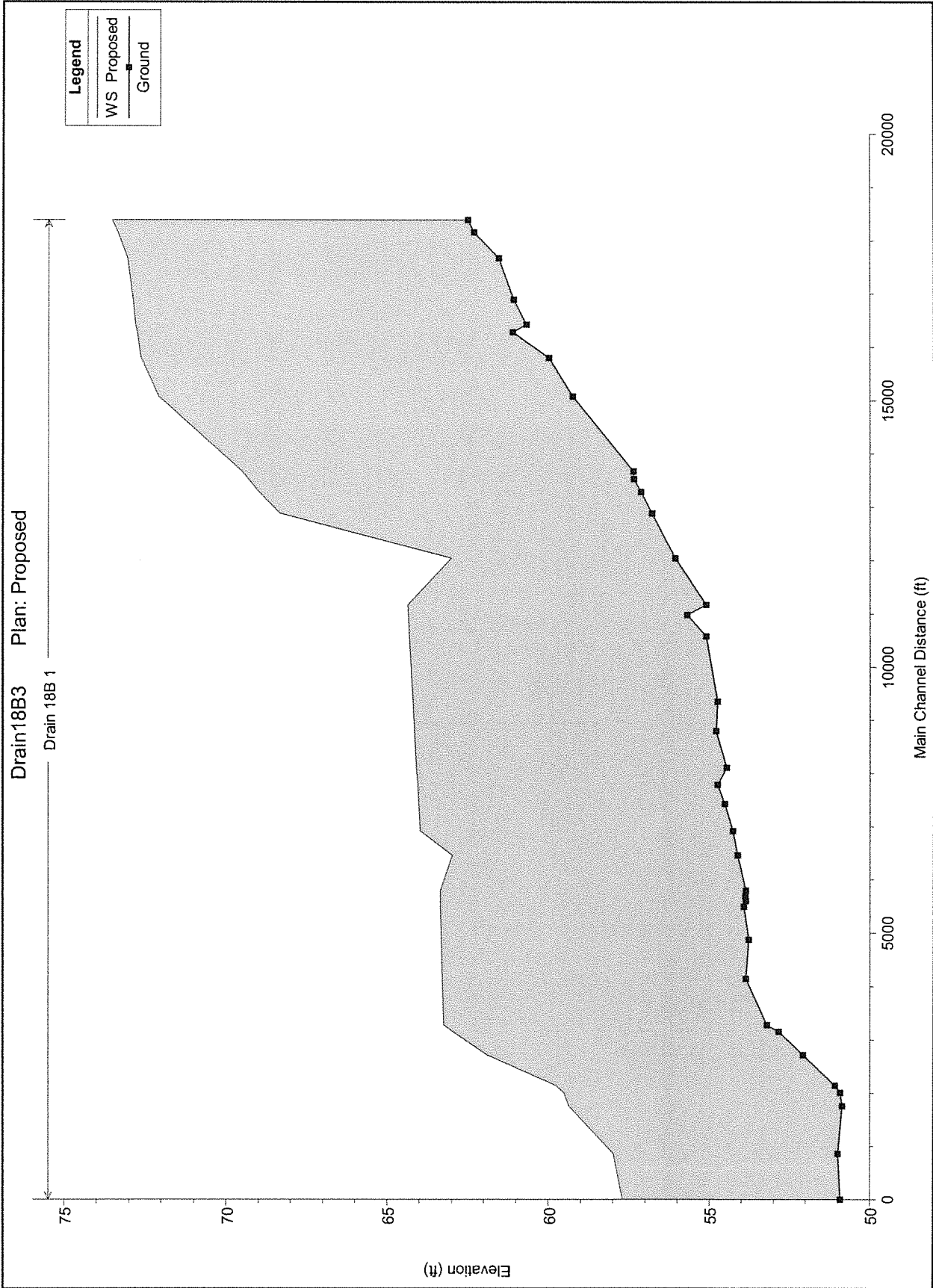


HEC-RAS Plan: Proposed_50ft River: Drain A Reach: 1 Profile: Proposed

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	59.33	Proposed	300.00	57.18	63.73	59.91	63.79	0.000351	1.97	151.94	35.94	0.17
1	1028.11	Proposed	300.00	57.62	64.15	60.73	64.24	0.000589	2.42	124.20	31.59	0.21
1	2770.09	Proposed	300.00	58.16	64.55		64.55	0.000051	0.68	731.97	420.28	0.07
1	3591.12	Proposed	300.00	62.58	66.13	66.13	66.84	0.012207	6.93	48.76	37.93	0.88
1	3629.04 Mile 4		Culvert									
1	3665.26	Proposed	400.00	57.58	67.06	58.81	67.07	0.000012	0.54	741.84	106.46	0.04
1	3807.10	Proposed	400.00	57.92	67.06	59.14	67.07	0.000015	0.57	706.67	104.56	0.04
1	4567.12	Proposed	400.00	57.57	67.08	60.53	67.11	0.000144	1.54	259.66	44.42	0.11
1	5453.33	Proposed	400.00	57.65	67.24	61.67	67.30	0.000278	2.01	199.07	36.24	0.15
1	5893.28	Proposed	400.00	58.40	67.36	62.02	67.43	0.000297	2.10	190.51	33.44	0.16
1	6307.40	Proposed	400.00	58.51	67.50	62.15	67.54	0.000205	1.69	236.74	47.61	0.13
1	6382.77 Mile 4.5		Culvert									
1	6500.33	Proposed	400.00	58.95	68.17	62.75	68.18	0.000130	1.04	716.54	564.68	0.08
1	6783.84	Proposed	400.00	58.95	68.21		68.21	0.000063	0.74	1054.54	757.00	0.06

HEC-RAS Plan: Existing River: Drain A Reach: 1 Profile: Proposed

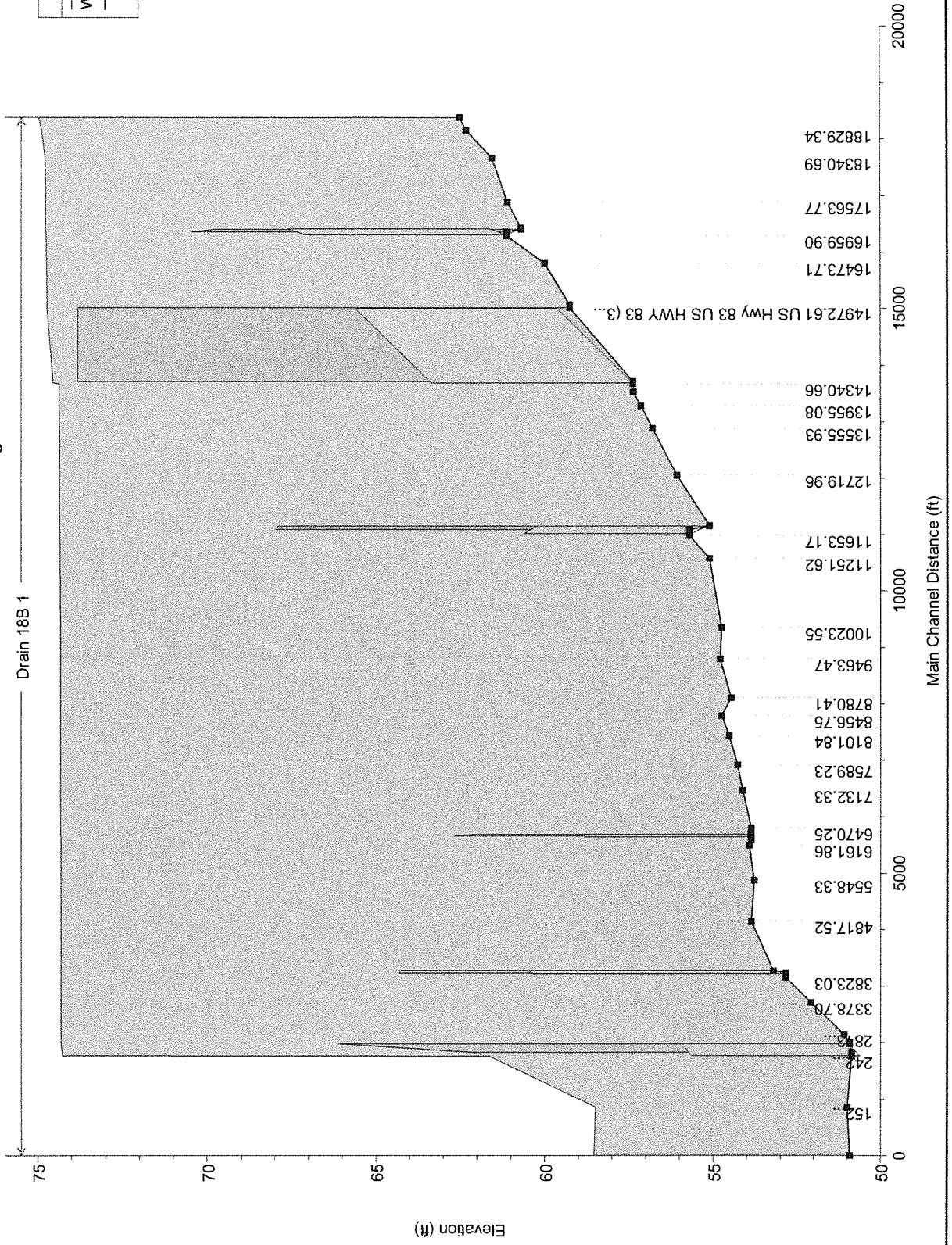
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	59.33	Proposed	300.00	57.18	66.27	59.91	66.29	0.000350	1.15	268.73	58.86	0.08
1	1028.11	Proposed	300.00	57.62	66.72	60.73	66.75	0.000601	1.38	216.77	40.68	0.11
1	2770.09	Proposed	300.00	58.16	66.82	61.17	66.83	0.000005	0.15	1700.86	429.07	0.01
1	3591.12	Proposed	300.00	62.58	67.58	66.13	67.68	0.004372	2.48	115.44	54.58	0.26
1	3629.04 Mile 4		Culvert									
1	3665.26	Proposed	400.00	57.58	67.69	61.18	67.69	0.000012	0.22	1596.26	440.22	0.02
1	3807.10	Proposed	400.00	57.92	67.69	61.65	67.69	0.000013	0.22	1569.01	441.71	0.02
1	4567.12	Proposed	400.00	57.57	67.72	60.53	67.72	0.000086	0.57	832.17	370.21	0.04
1	5453.33	Proposed	400.00	57.65	68.20	61.68	68.25	0.000799	1.70	235.39	39.76	0.12
1	5893.28	Proposed	400.00	58.40	68.56	62.02	68.61	0.000814	1.72	233.17	37.73	0.12
1	6307.40	Proposed	400.00	58.51	68.15	65.07	69.57	0.012436	9.56	41.83	51.84	0.55
1	6382.77 Mile 4.5		Culvert									
1	6500.33	Proposed	400.00	58.95	70.89	65.47	70.89	0.000004	0.25	2278.99	581.57	0.02
1	6783.84	Proposed	400.00	58.95	70.89	62.96	70.89	0.000002	0.18	3140.91	787.50	0.01



Drain18B3 Plan: Existing

Drain 18B 1

Legend	
WS 10-year	
Ground	

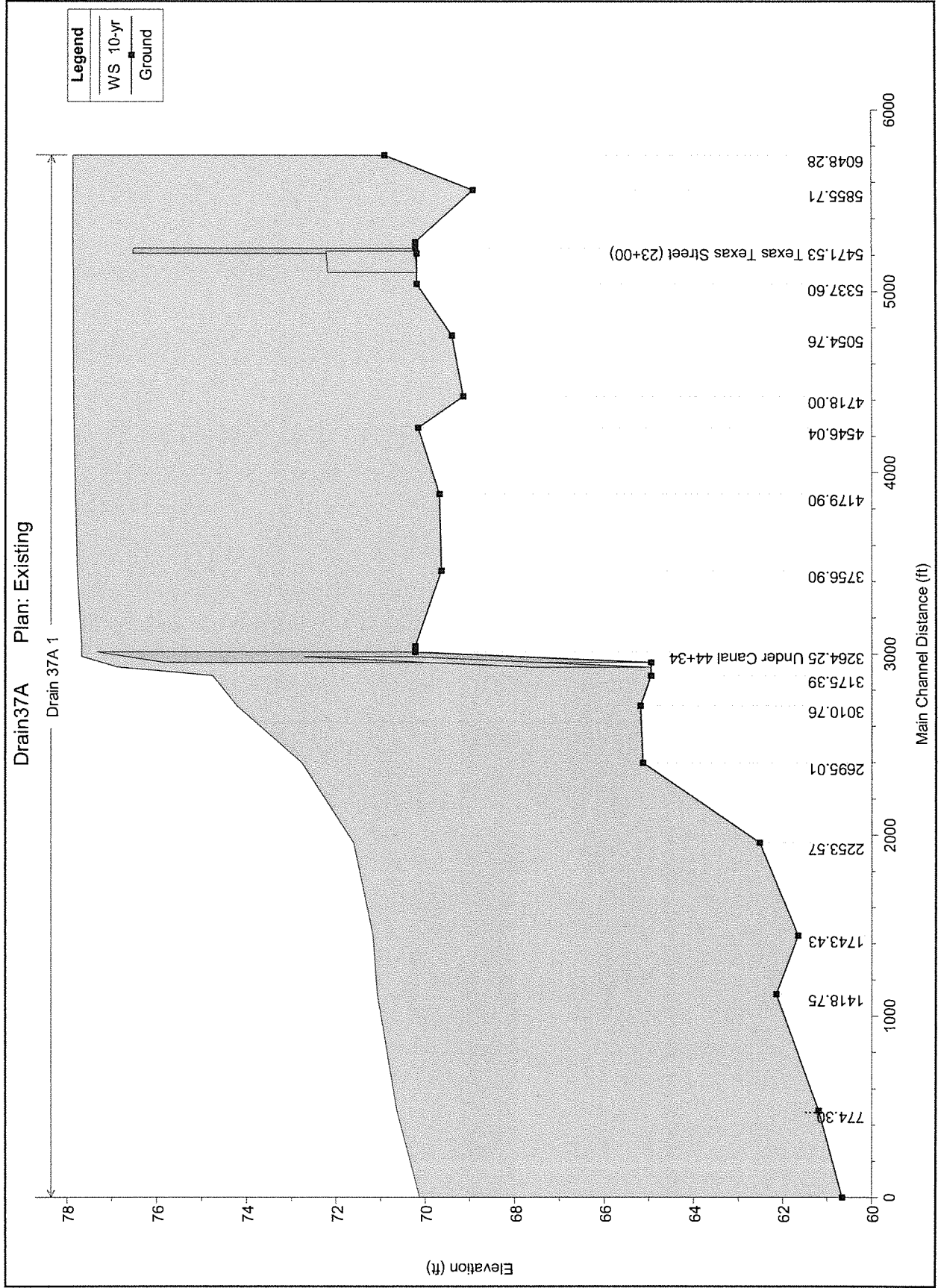


HEC-RAS Plan: Proposed River: Drain 18B Reach: 1 Profile: Proposed

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	670.90	Proposed	1374.00	50.92	57.70	56.05	57.71	0.000200	0.99	2034.10	1496.91	0.08
1	1528.26	Proposed	1374.00	51.00	57.98		58.23	0.004110	4.00	343.63	96.26	0.37
1	2426.22	Proposed	1374.00	50.86	59.37		59.45	0.000654	2.26	607.12	98.66	0.16
1	2673.81	Proposed	1374.00	50.92	59.51		59.77	0.002150	4.11	334.47	51.13	0.28
1	2813.40	Proposed	1374.00	51.08	59.77		60.28	0.004840	5.73	239.69	39.82	0.41
1	3378.70	Proposed	1374.00	52.08	61.91		62.22	0.002518	4.50	305.08	44.20	0.30
1	3823.03	Proposed	1374.00	52.83	62.97		63.23	0.002032	4.10	335.34	48.35	0.27
1	3949.19	Proposed	1374.00	53.20	63.25		63.27	0.000038	1.05	1310.67	213.63	0.06
1	4817.52	Proposed	1374.00	53.85	63.29		63.31	0.000048	1.13	1211.61	158.27	0.07
1	5548.33	Proposed	1374.00	53.76	63.32	55.53	63.34	0.000045	1.11	1296.54	452.73	0.07
1	6161.86	Proposed	1374.00	53.91	63.35	55.68	63.37	0.000047	1.14	1210.56	154.73	0.07
1	6269.93	Proposed	1374.00	53.85	63.35	55.62	63.37	0.000046	1.12	1267.27	326.76	0.07
1	6365.28	Proposed	1906.00	53.87	63.35	56.06	63.39	0.000085	1.58	1218.14	157.05	0.10
1	6470.25	Proposed	1906.00	53.85	63.36	56.05	63.39	0.000086	1.56	1243.63	221.54	0.10
1	7132.33	Proposed	1906.00	54.11	62.98		63.82	0.005819	7.34	259.62	37.38	0.49
1	7589.23	Proposed	1906.00	54.26	63.98	56.45	64.02	0.000083	1.52	1261.99	182.10	0.09
1	8101.84	Proposed	1906.00	54.51	64.02	56.71	64.06	0.000089	1.56	1229.87	194.01	0.10
1	8456.75	Proposed	1906.00	54.72	64.06		64.09	0.000095	1.59	1261.24	404.15	0.10
1	8780.41	Proposed	1906.00	54.44	64.09		64.12	0.000085	1.53	1244.17	179.20	0.10
1	9463.47	Proposed	1906.00	54.77	64.15		64.19	0.000094	1.59	1201.43	156.26	0.10
1	10023.55	Proposed	1906.00	54.72	64.20		64.24	0.000091	1.57	1217.60	156.89	0.10
1	11251.62	Proposed	1679.00	55.09	64.31		64.34	0.000078	1.43	1177.14	155.34	0.09
1	11653.17	Proposed	1679.00	55.68	64.34		64.38	0.000097	1.54	1091.24	151.98	0.10
1	11835.71	Proposed	1679.00	55.08	64.36		64.39	0.000076	1.41	1186.81	155.69	0.09
1	12719.96	Proposed	1679.00	56.04	63.01	63.01	65.35	0.016864	12.29	136.67	29.17	1.00
1	13555.93	Proposed	1679.00	56.77	68.34		68.76	0.001658	5.19	323.20	43.24	0.33
1	13955.08	Proposed	1679.00	57.11	69.00		69.36	0.001349	4.84	346.99	44.03	0.30
1	14197.84	Proposed	1679.00	57.33	69.32		69.72	0.001539	5.07	331.36	43.33	0.32
1	14340.66	Proposed	1679.00	57.35	69.51		70.10	0.002699	6.15	273.04	40.24	0.42
1	15746.59	Proposed	1679.00	59.23	72.10		72.32	0.000957	4.01	604.75	460.16	0.26
1	16473.71	Proposed	967.00	59.98	72.65		72.67	0.000189	1.70	1596.78	1025.67	0.11
1	16959.90	Proposed	967.00	61.10	72.75		72.80	0.000333	2.24	1062.11	809.06	0.15
1	17101.11	Proposed	967.00	60.67	72.81		72.83	0.000151	1.66	1549.83	1068.95	0.10
1	17563.77	Proposed	967.00	61.07	72.88		72.91	0.000182	1.63	1189.35	819.41	0.11
1	18340.69	Proposed	967.00	61.53	73.05		73.18	0.000648	2.85	348.91	94.02	0.21
1	18829.34	Proposed	967.00	62.30	73.36		73.49	0.000633	2.92	330.86	54.72	0.21
1	19057.40	Proposed	967.00	62.49	73.53		73.63	0.000494	2.50	386.20	68.13	0.19

HEC-RAS Plan: Existing River: Drain 188 Reach: 1 Profile: 10-year

Reach	River Sta	Profile	Q Total (cfs)	Min Chl El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	670.90	10-year	2873.00	50.92	58.53	56.62	58.54	0.000200	1.12	3355.11	1675.70	0.09
1	1528.26	10-year	2873.00	51.00	58.49		59.31	0.012623	7.29	393.96	104.02	0.66
1	2426.22	10-year	2873.00	50.86	61.63		61.81	0.001144	3.39	847.52	113.91	0.22
1	2533.31	Unnamed	Culvert									
1	2673.81	10-year	2873.00	50.92	74.32	57.24	74.32	0.000001	0.18	20283.68	1977.22	0.01
1	2813.40	10-year	2873.00	51.08	74.32		74.32	0.000001	0.18	19711.84	1976.99	0.01
1	3378.70	10-year	2873.00	52.08	74.32		74.32	0.000001	0.16	21285.76	2247.71	0.01
1	3823.03	10-year	2873.00	52.83	74.32		74.32	0.000001	0.17	20741.77	2231.49	0.01
1	3893.40	Mile 2	Culvert									
1	3949.19	10-year	3029.00	53.20	74.32	61.33	74.32	0.000002	0.22	20731.32	2235.78	0.01
1	4817.52	10-year	3029.00	53.85	74.32		74.32	0.000003	0.23	18590.44	1850.52	0.01
1	5548.33	10-year	3029.00	53.76	74.32		74.33	0.000001	0.18	24065.67	2040.17	0.01
1	6161.86	10-year	3029.00	53.91	74.33		74.33	0.000001	0.16	20143.36	1674.06	0.01
1	6269.93	10-year	3029.00	53.85	74.33		74.33	0.000003	0.31	11772.74	1012.75	0.01
1	6324.11	Mile 2.5	Culvert									
1	6365.28	10-year	1906.00	53.87	74.33	59.45	74.33	0.000001	0.22	13109.47	1014.28	0.01
1	6470.25	10-year	1906.00	53.85	74.33		74.33	0.000001	0.21	14509.23	1149.97	0.01
1	7132.33	10-year	1906.00	54.11	74.33		74.33	0.000004	0.33	8149.28	779.68	0.02
1	7589.23	10-year	1906.00	54.26	74.33		74.33	0.000003	0.29	9407.92	888.26	0.01
1	8101.84	10-year	1906.00	54.51	74.33		74.33	0.000002	0.23	11967.13	1185.10	0.01
1	8456.75	10-year	1906.00	54.72	74.34		74.34	0.000003	0.26	10748.58	1106.73	0.01
1	8780.41	10-year	1906.00	54.44	74.34		74.34	0.000002	0.23	10272.71	1084.47	0.01
1	9463.47	10-year	1906.00	54.77	74.34		74.34	0.000002	0.23	10343.50	1160.50	0.01
1	10023.55	10-year	1906.00	54.72	74.34		74.34	0.000002	0.24	9767.66	1110.80	0.01
1	11251.62	10-year	1679.00	55.09	74.34		74.34	0.000013	0.53	6063.53	910.38	0.03
1	11653.17	10-year	1679.00	55.68	74.35		74.35	0.000009	0.47	6501.65	918.03	0.02
1	11740.26	International	Culvert									
1	11835.71	10-year	1679.00	55.08	74.36	60.06	74.36	0.000003	0.35	6839.93	932.13	0.02
1	12719.96	10-year	1679.00	56.04	74.36		74.36	0.000007	0.42	5910.18	964.25	0.02
1	13555.93	10-year	1679.00	56.77	74.37		74.37	0.000005	0.36	7237.28	1281.69	0.02
1	13955.08	10-year	1679.00	57.11	74.37		74.37	0.000008	0.46	5714.67	1008.92	0.02
1	14197.84	10-year	1679.00	57.33	74.37		74.37	0.000011	0.54	4479.71	747.42	0.03
1	14340.66	10-year	1679.00	57.35	74.37		74.38	0.000014	0.59	4074.72	739.02	0.03
1	14972.61	US Hwy 83	Culvert									
1	15746.59	10-year	1679.00	59.23	74.73	66.34	74.73	0.000018	0.66	3999.97	1082.45	0.04
1	16473.71	10-year	967.00	59.98	74.75		74.75	0.000021	0.63	4080.53	1328.97	0.04
1	16959.90	10-year	967.00	61.10	74.76	66.55	74.76	0.000039	0.85	3000.51	1523.02	0.05
1	17039.84	Airport	Culvert									
1	17101.11	10-year	967.00	60.67	74.77	65.79	74.77	0.000018	0.67	4158.77	1487.31	0.04
1	17563.77	10-year	967.00	61.07	74.78		74.78	0.000024	0.70	3249.98	1391.55	0.04
1	18340.69	10-year	967.00	61.53	74.79		74.84	0.000204	1.80	1033.80	671.47	0.12
1	18829.34	10-year	967.00	62.30	74.90		74.98	0.000345	2.24	462.94	255.87	0.16
1	19057.40	10-year	967.00	62.49	74.98		75.04	0.000249	1.98	489.04	73.16	0.13



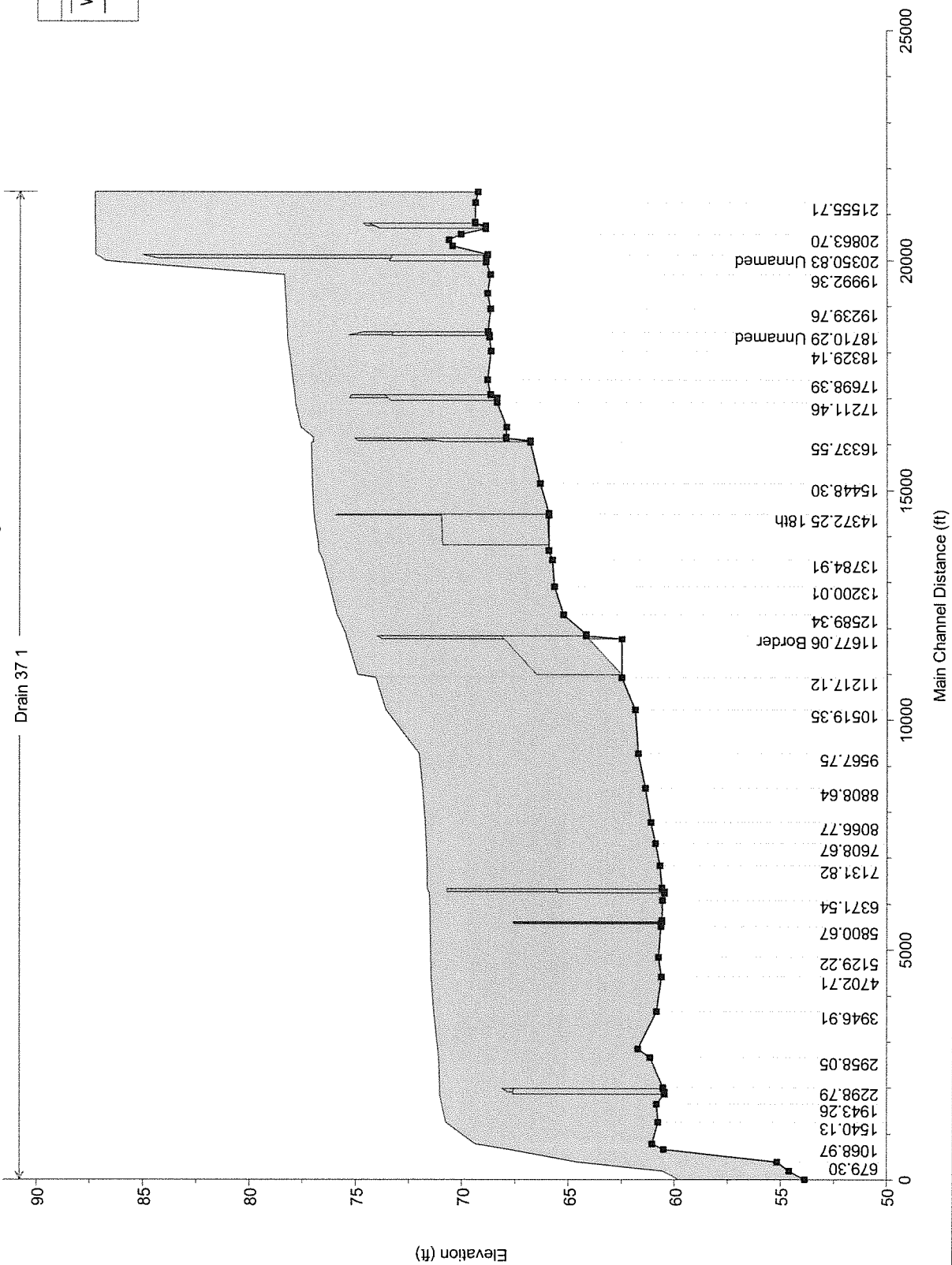
HEC-RAS Plan: Existing River: Drain 37A Reach: 1 Profile: 10-yr

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	297.42	10-yr	590.00	60.66	70.13	64.78	70.25	0.001102	2.87	215.61	901.63	0.21
1	774.30	10-yr	590.00	61.18	70.64		70.76	0.001040	2.80	211.17	38.66	0.20
1	1418.75	10-yr	590.00	62.13	71.08		71.11	0.000303	1.55	597.87	434.51	0.11
1	1743.43	10-yr	590.00	61.64	71.18		71.26	0.000615	2.29	257.28	40.66	0.16
1	2253.57	10-yr	590.00	62.51	71.61		71.81	0.001989	3.64	162.10	29.89	0.28
1	2895.01	10-yr	590.00	65.12	72.77		73.16	0.004744	5.05	116.81	25.23	0.41
1	3010.76	10-yr	590.00	65.18	74.22		74.56	0.004118	4.70	125.65	26.06	0.38
1	3175.39	10-yr	300.00	64.94	74.75	67.96	74.78	0.000307	1.38	216.98	37.44	0.10
1	3264.25	Under Canal	Culvert									
1	3339.04	10-yr	300.00	70.22	77.67	73.38	77.70	0.000420	1.47	418.92	652.14	0.12
1	3756.90	10-yr	300.00	69.64	77.76		77.77	0.000109	1.00	625.07	619.54	0.08
1	4179.90	10-yr	300.00	69.68	77.81		77.82	0.000103	0.93	677.26	635.85	0.08
1	4546.04	10-yr	300.00	70.16	77.84		77.85	0.000049	0.71	1018.87	752.35	0.06
1	4718.00	10-yr	300.00	69.14	77.85		77.85	0.000033	0.62	1209.76	765.19	0.05
1	5054.76	10-yr	300.00	69.40	77.86		77.86	0.000026	0.52	1401.67	932.24	0.04
1	5337.60	10-yr	300.00	70.19	77.87	73.12	77.87	0.000024	0.49	1205.27	898.75	0.04
1	5471.53	Texas	Culvert									
1	5570.80	10-yr	300.00	70.22	77.87	73.37	77.87	0.000014	0.41	1734.32	982.57	0.03
1	5855.71	10-yr	300.00	68.93	77.87		77.87	0.000013	0.40	1714.03	960.68	0.03
1	6048.28	10-yr	300.00	70.92	77.88		77.88	0.000007	0.26	2392.85	1237.69	0.02

Drain37 Plan: Existing w/o Levee

Drain 37 1

Legend	
WS 10yr	
Ground	

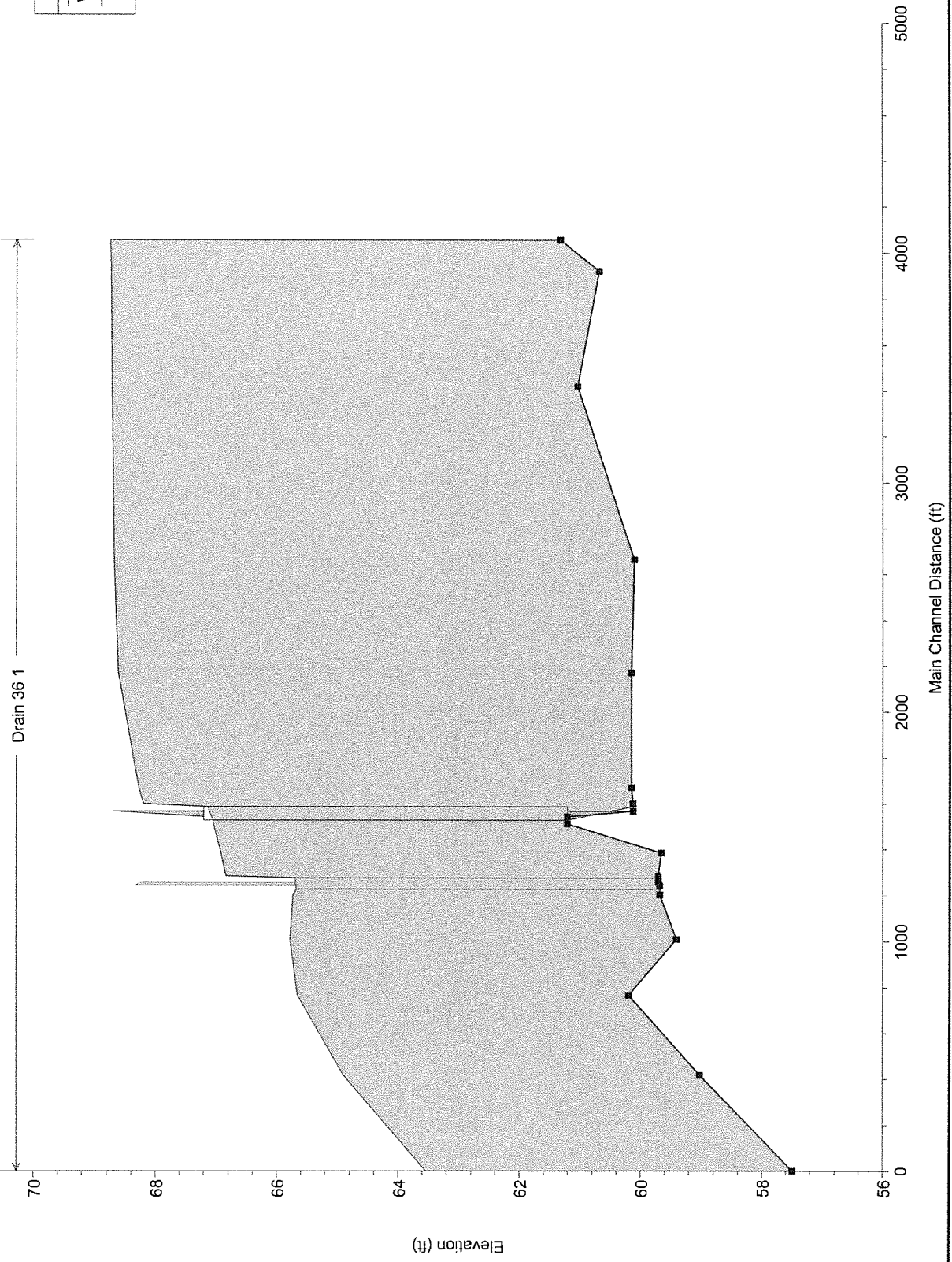


Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	296.28	10yr	2725.00	53.86	59.80	56.16	59.82	0.000170	0.59	2676.19	742.00	0.05
1	485.33	10yr	2725.00	54.61	60.55	60.55	61.63	0.032864	8.56	326.43	153.08	0.75
1	679.30	10yr	2725.00	55.17	64.63	62.14	65.72	0.015965	8.39	324.88	47.23	0.56
1	948.68	10yr	2725.00	60.50	67.81		68.33	0.007370	4.70	483.52	127.09	0.37
1	1068.97	10yr	2725.00	61.06	69.40	69.40	69.80	0.014550	6.48	626.85	589.21	0.51
1	1540.13	10yr	2725.00	60.77	70.77		70.81	0.000776	1.67	1786.06	778.04	0.12
1	1943.26	10yr	2725.00	60.84	70.97		70.98	0.000318	1.04	2851.86	1348.43	0.08
1	2151.83	10yr	2725.00	60.46	71.06	69.65	71.06	0.000111	0.72	4586.52	2009.00	0.05
1	2256.32 Bridge Avenue	Culvert										
1	2298.79	10yr	2725.00	60.53	71.06	69.57	71.06	0.000076	0.59	4732.76	1961.06	0.04
1	2958.05	10yr	2757.00	61.15	71.11		71.12	0.000305	1.07	3046.34	1522.74	0.08
1	3142.51	10yr	2757.00	61.72	71.15		71.17	0.000253	0.99	3147.69	1486.71	0.07
1	3946.91	10yr	2757.00	60.84	71.34		71.35	0.000234	1.01	3372.32	1596.61	0.07
1	4702.71	10yr	2757.00	60.60	71.45		71.46	0.000092	0.66	4514.99	1643.62	0.04
1	5129.22	10yr	2757.00	60.75	71.48		71.48	0.000048	0.48	5625.85	1717.79	0.03
1	5800.67	10yr	2356.00	60.62	71.50		71.51	0.000026	0.35	6209.29	1763.02	0.02
1	5869.51 34th / Mile 5	Bridge										
1	5937.88	10yr	2356.00	60.57	71.51	68.54	71.52	0.000059	0.54	4605.18	1534.24	0.03
1	6371.54	10yr	2356.00	60.55	71.53		71.54	0.000104	0.70	3379.64	1085.62	0.04
1	6523.05	10yr	2356.00	60.46	71.55	67.92	71.56	0.000109	0.79	3611.08	1327.04	0.05
1	6580.23 Texas	Culvert										
1	6648.62	10yr	2356.00	60.57	71.64	68.20	71.65	0.000051	0.80	4510.00	1399.47	0.05
1	7131.82	10yr	2356.00	60.66	71.66		71.66	0.000034	0.69	5099.73	1426.57	0.04
1	7608.67	10yr	2356.00	60.88	71.69		71.70	0.000125	1.20	3600.56	1604.20	0.08
1	8066.77	10yr	2356.00	61.09	71.74		71.75	0.000123	1.12	3461.28	1413.51	0.07
1	8808.64	10yr	2356.00	61.35	71.85		71.87	0.000204	1.42	2873.99	1321.67	0.10
1	9567.75	10yr	1909.00	61.68	72.03		72.24	0.002348	4.50	731.35	541.35	0.32
1	10519.35	10yr	1909.00	61.82	73.58	69.84	73.66	0.001061	3.09	1262.84	1129.49	0.21
1	11217.12	10yr	1909.00	62.47	74.07	74.07	74.11	0.000528	2.33	1628.12	1130.82	0.15
1	11677.06 Border	Culvert										
1	12162.11	10yr	1909.00	64.15	75.47	75.05	75.56	0.002104	3.43	1171.42	1576.88	0.26
1	12589.34	10yr	1909.00	65.23	75.89		75.91	0.000615	1.94	1935.66	1659.83	0.15
1	13200.01	10yr	1909.00	65.66	76.23		76.25	0.000543	1.86	2044.93	1730.04	0.14
1	13784.91	10yr	1909.00	65.75	76.55		76.57	0.000308	1.54	2513.29	1938.26	0.11
1	13987.29	10yr	1909.00	65.92	76.76	76.76	76.78	0.000367	1.67	2444.90	2099.86	0.12
1	14372.25 18th	Culvert										
1	14801.17	10yr	1909.00	65.91	76.99	75.85	76.99	0.000086	0.94	3615.76	1975.61	0.06
1	15448.30	10yr	1909.00	66.31	77.04		77.05	0.000095	0.99	3016.40	1439.65	0.07
1	16337.55	10yr	1825.00	66.79	77.11	75.08	77.13	0.000280	1.65	2150.01	1564.40	0.11
1	16366.44 Westgate	Culvert										
1	16448.22	10yr	1825.00	67.93	77.00	76.77	77.26	0.002814	4.89	754.61	1145.43	0.36
1	16670.84	10yr	1825.00	67.91	77.60		77.65	0.000689	2.62	1431.88	1145.23	0.18
1	17211.46	10yr	1825.00	68.35	77.87	75.46	77.89	0.000368	1.85	1885.08	1386.04	0.13

HEC-RAS Plan: Existing w/ Lev River: Drain 37 Reach: 1 Profile: 10yr (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	17304.63 Unnamed											
1	17382.03	10yr	1825.00	68.65	77.89	75.66	77.90	0.000249	1.56	2285.67	1357.72	0.11
1	17698.39	10yr	1825.00	68.81	77.97		77.98	0.000261	1.58	2209.07	1337.15	0.11
1	18329.14	10yr	1825.00	68.63	78.14		78.16	0.000303	1.77	2164.53	1429.69	0.12
1	18625.46	10yr	1825.00	68.70	78.23	77.05	78.25	0.000261	1.62	2294.81	1431.88	0.11
1	18710.29 Unnamed											
1	18746.22	10yr	1825.00	68.79	78.24	75.86	78.25	0.000140	1.24	2827.30	1470.61	0.08
1	19239.76	10yr	1825.00	68.67	78.30		78.30	0.000079	0.92	3459.22	1503.93	0.06
1	19585.81	10yr	1825.00	68.80	78.33		78.33	0.000099	1.00	2976.20	1233.69	0.07
1	19992.36	10yr	1825.00	68.67	78.37		78.38	0.000130	1.22	2437.80	944.72	0.08
1	20258.29	10yr	1825.00	68.87	86.37	86.37	86.37	0.000012	0.60	3887.24	781.81	0.03
1	20350.83 Unnamed											
1	20426.76	10yr	1825.00	68.81	87.25	86.26	87.26	0.000022	0.78	3883.39	820.53	0.04
1	20615.47	10yr	1825.00	70.47	87.26		87.26	0.000002	0.24	8988.42	966.87	0.01
1	20738.15	10yr	1825.00	70.63	87.26		87.26	0.000001	0.15	13066.74	1259.79	0.01
1	20863.70	10yr	1825.00	70.06	87.26		87.26	0.000001	0.14	13934.78	1281.55	0.01
1	20978.49	10yr	1825.00	68.90	87.26	75.78	87.26	0.000001	0.15	13739.67	1265.33	0.01
1	21056.29 6th Street											
1	21125.82	10yr	1825.00	69.40	87.28	76.38	87.28	0.000001	0.15	13613.50	1274.20	0.01
1	21555.71	10yr	1825.00	69.38	87.28		87.28	0.000001	0.14	14395.96	1352.10	0.01
1	21785.60	10yr	1825.00	69.25	87.28		87.28	0.000001	0.13	15149.85	1431.87	0.01

Drain36 Plan: Proposed



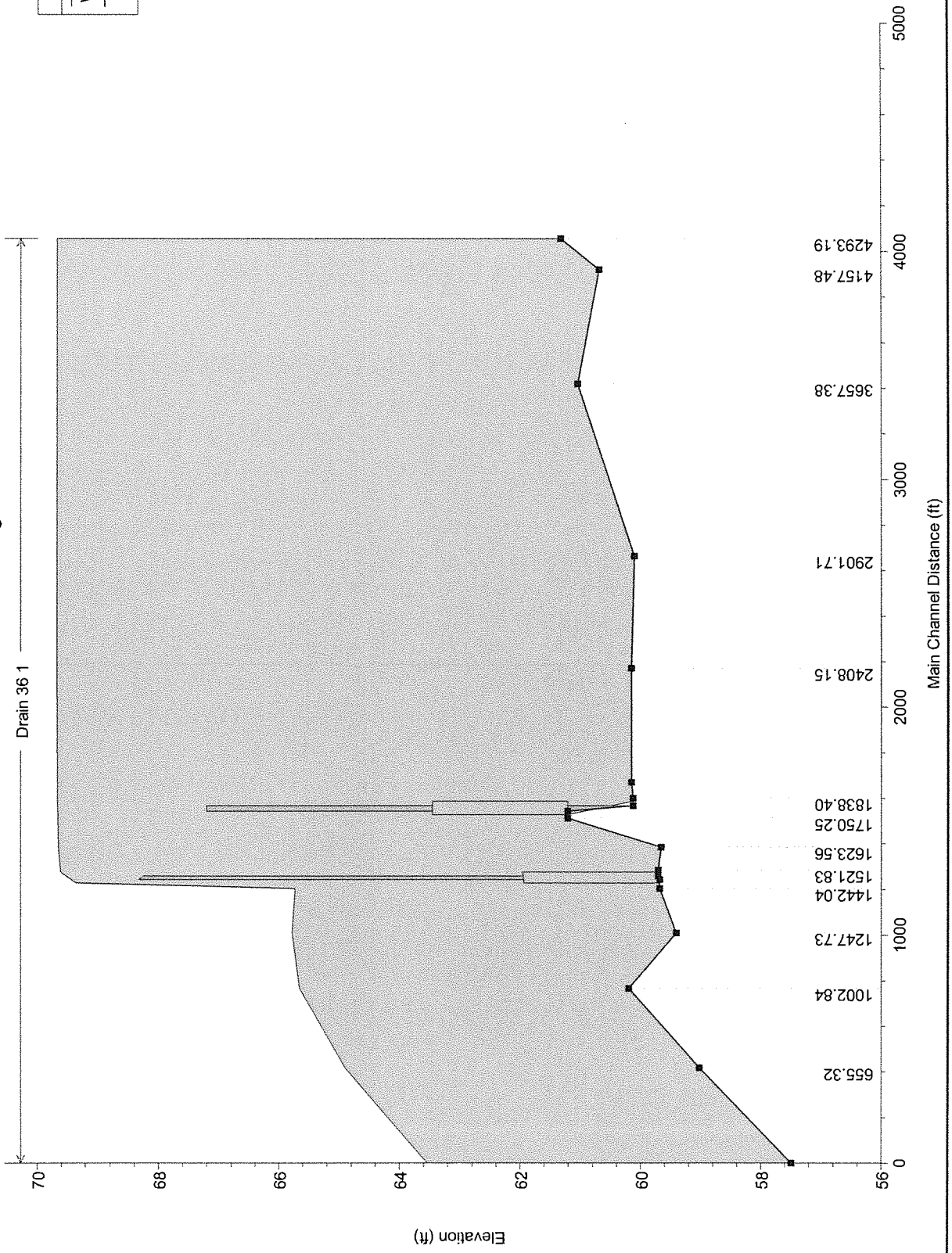
Drain36 Plan: Existing W/O Levee

Drain 36 1

Legend

WS 10-yr

Ground



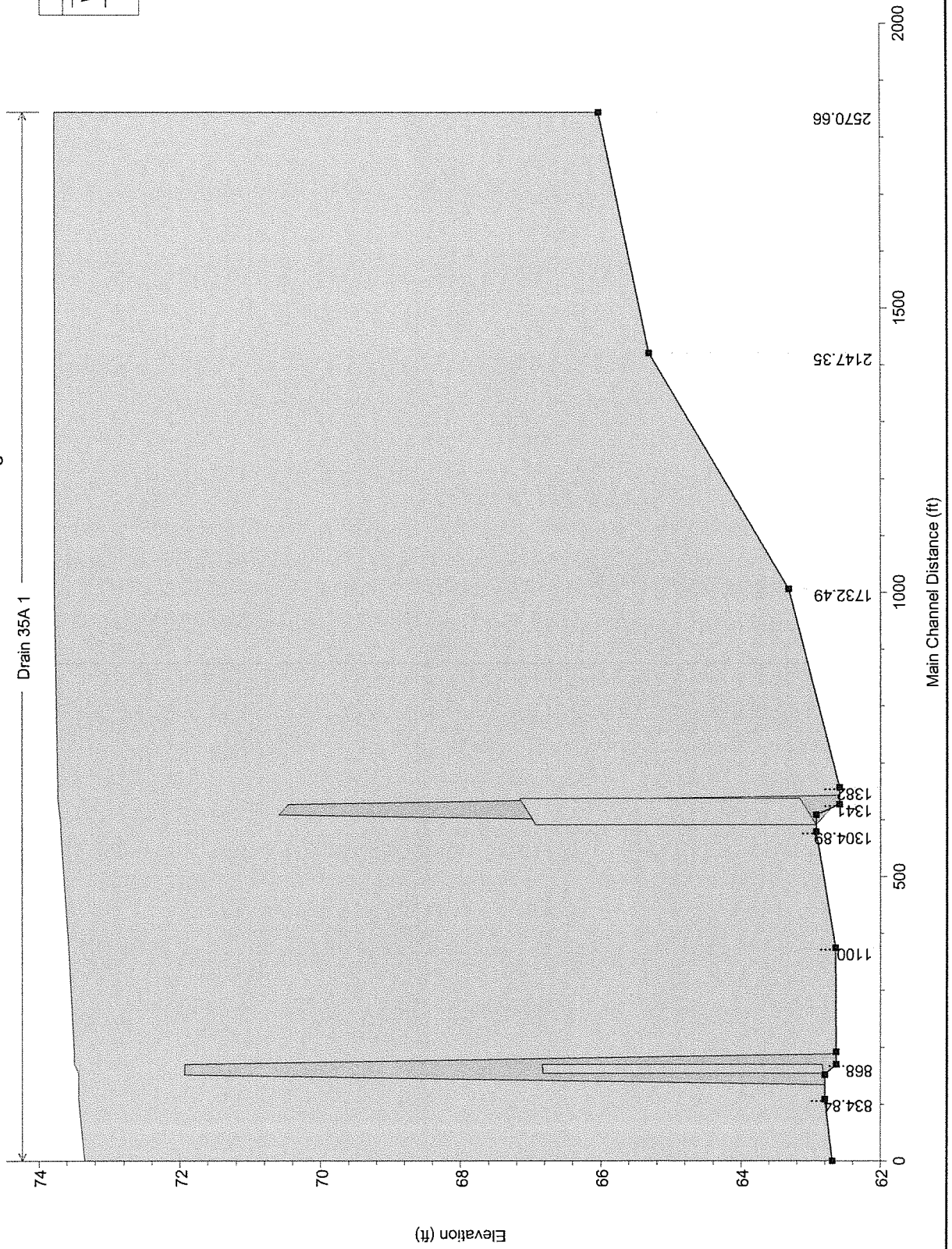
HEC-RAS Plan: W0 Levee River: Drain 36 Reach: 1 Profile: 10-yr

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	237.49	10-yr	328.00	57.49	63.54	61.11	63.72	0.003504	3.44	95.41	27.26	0.32
1	655.32	10-yr	328.00	59.02	64.90		65.08	0.003046	3.42	95.91	23.83	0.30
1	1002.84	10-yr	328.00	60.19	65.66	62.62	65.74	0.001251	2.24	146.22	38.24	0.20
1	1247.73	10-yr	328.00	59.40	65.78	61.46	65.79	0.000063	0.61	743.69	197.39	0.05
1	1442.04	10-yr	328.00	59.68	65.73	62.56	65.86	0.001941	2.83	115.92	28.14	0.25
1	1488.23 Drive Way		Culvert									
1	1521.83	10-yr	328.00	59.70	69.62	62.56	69.64	0.000241	1.11	295.49	610.62	0.09
1	1623.56	10-yr	328.00	59.65	69.65		69.65	0.000091	0.76	854.16	632.40	0.06
1	1750.25	10-yr	328.00	61.20	69.66	63.81	69.66	0.000041	0.39	1116.74	749.57	0.03
1	1793.21 Drive Way		Culvert									
1	1838.40	10-yr	328.00	60.12	69.67	63.03	69.67	0.000033	0.35	1174.83	715.49	0.03
1	1908.88	10-yr	328.00	60.14	69.67		69.67	0.000029	0.34	1259.48	790.47	0.03
1	2408.15	10-yr	328.00	60.14	69.67		69.67	0.000003	0.11	3329.86	1441.71	0.01
1	2901.71	10-yr	328.00	60.09	69.67		69.68	0.000000	0.05	5747.95	1468.33	0.00
1	3657.38	10-yr	328.00	61.03	69.68		69.68	0.000000	0.04	5865.75	1475.19	0.00
1	4157.48	10-yr	328.00	60.67	69.68		69.68	0.000004	0.14	2865.32	1492.55	0.01
1	4293.19	10-yr	328.00	61.31	69.68		69.68	0.000007	0.17	2400.25	1390.14	0.01

Drain35A Plan: Existing

Drain 35A 1

Legend	
WS PF 1	
Ground	

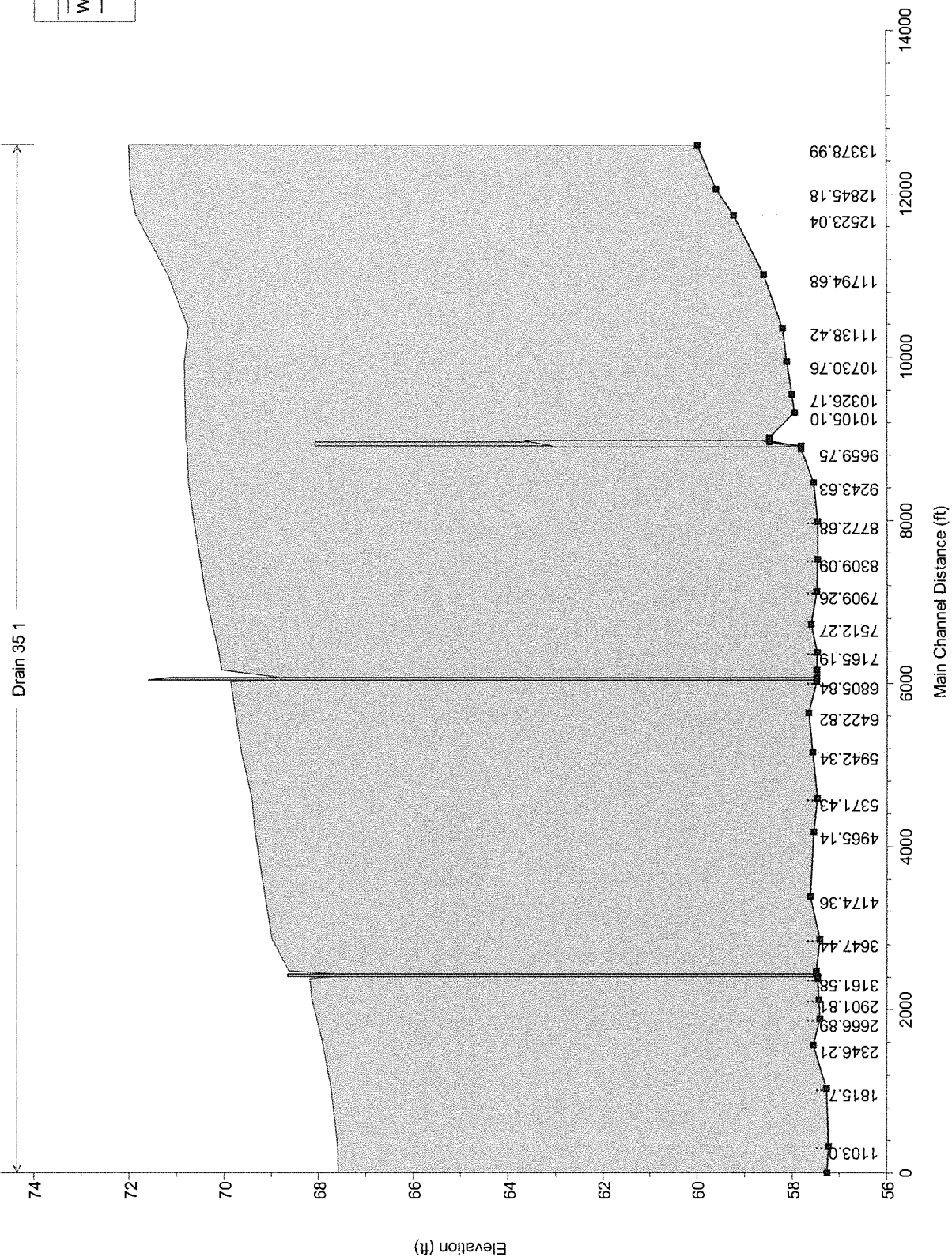


HEC-RAS Plan: Existing River: Drain 35A Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	726.19	PF 1	836.00	62.69	73.35	67.93	73.43	0.000610	2.63	490.01	378.74	0.18
1	834.84	PF 1	836.00	62.80	73.43		73.50	0.000577	2.39	520.87	334.42	0.18
1	868.12	Culvert										
1	918.10	PF 1	836.00	62.63	73.50	67.19	73.57	0.000437	2.32	538.21	323.14	0.16
1	1100.84	PF 1	836.00	62.64	73.57		73.65	0.000485	2.47	463.74	163.53	0.16
1	1304.89	PF 1	836.00	62.92	73.68	67.39	73.74	0.000324	2.09	586.75	207.54	0.14
1	1341.82	Culvert										
1	1382.90	PF 1	836.00	62.58	73.73	66.95	73.77	0.000269	1.90	801.07	390.79	0.12
1	1732.49	PF 1	836.00	63.31	73.78		73.78	0.000008	0.35	5288.23	1247.81	0.02
1	2147.35	PF 1	836.00	65.30	73.78		73.78	0.000003	0.20	7620.55	1447.38	0.01
1	2570.66	PF 1	836.00	66.02	73.78		73.78	0.000009	0.30	4939.91	1181.24	0.02

Drain35 Plan: Existing

Drain 35 1



HEC-RAS Plan: Existing River: Drain 35 Reach: 1 Profile: 10-year

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	784.64	10-year	1533.00	57.26	67.58	61.50	67.60	0.000100	1.59	1974.65	829.98	0.10
1	1103.05	10-year	1533.00	57.23	67.60	61.25	67.66	0.000206	2.28	1031.46	357.05	0.15
1	1815.75	10-year	1533.00	57.27	67.73	61.10	67.86	0.000320	2.83	541.31	69.75	0.18
1	2346.21	10-year	1533.00	57.55	67.90		68.06	0.000392	3.13	490.41	61.87	0.20
1	2666.89	10-year	1533.00	57.41	68.03		68.18	0.000397	3.11	493.64	64.33	0.20
1	2901.81	10-year	1533.00	57.43	68.15		68.27	0.000304	2.80	599.10	169.76	0.17
1	3161.58	10-year	1533.00	57.45	68.18	62.61	68.41	0.000628	3.82	401.16	89.40	0.25
1	3204.82	Millie 5	Bridge									
1	3256.74	10-year	1533.00	57.48	68.64	63.06	68.92	0.000780	4.21	364.46	169.78	0.27
1	3647.44	10-year	1533.00	57.41	68.99	61.70	69.11	0.000301	2.77	649.06	309.86	0.17
1	4174.36	10-year	1533.00	57.61	69.14	61.48	69.25	0.000262	2.72	564.56	64.43	0.16
1	4965.14	10-year	1533.00	57.54	69.35		69.44	0.000197	2.37	645.85	74.98	0.14
1	5371.43	10-year	1533.00	57.46	69.41		69.56	0.000384	3.17	483.43	58.09	0.19
1	5942.34	10-year	1533.00	57.56	69.63		69.75	0.000265	2.75	557.70	63.15	0.16
1	6422.82	10-year	1533.00	57.64	69.76		69.87	0.000251	2.69	570.54	64.27	0.16
1	6805.84	10-year	1533.00	57.47	69.86	61.90	69.97	0.000238	2.62	585.57	66.67	0.16
1	6863.14	24Th	Bridge									
1	6949.43	10-year	1533.00	57.47	70.05	62.34	70.19	0.000317	3.01	509.47	446.38	0.18
1	7165.19	10-year	1916.00	57.46	70.12	62.88	70.27	0.000380	3.08	652.39	287.14	0.19
1	7512.27	10-year	1916.00	57.59	70.26	63.14	70.40	0.000361	3.01	638.27	93.35	0.19
1	7909.26	10-year	1916.00	57.47	70.41	62.54	70.52	0.000262	2.71	724.56	102.10	0.16
1	8309.09	10-year	1916.00	57.45	70.52	63.30	70.62	0.000243	2.63	744.69	104.40	0.16
1	8772.68	10-year	1916.00	57.45	70.63	62.21	70.72	0.000187	2.40	818.05	105.29	0.14
1	9243.63	10-year	1916.00	57.54	70.76	62.59	70.77	0.000057	1.35	2383.92	619.95	0.08
1	9659.75	10-year	1916.00	57.80	70.78	63.02	70.80	0.000063	1.46	2975.59	1143.04	0.08
1	9718.88	18th	Culvert									
1	9795.30	10-year	1916.00	58.46	70.91	64.16	70.92	0.000039	1.17	3447.39	987.85	0.06
1	10105.10	10-year	1916.00	57.94	70.82		70.83	0.000038	1.11	3275.49	948.56	0.06
1	10326.17	10-year	1916.00	57.99	70.83		70.84	0.000036	1.08	3463.82	1040.50	0.06
1	10730.76	10-year	1916.00	58.10	70.84	64.59	70.86	0.000086	1.61	1894.17	387.18	0.09
1	11138.42	10-year	1916.00	58.19	70.75	63.93	71.01	0.000624	4.06	490.17	81.00	0.25
1	11794.68	10-year	1916.00	58.58	71.19	65.41	71.56	0.001016	4.83	410.61	100.46	0.31
1	12523.04	10-year	1916.00	59.21	71.86	65.64	71.96	0.000309	2.95	1492.66	517.47	0.18
1	12845.18	10-year	1916.00	59.58	71.99		72.00	0.000059	1.31	2799.84	817.99	0.08
1	13378.99	10-year	1916.00	59.98	72.02		72.07	0.000225	2.39	1603.19	753.94	0.15

Drain34A Plan: Existing

Drain34A 1

Legend	
WS 10-year	
Ground	



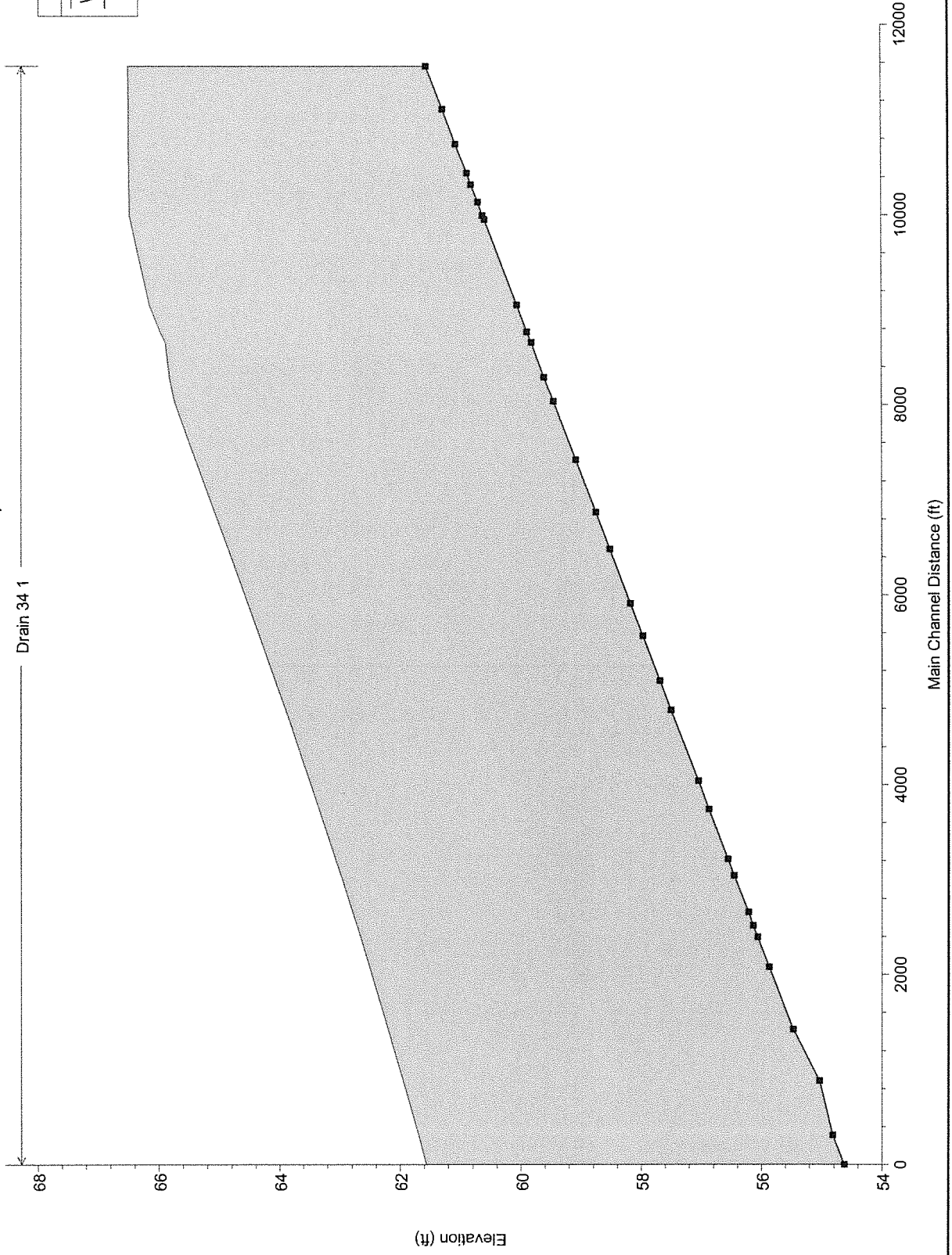
HEC-RAS Plan: Existing River: Drain34A Reach: 1 Profile: 10-year

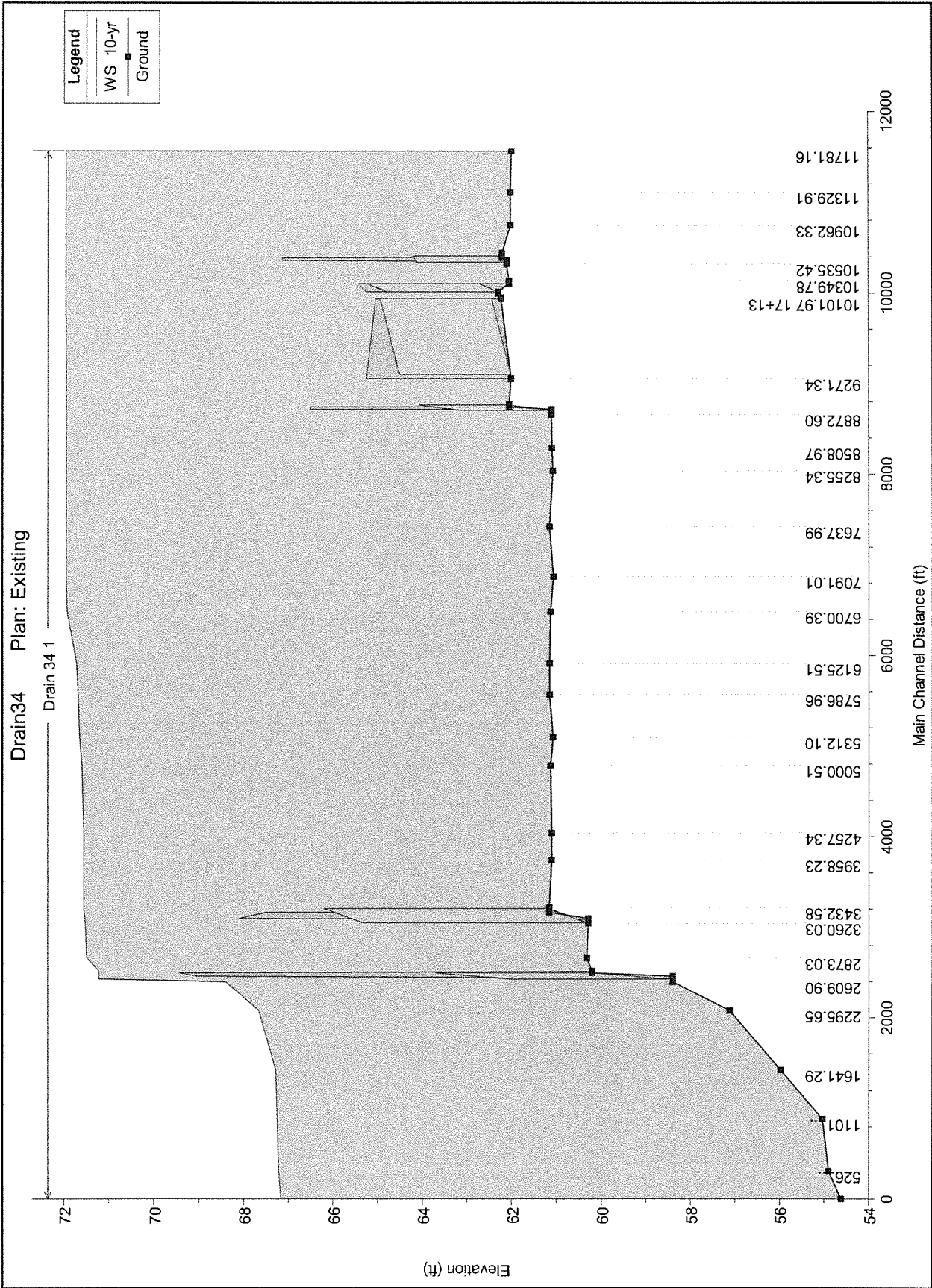
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	111.29	10-year	210.00	61.05	66.97	62.59	66.99	0.000190	1.19	177.71	54.01	0.10
1	642.51	10-year	210.00	61.14	67.06	62.61	67.08	0.000153	1.06	197.83	44.45	0.09
1	1251.46	10-year	210.00	61.15	67.20	63.43	67.26	0.000621	1.90	110.62	27.96	0.17
1	2019.16	10-year	210.00	61.41	67.28	63.96	67.28	0.000007	0.19	1436.06	769.07	0.02
1	2103.79		Culvert									
1	2176.40	10-year	210.00	61.32	67.28	63.87	67.28	0.000011	0.23	1211.76	839.75	0.02
1	2840.74	10-year	210.00	61.45	67.29		67.29	0.000048	0.49	740.16	703.89	0.05
1	3769.44	10-year	210.00	64.27	66.97	66.97	67.83	0.027347	7.48	28.09	16.34	1.00
1	4449.30	10-year	210.00	65.34	70.12	67.69	70.20	0.001234	2.38	129.23	325.86	0.23
1	5053.17	10-year	210.00	63.75	70.58		70.63	0.000448	1.68	132.35	170.16	0.14

Drain34 Plan: Proposed

Drain 34 1

Legend	
WS PF 2	
Ground	





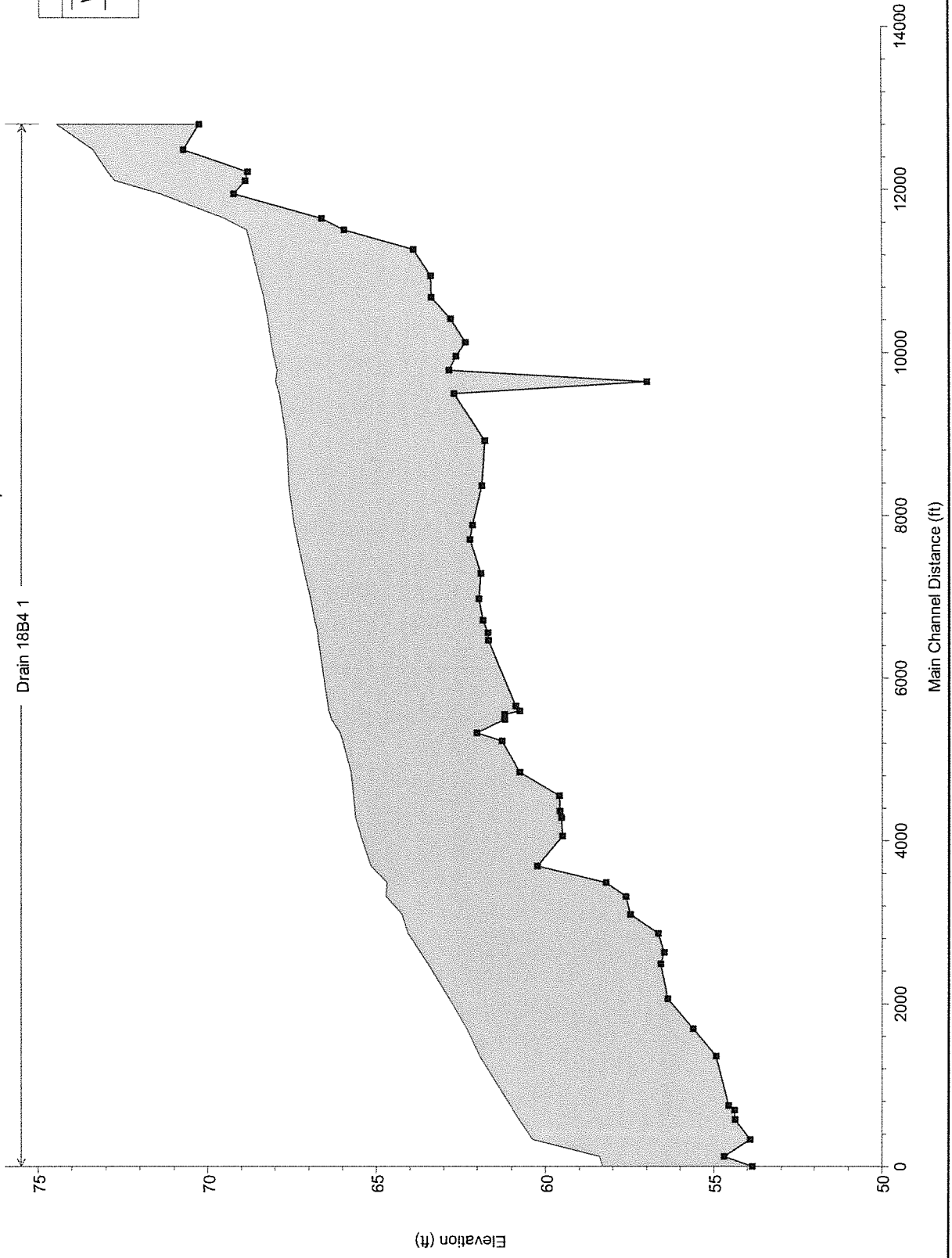
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	216.72	PF 2	750.00	54.62	61.57	57.32	61.65	0.000400	2.36	318.39	66.68	0.19
1	526.47	PF 2	750.00	54.81	61.69		61.78	0.000416	2.39	314.07	66.29	0.19
1	1101.36	PF 2	750.00	55.03	61.95		62.04	0.000494	2.43	310.47	84.07	0.20
1	1641.29	PF 2	750.00	55.47	62.20		62.30	0.000453	2.46	304.29	65.40	0.20
1	2295.65	PF 2	750.00	55.87	62.50		62.60	0.000480	2.52	297.95	64.81	0.21
1	2609.90	PF 2	750.00	56.06	62.66		62.76	0.000492	2.54	295.45	64.58	0.21
1	2733.03	PF 2	750.00	56.13	62.72		62.82	0.000494	2.54	294.83	64.52	0.21
1	2873.03	PF 2	750.00	56.21	62.79		62.89	0.000498	2.55	294.14	64.46	0.21
1	3260.03	PF 2	750.00	56.45	62.98		63.08	0.000512	2.58	291.17	64.18	0.21
1	3432.58	PF 2	750.00	56.55	63.07		63.17	0.000516	2.58	290.39	64.10	0.21
1	3958.23	PF 2	750.00	56.86	63.34		63.45	0.000527	2.60	288.07	63.89	0.22
1	4257.34	PF 2	750.00	57.04	63.50		63.61	0.000534	2.62	286.64	63.76	0.22
1	5000.51	PF 2	750.00	57.49	63.90		64.01	0.000551	2.65	283.54	63.46	0.22
1	5312.10	PF 2	750.00	57.68	64.07		64.18	0.000557	2.66	282.43	63.36	0.22
1	5786.96	PF 2	750.00	57.96	64.34		64.45	0.000562	2.66	281.44	63.26	0.22
1	6125.51	PF 2	750.00	58.17	64.53		64.64	0.000569	2.68	280.22	63.15	0.22
1	6700.39	PF 2	750.00	58.51	64.86		64.97	0.000573	2.68	279.41	63.06	0.22
1	7091.01	PF 2	750.00	58.74	65.08		65.19	0.000576	2.69	279.04	63.03	0.23
1	7637.99	PF 2	750.00	59.07	65.40	61.78	65.51	0.000581	2.70	278.15	62.95	0.23
1	8255.34	PF 2	750.00	59.44	65.74	62.14	65.78	0.000295	1.92	695.44	410.50	0.16
1	8508.97	PF 2	750.00	59.60	65.82		65.85	0.000240	1.72	882.88	868.49	0.15
1	8872.60	PF 2	750.00	59.81	65.89	62.52	66.02	0.000678	2.85	262.97	61.48	0.24
1	8985.12	PF 2	750.00	59.88	65.97		66.09	0.000657	2.81	300.03	268.78	0.24
1	9271.34	PF 2	750.00	60.05	66.16	62.76	66.28	0.000666	2.83	264.61	61.63	0.24
1	10166.81	PF 2	750.00	60.59	66.47		66.49	0.000107	1.28	1039.69	747.37	0.10
1	10212.02	PF 2	250.00	60.62	66.49		66.49	0.000013	0.44	863.79	622.08	0.03
1	10349.78	PF 2	250.00	60.70	66.49		66.50	0.000020	0.54	545.16	367.05	0.04
1	10535.42	PF 2	250.00	60.81	66.50		66.50	0.000022	0.55	541.30	388.49	0.04
1	10655.79	PF 2	250.00	60.88	66.50		66.50	0.000013	0.43	877.88	532.01	0.03
1	10962.33	PF 2	250.00	61.07	66.51		66.51	0.000008	0.36	1419.47	992.62	0.03
1	11329.91	PF 2	250.00	61.29	66.51		66.51	0.000007	0.32	1569.04	971.18	0.03
1	11781.16	PF 2	250.00	61.56	66.51		66.51	0.000009	0.34	1385.68	894.56	0.03

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	216.72	10-yr	1009.00	54.62	67.17	59.84	67.19	0.000401	1.54	975.85	319.26	0.10
1	526.47	10-yr	1009.00	54.90	67.22	59.97	67.22	0.000041	0.52	3024.17	767.09	0.03
1	1101.36	10-yr	1009.00	55.03	67.25	59.65	67.25	0.000038	0.52	3222.38	1038.62	0.03
1	1641.29	10-yr	1009.00	55.97	67.29	61.57	67.30	0.000390	1.41	1281.70	581.70	0.10
1	2295.65	10-yr	1009.00	57.12	67.66		67.85	0.002049	3.47	290.92	40.28	0.23
1	2609.90	10-yr	1009.00	58.40	68.40	63.68	68.65	0.003096	4.04	250.05	38.15	0.28
1	2670.33	Unnamed STreet	Culvert									
1	2733.03	10-yr	1009.00	60.20	71.22	66.05	71.43	0.002697	3.81	337.31	159.59	0.26
1	2873.03	10-yr	1009.00	60.32	71.49	65.17	71.49	0.000115	0.80	2185.94	767.38	0.05
1	3260.03	10-yr	1009.00	60.28	71.52	65.12	71.52	0.000090	0.64	2732.91	1091.03	0.05
1	3351.52	Intl Blvd	Culvert									
1	3432.58	10-yr	1009.00	61.15	71.55	65.42	71.55	0.000010	0.34	3818.83	1092.50	0.02
1	3958.23	10-yr	1009.00	61.10	71.55	65.26	71.56	0.000009	0.35	3620.12	892.29	0.02
1	4257.34	10-yr	1009.00	61.10	71.56	64.65	71.56	0.000033	0.66	2203.40	734.15	0.04
1	5000.51	10-yr	1009.00	61.12	71.60	64.91	71.62	0.000183	1.50	1483.70	690.13	0.10
1	5312.10	10-yr	1009.00	61.06	71.65	65.34	71.66	0.000133	1.27	2025.67	988.19	0.09
1	5786.96	10-yr	1009.00	61.14	71.69		71.70	0.000171	1.46	1749.11	1252.51	0.10
1	6125.51	10-yr	1009.00	61.14	71.72	65.02	71.82	0.000522	2.62	392.05	76.12	0.17
1	6700.39	10-yr	1009.00	61.12	71.93	65.07	71.94	0.000093	1.10	2156.37	831.73	0.07
1	7091.01	10-yr	1009.00	61.05	71.94		71.94	0.000003	0.22	5851.36	1252.32	0.01
1	7637.99	10-yr	1009.00	61.14	71.94		71.94	0.000002	0.18	7184.98	1330.97	0.01
1	8255.34	10-yr	1009.00	61.06	71.94		71.94	0.000001	0.15	9977.38	1629.37	0.01
1	8508.97	10-yr	1009.00	61.09	71.94		71.94	0.000001	0.16	9448.96	1599.66	0.01
1	8872.60	10-yr	1009.00	61.10	71.95	64.70	71.95	0.000002	0.19	8347.46	1473.87	0.01
1	8945.90	Mile 3 1/2	Culvert									
1	8985.12	10-yr	1009.00	62.04	71.95	66.78	71.95	0.000004	0.24	6576.28	1488.18	0.02
1	9271.34	10-yr	1009.00	62.00	71.95		71.95	0.000004	0.25	6249.27	1244.48	0.02
1	10101.97		Culvert									
1	10166.81	10-yr	1009.00	62.23	71.96	65.87	71.96	0.000003	0.23	6239.98	1032.53	0.01
1	10212.02	10-yr	504.00	62.29	71.96	65.76	71.96	0.000001	0.10	6110.78	1059.99	0.01
1	10290.22		Culvert									
1	10349.78	10-yr	504.00	62.04	71.96	64.88	71.96	0.000001	0.12	5799.17	1092.66	0.01
1	10535.42	10-yr	504.00	62.10	71.96	64.65	71.96	0.000001	0.12	5606.81	1114.73	0.01
1	10586.51	18th Street	Culvert									
1	10655.79	10-yr	504.00	62.21	71.96	66.18	71.96	0.000001	0.11	5766.44	1106.21	0.01
1	10962.33	10-yr	504.00	62.01	71.96		71.96	0.000000	0.08	7248.81	1125.81	0.01
1	11329.91	10-yr	504.00	62.01	71.96		71.96	0.000000	0.08	7618.11	1174.36	0.00
1	11781.16	10-yr	504.00	61.99	71.96		71.96	0.000000	0.08	6663.34	1033.20	0.01

Drain 18B4 Plan: Proposed

Drain 18B4 1

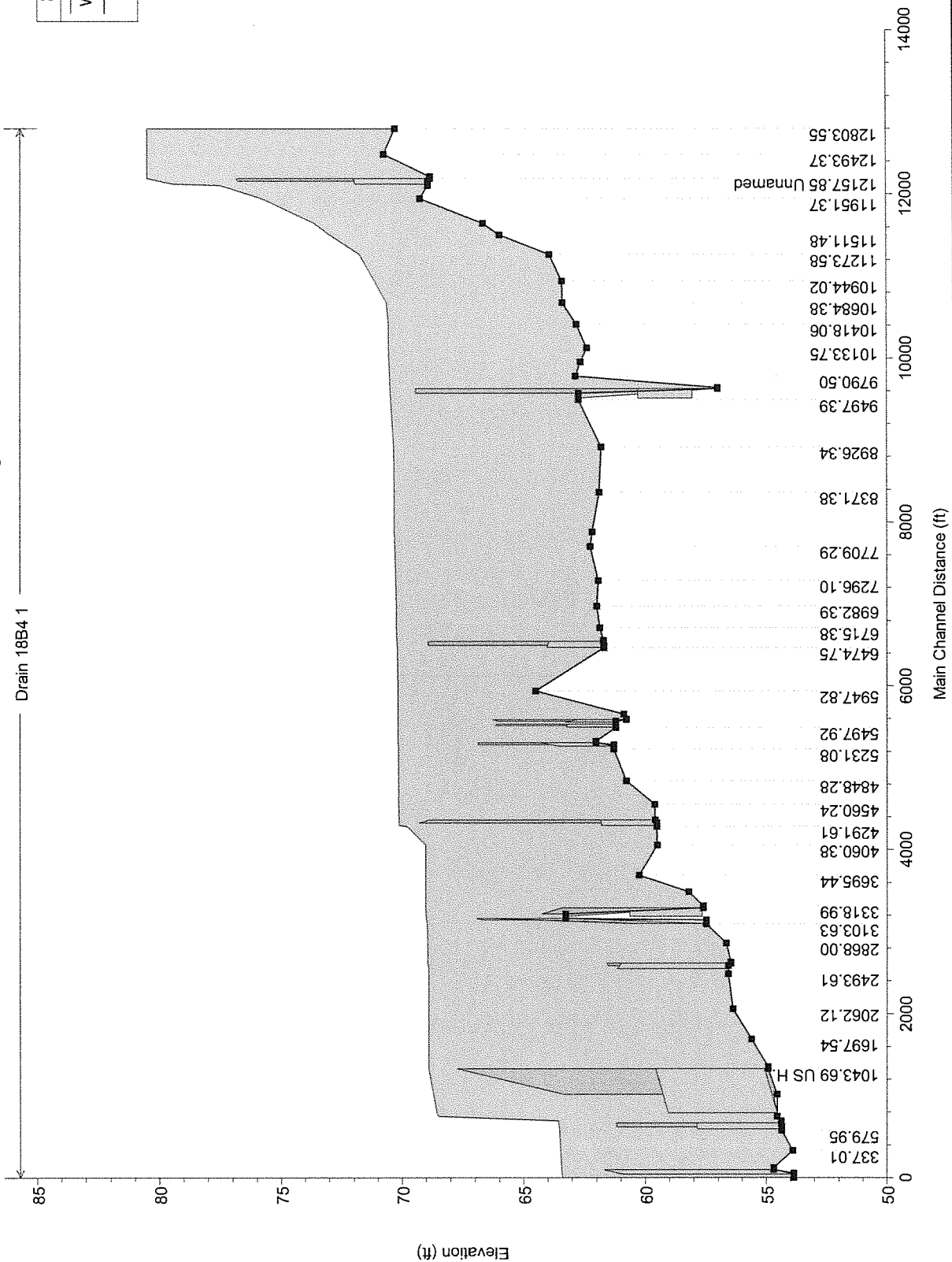
Legend	
WS 10yr	
Ground	



Drain 18B4 Plan: Existing

Drain 18B4 1

Legend	
WS 10yr	
Ground	



HEC-RAS Plan: Proposed River: Drain 18B4 Reach: 1 Profile: 10yr

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	5.36	10yr	1294.00	53.85	58.30	55.47	58.35	0.001101	1.79	722.52	215.49	0.17
1	126.15	10yr	1294.00	54.68	58.40	58.40	59.84	0.013210	9.63	134.43	47.32	1.01
1	337.01	10yr	1294.00	53.91	60.37		60.69	0.001589	4.51	286.79	63.76	0.37
1	579.95	10yr	1294.00	54.35	60.77		61.07	0.001551	4.44	306.43	77.50	0.37
1	695.04	10yr	1294.00	54.37	60.95		61.25	0.001479	4.40	294.31	64.47	0.36
1	752.96	10yr	1294.00	54.55	61.03		61.34	0.001570	4.49	288.06	64.90	0.37
1	1362.61	10yr	1294.00	54.92	61.93		62.17	0.001135	3.99	337.52	110.00	0.32
1	1697.54	10yr	1294.00	55.60	62.32	59.33	62.60	0.001357	4.26	311.39	134.64	0.35
1	2062.12	10yr	1294.00	56.36	62.83	60.10	63.14	0.001584	4.51	287.06	63.79	0.37
1	2493.61	10yr	1294.00	56.56	63.48	60.29	63.74	0.001142	4.09	324.34	77.81	0.32
1	2634.00	10yr	1294.00	56.46	63.69	60.19	63.96	0.002222	4.14	326.13	134.48	0.32
1	2868.00	10yr	1294.00	56.64	64.06	60.37	64.26	0.000810	3.65	377.61	81.97	0.28
1	3103.63	10yr	1294.00	57.47	64.25	61.21	64.53	0.001223	4.30	305.52	64.70	0.34
1	3318.99	10yr	1294.00	57.60	64.71		64.79	0.000450	2.62	1126.90	939.45	0.20
1	3495.20	10yr	1294.00	58.19	64.68	61.91	64.99	0.001561	4.48	288.63	64.35	0.37
1	3695.44	10yr	486.00	60.23	65.16	62.31	65.25	0.000615	2.42	224.99	147.19	0.23
1	4060.38	10yr	486.00	59.48	65.46	61.25	65.50	0.000771	1.62	299.94	66.17	0.13
1	4291.61	10yr	486.00	59.51	65.62		65.64	0.000462	1.23	395.84	83.64	0.10
1	4368.74	10yr	486.00	59.56	65.63	61.64	65.67	0.000216	1.69	380.46	206.61	0.14
1	4560.24	10yr	486.00	59.58	65.67		65.72	0.000282	1.84	270.86	123.80	0.16
1	4848.28	10yr	486.00	60.74	65.76		65.85	0.000600	2.42	201.09	55.12	0.22
1	5231.08	10yr	486.00	61.26	66.00		66.09	0.000661	2.46	267.37	312.17	0.23
1	5329.09	10yr	486.00	62.00	66.08		66.23	0.002391	3.11	156.23	49.26	0.31
1	5497.92	10yr	486.00	61.19	66.33		66.42	0.000525	2.35	219.42	170.11	0.21
1	5560.70	10yr	486.00	61.19	66.37		66.45	0.000510	2.28	238.52	217.66	0.21
1	5601.96	10yr	486.00	60.75	66.41		66.47	0.000365	2.01	270.93	217.91	0.18
1	5661.61	10yr	486.00	60.86	66.43		66.50	0.000382	2.05	279.08	278.31	0.18
1	6474.75	10yr	486.00	61.67	66.73		66.74	0.000213	0.85	583.19	174.54	0.08
1	6561.32	10yr	486.00	61.68	66.75	63.52	66.80	0.001170	1.81	283.24	102.38	0.17
1	6715.38	10yr	486.00	61.92	66.84		66.90	0.000410	2.09	346.68	232.70	0.19
1	6982.39	10yr	486.00	61.95	66.95		67.04	0.000605	2.42	207.43	104.27	0.22
1	7296.10	10yr	486.00	61.88	67.14		67.22	0.000503	2.27	214.22	56.52	0.21
1	7709.29	10yr	486.00	62.21	67.35		67.43	0.000548	2.34	207.67	55.82	0.21
1	7887.34	10yr	486.00	62.13	67.45	64.22	67.53	0.000480	2.23	217.88	58.43	0.20
1	8371.38	10yr	486.00	61.85	67.61	63.93	67.62	0.000099	1.10	796.55	377.41	0.09
1	8926.34	10yr	486.00	61.76	67.67	63.84	67.72	0.000319	1.93	252.36	60.44	0.17
1	9497.39	10yr	486.00	62.69	67.88		67.97	0.000526	2.30	210.87	56.18	0.21
1	9646.50	10yr	486.00	56.97	67.99		68.00	0.000025	0.76	639.92	91.13	0.05

HEC-RAS Plan: Proposed River: Drain 18B4 Reach: 1 Profile: 10yr (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	9790.50	10yr	486.00	62.83	67.95		68.03	0.000557	2.35	206.46	55.70	0.22
1	9958.15	10yr	486.00	62.62	68.05	64.70	68.11	0.000416	2.11	256.54	105.73	0.19
1	10133.75	10yr	486.00	62.35	68.12		68.18	0.000349	1.99	244.36	63.92	0.17
1	10418.06	10yr	486.00	62.79	68.22	64.87	68.30	0.000442	2.17	224.47	57.60	0.19
1	10684.38	10yr	486.00	63.37	68.35		68.44	0.000619	2.44	198.86	54.88	0.23
1	10944.02	10yr	486.00	63.38	68.51		68.59	0.000552	2.35	207.12	55.77	0.21
1	11273.58	10yr	486.00	63.90	68.70		68.81	0.000711	2.57	189.26	53.82	0.24
1	11511.48	10yr	486.00	65.96	68.85		69.24	0.004672	4.98	97.50	42.36	0.58
1	11652.45	10yr	486.00	66.63	69.51		69.90	0.004730	5.01	97.09	42.31	0.58
1	11951.37	10yr	486.00	69.24	71.43	71.31	72.20	0.012691	7.03	69.18	38.15	0.92
1	12111.02	10yr	486.00	68.90	72.75		72.94	0.001634	3.45	140.80	48.11	0.36
1	12219.83	10yr	486.00	68.82	72.95		73.10	0.001261	3.15	154.31	49.77	0.32
1	12493.37	10yr	486.00	70.73	73.38		73.86	0.006414	5.56	87.38	40.90	0.67
1	12803.55	10yr	486.00	70.28	74.47		74.62	0.001192	3.09	157.41	50.14	0.31

Reach	River Sta	Profile	Q Total (cfs)	Min Chl El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	5.36	10yr	1294.00	53.85	63.40	63.40	63.40	0.000059	0.49	2896.03	743.77	0.03
1	49.59	Unnamed Street	Culvert									
1	126.15	10yr	1294.00	54.68	63.45	63.45	63.45	0.000199	0.67	2191.16	1098.44	0.05
1	337.01	10yr	1294.00	53.91	63.49	63.49	63.49	0.000145	0.63	2629.79	1379.43	0.05
1	579.95	10yr	1294.00	54.35	63.53	62.64	63.54	0.000271	0.86	2065.41	1388.16	0.06
1	644.26	Unnamed	Culvert									
1	695.04	10yr	1294.00	54.37	63.56	62.54	63.57	0.000405	1.03	1709.90	1221.81	0.08
1	752.96	10yr	1294.00	54.55	68.52	68.52	68.52	0.000003	0.15	7832.46	2091.81	0.01
1	1043.69	US Hwy 83	Culvert									
1	1362.61	10yr	1294.00	54.92	68.90	68.48	68.90	0.000004	0.17	6944.01	1121.66	0.01
1	1697.54	10yr	1294.00	55.60	68.90		68.90	0.000003	0.13	7983.22	1255.07	0.01
1	2062.12	10yr	1294.00	56.36	68.90		68.90	0.000003	0.12	8513.97	1366.75	0.01
1	2493.61	10yr	1294.00	56.56	68.90	62.65	68.91	0.000004	0.16	7627.84	1435.43	0.01
1	2575.54	Unnamed	Culvert									
1	2634.00	10yr	1294.00	56.46	68.95	62.48	68.95	0.000004	0.16	7738.46	1470.38	0.01
1	2868.00	10yr	1294.00	56.64	68.95		68.95	0.000013	0.26	4112.89	653.99	0.02
1	3103.63	10yr	1294.00	57.47	68.95	67.61	68.96	0.000053	0.51	2350.01	474.56	0.03
1	3153.18	Unnamed	Culvert									
1	3174.11	10yr	1294.00	63.26	69.01	65.53	69.01	0.000129	0.60	1790.05	460.70	0.05
1	3221.79	Hwy 374	Culvert									
1	3318.99	10yr	1294.00	57.60	69.02	64.80	69.02	0.000010	0.22	5164.79	981.97	0.01
1	3495.20	10yr	1294.00	58.19	69.02		69.02	0.000013	0.22	4627.71	938.39	0.01
1	3695.44	10yr	486.00	60.23	69.02		69.02	0.000003	0.10	3614.30	861.77	0.01
1	4060.38	10yr	486.00	59.48	69.03		69.03	0.000004	0.12	3097.21	531.79	0.01
1	4291.61	10yr	486.00	59.51	69.80	69.80	69.80	0.000080	0.56	994.30	393.93	0.04
1	4341.31	Canal	Culvert									
1	4368.74	10yr	486.00	59.56	70.13	69.36	70.13	0.000016	0.27	1831.04	460.72	0.02
1	4560.24	10yr	486.00	59.58	70.14		70.14	0.000009	0.17	2535.39	676.38	0.01
1	4848.28	10yr	486.00	60.74	70.14		70.14	0.000011	0.18	2493.31	744.24	0.01
1	5231.08	10yr	486.00	61.26	70.14	66.96	70.14	0.000007	0.15	2966.34	819.45	0.01
1	5289.61	Mile 6.5	Culvert									
1	5329.09	10yr	486.00	62.00	70.16	67.05	70.16	0.000016	0.21	2336.20	813.48	0.02
1	5497.92	10yr	486.00	61.19	70.16	66.25	70.16	0.000020	0.25	1945.22	606.34	0.02
1	5518.81		Culvert									
1	5560.70	10yr	486.00	61.19	70.17	66.53	70.17	0.000017	0.23	2101.02	659.44	0.02
1	5582.19		Culvert									
1	5601.96	10yr	486.00	60.75	70.17	66.67	70.17	0.000013	0.21	2384.70	738.13	0.01
1	5661.61	10yr	486.00	60.86	70.17		70.17	0.000012	0.21	2474.47	748.11	0.01
1	5947.82	10yr	486.00	64.49	70.18		70.18	0.000018	0.19	1962.61	597.23	0.02
1	6474.75	10yr	486.00	61.67	70.19	68.97	70.19	0.000036	0.37	1379.46	329.12	0.03
1	6521.85	Canal	Culvert									
1	6561.32	10yr	486.00	61.68	70.21	69.04	70.21	0.000090	0.59	1013.40	368.48	0.04
1	6715.38	10yr	486.00	61.82	70.22		70.22	0.000030	0.34	1461.77	411.97	0.02

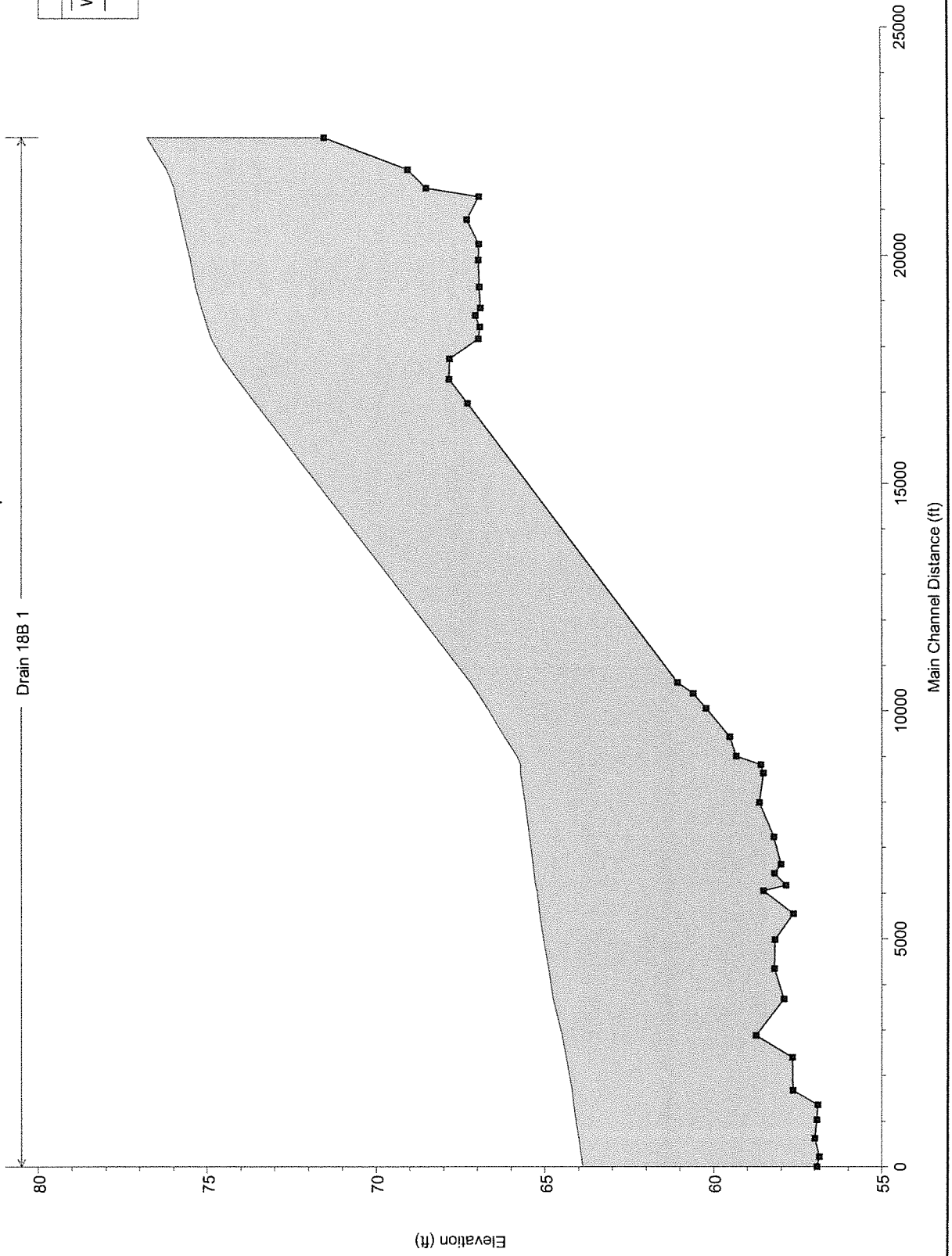
HEC-RAS Plan: Existing River: Drain 1884 Reach: 1 Profile: 10yr (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	6982.39	10yr	486.00	61.95	70.23		70.23	0.000054	0.42	1435.31	668.55	0.03
1	7296.10	10yr	486.00	61.88	70.25		70.26	0.000141	0.61	1009.17	633.56	0.05
1	7709.29	10yr	486.00	62.21	70.30		70.30	0.000074	0.44	1319.49	651.87	0.03
1	7887.34	10yr	486.00	62.13	70.31		70.31	0.000042	0.31	1645.87	708.33	0.02
1	8371.38	10yr	486.00	61.85	70.32		70.32	0.000012	0.19	2483.20	790.45	0.01
1	8926.34	10yr	486.00	61.76	70.33		70.33	0.000112	0.55	1118.98	642.85	0.04
1	9497.39	10yr	486.00	62.69	70.45	69.45	70.46	0.000598	0.95	688.74	613.55	0.09
1	9584.14 Mile 3		Culvert									
1	9646.50	10yr	486.00	56.97	70.48	68.50	70.48	0.000072	0.59	1095.61	602.75	0.04
1	9790.50	10yr	486.00	62.83	70.50		70.50	0.000230	0.70	935.90	656.54	0.06
1	9958.15	10yr	486.00	62.62	70.52		70.52	0.000078	0.43	1375.52	754.44	0.03
1	10133.75	10yr	486.00	62.35	70.53		70.53	0.000066	0.40	1443.19	744.02	0.03
1	10418.06	10yr	486.00	62.79	70.55		70.55	0.000165	0.56	912.47	518.04	0.05
1	10684.38	10yr	486.00	63.37	70.63		70.69	0.003067	2.35	312.62	384.39	0.20
1	10944.02	10yr	486.00	63.38	71.11		71.13	0.001123	1.47	461.19	467.52	0.12
1	11273.58	10yr	486.00	63.90	71.74		71.88	0.005981	3.26	204.54	271.69	0.28
1	11511.48	10yr	486.00	65.96	72.99	70.11	73.09	0.004425	2.79	272.42	457.56	0.24
1	11652.45	10yr	486.00	66.63	73.64		73.81	0.005710	3.35	144.96	32.25	0.28
1	11951.37	10yr	486.00	69.24	75.79		76.08	0.010157	4.27	113.78	25.82	0.36
1	12111.02	10yr	486.00	68.90	77.49	74.87	78.49	0.016794	8.04	60.48	91.39	0.52
1	12157.85 Unnamed		Culvert									
1	12219.83	10yr	486.00	68.82	80.49	74.94	80.49	0.000021	0.27	1963.11	665.98	0.02
1	12493.37	10yr	486.00	70.73	80.49		80.50	0.000014	0.18	2091.46	579.77	0.01
1	12803.55	10yr	486.00	70.28	80.50		80.50	0.000012	0.18	2128.47	530.00	0.01

Drain 18B Plan: Proposed

Drain 18B 1

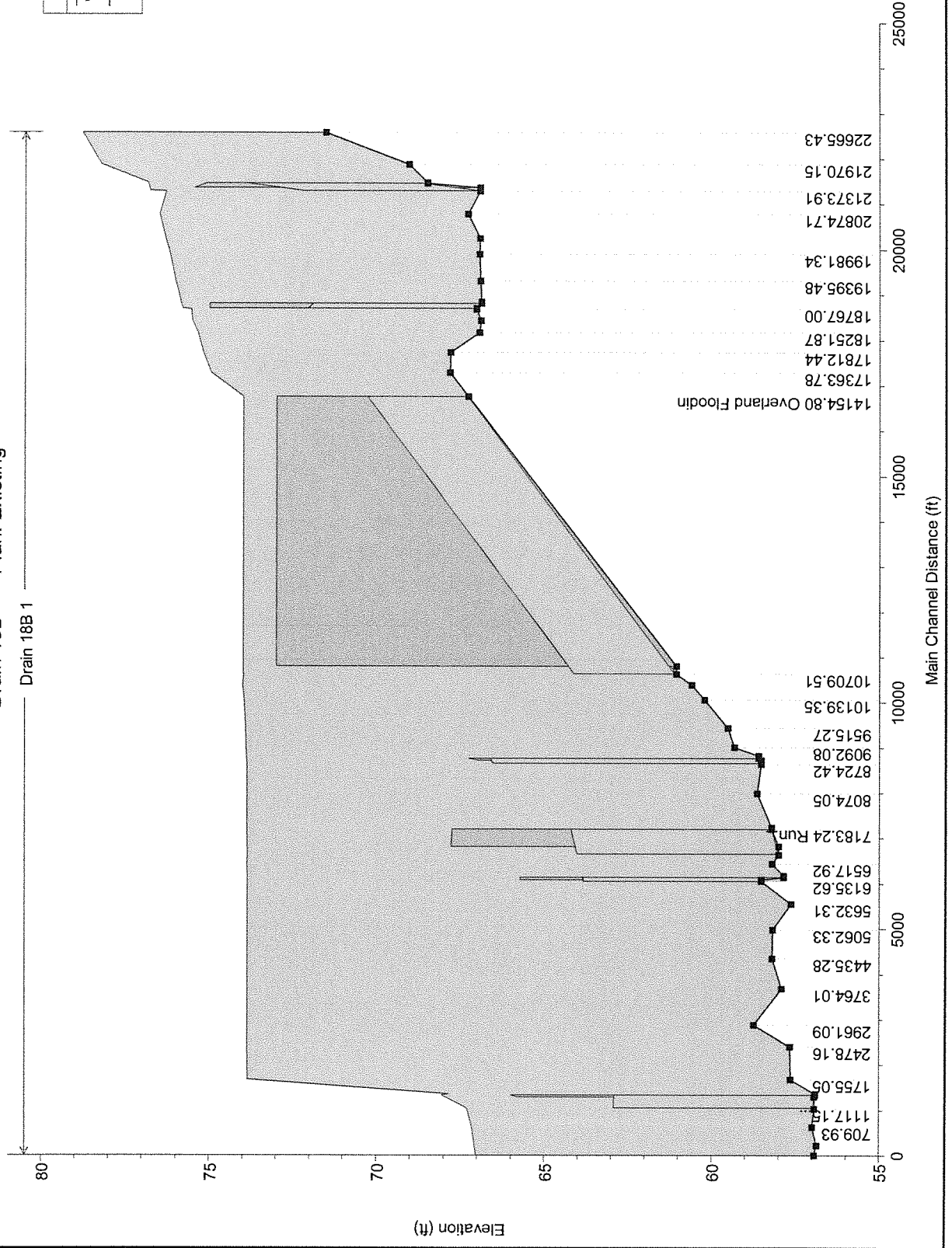
Legend	
WS 10-yr	
Ground	



Drain 18B Plan: Existing

Drain 18B 1

Legend	
WS 10-yr	
Ground	



Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	85.04	10-yr	1638.00	56.92	63.88	58.90	63.94	0.000200	1.95	840.86	141.75	0.14
1	309.29	10-yr	1638.00	56.85	63.92		63.98	0.000189	1.91	857.29	142.43	0.14
1	709.93	10-yr	1638.00	56.99	64.00		64.06	0.000195	1.93	848.23	142.05	0.14
1	1117.15	10-yr	1638.00	56.92	64.08		64.13	0.000181	1.88	869.63	142.95	0.13
1	1445.46	10-yr	1638.00	56.89	64.15		64.19	0.000146	1.71	1208.53	288.46	0.12
1	1755.05	10-yr	1638.00	57.64	64.19		64.26	0.000247	2.09	783.53	139.29	0.16
1	2478.16	10-yr	1638.00	57.65	64.36		64.43	0.000227	2.03	806.64	140.28	0.15
1	2961.09	10-yr	1638.00	58.74	64.49		64.58	0.000390	2.43	673.57	134.46	0.19
1	3764.01	10-yr	1638.00	57.90	64.75		64.81	0.000212	1.99	825.09	141.07	0.14
1	4435.28	10-yr	1638.00	58.19	64.89		64.95	0.000228	2.04	804.78	140.21	0.15
1	5062.33	10-yr	1638.00	58.17	65.03		65.09	0.000209	1.98	842.14	198.65	0.14
1	5632.31	10-yr	1638.00	57.62	65.15		65.19	0.000151	1.77	950.50	283.08	0.12
1	6135.62	10-yr	1638.00	58.51	65.23		65.29	0.000222	2.02	845.89	349.86	0.15
1	6260.96	10-yr	1638.00	57.84	65.27		65.32	0.000159	1.80	908.55	144.58	0.13
1	6517.92	10-yr	1638.00	58.18	65.31		65.37	0.000184	1.89	865.70	145.89	0.14
1	6716.61	10-yr	1638.00	57.99	65.35		65.40	0.000164	1.82	898.42	144.16	0.13
1	7319.12	10-yr	1638.00	58.20	65.45		65.50	0.000173	1.86	882.71	143.50	0.13
1	8074.05	10-yr	1638.00	58.63	65.59		65.65	0.000200	1.95	840.86	141.74	0.14
1	8724.42	10-yr	1638.00	58.51	65.72		65.77	0.000177	1.87	876.23	143.22	0.13
1	8902.84	10-yr	1638.00	58.59	65.72		65.88	0.000615	3.22	508.52	92.74	0.24
1	9092.08	10-yr	1638.00	59.31	65.82		66.03	0.000857	3.62	452.82	89.07	0.28
1	9515.27	10-yr	1638.00	59.51	66.18		66.37	0.000782	3.50	480.95	181.84	0.27
1	10139.35	10-yr	1638.00	60.20	66.69		66.89	0.000870	3.64	450.49	88.91	0.28
1	10471.77	10-yr	1638.00	60.58	66.98		67.19	0.000914	3.70	442.70	88.40	0.29
1	10709.51	10-yr	1638.00	61.05	67.20		67.43	0.001056	3.89	420.95	86.90	0.31
1	16847.81	10-yr	1688.00	67.27	73.57	70.35	73.80	0.001020	3.89	434.20	88.86	0.31
1	17363.78	10-yr	1688.00	67.82	74.10	70.90	74.34	0.001042	3.90	432.29	87.83	0.31
1	17812.44	10-yr	1688.00	67.81	74.55	70.89	74.75	0.000799	3.56	474.59	90.81	0.27
1	18251.87	10-yr	1688.00	66.95	74.88	70.03	75.01	0.000437	2.89	584.32	96.85	0.21
1	18515.36	10-yr	1688.00	66.90	74.99	69.98	75.11	0.000368	2.84	602.00	100.90	0.19
1	18767.00	10-yr	1688.00	67.03	75.09	70.11	75.21	0.000410	2.82	597.99	99.84	0.20
1	18931.46	10-yr	1688.00	66.88	75.16	69.96	75.28	0.000361	2.73	619.14	97.30	0.19
1	19395.48	10-yr	1688.00	66.92	75.35	70.00	75.43	0.000272	2.34	1269.51	620.29	0.16
1	19981.34	10-yr	1688.00	66.94	75.50	70.02	75.60	0.000308	2.61	664.97	137.22	0.18
1	20339.97	10-yr	1688.00	66.93	75.61	70.01	75.71	0.000299	2.55	745.54	632.33	0.17
1	20874.71	10-yr	1688.00	67.29	75.78	70.37	75.88	0.000331	2.64	640.48	102.33	0.18
1	21373.91	10-yr	1688.00	66.93	75.95	70.00	76.04	0.000271	2.43	694.69	104.10	0.17
1	21563.90	10-yr	1688.00	68.50	75.99	71.58	76.14	0.000534	3.11	542.46	94.81	0.23

HEC-RAS Plan: Proposed River: Drain 18B Reach: 1 Profile: 10-yr (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	21970.15	10-yr	1688.00	69.05	76.21	72.13	76.38	0.000639	3.30	511.92	93.09	0.25
1	22665.43	10-yr	1688.00	71.54	76.79		77.16	0.001986	4.89	345.41	81.52	0.42

HEC-RAS Plan: Existing River: Drain 18B Reach: 1 Profile: 10-yr

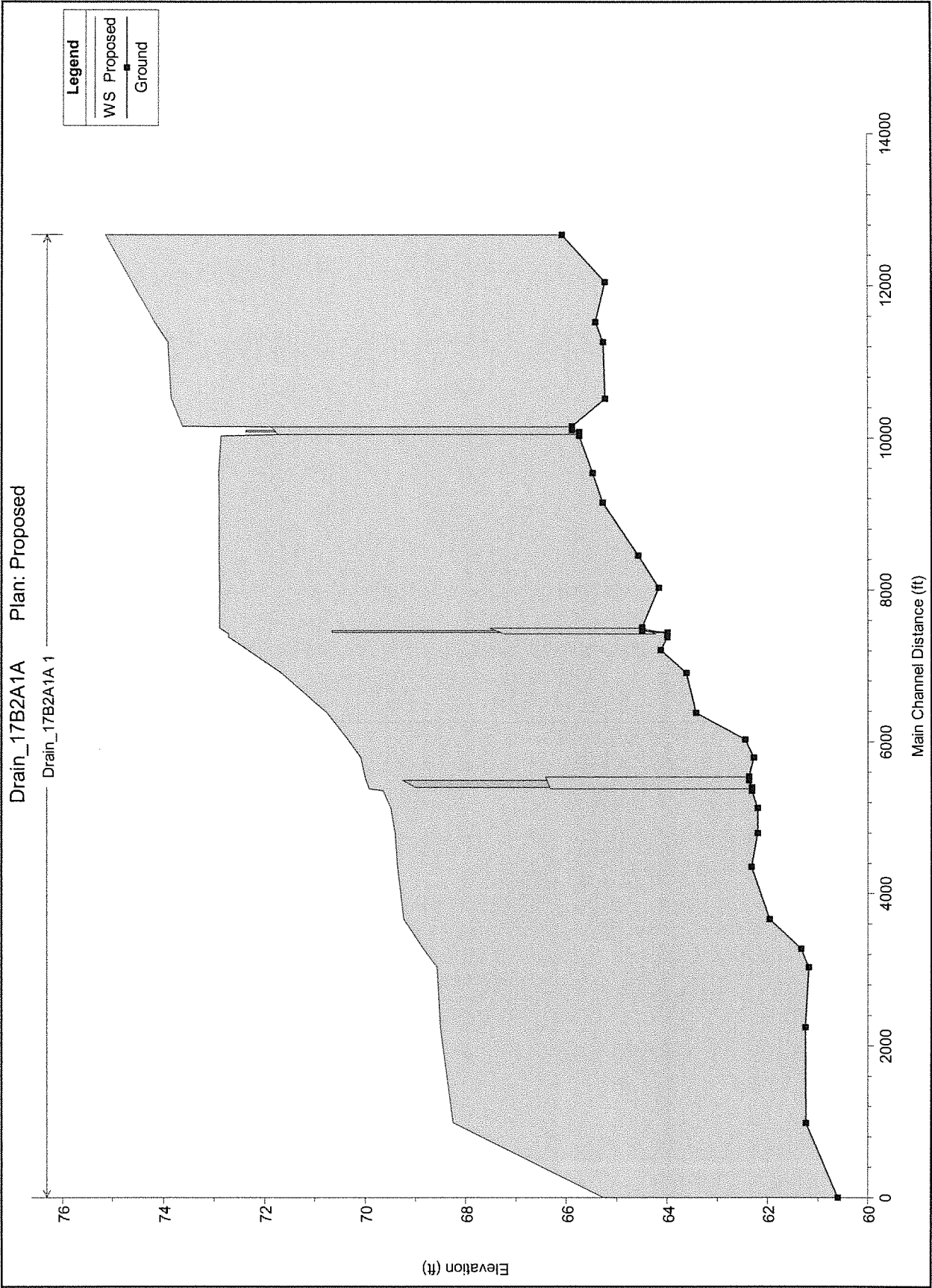
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	85.04	10-yr	1638.00	56.92	67.04	62.85	67.05	0.000200	1.25	2238.94	1245.12	0.09
1	309.29	10-yr	1638.00	56.85	67.08		67.09	0.000181	1.18	2286.41	1217.41	0.08
1	709.93	10-yr	1638.00	56.99	67.15		67.16	0.000165	1.17	2237.73	1129.03	0.08
1	1117.15	10-yr	1638.00	56.92	67.30	67.30	67.36	0.000055	2.61	2154.15	1269.98	0.17
1	1180.49 Mile 9	Culvert										
1	1445.46	10-yr	1638.00	56.89	67.85	67.85	73.31	0.001478	18.74	87.38	1138.84	1.00
1	1755.05	10-yr	1638.00	57.64	73.86		73.86	0.000003	0.26	9780.90	1297.78	0.01
1	2478.16	10-yr	1638.00	57.65	73.86		73.86	0.000003	0.21	10572.75	1400.39	0.01
1	2961.09	10-yr	1638.00	58.74	73.86		73.86	0.000003	0.21	11462.71	1522.43	0.01
1	3764.01	10-yr	1638.00	57.90	73.86		73.86	0.000003	0.20	11957.33	1634.83	0.01
1	4435.28	10-yr	1638.00	58.19	73.86		73.86	0.000001	0.13	12670.74	1679.86	0.01
1	5062.33	10-yr	1638.00	58.17	73.86		73.86	0.000002	0.16	10630.51	1444.48	0.01
1	5832.31	10-yr	1638.00	57.62	73.86		73.87	0.000003	0.25	6718.77	813.90	0.01
1	6135.62	10-yr	1638.00	58.51	73.86	65.71	73.87	0.000002	0.75	6785.40	803.57	0.04
1	6183.29 Mile 3.5	Culvert										
1	6260.96	10-yr	1638.00	57.84	73.86	65.75	73.87	0.000006	1.23	5967.68	803.28	0.06
1	6517.92	10-yr	1638.00	58.18	73.87		73.87	0.000014	0.45	6324.08	861.25	0.02
1	6716.61	10-yr	1638.00	57.99	73.87	63.75	73.88	0.000003	0.97	7443.43	1086.83	0.05
1	7183.24 Runway	Culvert										
1	7319.12	10-yr	1638.00	58.20	73.88	64.44	73.88	0.000002	0.65	7843.59	1100.67	0.03
1	8074.05	10-yr	1638.00	58.63	73.89		73.89	0.000014	0.44	5864.65	1028.44	0.02
1	8724.42	10-yr	1638.00	58.51	73.89	67.40	73.89	0.000002	0.84	7572.23	1086.26	0.04
1	8808.93 Airport	Culvert										
1	8902.84	10-yr	1638.00	58.59	73.89	67.41	73.90	0.000007	1.26	6313.50	1088.68	0.06
1	9092.08	10-yr	1638.00	59.31	73.91		73.91	0.000027	0.65	5426.69	1046.32	0.04
1	9515.27	10-yr	1638.00	59.51	73.92		73.92	0.000056	0.87	4370.25	1049.72	0.05
1	10139.35	10-yr	1638.00	60.20	73.97		73.98	0.000127	1.29	2906.81	778.17	0.07
1	10471.77	10-yr	1638.00	60.58	74.02		74.05	0.000373	2.01	1641.87	518.31	0.12
1	10709.51	10-yr	1638.00	61.05	73.99	72.50	74.14	0.000066	3.14	704.95	245.71	0.19
1	14154.80 Overland Floodin	Culvert										
1	16847.81	10-yr	1688.00	67.27	74.01	73.81	74.16	0.004727	4.21	760.15	912.11	0.35
1	17363.78	10-yr	1688.00	67.82	74.95		74.98	0.000804	1.68	1617.42	1261.66	0.14
1	17812.44	10-yr	1688.00	67.81	75.20		75.21	0.000370	1.05	2323.74	1271.14	0.09
1	18251.87	10-yr	1688.00	66.95	75.36		75.39	0.000644	1.72	1304.22	668.45	0.13
1	18515.36	10-yr	1688.00	66.90	75.53		75.57	0.000891	2.04	1140.18	618.57	0.15
1	18767.00	10-yr	1688.00	67.03	75.56	75.34	75.69	0.000156	3.73	1553.09	1029.05	0.28
1	18768	Culvert										
1	18931.46	10-yr	1688.00	66.88	75.86	75.30	75.98	0.000086	3.16	1935.74	1098.35	0.22
1	19395.48	10-yr	1688.00	66.92	76.04		76.05	0.000242	1.53	2439.38	1089.09	0.11
1	19981.34	10-yr	1688.00	66.94	76.20		76.24	0.000439	2.12	1646.30	847.55	0.15
1	20339.97	10-yr	1688.00	66.93	76.33		76.36	0.000405	1.92	2033.02	1250.20	0.14

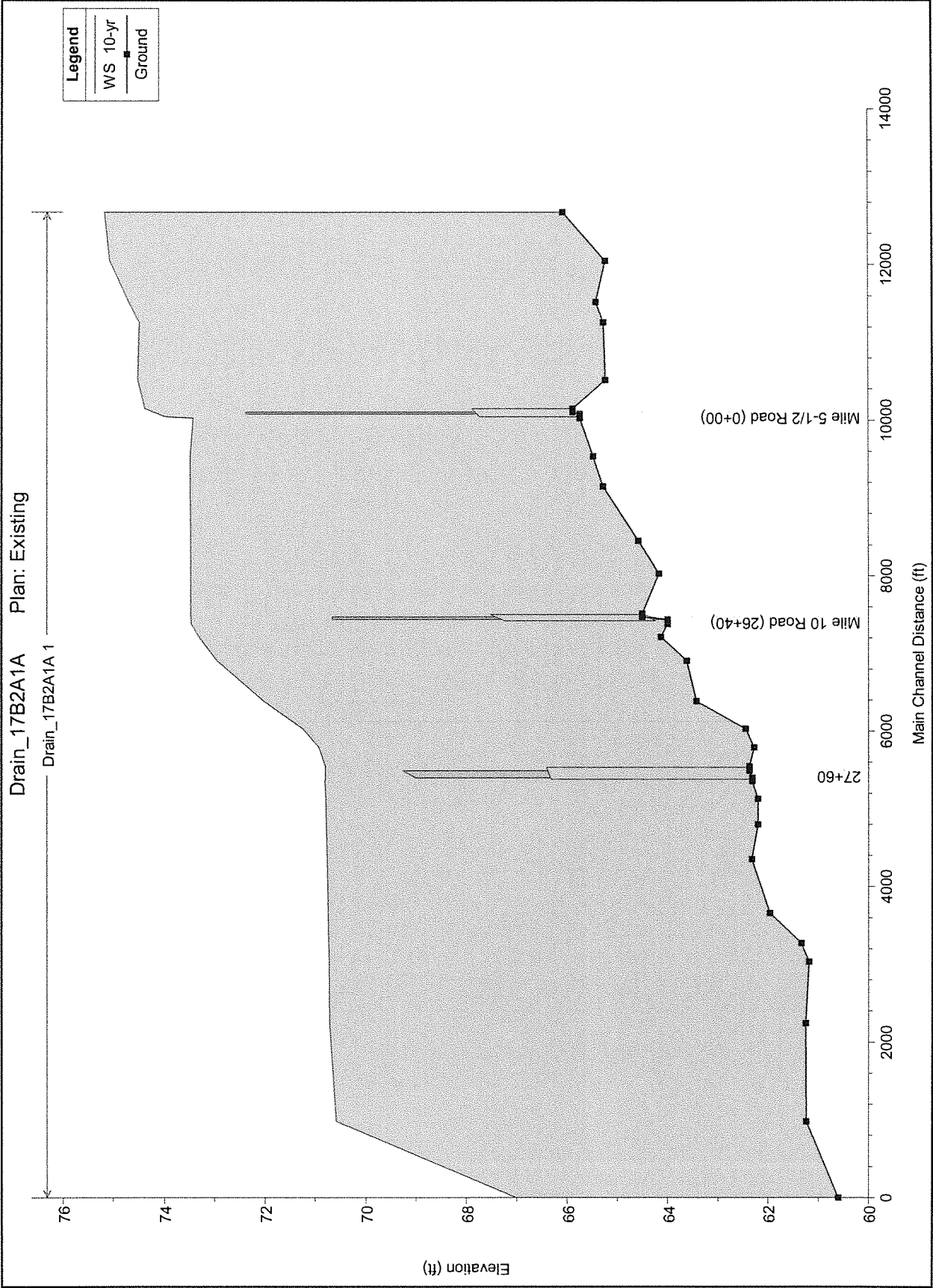
HEC-RAS Plan: Existing River: Drain 18B Reach: 1 Profile: 10-yr (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	20874.71	10-yr	1688.00	67.29	76.51		76.54	0.000337	1.92	1974.46	1096.42	0.13
1	21373.91	10-yr	1688.00	66.93	76.32	75.74	77.16	0.000563	7.73	575.92	885.83	0.54
1	21460.93 Westgate		Culvert									
1	21563.90	10-yr	1688.00	68.50	76.84	76.84	77.87	0.001166	10.09	817.13	631.00	0.75
1	21970.15	10-yr	1688.00	69.05	78.24		78.26	0.000489	2.03	1905.46	1115.59	0.15
1	22665.43	10-yr	1688.00	71.54	78.80		78.89	0.002043	3.35	859.87	654.87	0.29

HEC-RAS Plan: Proposed River: Drain_17B2A1A Reach: 1 Profile: Proposed

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	105.358	Proposed	488.00	60.60	65.26	65.26	66.71	0.025028	9.64	50.62	17.47	1.00
1	1087.866	Proposed	488.00	61.23	68.25	63.58	68.32	0.000487	2.05	237.56	46.43	0.16
1	2348.66	Proposed	488.00	61.24	68.51	64.92	68.51	0.000072	0.69	1036.71	589.85	0.06
1	3140.081	Proposed	488.00	61.18	68.58	64.48	68.69	0.000979	2.74	232.19	442.68	0.22
1	3379.539	Proposed	488.00	61.33	68.85	65.33	68.98	0.001514	3.16	243.52	717.84	0.26
1	3767.652	Proposed	385.00	61.95	69.24	65.01	69.26	0.000347	1.55	475.27	670.62	0.13
1	4459.743	Proposed	385.00	62.31	69.36	65.58	69.36	0.000080	0.70	1108.68	1339.18	0.06
1	4903.98	Proposed	385.00	62.19	69.41	65.30	69.42	0.000243	1.24	622.14	830.20	0.11
1	5234.688	Proposed	385.00	62.19	69.49	65.05	69.57	0.000711	2.26	170.04	37.63	0.19
1	5461.565	Proposed	385.00	62.30	69.65	64.87	69.70	0.000445	1.87	205.45	43.11	0.15
1	5554.182 Mile 5	Culvert										
1	5650.076	Proposed	385.00	62.36	70.00	65.72	70.03	0.000392	1.60	431.27	630.98	0.14
1	5897.099	Proposed	385.00	62.27	70.09	65.80	70.20	0.001042	2.68	143.75	31.37	0.22
1	6135.702	Proposed	385.00	62.44	70.34	66.07	70.46	0.001084	2.72	141.69	31.20	0.22
1	6490.198	Proposed	385.00	63.41	70.77	67.42	70.92	0.001513	3.14	122.79	28.21	0.26
1	7014.785	Proposed	385.00	63.60	71.67	68.24	71.89	0.002204	3.71	103.83	22.51	0.30
1	7317.826	Proposed	385.00	64.12	72.34	68.75	72.55	0.002135	3.61	106.55	23.56	0.30
1	7485.477	Proposed	385.00	63.98	72.72	68.89	72.89	0.001958	3.36	114.55	28.95	0.29
1	7566.658 Mile 10	Culvert										
1	7617.867	Proposed	385.00	64.49	72.90	68.17	72.90	0.000006	0.21	2175.89	750.23	0.02
1	8134.077	Proposed	385.00	64.15	72.90	68.35	72.90	0.000002	0.10	4154.51	1724.83	0.01
1	8560.082	Proposed	385.00	64.56	72.90	68.48	72.90	0.000004	0.16	2320.37	631.03	0.01
1	9258.854	Proposed	385.00	65.26	72.91	69.12	72.91	0.000014	0.30	1541.77	618.18	0.03
1	9644.187	Proposed	385.00	65.46	72.92	69.61	72.92	0.000036	0.46	1143.21	618.38	0.04
1	10134.37	Proposed	385.00	65.73	72.87	69.57	73.08	0.002195	3.68	104.54	23.23	0.31
1	10201.73 Mile 51/2	Culvert										
1	10256.27	Proposed	385.00	65.87	73.63	69.59	73.77	0.001284	2.98	129.41	27.52	0.24
1	10623.75	Proposed	385.00	65.22	73.85	69.23	73.86	0.000081	0.71	864.66	600.82	0.06
1	11365	Proposed	385.00	65.25	73.92	69.27	74.04	0.001044	2.78	138.68	27.18	0.22
1	11629.53	Proposed	385.00	65.41	74.18	69.28	74.29	0.000870	2.63	146.36	26.77	0.20
1	12155.33	Proposed	385.00	65.22	74.64	69.36	74.73	0.000814	2.51	157.55	46.36	0.19
1	12779.1	Proposed	385.00	66.07	75.16	70.22	75.16	0.000008	0.25	1893.41	697.02	0.02





HEC-RAS Plan: Existing River: Drain_17B2A1A Reach: 1 Profile: 10-yr

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	105.358	10-yr	950.00	60.60	67.02	67.02	68.94	0.023398	11.12	85.42	22.27	1.00
1	1087.866	10-yr	950.00	61.23	70.59	64.73	70.69	0.000525	2.58	387.74	74.47	0.17
1	2348.66	10-yr	950.00	61.24	70.72	66.52	70.72	0.000006	0.27	4463.09	1302.81	0.02
1	3140.081	10-yr	950.00	61.18	70.73	65.98	70.73	0.000012	0.37	3689.61	1349.55	0.03
1	3379.539	10-yr	950.00	61.33	70.73	70.73	70.74	0.000053	0.72	2235.50	1237.18	0.05
1	3767.652	10-yr	1107.00	61.95	70.75	67.36	70.75	0.000025	0.48	3310.99	1390.57	0.04
1	4459.743	10-yr	1107.00	62.31	70.77	68.00	70.77	0.000034	0.56	3046.29	1427.99	0.04
1	4903.98	10-yr	1107.00	62.19	70.78	67.68	70.79	0.000040	0.61	2874.34	1391.81	0.05
1	5234.688	10-yr	1107.00	62.19	70.80	67.33	70.80	0.000062	0.77	2369.04	1266.41	0.06
1	5461.565	10-yr	1107.00	62.30	70.81	66.95	70.82	0.000073	0.82	2356.45	1485.28	0.06
1	5554.182 Mile 5		Culvert									
1	5650.076	10-yr	1107.00	62.36	70.80	68.21	70.83	0.000431	1.88	1235.58	1199.75	0.15
1	5897.099	10-yr	1107.00	62.27	70.93	68.39	71.01	0.001170	3.09	688.29	599.57	0.24
1	6135.702	10-yr	1107.00	62.44	71.25	68.70	71.41	0.002195	3.94	495.95	528.74	0.32
1	6490.198	10-yr	1107.00	63.41	72.03	69.89	72.15	0.001994	3.58	531.46	505.09	0.31
1	7014.785	10-yr	385.00	63.60	72.96	68.24	73.08	0.001142	2.85	134.94	26.66	0.22
1	7317.826	10-yr	385.00	64.12	73.32	68.75	73.45	0.001282	2.93	131.45	27.60	0.24
1	7485.477	10-yr	385.00	63.98	73.47	68.89	73.47	0.000004	0.15	2616.84	1285.00	0.01
1	7566.658 Mile 10		Culvert									
1	7617.867	10-yr	385.00	64.49	73.48	68.17	73.48	0.000003	0.16	2610.69	751.94	0.01
1	8134.077	10-yr	385.00	64.15	73.48	68.35	73.48	0.000001	0.08	5153.79	1728.67	0.01
1	8560.082	10-yr	385.00	64.56	73.48	68.48	73.48	0.000001	0.08	5481.06	1748.81	0.01
1	9258.854	10-yr	385.00	65.26	73.48	69.12	73.48	0.000007	0.23	1897.18	621.96	0.02
1	9644.187	10-yr	385.00	65.46	73.49	69.61	73.49	0.000015	0.32	1496.05	619.16	0.03
1	10134.37	10-yr	385.00	65.73	73.43	69.57	73.59	0.001632	3.26	118.10	25.35	0.27
1	10201.73 Mile 51/2		Culvert									
1	10256.27	10-yr	385.00	65.87	74.39	69.59	74.49	0.000915	2.53	152.27	36.68	0.21
1	10623.75	10-yr	385.00	65.22	74.52	69.23	74.52	0.000019	0.37	1878.04	1481.75	0.03
1	11365	10-yr	385.00	65.25	74.50	69.27	74.59	0.000785	2.47	165.17	112.09	0.19
1	11629.53	10-yr	385.00	65.41	74.70	69.28	74.79	0.000681	2.37	175.45	82.05	0.18
1	12155.33	10-yr	385.00	65.22	75.07	69.36	75.15	0.000709	2.29	180.26	60.61	0.18
1	12779.1	10-yr	385.00	66.07	75.18	70.22	75.18	0.000008	0.25	1905.56	700.51	0.02

Appendix D

See CD/DVD.

Appendix D-1

Inventory of Existing and Proposed Structures

Stream Name	Location	Existing Dimensions	Proposed Dimensions
Drain 17B2 A1A	Mile 5 1/2	2' Diameter RCP	None
Drain 17B2 A1A	Mile 5	4' Diameter RCP	None
Drain 17B2 A1A	Mile 10	3' Diameter RCP	One 10' x 6' Box Culvert
Drain A	Mile 4	3.5' Diameter RCP	10' x 8' Box Culvert
Drain A	Mile 4.5	4.5' Diameter RCP	10' x 8' Box Culvert
Drain 17B2	Mile 2 1/2	Two 2.25' RCPs	Five 10' x 8' Box Culverts
Drain 17B2	Mile 3	6.2' x 5.2' Box Culvert	Five 10' x 8' Box Culverts
Drain 17B2	Mile 3 1/2	5' Diameter RCP	Four 10' x 8' Box Culverts
Drain 17B2	Unnamed Road upstream of Mile 3 1/2	2.25' Diameter RCP	Four 10' x 8' Box Culverts
Drain 17B2	Unnamed Gravel Road downstream of Mile 4 1/2	2' Diameter RCP	Four 10' x 8' Box Culverts
Drain 17B2	Mile 4 1/2	One 3' Diameter RCP and One 2' Diameter RCP	Four 10' x 8' Box Culverts
Drain 18B	Mile 9	7' x 7' Box Culvert	Five 10' x 10' Box Culverts
Drain 18B	Mile 3	9' x 6' Box Culvert	Five 10' x 10' Box Culverts
Drain 18B	Runway	Two-6' diameter and one 5' diameter RCP	Five 10' x 10' Box Culverts
Drain 18B	Airport	10' x 8' Box Culvert	Five 10' x 10' Box Culverts
Drain 18B	Border Avenue	7' x 3' Box culvert	Five 10' x 10' Box Culverts
Drain 18B	Paso Del Norte	7.5' x 7.5' Box Culvert	Five 10' x 10' Box Culverts
Drain 18B	Unnamed (Between Border and Westgate)	5' Diameter RCP	Five 10' x 10' Box Culverts
Drain 18B	Westgate	5.25' Diameter RCP	Five 10' x 10' Box Culverts
Drain 18B3	Unnamed Street under Canal	Two-4' x 4' Box culverts	None
Drain 18B4	Mile 2	Two-7.5' x 7.5' Box Culvert	None
Drain 18B5	Mile 2 1/2	Two-5' Diameter RCPs	Four-10' x 8' Box culverts
Drain 18B6	International Blvd	Two 7' x 5' Box Culverts	Four- 10' x 7' Box Culverts
Drain 18B7	US Hwy 83	6' x 6' Box Culvert	Four- 10' x 7' Box Culverts
Drain 18B8	Airport Road	6' x 6' Box Culvert	Two- 10' x 8' Box Culverts
Drain 18B4	Unnamed Street at Outfall	6' x 7' Box Culvert	Four- 8' x 7' Box Culverts
Drain 18B4	Driveway downstream of US Hwy 83	3.5' Diameter RCP	Four- 8' x 7' Box Culverts
Drain 18B4	US Hwy 83	4.5' Diameter RCP	Four- 8' x 7' Box Culverts
Drain 18B4	Unnamed Driveway Downstream of Hwy 374	4.5' Diameter RCP	Four- 8' x 7' Box Culverts

Inventory of Existing and Proposed Structures

Stream Name	Location	Existing Dimensions	Proposed Dimensions
Drain 18B4	Unnamed crossing immediately downstream of Hwy 374	3' Diameter RCP	Four- 8' x 7' Box Culverts
Drain 18B4	State Highway 374	3' Diameter RCP	Four- 8' x 7' Box Culverts
Drain 18B4	Canal Crossing upstream of Hwy 374	2.25' Diameter RCP	Three 8' x 5' Box Culverts
Drain 18B4	Mile 6 1/2	2.25' Diameter RCP	Three 8' x 5' Box Culverts
Drain 18B4	Driveway Culverts upstream of Mile 6.5	2' Diameter RCP	Three 8' x 5' Box Culverts
Drain 18B4	Canal Crossing upstream of Mile 6 1/2	2.25' Diameter RCP	Three 8' x 5' Box Culverts
Drain 18B4	Mile 3	2.25' Diameter RCP	Three 8' x 5' Box Culverts
Drain 18B4	Unnamed Driveway next to Circle Drive	2.0' Diameter RCP and 3.0' Diameter RCP	Three 8' x 5' Box Culverts
Drain 34	Unnamed Street downstream of International Blvd	3' Diameter RCP	Three- 10' x 8' Box Culverts
Drain 34	International Blvd	5' x 5' Box Culvert	Three- 10' x 8' Box Culverts
Drain 34	Mile 3 1/2	2' Diameter RCP	Three- 10' x 8' Box Culverts
Drain 34	Long culvert upstream of Mile 3 1/2	2.5' Diameter RCP	Four-10' x 4' Box Culverts
Drain 34	Drive way downstream of 18th Street	2.5' Diameter RCP	Four-10' x 4' Box Culverts
Drain 34	18th Street	2' Diameter RCP	Four-10' x 4' Box Culverts
Drain 34A	FM 1015	5' x 2.5' Box culvert	None
Drain 35	Mile 5	Bridge	None
Drain 35	24th Street	Bridge	None
Drain 35	18th Street	Four - 5' Diameter RCPs	None
Drain 35	10th Street	8' x7' Box Culvert	None
Drain 35A	Academy Drive	3' Diameter RCP	None
Drain 35A	Driveways inside Cemetry	4' Diameter RCP	None
Drain 36	Driveway1	2.25' Diameter RCP	8' x 6' Box Culvert
Drain 36	Driveway2	2.25' Diameter RCP	8' x 6' Box Culvert
Drain 37	Bridge Avenue	Two - 8' x7' Box Culverts	7- 10' x9' Box Culverts
	34th Street	Bridge	7- 10' x9' Box Culverts

Inventory of Existing and Proposed Structures

Stream Name	Location	Existing Dimensions	Proposed Dimensions
	Texas Blvd	One 5' Diameter RCP, One 5' x 5' Box and one 10'x 5'	6- 10' x9' Box Culverts
	Border Avenue	4' Diameter RCP	5- 10' x9' Box Culverts
	18th Street	5' Diameter RCP	5- 10' x9' Box Culverts
	Westgate	4' Diameter RCP	6- 10' x 7' Box Culverts
	Unnamed Road upstream of Westgate	5' x 5' Box Culvert	6- 10' x 7' Box Culverts
	Second Unnamed Road upstream of Westgate	4.5' diameter RCP	6- 10' x 7' Box Culverts
	Unnamed Driveway downstream of 6th Street	4.5' diameter RCP	6- 10' x 7' Box Culverts
	6th Street	5' Diameter RCP	6- 10' x 7' Box Culverts
Drain 37A	Texas Street	2' Diameter RCP	One-8' x 6' Box Culvert
Drain 37A	Canal Crossing	2.5' Diameter RCP	Two- 8' x 6' Box Culvert

Improvements to Drain A						
Item Description						
Replace Box Culvert at Mile 4 1/2 Road and Mile 4						
Excavation & Backfill	3600	C.Y.		\$10.68		\$38,448
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	2040	S.Y.		\$4.88		\$9,955
Hot Mix Asphaltic Concrete 8" Type B	2020	S.Y.		\$33.93		\$68,539
Hot Mix Asphaltic Concrete 4" Type C	2000	S.Y.		\$20.00		\$40,000
Lime	48	TON		\$166.04		\$7,970
Prime Coat	400	GAL		\$3.78		\$1,512
2 -10' x 8' Box Culvert	200	LF		\$750.00		\$150,000
Wing Wall	8	EA.		\$17,000.00		\$136,000
				Subtotal	\$452,423.72	
Channel Excavation 50-feet bottom						
EXCAVATION (CHANNEL)	3793	C.Y.		\$13.85		\$52,533
				Subtotal	\$52,533	
				Subtotal		\$504,957
Mobilization			11%			\$55,545.24
ROW Prep			4%			\$20,198.27
Insurance & Bond			3%			\$15,148.70
Markings & Signage			1%			\$5,049.57
Traffic Control			4%			\$20,198.27
SWPPP			5%			\$25,247.84
Tree Protection			2%			\$10,099.14
				Sub Total for Construction		\$656,444
Construction Contingency			25%			\$164,110.95
Engineering Design, Environmental, Real Estate			10%			\$82,055.48
				Sub Total for Construction & Engineering		\$902,610.23
Inflation 4 Years @ 4% per year						\$153,316.07
Total Drainage:						\$1,055,926.30

Improvements to Drain 37A						
Item Description						
Replace Box Culverts						
Excavation & Backfill	444	C.Y.	\$10.68			\$4,747
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	143	S.Y.	\$4.88			\$696
Hot Mix Asphaltic Concrete 8" Type B	137	S.Y.	\$33.93			\$4,660
Hot Mix Asphaltic Concrete 4" Type C	133	S.Y.	\$20.00			\$2,667
Lime	3	TON	\$166.04			\$531
Prime Coat	27	GAL	\$3.78			\$101
2-8' x 6' Box Culverts@ Canal Crossing	240	LF	\$550.00			\$132,000
1-8' x 6' Box Culvert @ Texas Blvd	56	LF	\$550.00			\$30,800
Wing Wall	8	EA.	\$10,500.00			\$84,000
			Subtotal		\$260,201.39	
Channel Excavation and Property Buyout						
EXCAVATION (CHANNEL)	75214	C.Y.	\$13.85			\$1,041,714
Property Buyouts (Trailer Home)	30	Each	\$30,000.00			\$900,000
			Subtotal		\$1,941,714	
Mobilization and Construction Costs						
Mobilization		11%		Subtotal		\$2,201,915
ROW Prep		4%				\$242,210.68
Insurance & Bond		3%				\$88,076.61
Markings & Signage		1%				\$66,057.46
Traffic Control		4%				\$22,019.15
SWPPP		5%				\$88,076.61
Tree Protection		2%				\$110,095.76
			Sub Total for Construction			\$44,038.31
						\$2,862,490
Construction Contingency and Professional Fees						
Construction Contingency		25%				\$715,622.47
Engineering Design, Environmental, Real Estate		10%				\$357,811.24
			Sub Total for Construction & Engineering			\$3,935,923.59
Inflation 4 Years @ 4% per year						\$668,550.31
Total Drainage:						\$4,604,473.90

Improvements to Drain 37						
Item Description						
Replace Box Culverts						
Excavation & Backfill	24407	C.Y.		\$10.68		\$260,671
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	7835	S.Y.		\$4.88		\$38,234
Hot Mix Asphaltic Concrete 8" Type B	7542	S.Y.		\$33.93		\$255,896
Hot Mix Asphaltic Concrete 4" Type C	7322	S.Y.		\$20.00		\$146,444
Lime	176	TON		\$166.04		\$29,179
Prime Coat	1464	GAL		\$3.78		\$5,536
7- 10' x 9' Box Culverts@ Bridge Avenue, 34th, Levee	1974	LF		\$852.00		\$1,681,848
6- 10' x 9' Box Culverts @ Texas Blvd	510	LF		\$852.00		\$434,520
5- 10' x 9' Box Culverts @ Border and 18th Ave	7600	LF		\$852.00		\$6,475,200
6 - 10' x 7' Box Culverts @ 5 Crossings	3120	LF		\$850.00		\$2,652,000
Wing Wall	44	EA.		\$17,000.00		\$748,000
				Subtotal	\$12,727,527.92	
Channel & Detention Excavation						
EXCAVATION (CHANNEL)	661125	C.Y.		\$13.85		\$9,156,581.25
Buyouts	30	Home		\$150,000.00		\$4,500,000.00
				Subtotal	\$13,656,581	
Mobilization						
		11%		Subtotal		\$26,384,109
ROW Prep		4%				\$2,902,252.01
Insurance & Bond		3%				\$1,055,364.37
Markings & Signage		1%				\$791,523.28
Traffic Control		4%				\$263,841.09
SWPPP		5%				\$1,055,364.37
Tree Protection		2%				\$1,319,205.46
						\$527,682.18
				Sub Total for Construction		\$34,299,342
Construction Contingency						
		25%				\$8,574,835.48
Engineering Design, Environmental, Real Estate		10%				\$4,287,417.74
				Sub Total for Construction & Engineering		\$47,161,595.15
Inflation 4 Years @ 4% per year						\$8,010,800.64

Total Drainage:	\$55,172,395.79
-----------------	-----------------

Improvements to Drain 18B3						
Item Description						
Replace Box Culverts						
Excavation & Backfill	722	C.Y.	\$10.68			\$7,713
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	232	S.Y.	\$4.88			\$1,131
Hot Mix Asphaltic Concrete 8" Type B	223	S.Y.	\$33.93			\$7,572
Hot Mix Asphaltic Concrete 4" Type C	217	S.Y.	\$20.00			\$4,333
Lime	5	TON	\$166.04			\$863
Prime Coat	43	GAL	\$3.78			\$164
1-8' x 6' Box Culverts @ 3 crossings	277	LF	\$550.00			\$152,350
Wing Wall	12	EA.	\$10,500.00			\$126,000
			Subtotal		\$300,127.27	
			Subtotal			\$300,127
Mobilization		11%				\$33,014.00
ROW Prep		4%				\$12,005.09
Insurance & Bond		3%				\$9,003.82
Markings & Signage		1%				\$3,001.27
Traffic Control		4%				\$12,005.09
SWPPP		5%				\$15,006.36
Tree Protection		2%				\$6,002.55
			Sub Total for Construction			\$390,165
Construction Contingency		25%				\$97,541.36
Engineering Design, Environmental, Real Estate		10%				\$48,770.68
			Sub Total for Construction & Engineering			\$536,477.49
Inflation 4 Years @ 4% per year						\$91,125.29
Total Drainage:						\$627,602.78

Improvements to Drain 35 and 35A						
Item Description						
Flashing Beacons at 18th Street		1	LS			\$50,000
Property Buyouts						
Drain 35A		65	Home	\$60,000.00		\$3,900,000.00
Drain 35A		75	Home	\$60,000.00		\$4,500,000.00
				Subtotal	\$8,400,000.00	
				Subtotal		\$8,450,000
Mobilization			11%			\$929,500.00
ROW Prep			4%			\$338,000.00
Insurance & Bond			3%			\$253,500.00
Markings & Signage			1%			\$84,500.00
Traffic Control			4%			\$338,000.00
SWPPP			5%			\$422,500.00
Tree Protection			2%			\$169,000.00
				Sub Total for Construction		\$10,985,000
Construction Contingency			0%			\$0.00
Engineering Design, Environmental, Real Estate			10%			\$1,098,500.00
				Sub Total for Construction & Engineering		\$12,083,500.00
Inflation 4 Years @ 4% per year						\$2,052,485.91
Total Drainage:						\$14,135,985.91

Improvements to Drain 34A				
Item Description				
Flashing Beacons at International Blvd	1	LS		\$50,000
			Subtotal	\$50,000.00
			Subtotal	\$50,000
Mobilization		11%		\$5,500.00
ROW Prep		4%		\$2,000.00
Insurance & Bond		3%		\$1,500.00
Markings & Signage		1%		\$500.00
Traffic Control		4%		\$2,000.00
		Sub Total for Construction		\$61,500
Construction Contingency		10%		\$6,150.00
Engineering Design, Environmental, Real Estate		10%		\$6,765.00
Inflation 4 Years @ 4% per year		Sub Total for Construction & Engineering		\$74,415.00
Total Drainage:				\$12,640.02
				\$87,055.02

Improvements to Drain 34						
Item Description						
Replace Box Culverts						
Excavation & Backfill	24889	C.Y.	\$10.68			\$265,813
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	7989	S.Y.	\$4.88			\$38,988
Hot Mix Asphaltic Concrete 8" Type B	7691	S.Y.	\$33.93			\$260,944
Hot Mix Asphaltic Concrete 4" Type C	7467	S.Y.	\$20.00			\$149,333
Lime	179	TON	\$166.04			\$29,754
Prime Coat	1493	GAL	\$3.78			\$5,645
3-10' x 8' Box Culverts @ 5 Crossings	3636	LF	\$750.00			\$2,727,000
4-10' x 4' Box Culverts @ 1 crossings	280	LF	\$775.00			\$217,000
Wing Wall	24	EA.	\$17,000.00			\$408,000
			Subtotal		\$4,102,478.10	
Channel & Detention Excavation						
EXCAVATION (CHANNEL)	162367	C.Y.	\$13.85			\$2,248,783
			Subtotal		\$2,248,783	
				Subtotal		\$6,351,261
Mobilization		11%				\$698,638.72
ROW Prep		4%				\$254,050.44
Insurance & Bond		3%				\$190,537.83
Markings & Signage		1%				\$63,512.61
Traffic Control		4%				\$254,050.44
SWPPP		5%				\$317,563.05
Tree Protection		2%				\$127,025.22
			Sub Total for Construction			\$8,256,639
Construction Contingency		25%				\$2,064,159.84
Engineering Design, Environmental, Real Estate		10%				\$1,032,079.92
			Sub Total for Construction & Engineering			\$11,352,879.13
Inflation 4 Years @ 4% per year						\$1,928,383.70
Total Drainage:						\$13,281,262.83

Improvements to Drain 18B4						
Item Description						
Replace Box Culverts						
Excavation & Backfill	20347	C.Y.	\$10.68			\$217,302
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	7257	S.Y.	\$4.88			\$35,414
Hot Mix Asphaltic Concrete 8" Type B	6986	S.Y.	\$33.93			\$237,024
Hot Mix Asphaltic Concrete 4" Type C	6782	S.Y.	\$20.00			\$135,644
Lime	163	TON	\$166.04			\$27,027
Prime Coat	1356	GAL	\$3.78			\$5,127
4-8' x 7' Box Culverts @ 3 Crossings	3588	LF	\$600.00			\$2,152,800
3-8' x 5' Box Culverts @ 10 crossings	3951	LF	\$850.00			\$3,358,350
Wing Wall	52	EA.	\$15,842.00			\$823,784
			Subtotal		\$6,992,473.56	
Channel Excavation						
EXCAVATION (CHANNEL)	84502	C.Y.	\$13.85			\$1,170,353
			Subtotal		\$1,170,353	
Subtotal						
					Subtotal	\$8,162,826
Mobilization		11%				\$897,910.89
ROW Prep		4%				\$326,513.05
Insurance & Bond		3%				\$244,884.79
Markings & Signage		1%				\$81,628.26
Traffic Control		4%				\$326,513.05
SWPPP		5%				\$408,141.31
Tree Protection		2%				\$163,256.53
			Sub Total for Construction			\$10,611,674
Construction Contingency						
		25%				\$2,652,918.54
Engineering Design, Environmental, Real Estate		10%				\$1,326,459.27
Inflation 4 Years @ 4% per year		Sub Total for Construction & Engineering				\$14,591,051.95
Total Drainage:						\$17,069,467.02

Improvements to Drain 18B3									
Item Description									
Replace Box Culverts									
Excavation & Backfill		48248	C.Y.		\$10.68				\$515,290
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)		6613	S.Y.		\$4.88				\$32,269
Hot Mix Asphaltic Concrete 8" Type B		6365	S.Y.		\$33.93				\$215,978
Hot Mix Asphaltic Concrete 4" Type C		6180	S.Y.		\$20.00				\$123,600
Lime		148	TON		\$166.04				\$24,627
Prime Coat		1236	GAL		\$3.78				\$4,672
2-10' x 8' Box Culverts		200	LF		\$785.00				\$157,000
4-10' x 7' Box Culverts		5244	LF		\$850.00				\$4,457,400
4-10' x 7' Box Culverts		532	LF		\$850.00				\$452,200
4 - 10' x 8' Box Culverts @ 2 crossings		800	LF		\$750.00				\$600,000
4- 10' x 8' Box Culverts		864	LF		\$750.00				\$648,000
Wing Wall		24	EA.		\$17,000.00				\$408,000
					Subtotal			\$7,639,036.87	
Channel & Detention Excavation									
EXCAVATION (CHANNEL)		314566	C.Y.		\$13.85				\$4,356,739
EXCAVATION (Detention)		1210000	C.Y.		\$13.85				\$16,758,500
					Subtotal			\$21,115,239	
Mobilization			11%					Subtotal	\$28,754,276
ROW Prep			4%						\$3,162,970.36
Insurance & Bond			3%						\$1,150,171.04
Markings & Signage			1%						\$862,628.28
Traffic Control			4%						\$287,542.76
SWPPP			5%						\$1,150,171.04
Tree Protection			2%						\$1,437,713.80
									\$575,085.52
								Sub Total for Construction	\$37,380,559
Construction Contengency			25%						\$9,345,139.69
Engineering Design, Environmental, Real Estate			10%						\$4,672,569.84
								Sub Total for Construction & Engineering	\$51,398,268.29

Inflation 4 Years @ 4% per year						\$8,730,435.84
Total Drainage:						\$60,128,704.13

Improvements to Drain 18B						
Item Description						
Replace Box Culverts						
Excavation & Backfill	194444.4	C.Y.	\$10.68			\$2,076,667
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	12364	S.Y.	\$4.88			\$60,338
Hot Mix Asphaltic Concrete 8" Type B	11902	S.Y.	\$33.93			\$403,842
Hot Mix Asphaltic Concrete 4" Type C	11556	S.Y.	\$20.00			\$231,111
Lime	277	TON	\$166.04			\$46,048
Prime Coat	2311	GAL	\$3.78			\$8,736
Seven Crossings with 5 - 10' x 10' Box Culvert	37500	LF	\$852.00			\$31,950,000
Wing Wall	28	EA.	\$17,000.00			\$476,000
			Subtotal	\$35,252,743.09		
Channel & Detention Excavation						
EXCAVATION (CHANNEL)	476563	C.Y.	\$13.85			\$6,600,398
EXCAVATION (Detention)	1016400	C.Y.	\$13.85			\$14,077,140
			Subtotal	\$20,677,538		
			Subtotal			\$55,930,281
Mobilization		11%				\$6,152,330.87
ROW Prep		4%				\$2,237,211.23
Insurance & Bond		3%				\$1,677,908.42
Markings & Signage		1%				\$559,302.81
Traffic Control		4%				\$2,237,211.23
SWPPP		5%				\$2,796,514.03
Tree Protection		2%				\$1,118,605.61
			Sub Total for Construction			\$72,709,365
Construction Contingency		25%				\$18,177,341.21
Engineering Design, Environmental, Real Estate		10%				\$9,088,670.60
					Sub Total for Construction & Engineering	\$99,975,376.65
Inflation 4 Years @ 4% per year						\$16,981,673.51
Total Drainage:						\$116,957,050.16

Improvements to Drain 17BA1A						
Replace Box Culvert at Mile 5 1/2 Road						
Excavation & Backfill	3600	C.Y.	\$10.68			\$38,448
LIME TREATED SUBGRADE (6" COMPACTED DEPTH)	52	S.Y.	\$4.88			\$252
Hot Mix Asphaltic Concrete 8" Type B	46	S.Y.	\$33.93			\$1,568
Hot Mix Asphaltic Concrete 4" Type C	44	S.Y.	\$20.00			\$889
Lime	1	TON	\$166.04			\$175
Prime Coat	9	GAL	\$3.78			\$33
10' x 6' Box Culvert	100	LF	\$850.00			\$85,000
Wing Wall	4	EA.	\$17,000.00			\$68,000
			Subtotal	\$194,365.40		
Detention Pond 17BA1A-2; 6' deep						
EXCAVATION (CHANNEL)	350803	C.Y.	\$13.85			\$4,858,624
			Subtotal	\$4,858,624		
Detention Pond 17BA1A-1; 2' deep						
EXCAVATION (CHANNEL)	20973	C.Y.	\$13.85			\$290,481
			Subtotal	\$290,481		
Mobilization				Subtotal		\$5,343,470
ROW Prep		11%				\$587,781.74
Insurance & Bond		4%				\$213,738.82
Markings & Signage		3%				\$160,304.11
Traffic Control		1%				\$53,434.70
SWPPP		4%				\$213,738.82
Tree Protection		5%				\$267,173.52
		2%				\$106,869.41
		Sub Total for Construction				\$6,946,512
Construction Contingency		25%				\$1,335,867.60
Engineering Design, Environmental, Real Estate		10%				\$828,237.91
		Sub Total for Construction & Engineering				\$9,110,617.01
Inflation 4 Years @ 4% per year						\$1,547,516.29
Total Drainage:						\$10,658,133.30

Appendix E

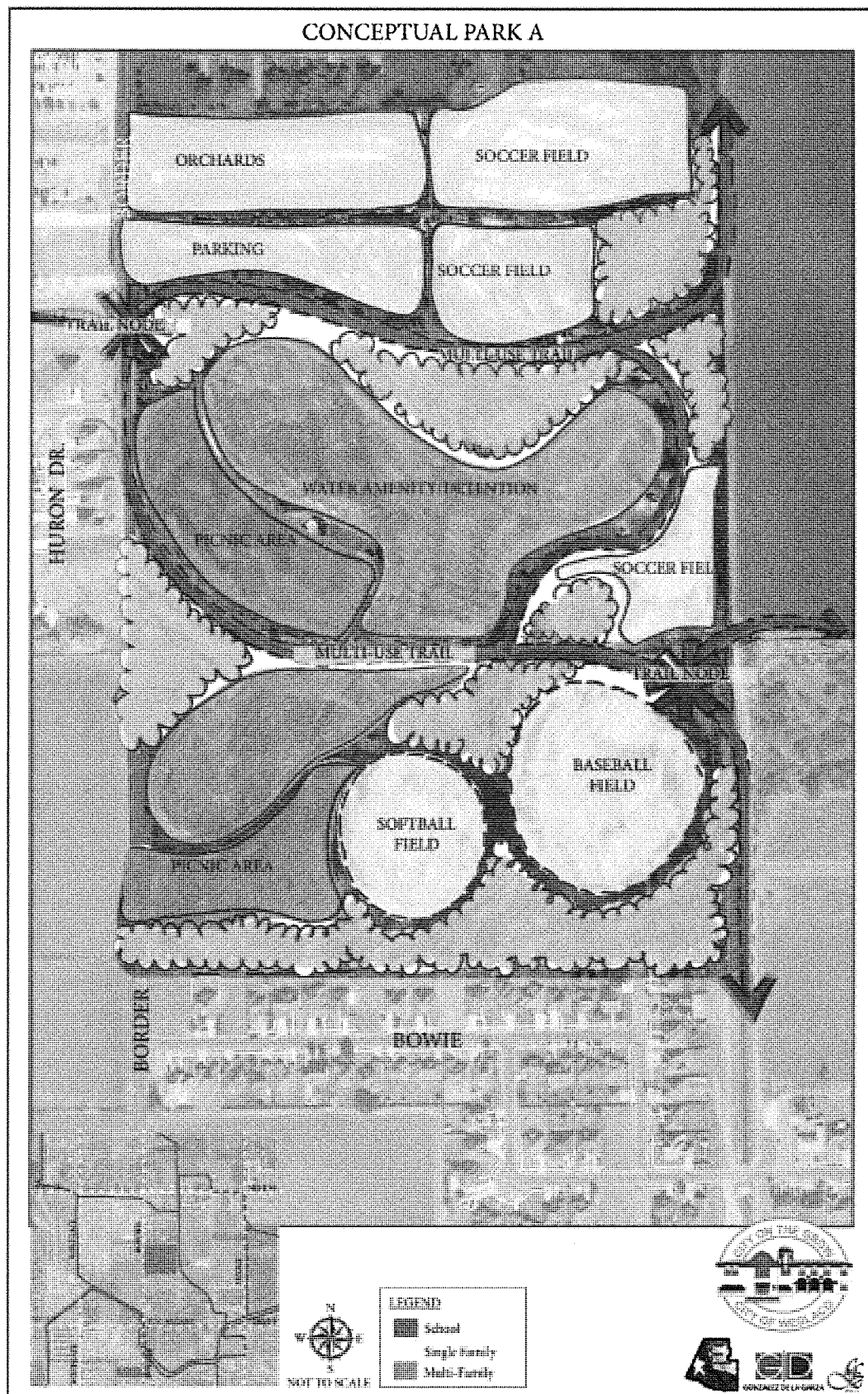
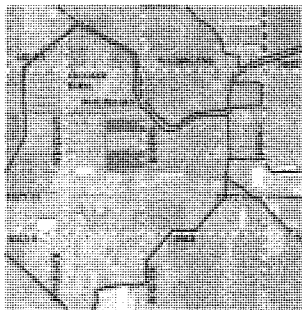
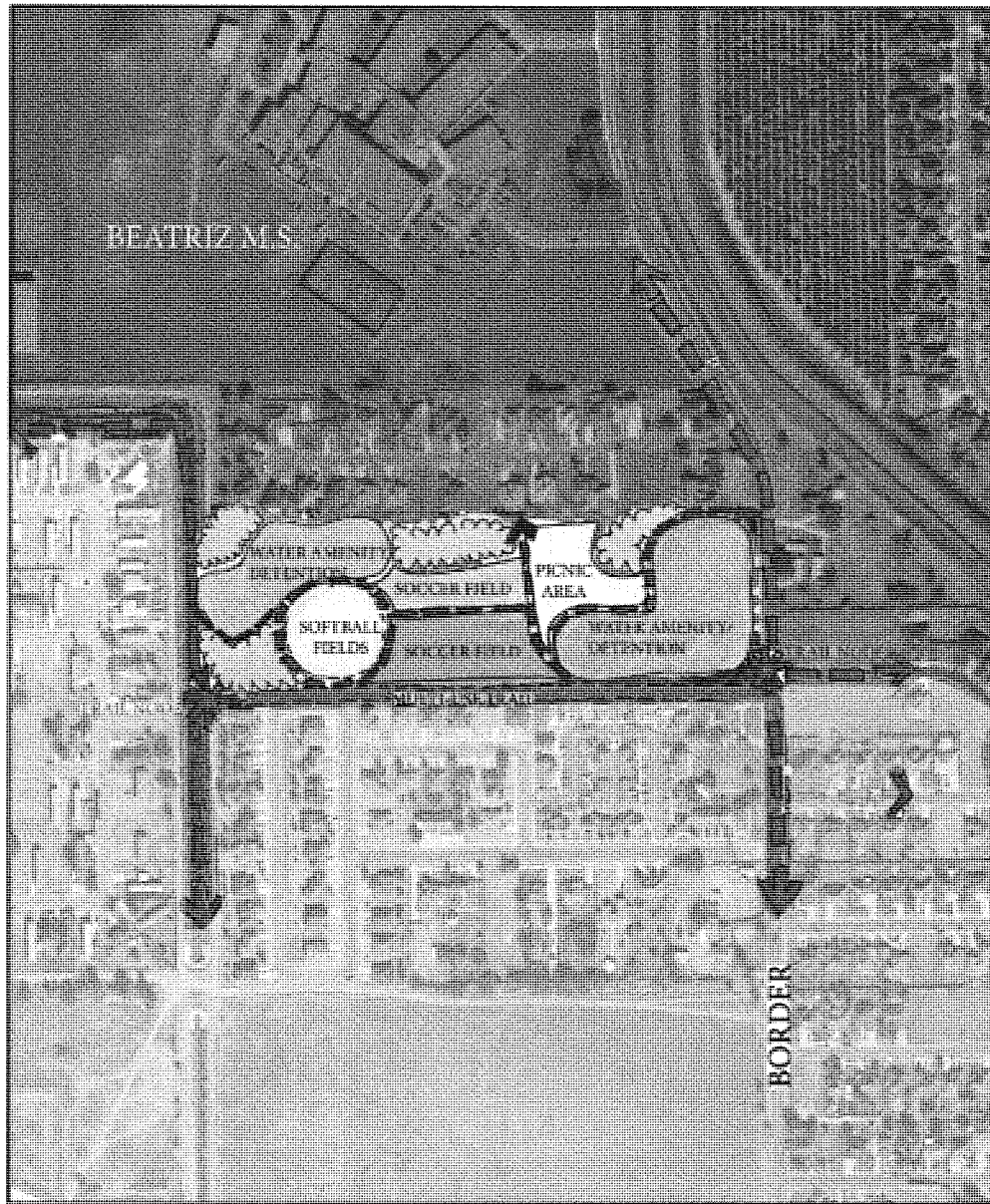


Figure 10.8

CONCEPTUAL PARK B



LEGEND

- School
- Single Family
- Multi-Family



Figure 10.9

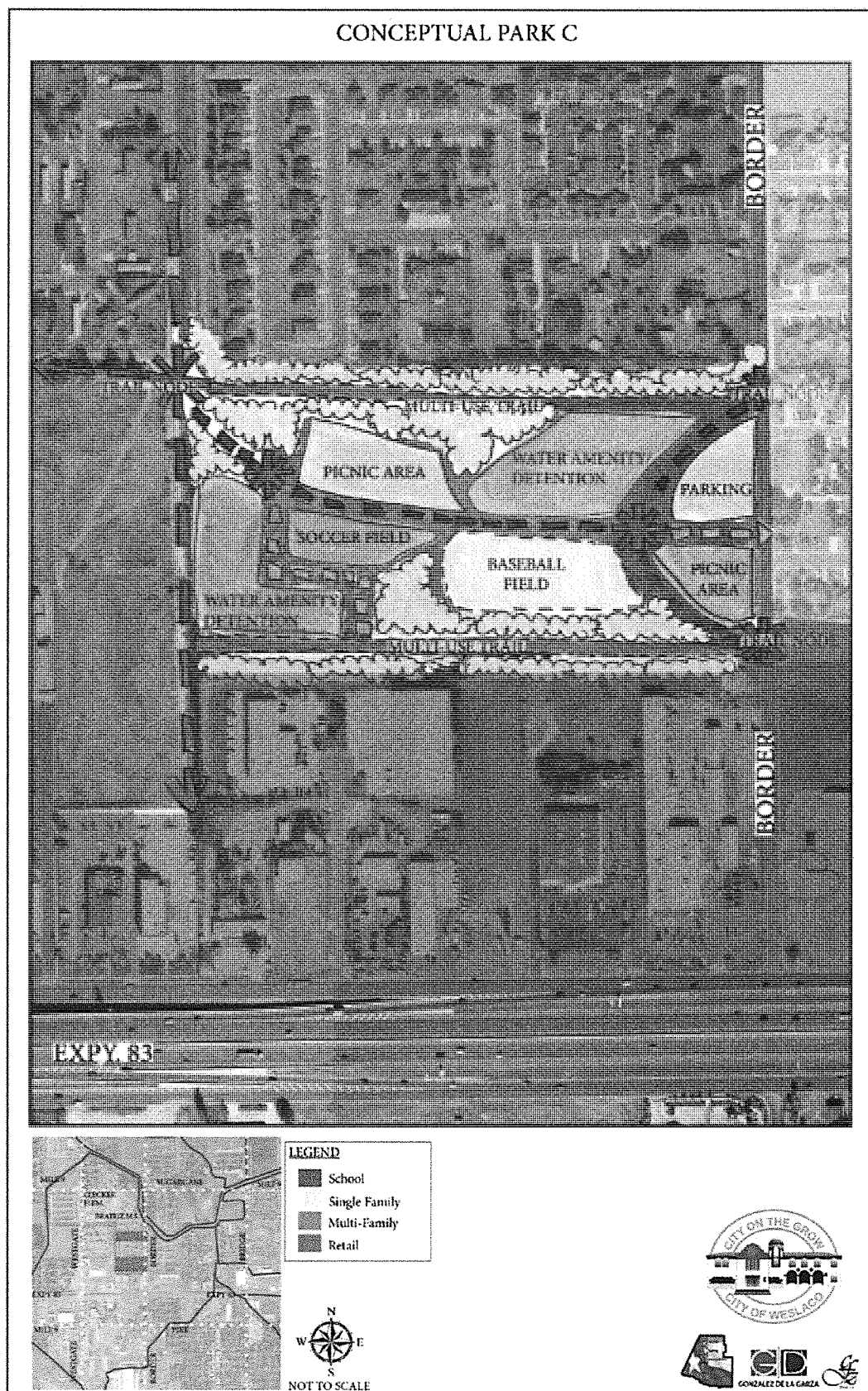
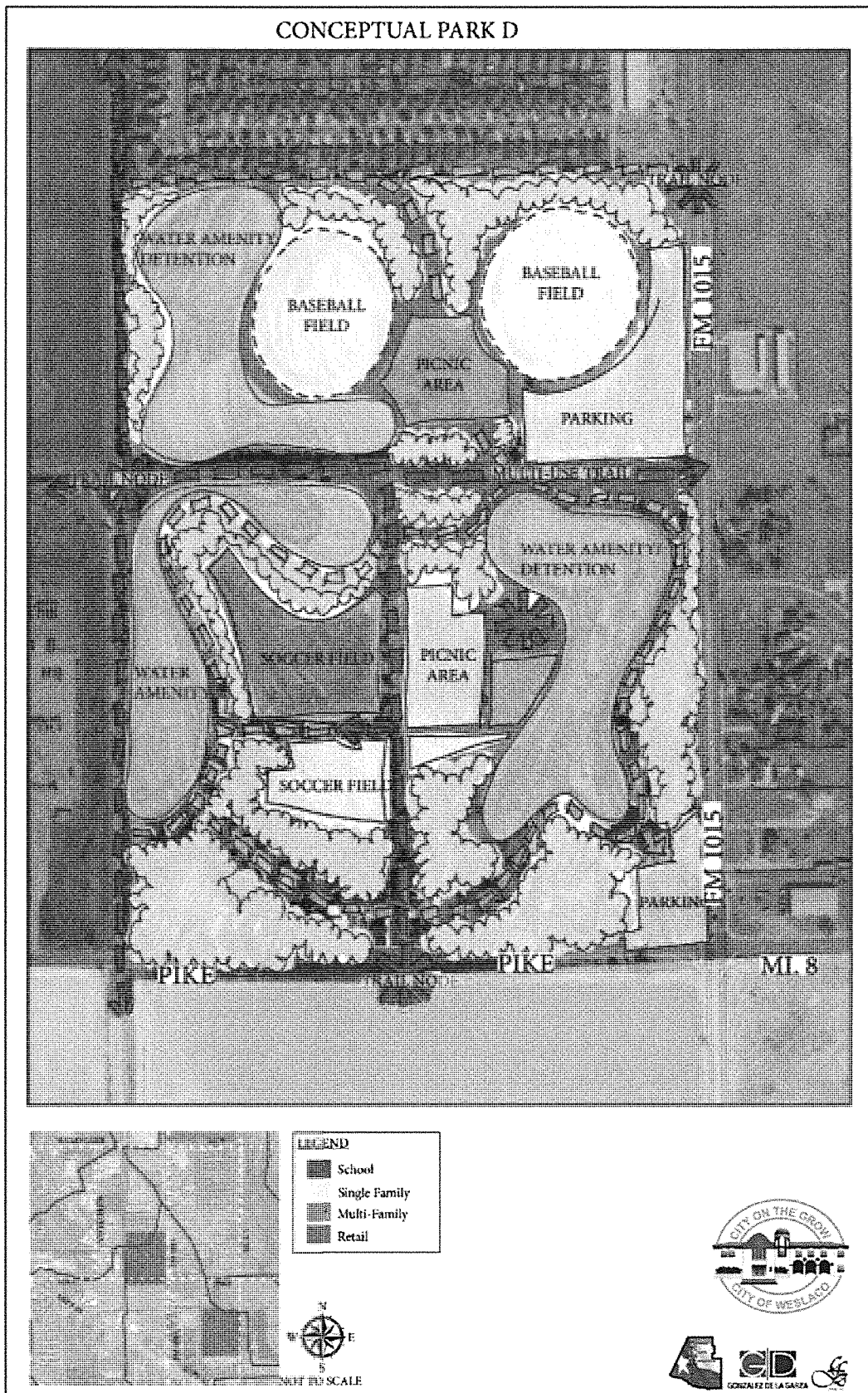


Figure 10.10



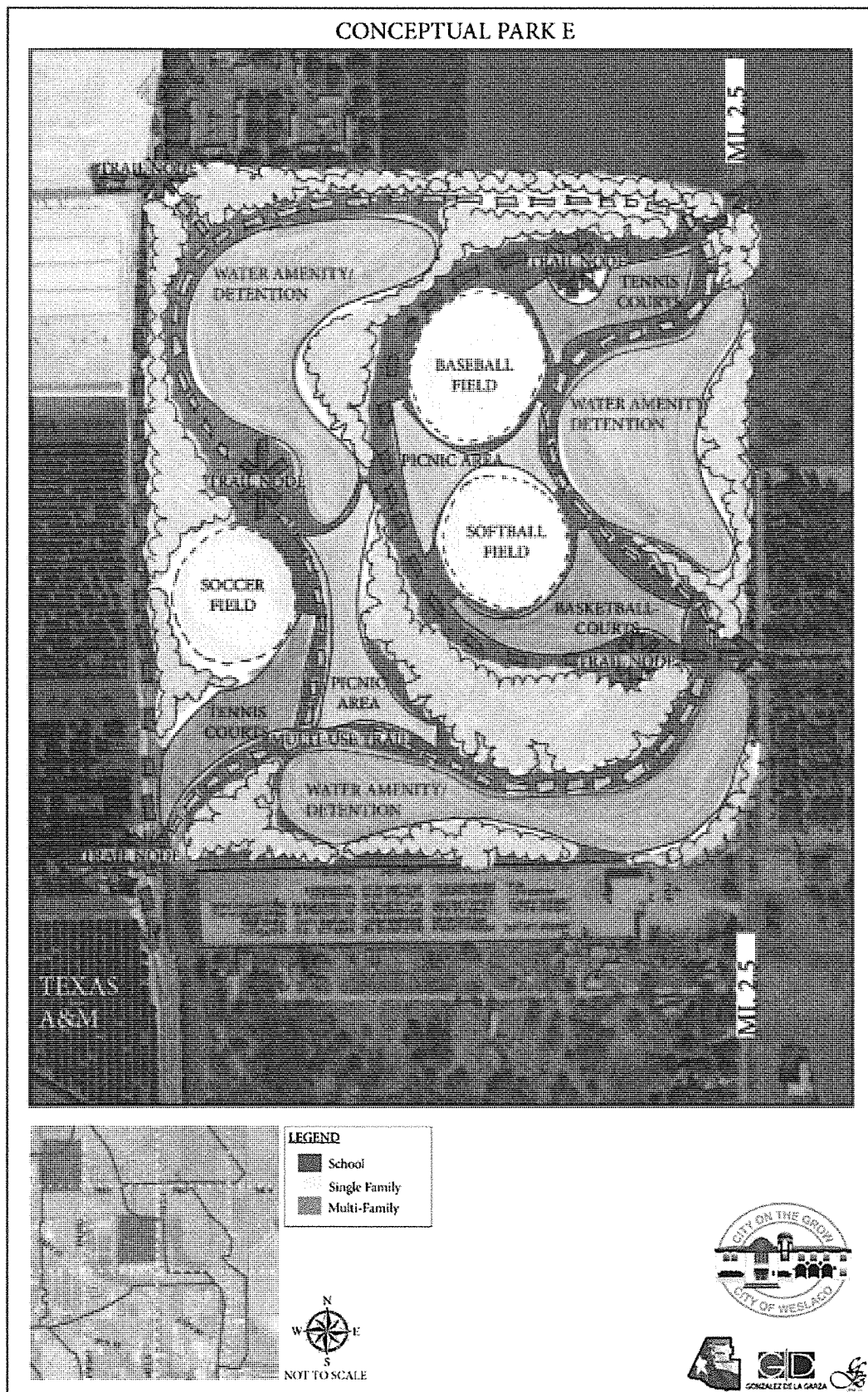
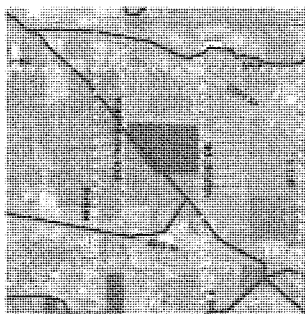


Figure 10.12

CONCEPTUAL PARK F/ WESLACO CITY PARK REDESIGN



LEGEND	
	School
	Single Family



Figure 10.13

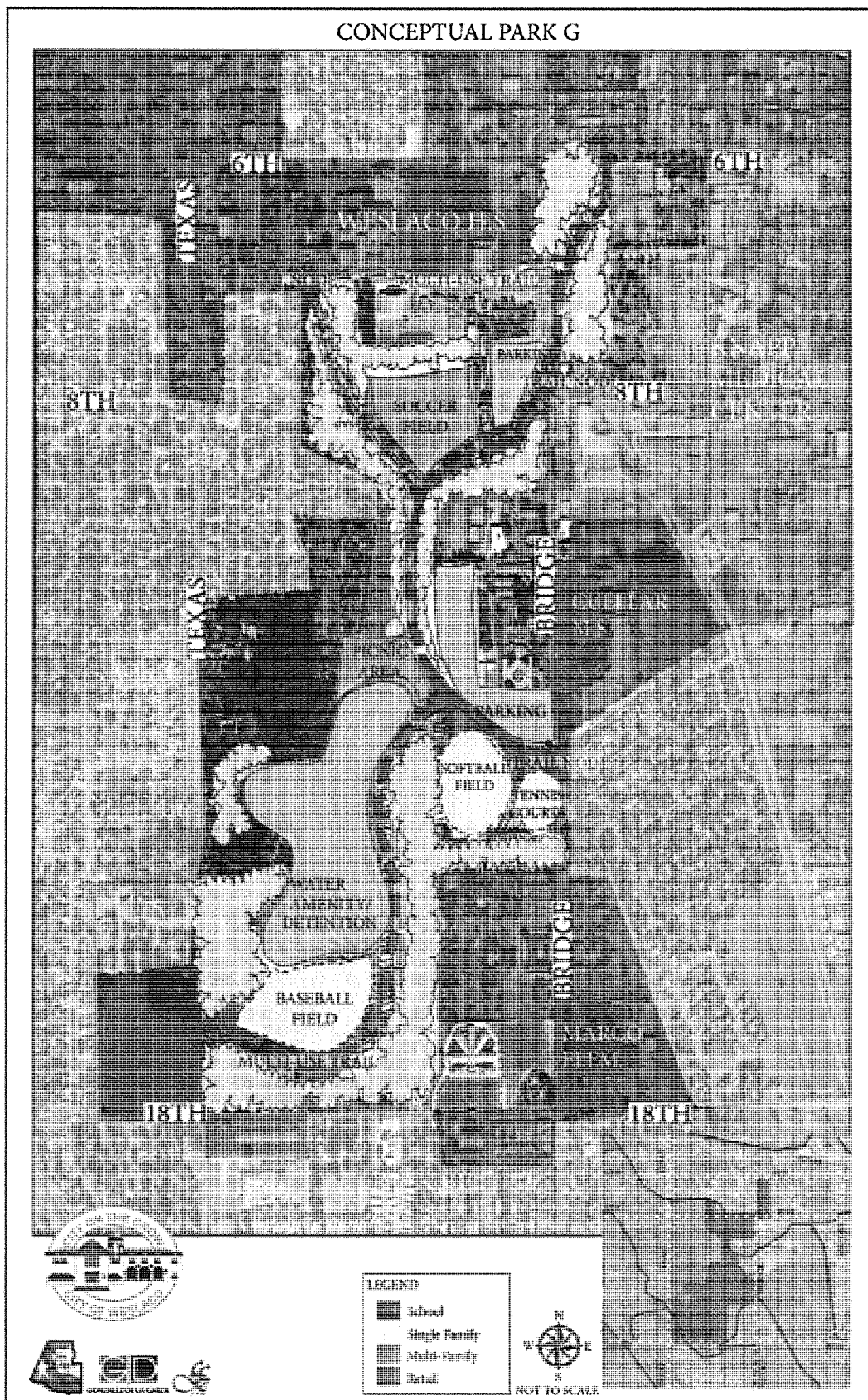
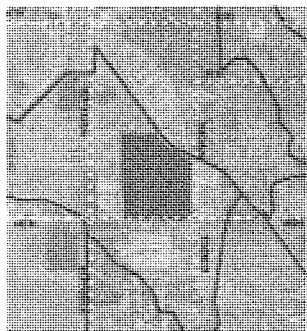


Figure 10.14

CONCEPTUAL PARK H/ HARLON BLOCK PARK REDESIGN



LEGEND

- School
- Single Family
- Multi-Family



Figure 10.15

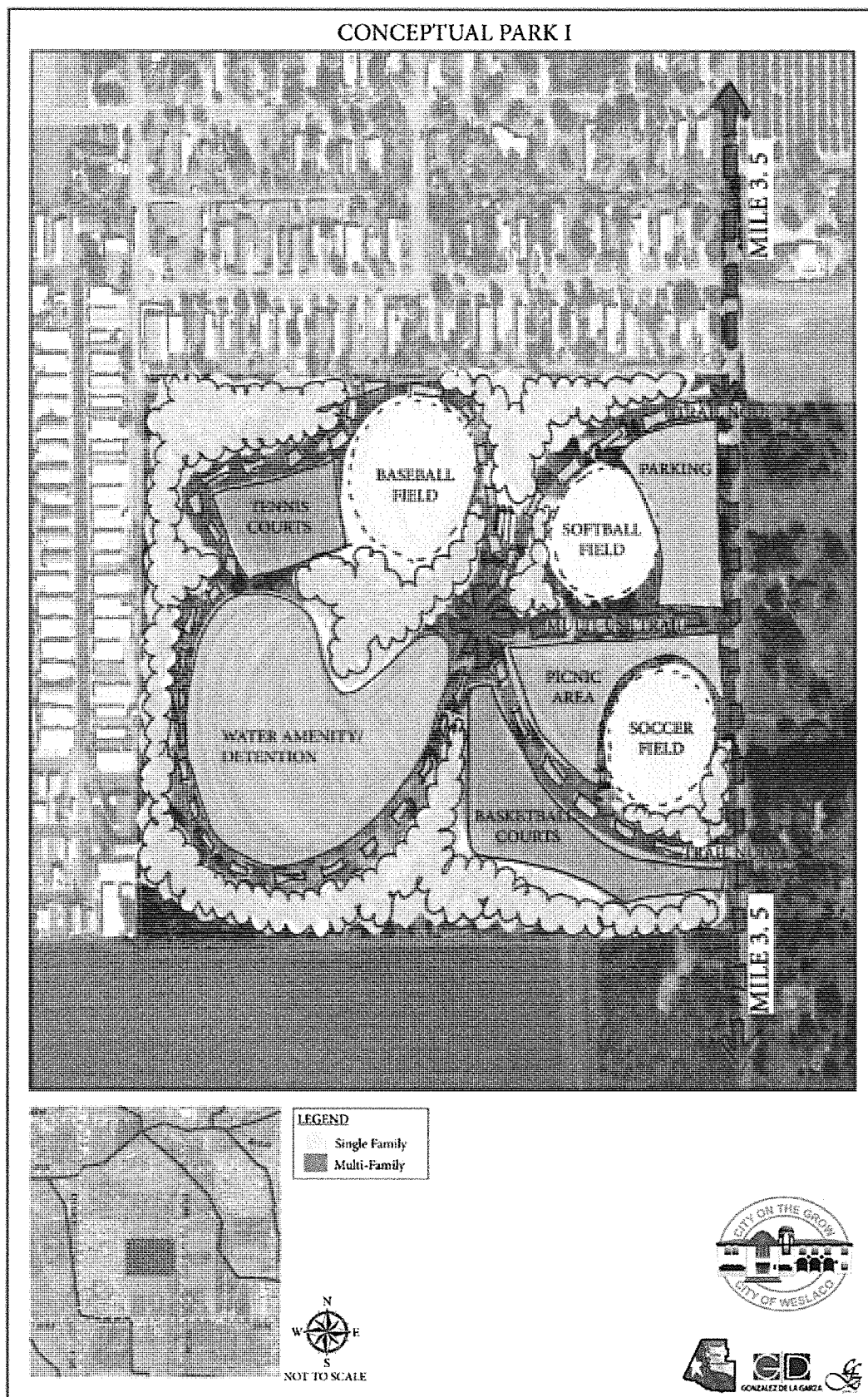
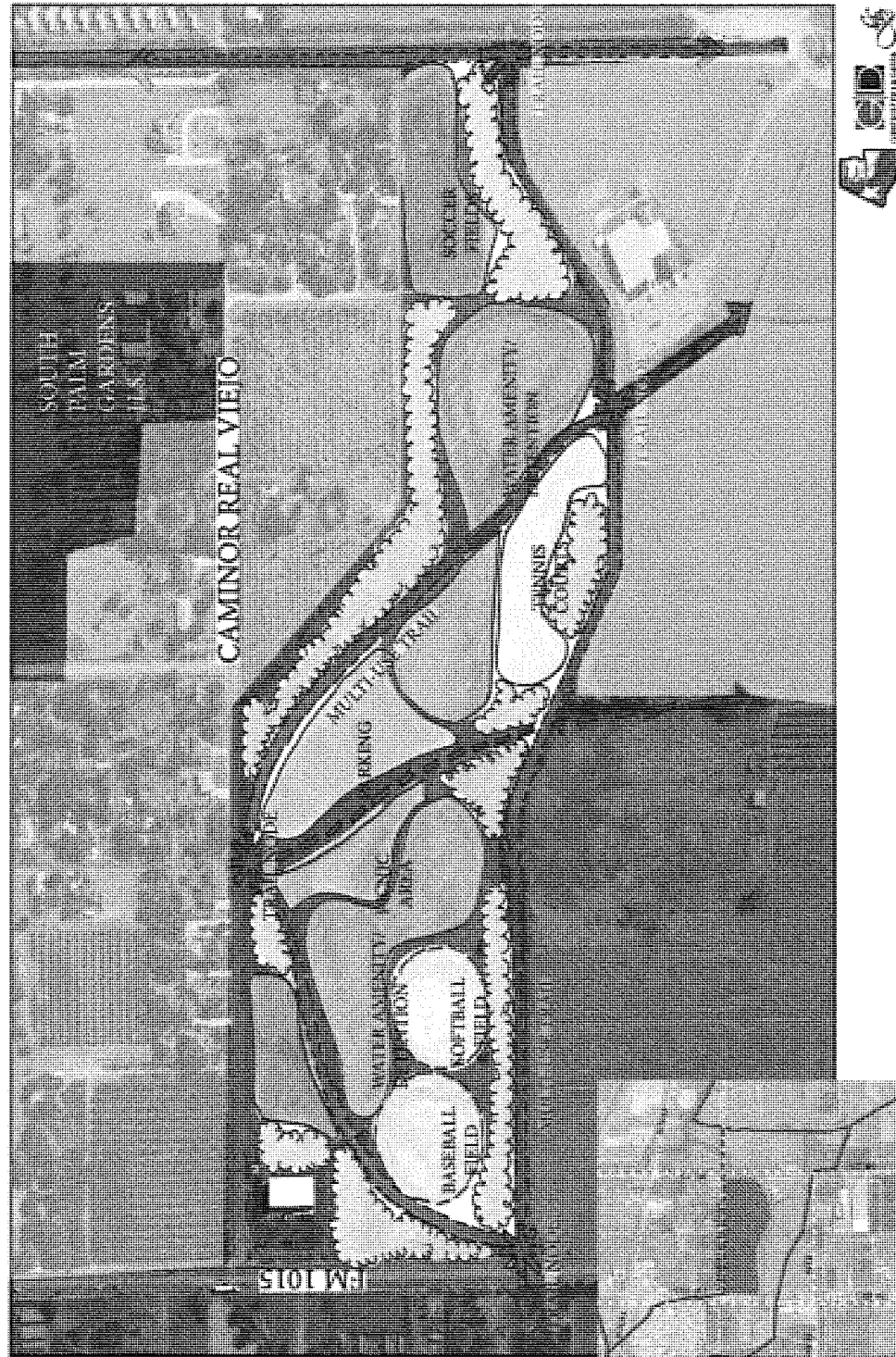


Figure 10.16

CONCEPTUAL PARK J



LEGEND	
	School
	Single Family
	Multi-Family
	Retail



Figure 10.17

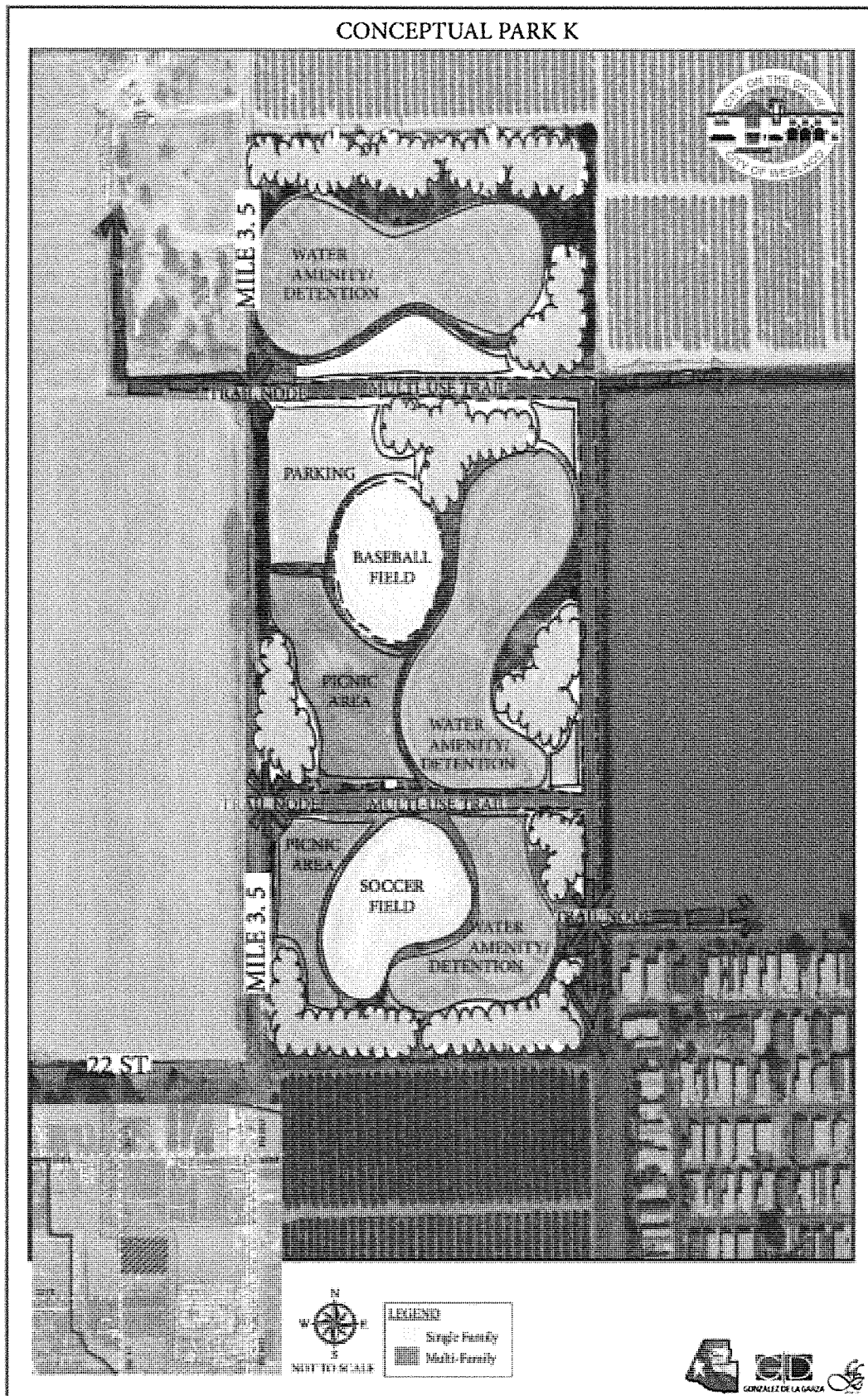


Figure 10.18

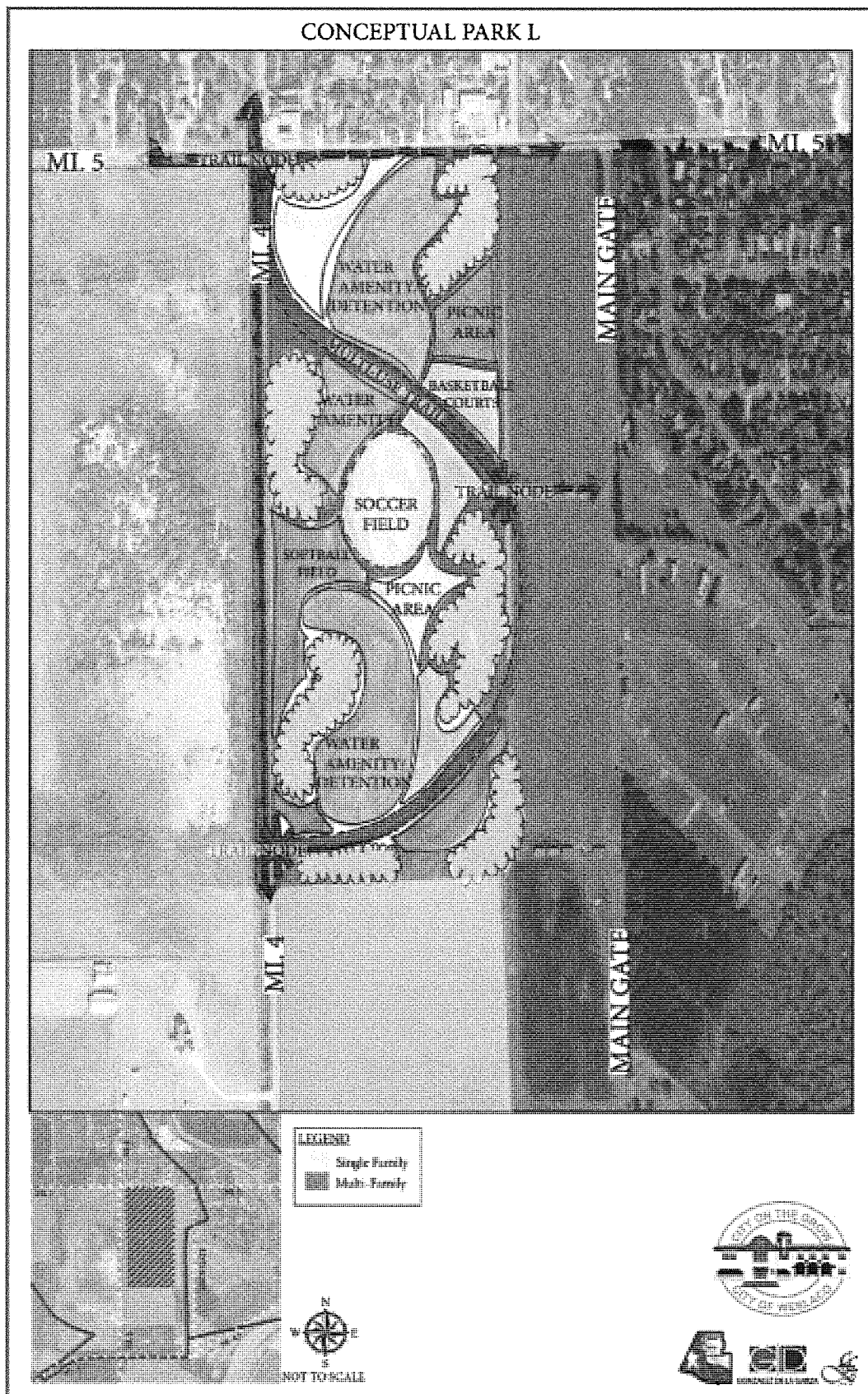


Figure 10.19

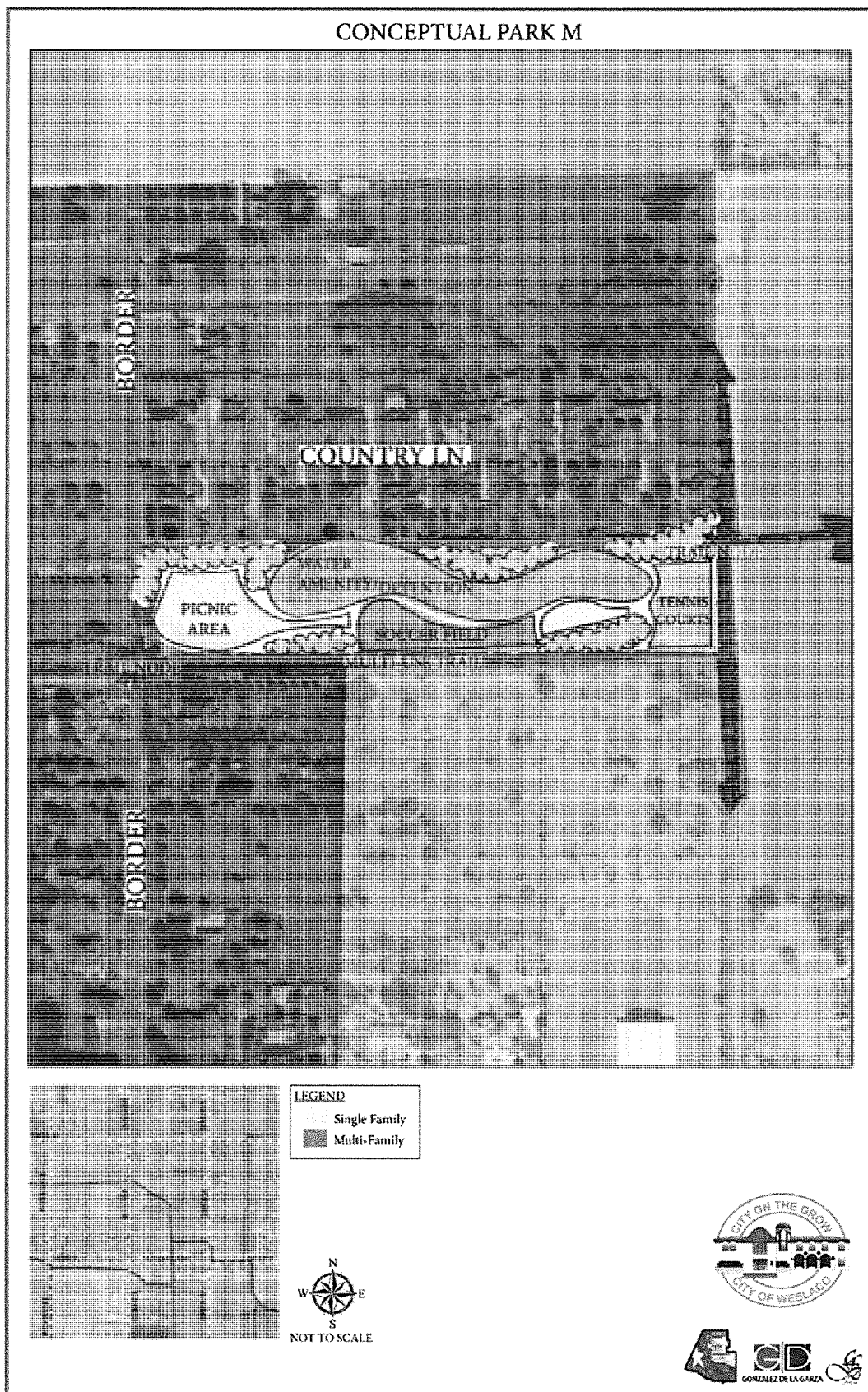


Figure 10.20

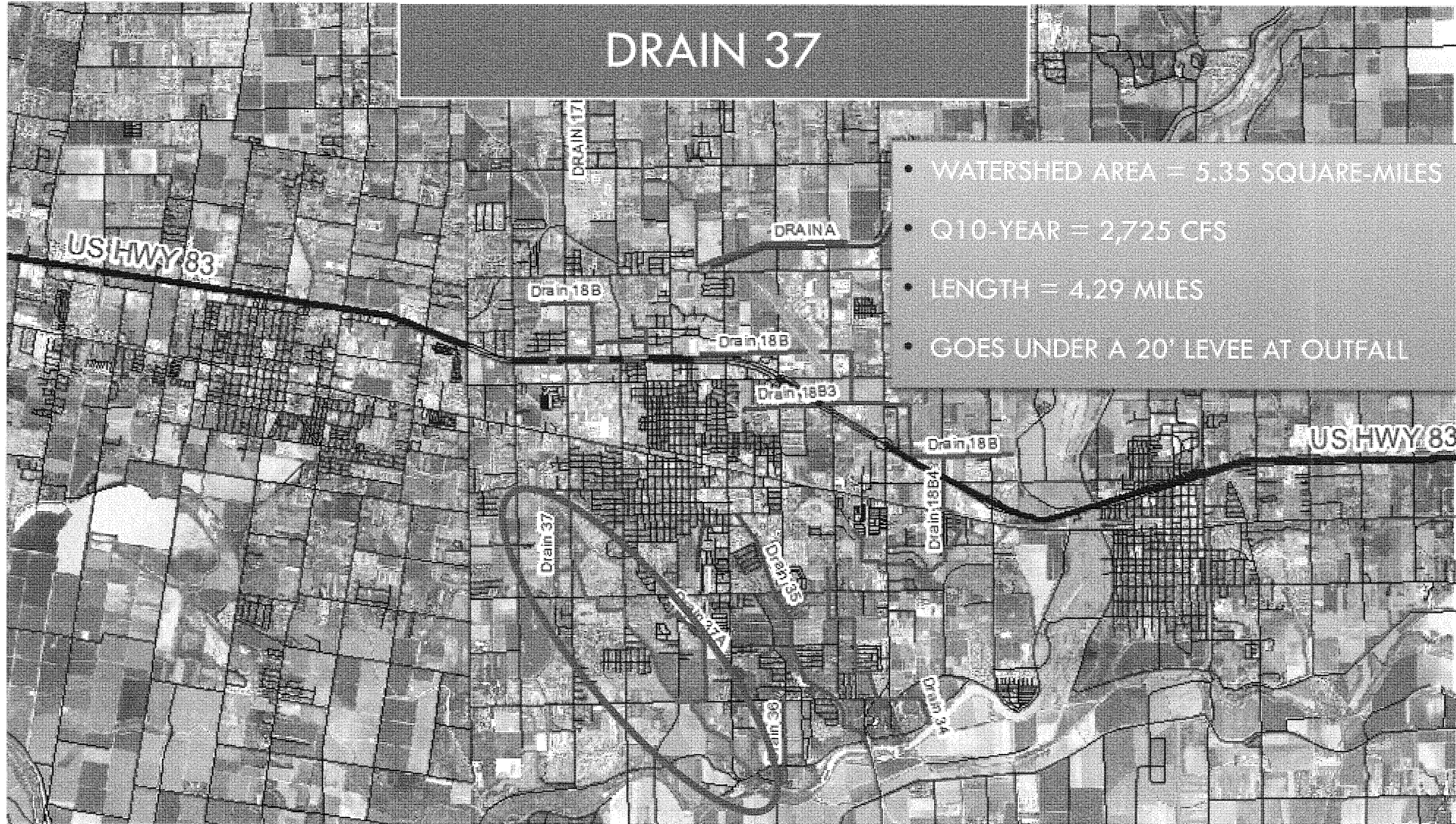
MASTER DRAINAGE PLAN, EXISTING CONDITIONS, AND PRELIMINARY ANALYSIS

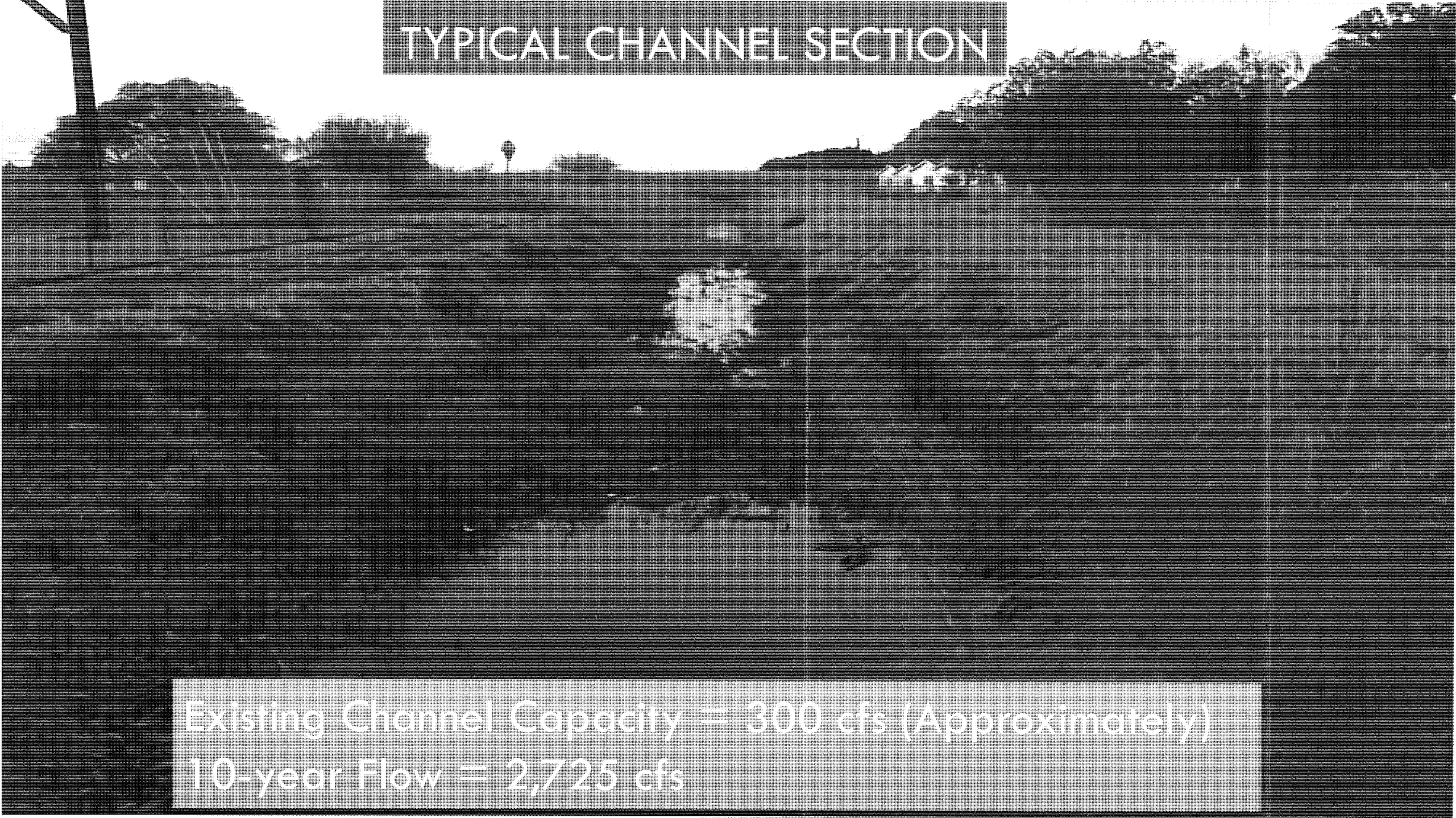
OCTOBER 21-22, 2014



DRAIN 37

- WATERSHED AREA = 5.35 SQUARE-MILES
- Q10-YEAR = 2,725 CFS
- LENGTH = 4.29 MILES
- GOES UNDER A 20' LEVEE AT OUTFALL

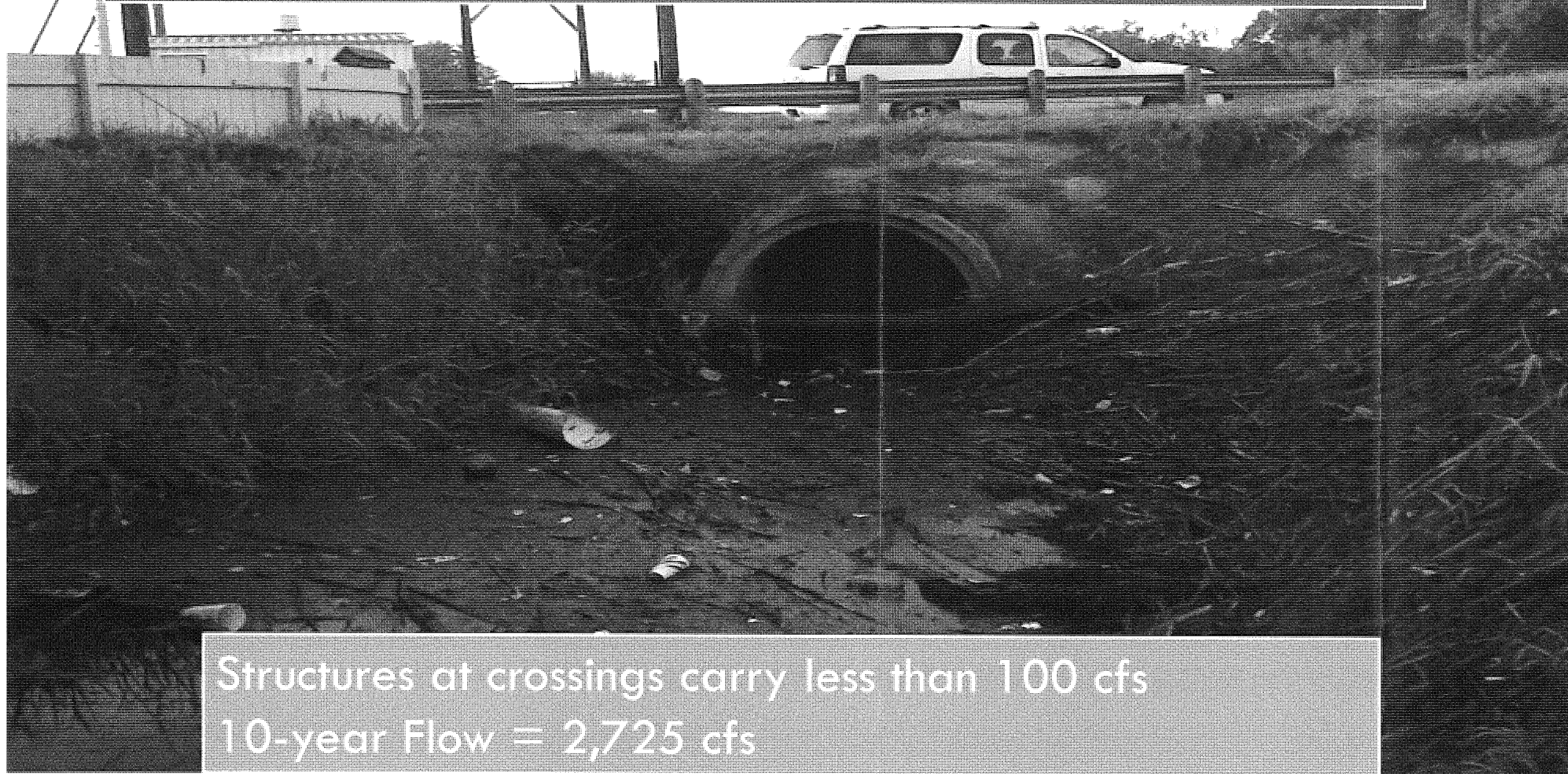


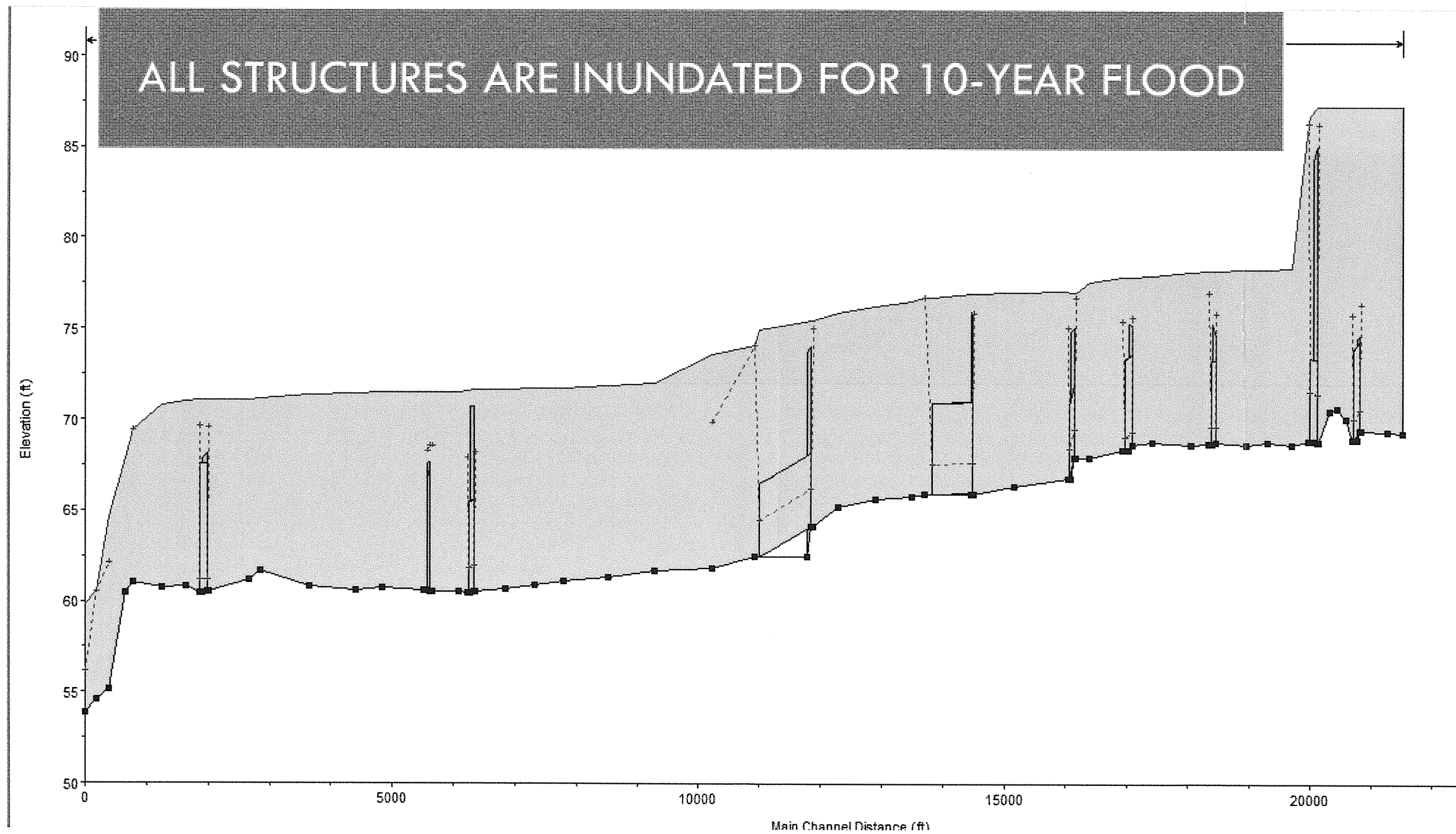


TYPICAL CHANNEL SECTION

Existing Channel Capacity = 300 cfs (Approximately)
10-year Flow = 2,725 cfs

TYPICAL CROSSINGS- SMALL PIPES AND DEEP CHANNELS



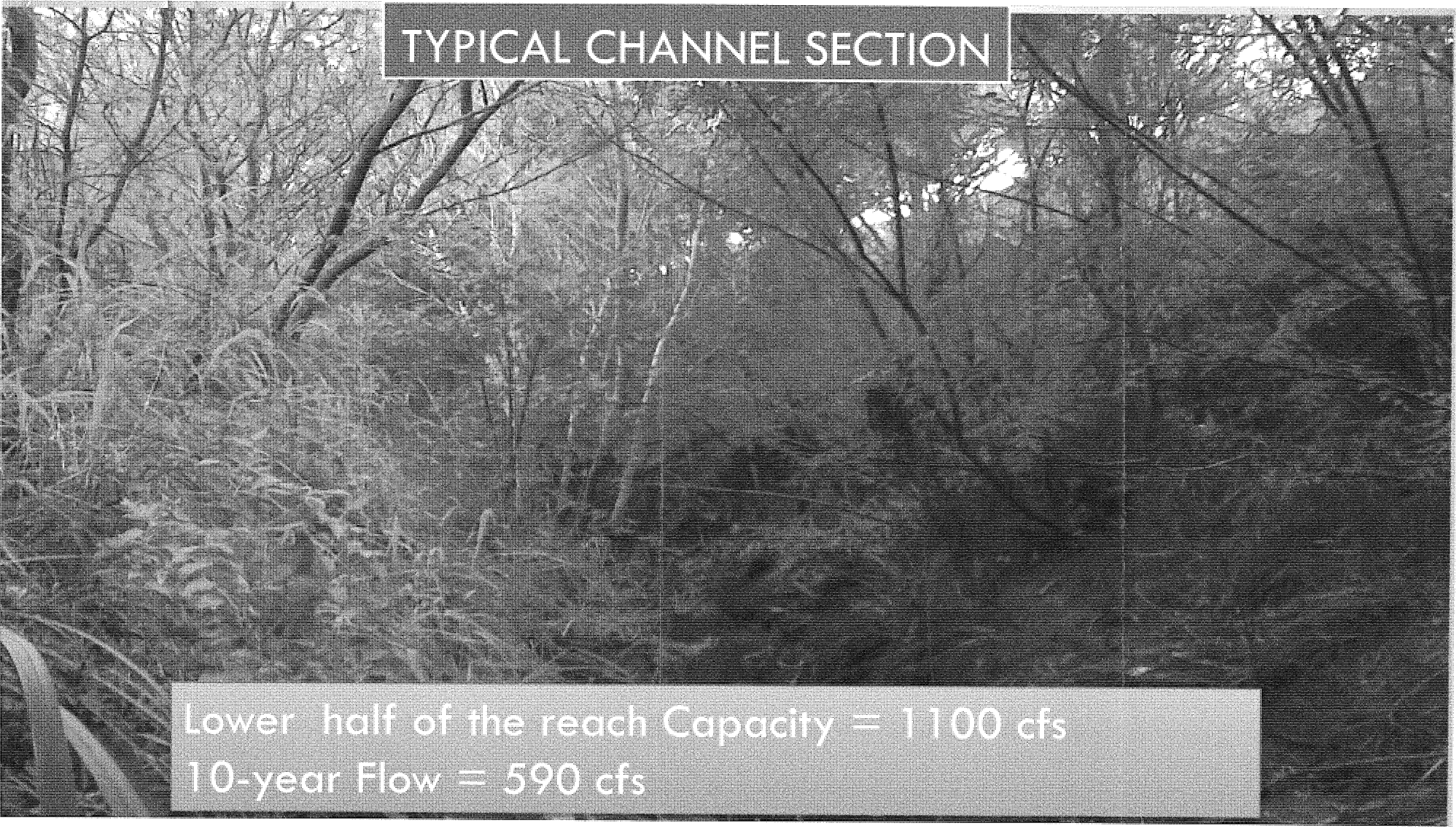


DRAIN 37A

- WATERSHED AREA = 0.56 SQUARE-MILES
- Q10-YEAR = 590 CFS
- LENGTH = 1.14 MILES

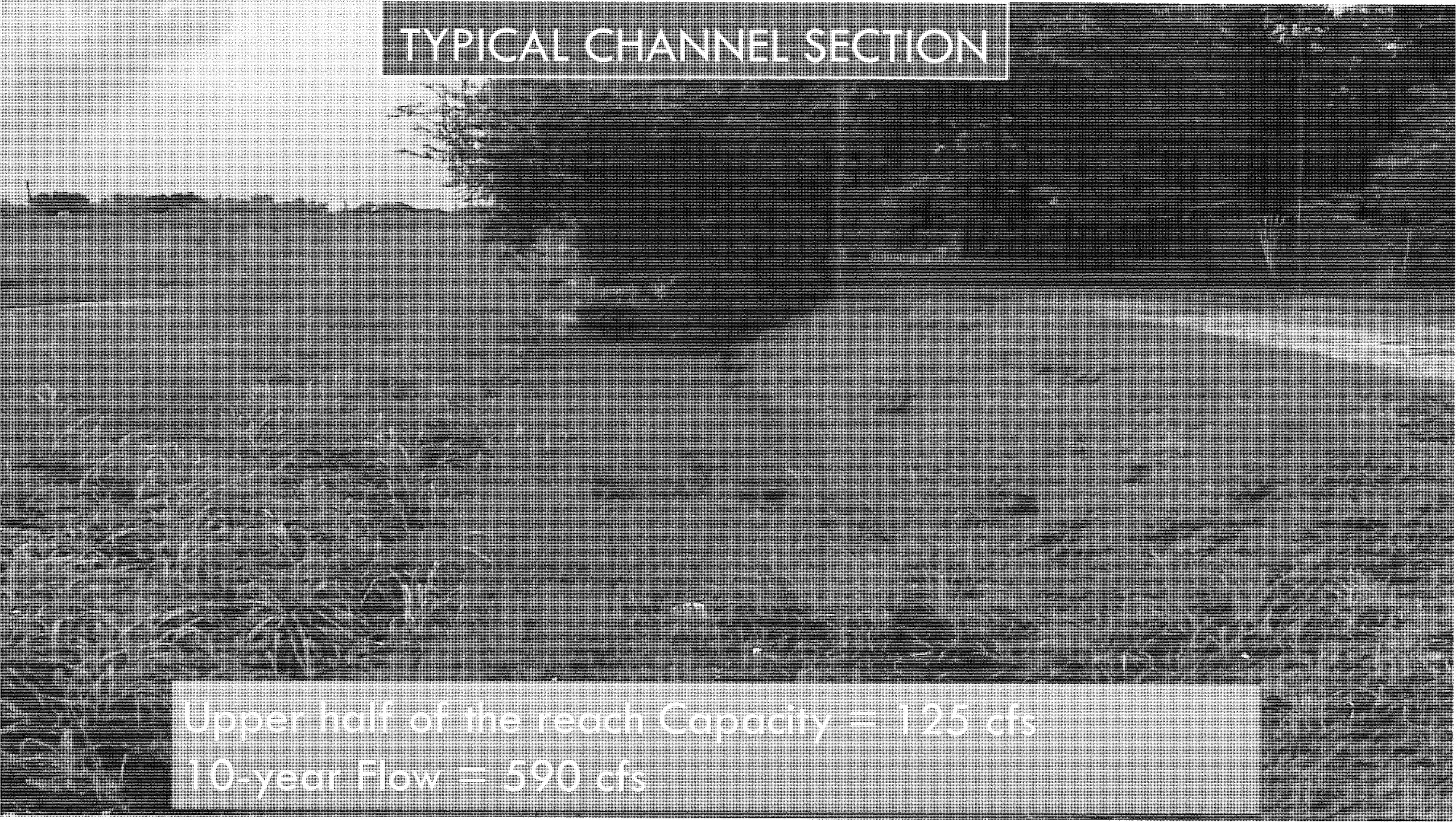
The map shows an aerial view of a rural area with a grid of fields. A network of drainage lines is overlaid, with several labeled: DRAIN 1, DRAIN 18B, DRAIN 18B3, DRAIN 18B4, DRAIN 37, DRAIN 39, DRAIN 37A (circled), DRAIN 36, and DRAIN 35. A major road, US HWY 83, runs diagonally across the map. A summary box in the top right corner provides key data for Drain 37A.

- WATERSHED AREA = 0.56 SQUARE-MILES
- Q10-YEAR = 590 CFS
- LENGTH = 1.14 MILES



TYPICAL CHANNEL SECTION

Lower half of the reach Capacity = 1100 cfs
10-year Flow = 590 cfs



TYPICAL CHANNEL SECTION

Upper half of the reach Capacity = 125 cfs
10-year Flow = 590 cfs



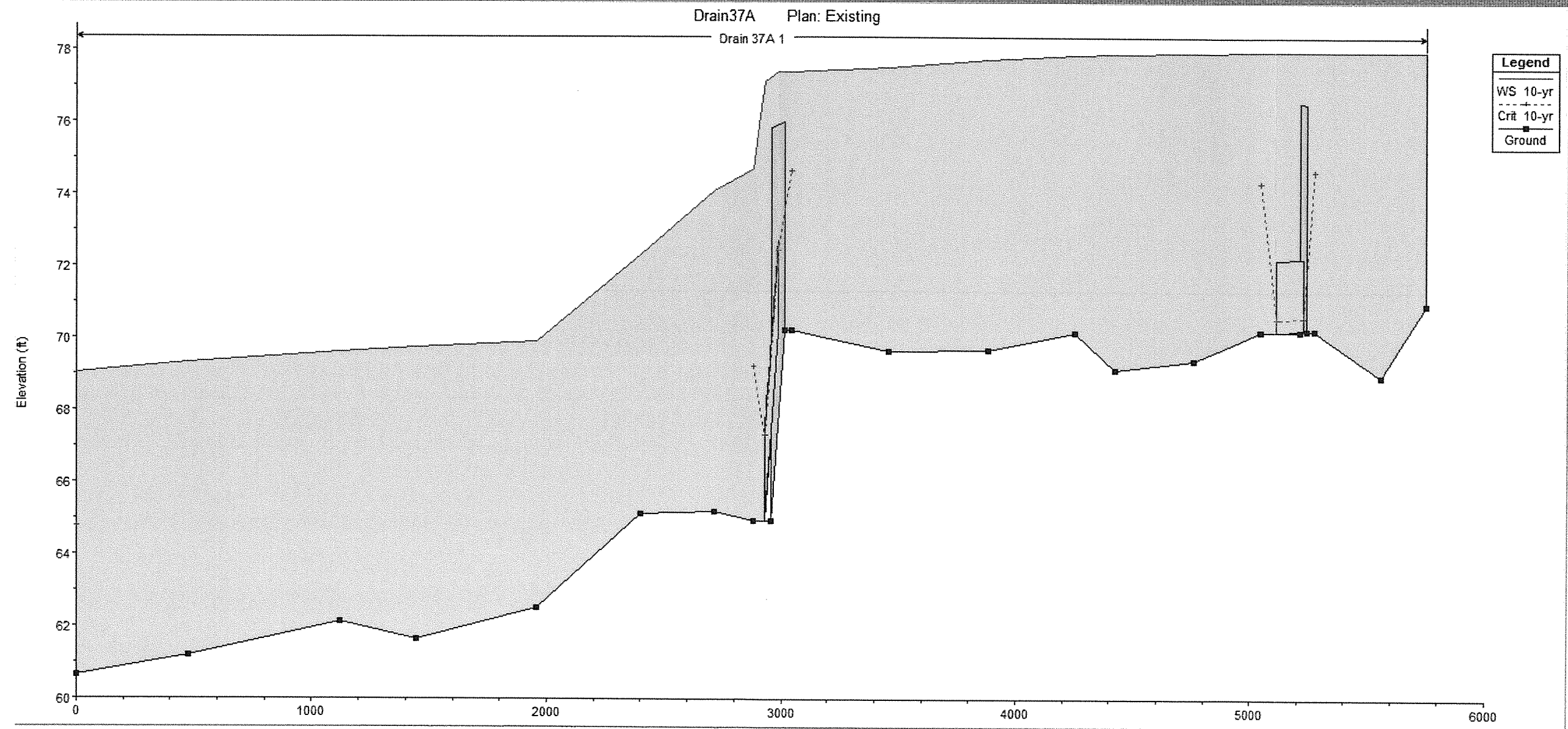
SEVERAL HOMES NEXT TO THE CHANNEL IN THE UPPER REACH; POTENTIAL FOR SIGNIFICANT FLOODING IN UPPER REACH.

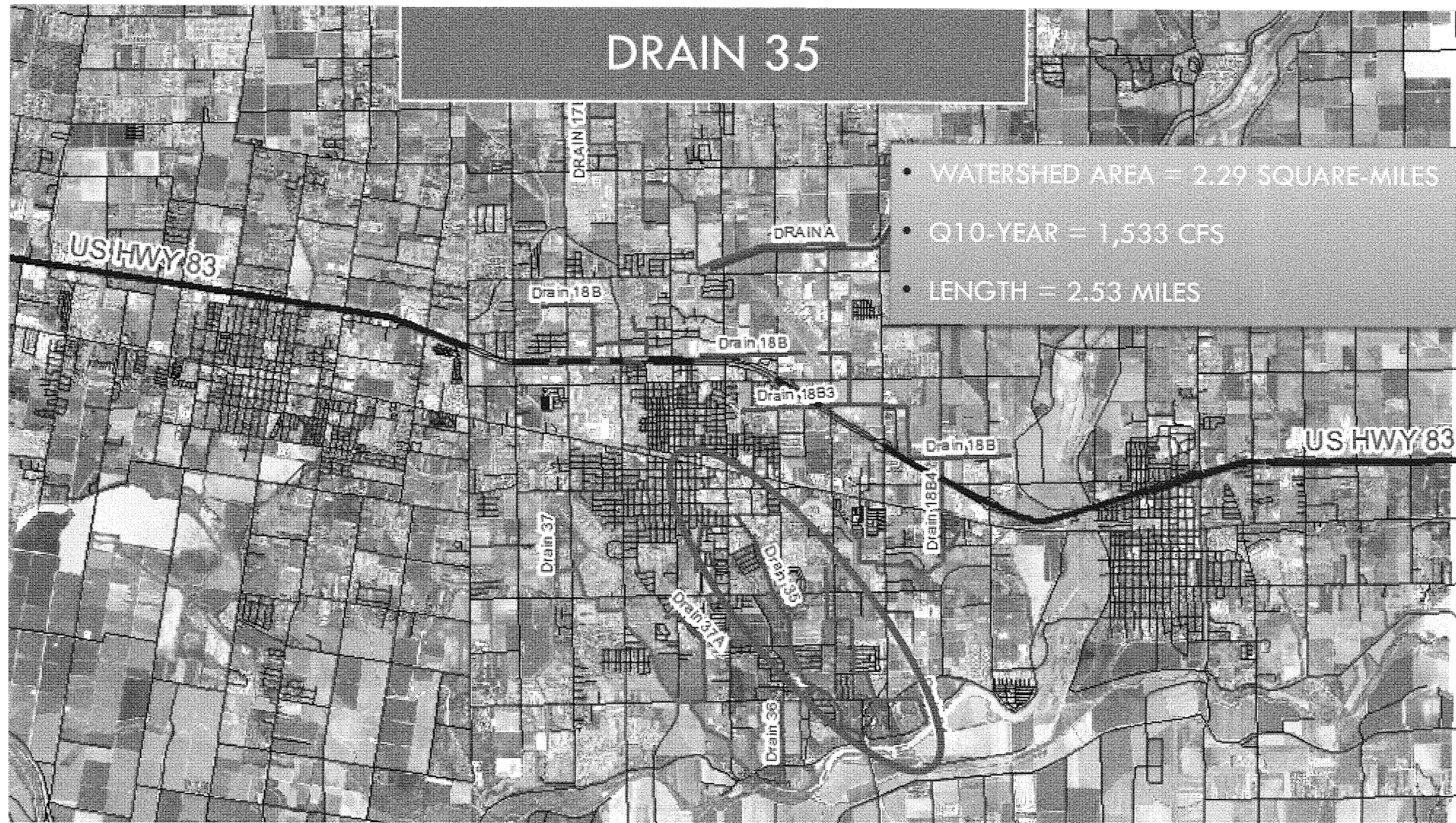
TYPICAL CROSSINGS- SMALL PIPES AND DEEP CHANNELS



Structures at crossings carry less than 50 cfs causing 6-foot of backwater.
10-year Flow = 2,725 cfs

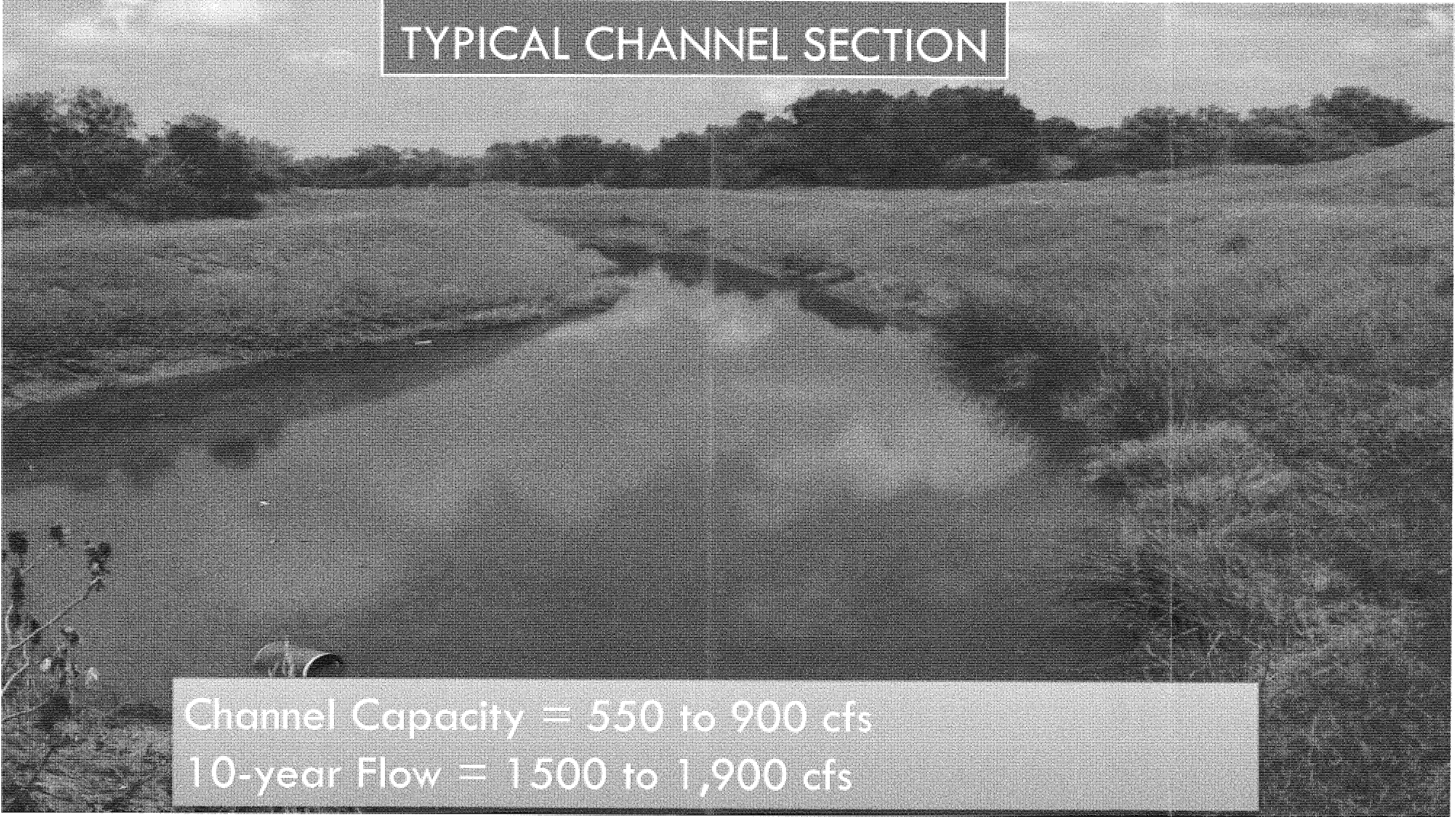
ALL STRUCTURES ARE INUNDATED FOR 10-YEAR FLOOD





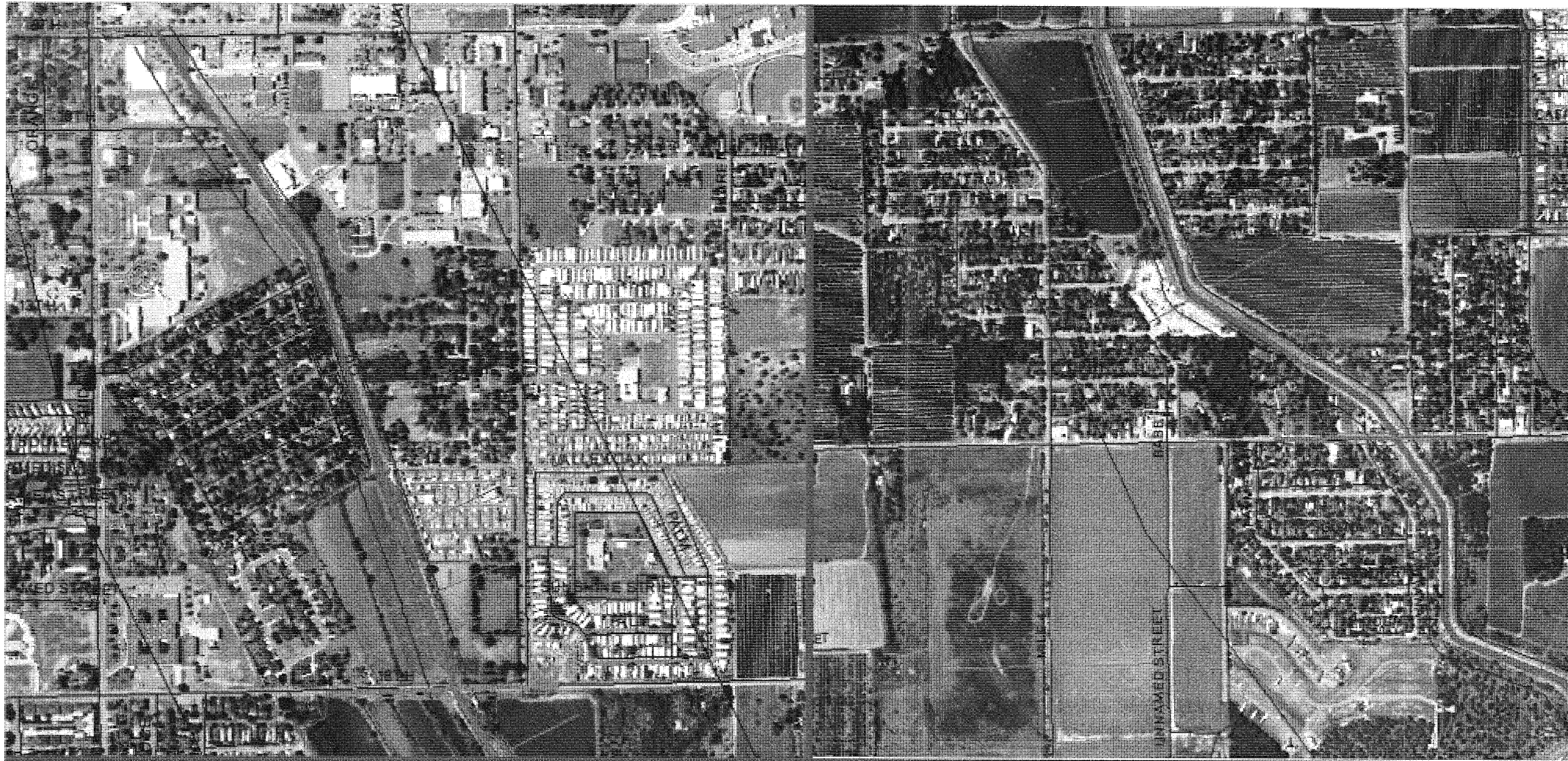
DRAIN 35

- WATERSHED AREA = 2.29 SQUARE-MILES
- Q10-YEAR = 1,533 CFS
- LENGTH = 2.53 MILES



TYPICAL CHANNEL SECTION

Channel Capacity = 550 to 900 cfs
10-year Flow = 1,500 to 1,900 cfs



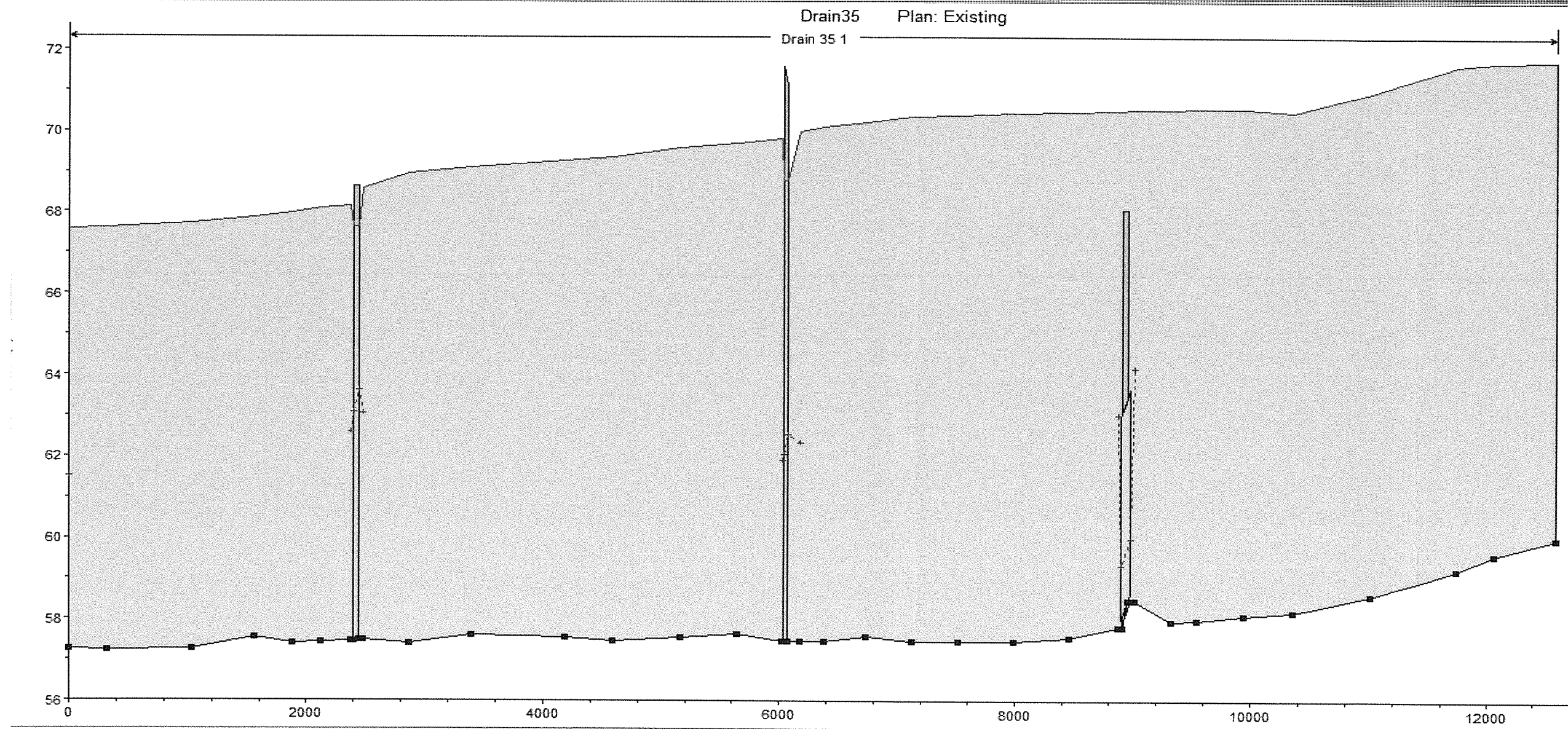
SEVERAL HOMES NEXT TO THE CHANNEL;
POTENTIAL FOR SIGNIFICANT FLOODING IN UPPER REACH.

TYPICAL CROSSINGS- ALL BRIDGE CROSSINGS EXCEPT ONE



Bridges Carry 10yr flow; Culvert Structure carries less than 90 cfs causing inundation of crossing by 2.5 feet for 10-year.
10-year Flow = 2,725 cfs

UPSTREAM CULVERT INUNDATED FOR 10-YEAR FLOOD



DRAIN 35-A

- WATERSHED AREA = 0.58 SQUARE-MILES
- Q10-YEAR = 863 CFS
- LENGTH = 0.5 MILES
- GOES UNDERGROUND FOR ABOUT 1/3 RD MILE BEFORE CONFLUENCE WITH DRAIN 35

TYPICAL CHANNEL SECTION

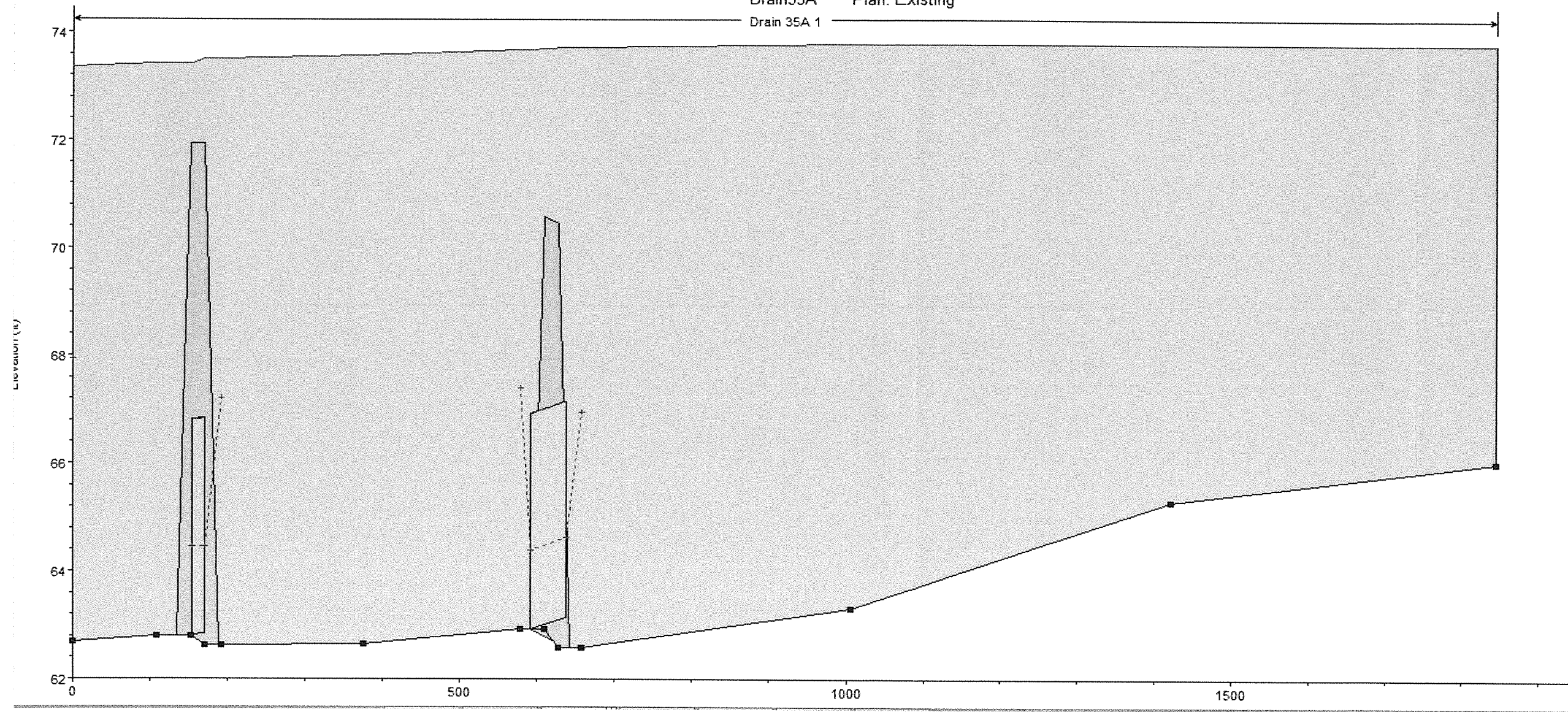
Channel Capacity = 550 to 700 cfs
Culvert Capacity = 25 cfs
10-year Flow = 863 cfs

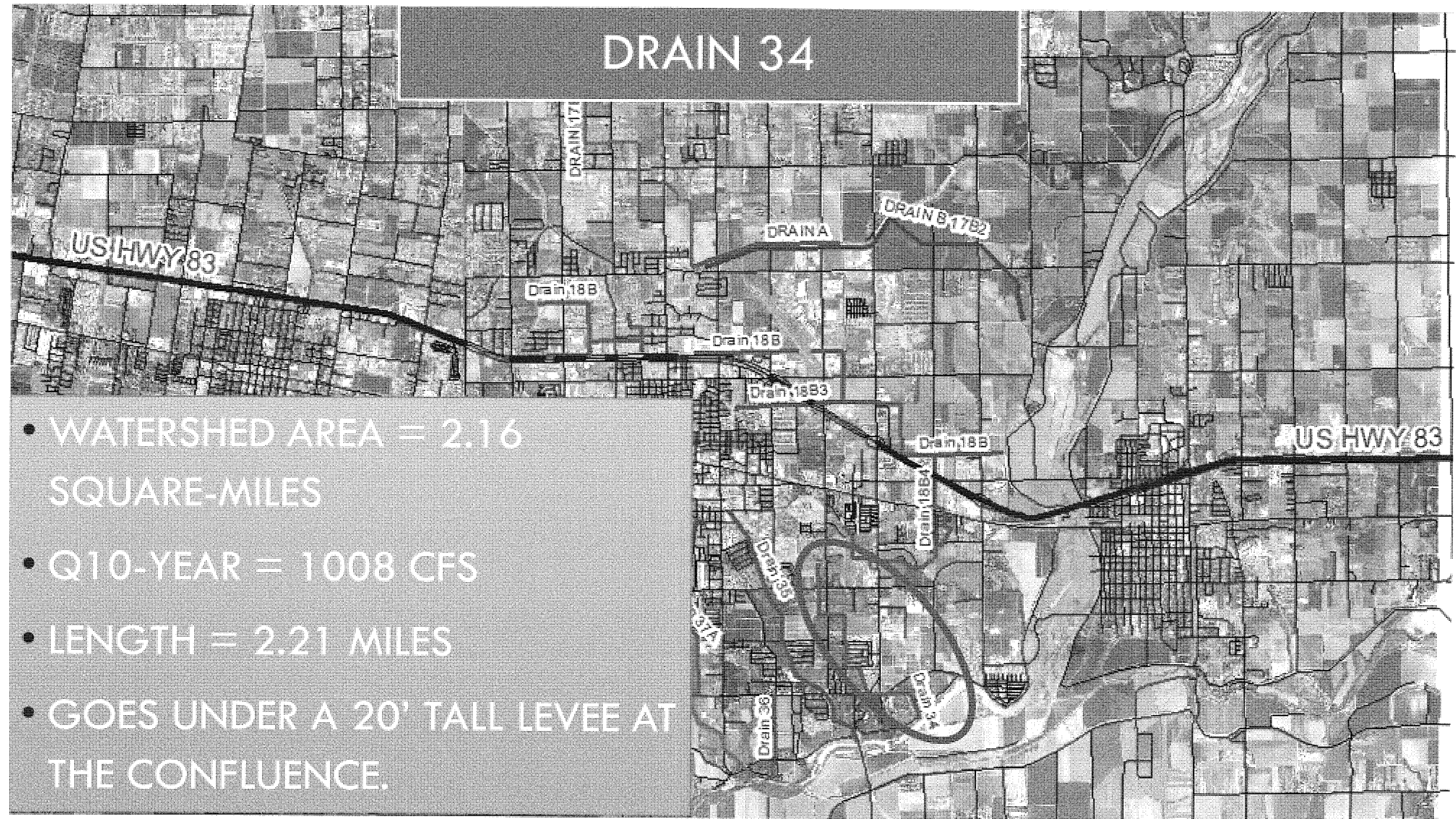


STORMDRAIN THAT CONNECTS 35A AND 35 IS UNDERSIZED AND CAUSES SEVERE STREET FLOODING

ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD

Drain35A Plan: Existing
Drain 35A 1







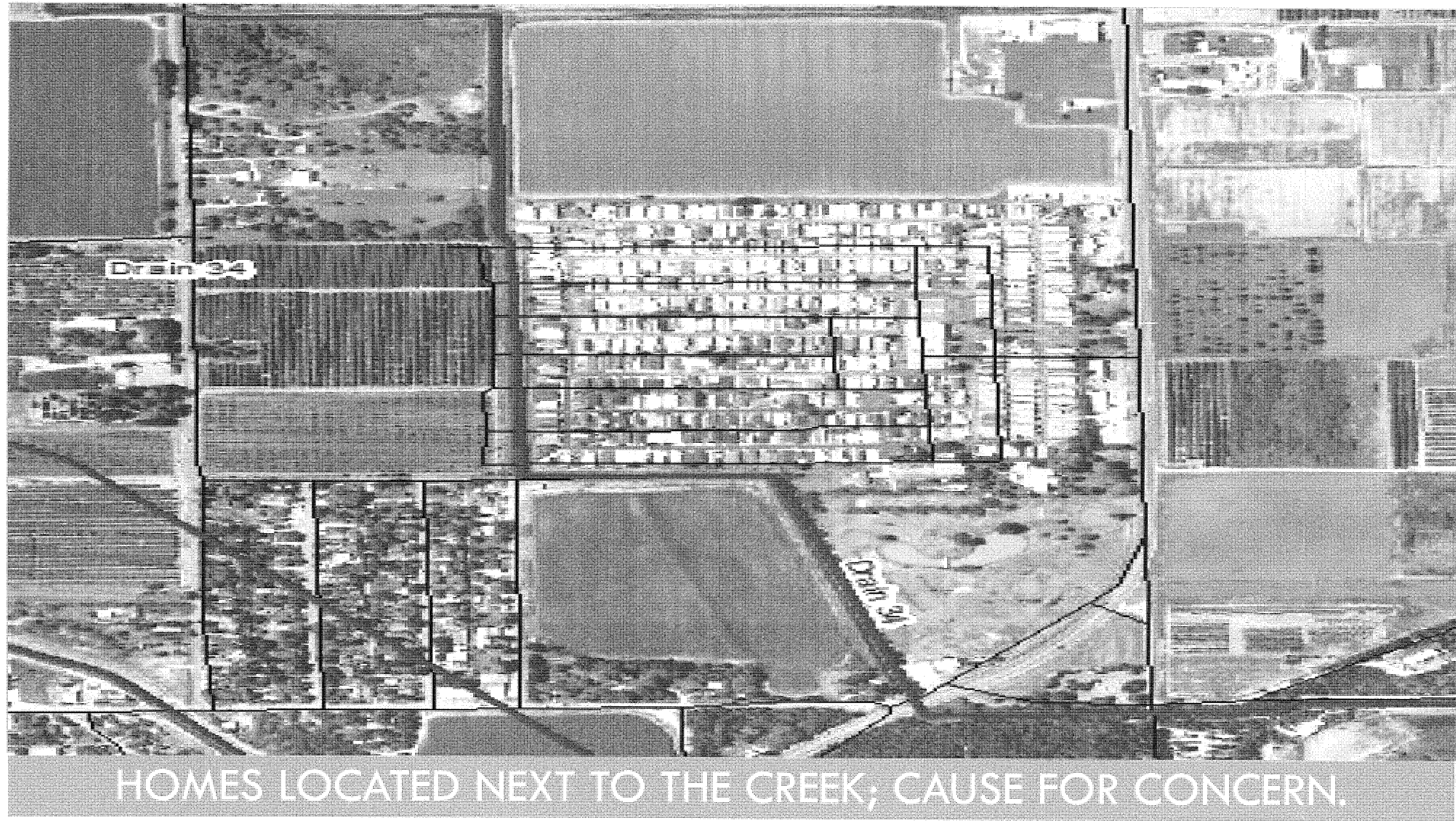
TYPICAL CHANNEL SECTION

D/S Reach Channel Capacity = 700 cfs;
U/S Reach Channel Capacity = 125 cfs
10-year Flow = 1008 cfs

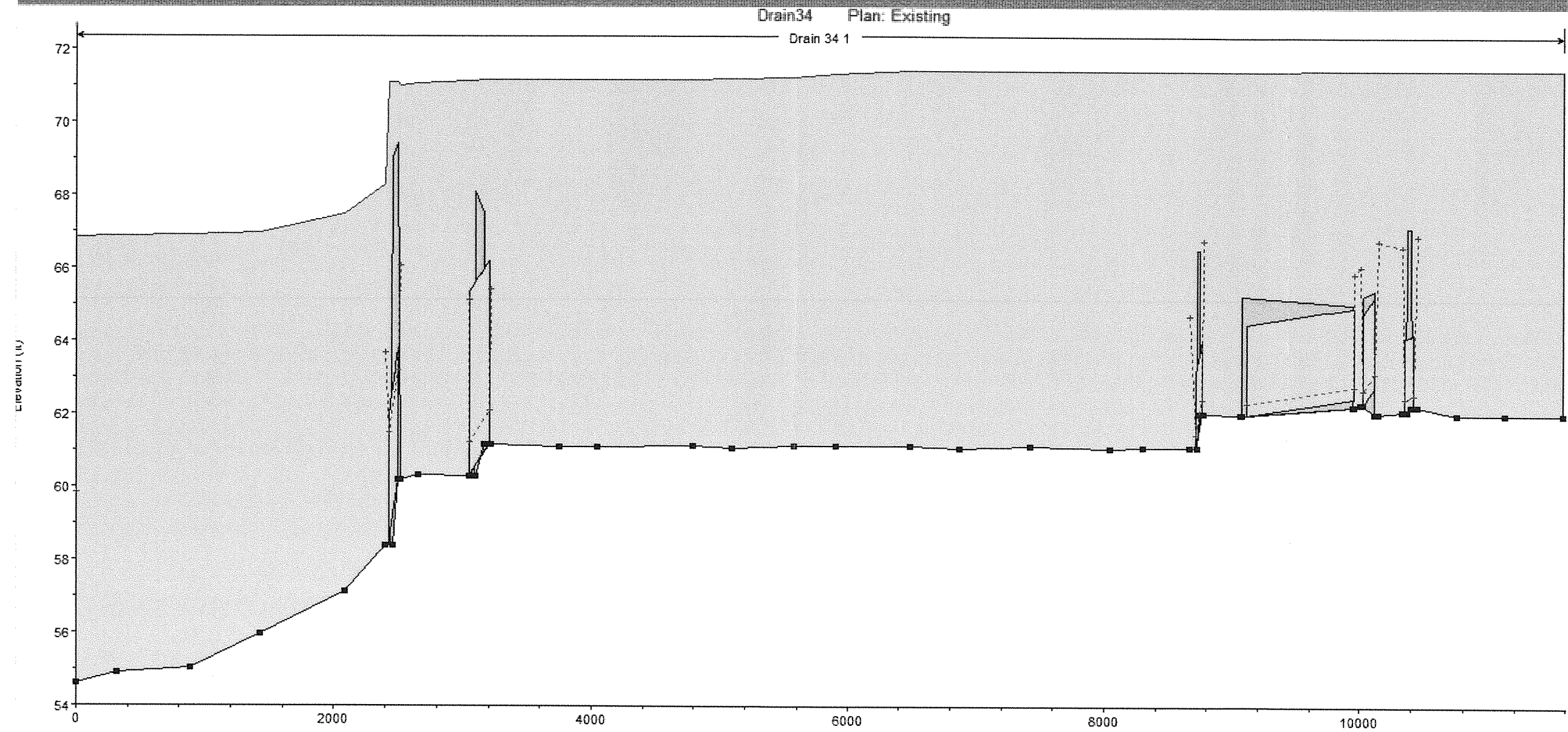
20' TALL LEVEE AT THE
MOST DOWNSTREAM END

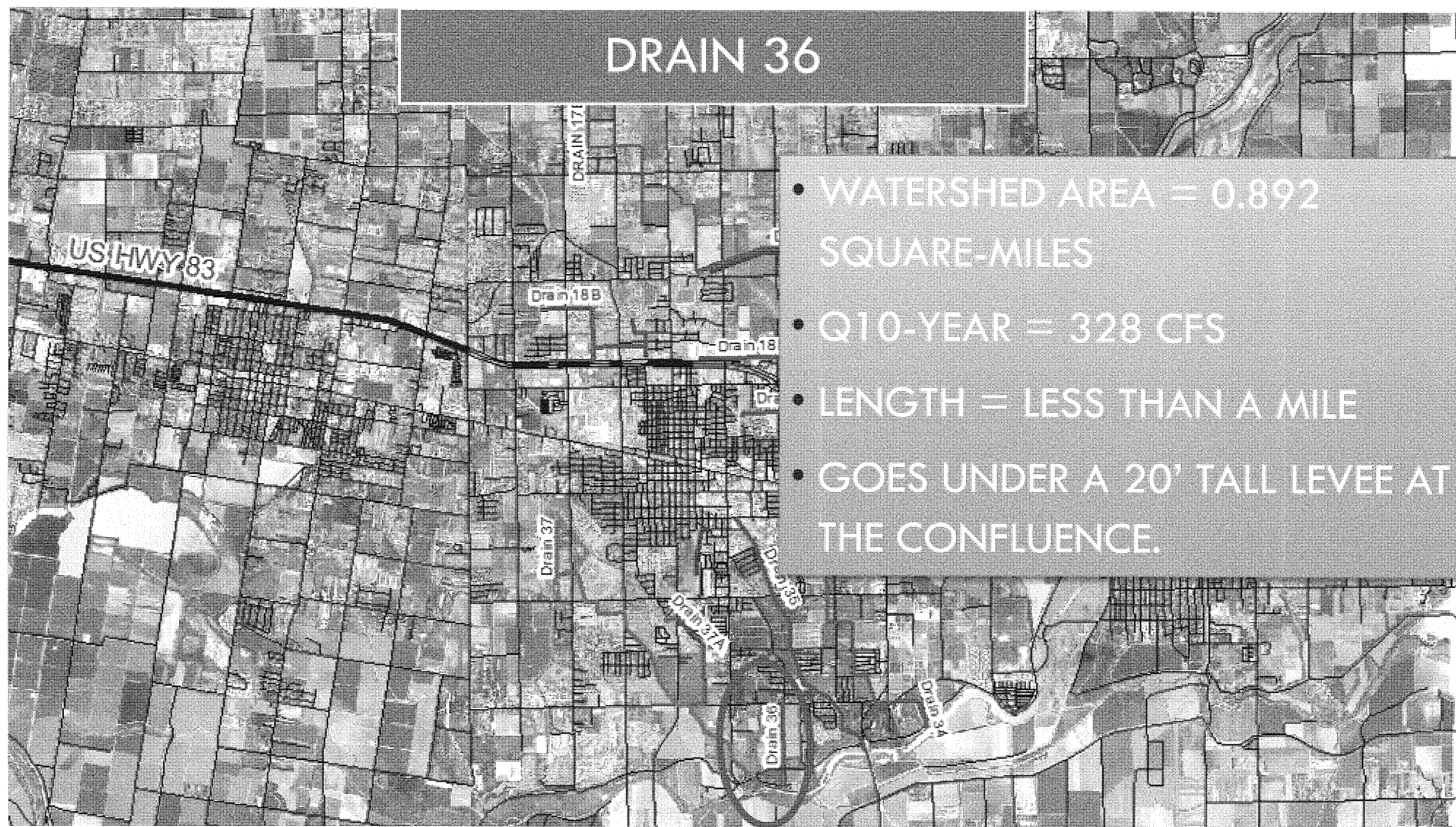
TYPICAL CULVERTS

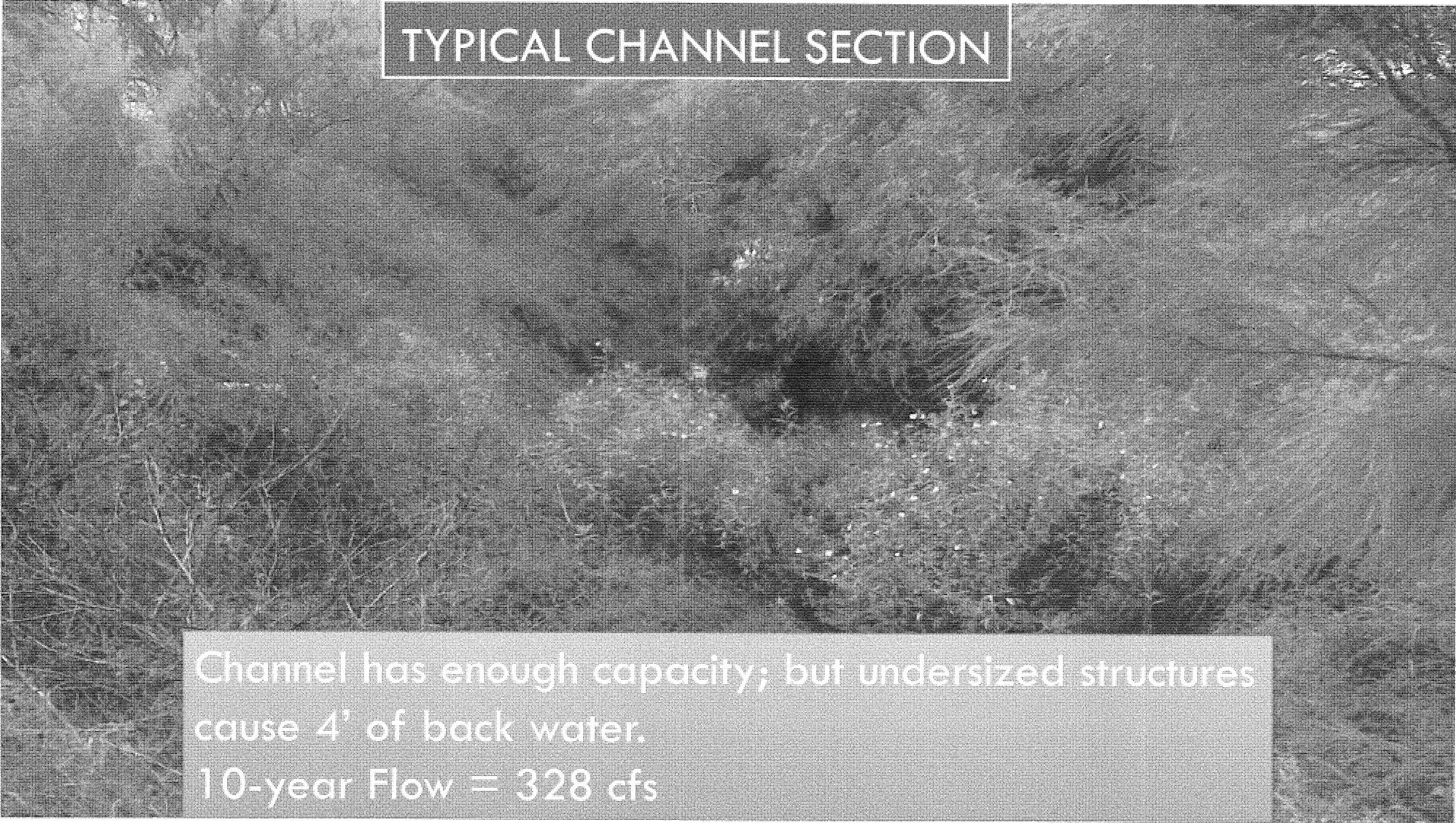
Culvert capacity less than 90 cfs; Causes significant Backwater.
10-year Flow = 1008 cfs; Most of the other culverts are blocked with
sediments and vegetation.



ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD

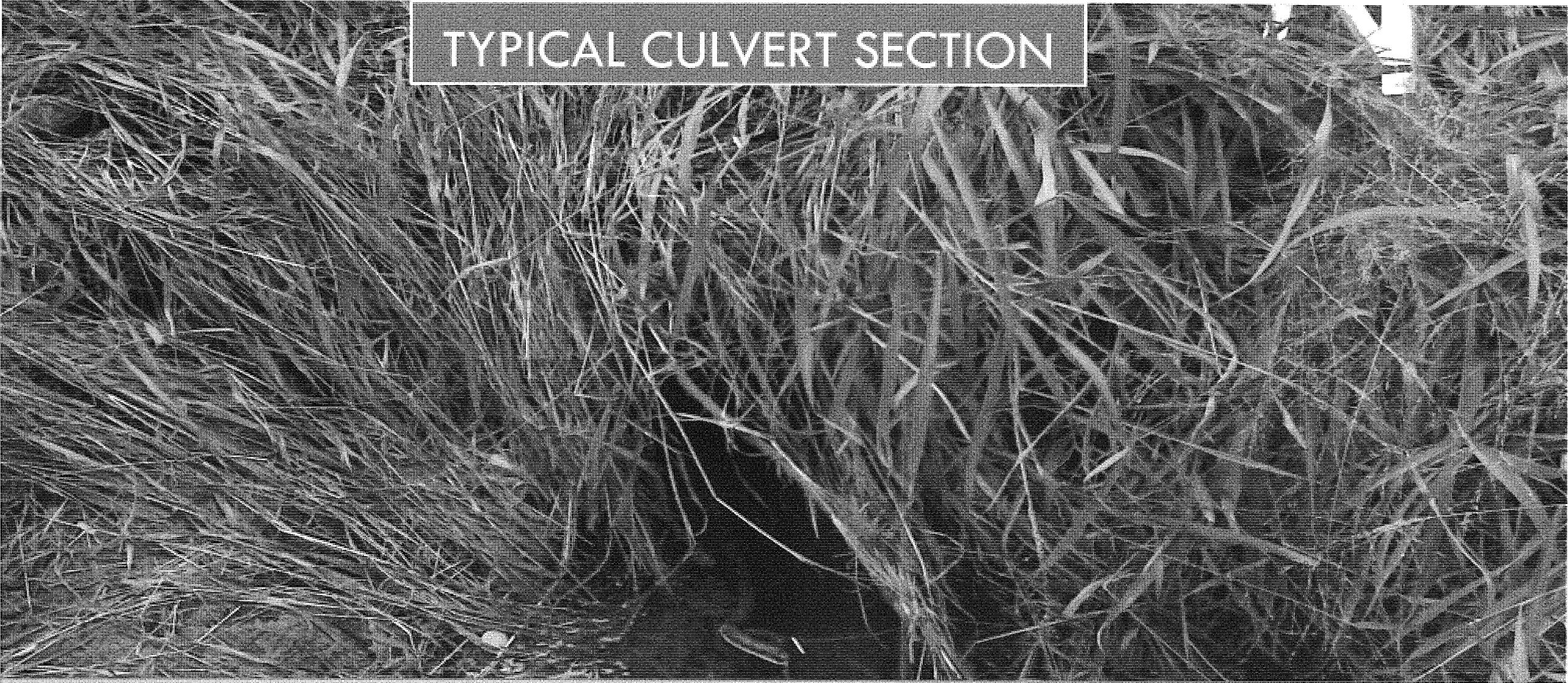






TYPICAL CHANNEL SECTION

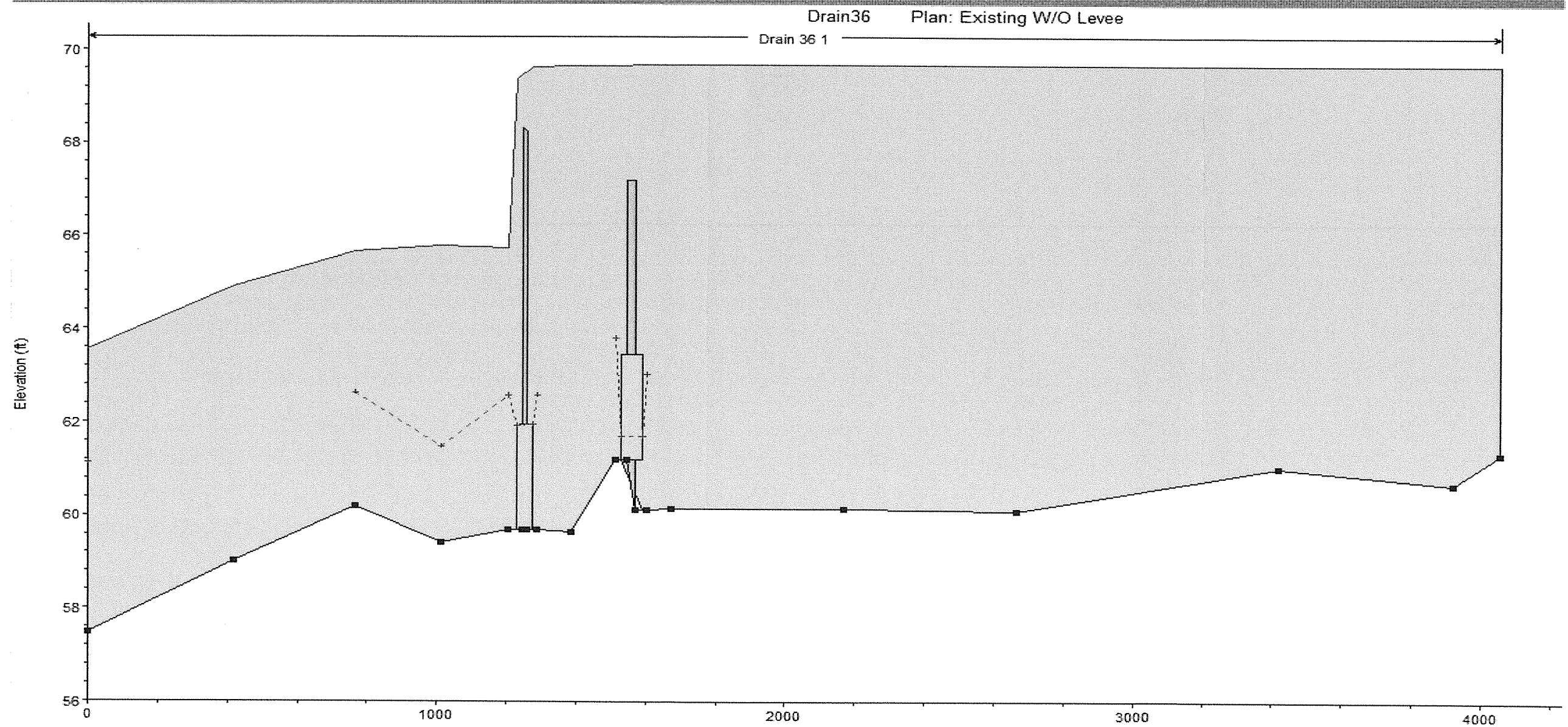
Channel has enough capacity; but undersized structures
cause 4' of back water.
10-year Flow = 328 cfs

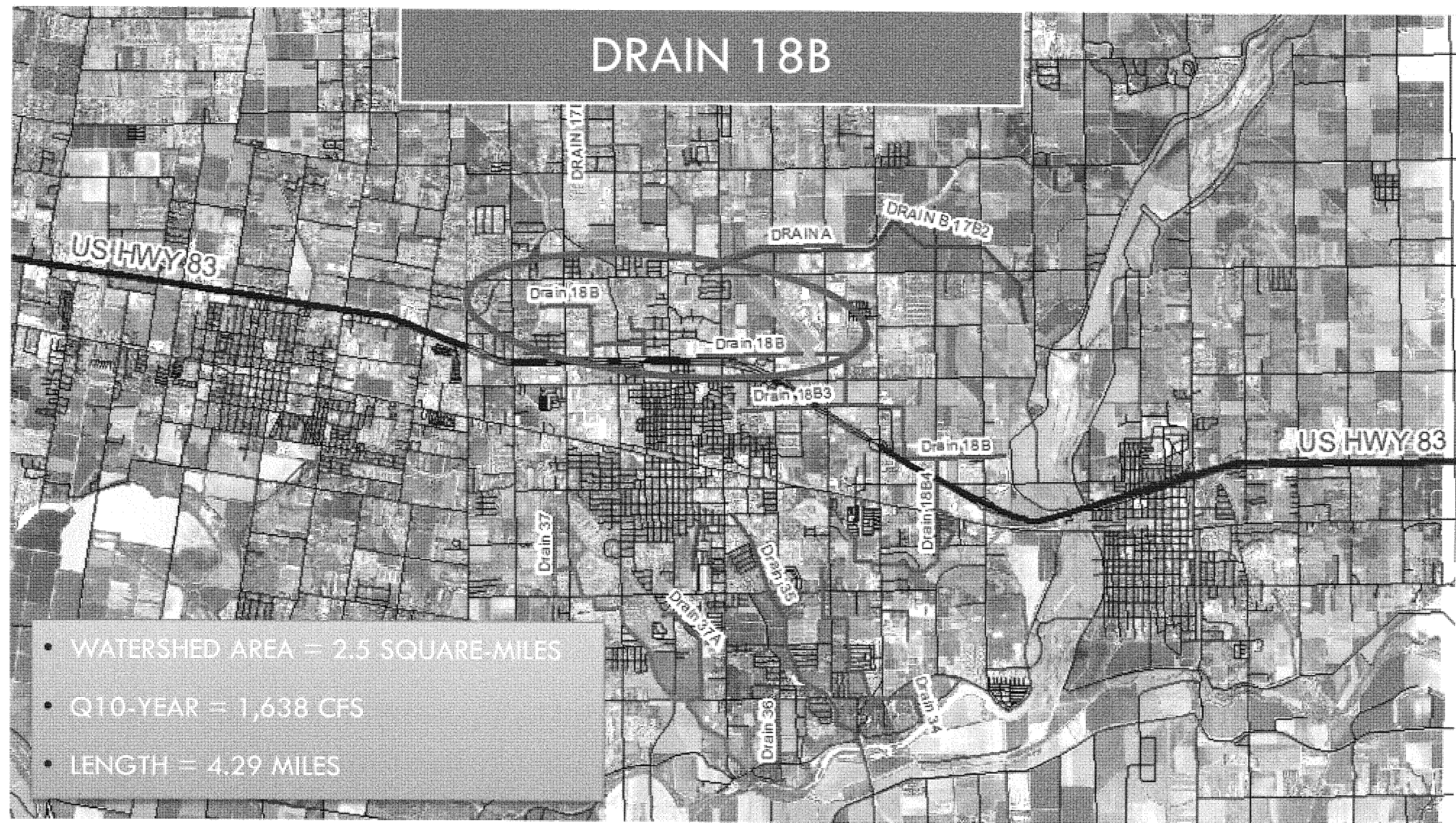


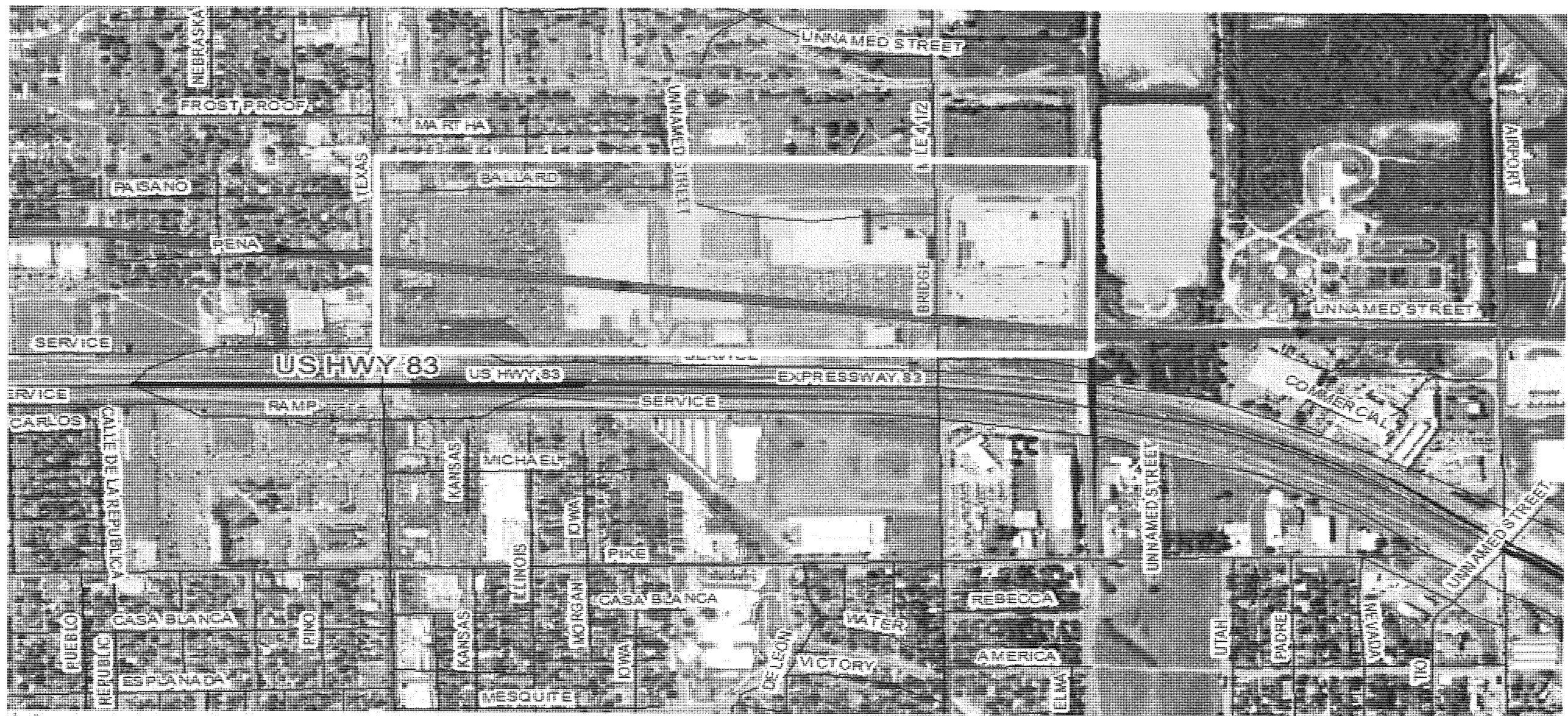
TYPICAL CULVERT SECTION

Channel has enough capacity; but undersized structures cause 4' of back water. Culverts carry less than 50 cfs; Heavy growth around culverts.
10-year Flow = 328 cfs

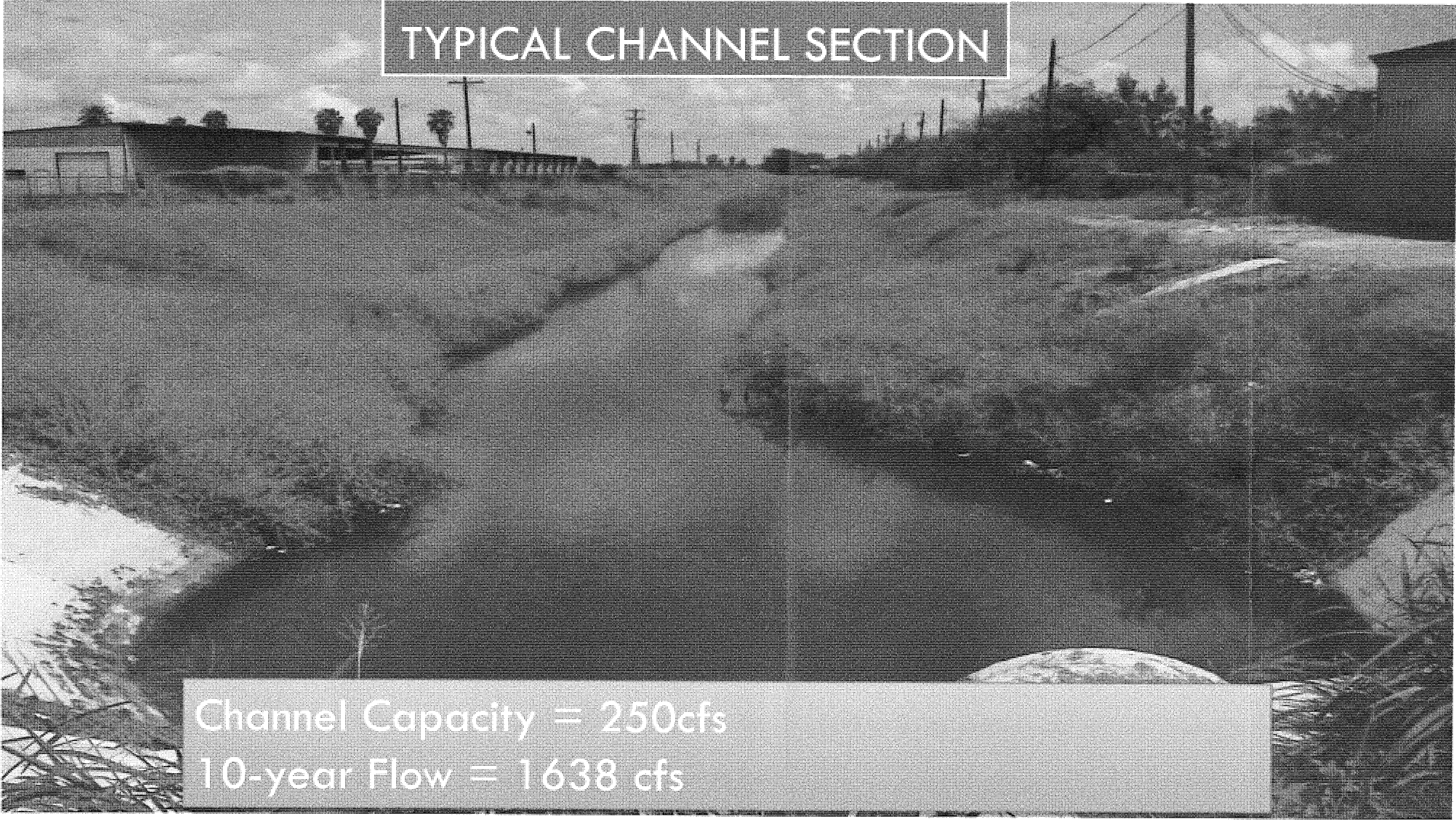
ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD







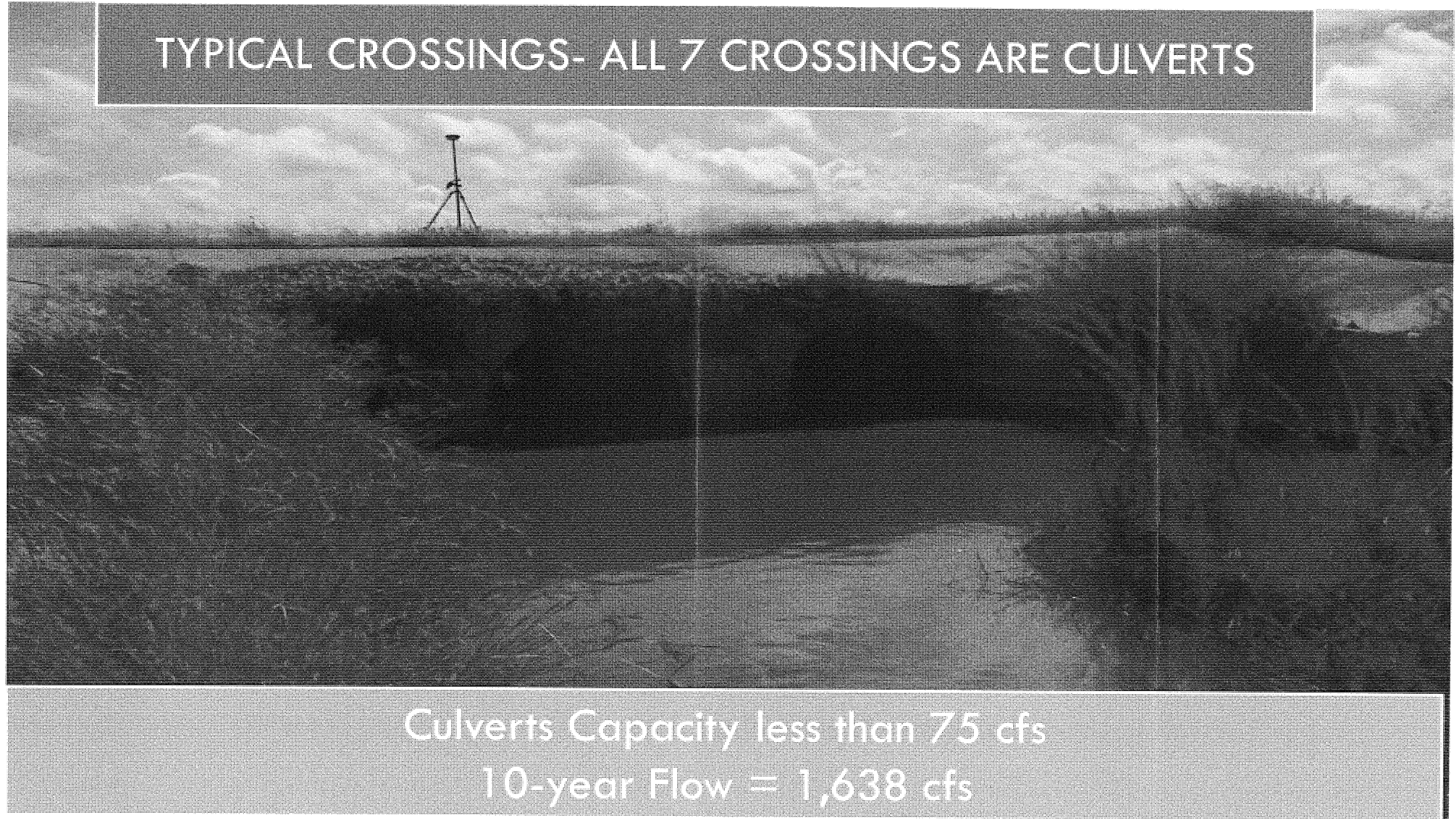
LONG STORMDRAIN RUNS UNDERGROUND FOR OVER A MILE. LOT OF OVERLAND FLOODING IN THIS AREA.



TYPICAL CHANNEL SECTION

Channel Capacity = 250cfs
10-year Flow = 1638 cfs

TYPICAL CROSSINGS- ALL 7 CROSSINGS ARE CULVERTS

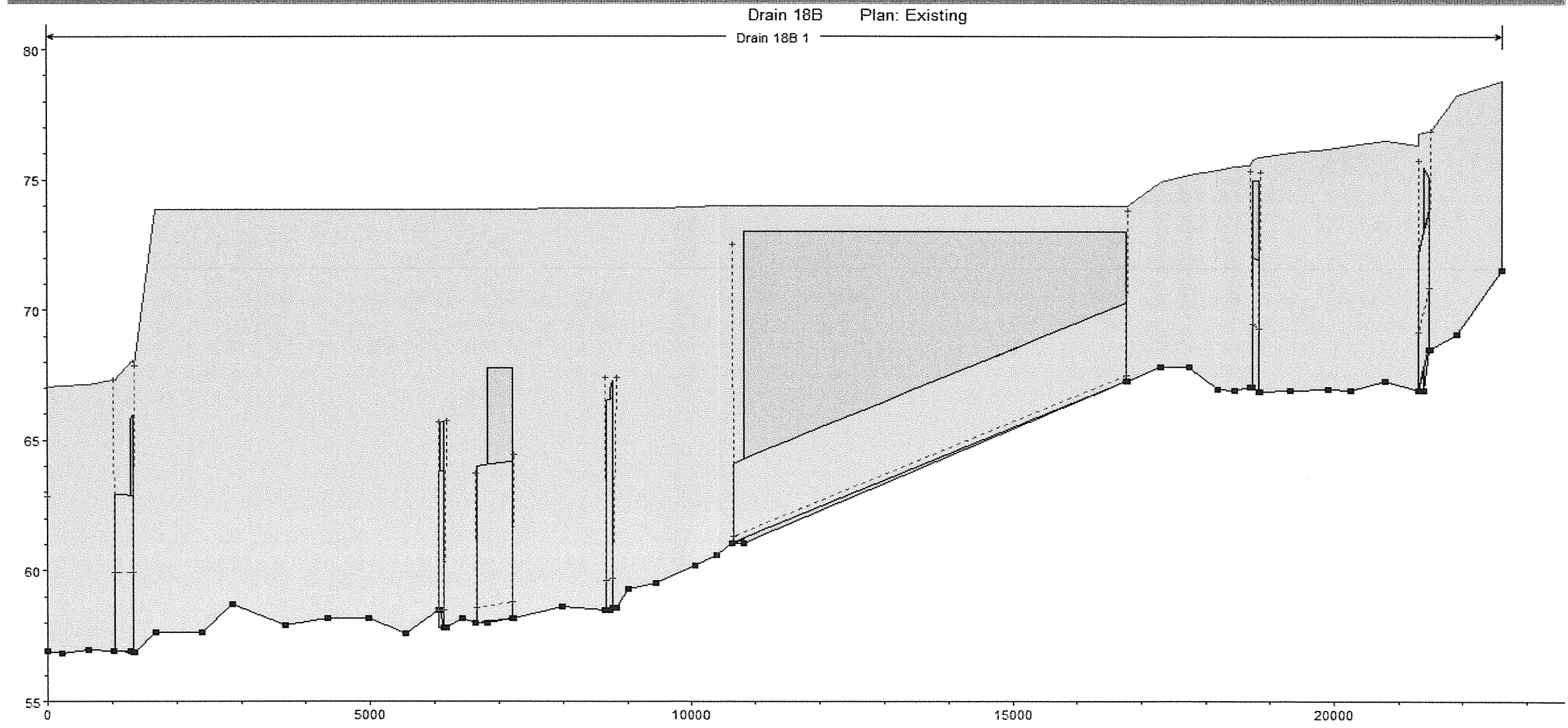


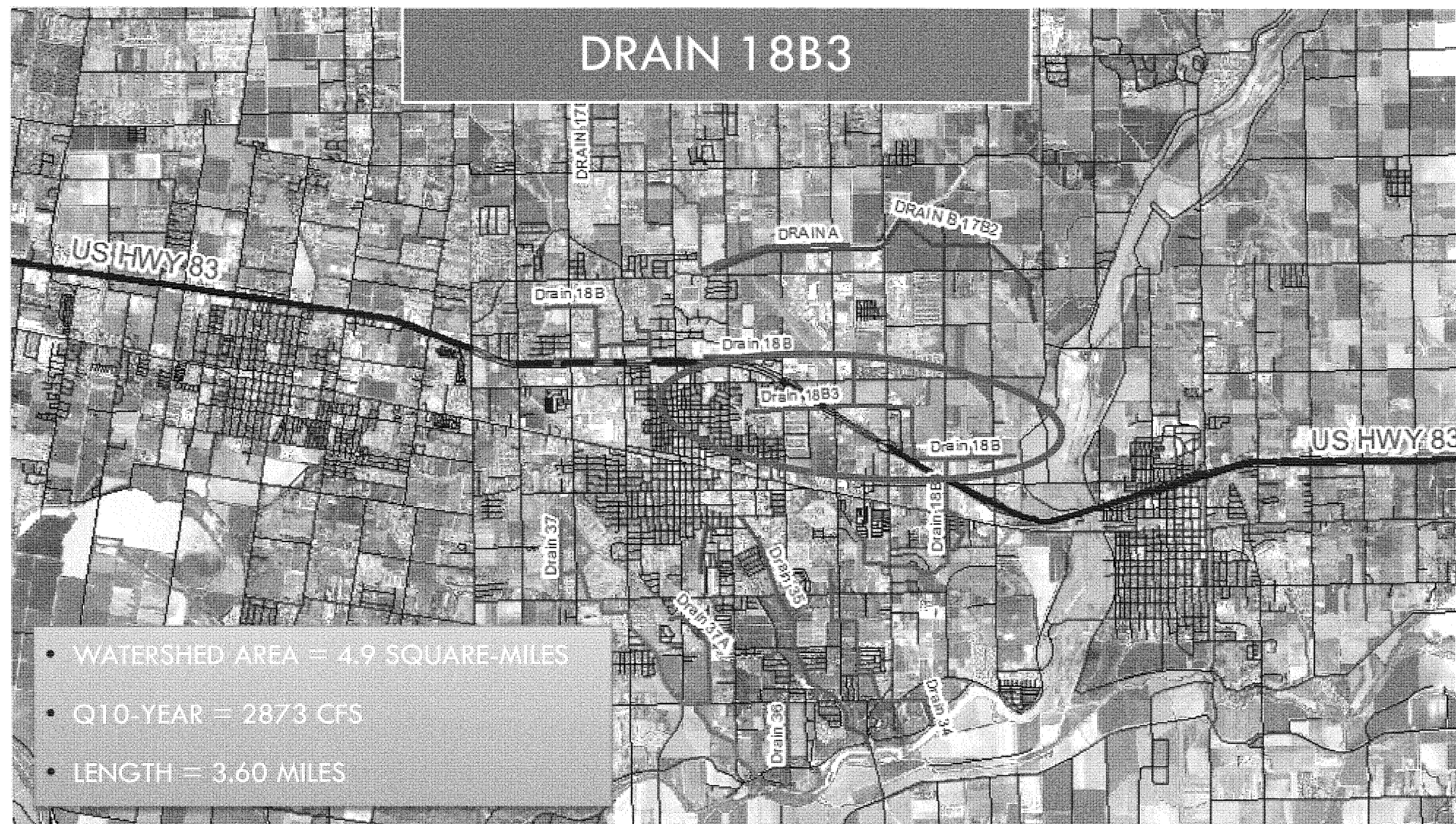
Culverts Capacity less than 75 cfs
10-year Flow = 1,638 cfs



Several homes and businesses are next to the creek

ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD





TYPICAL CHANNEL SECTION

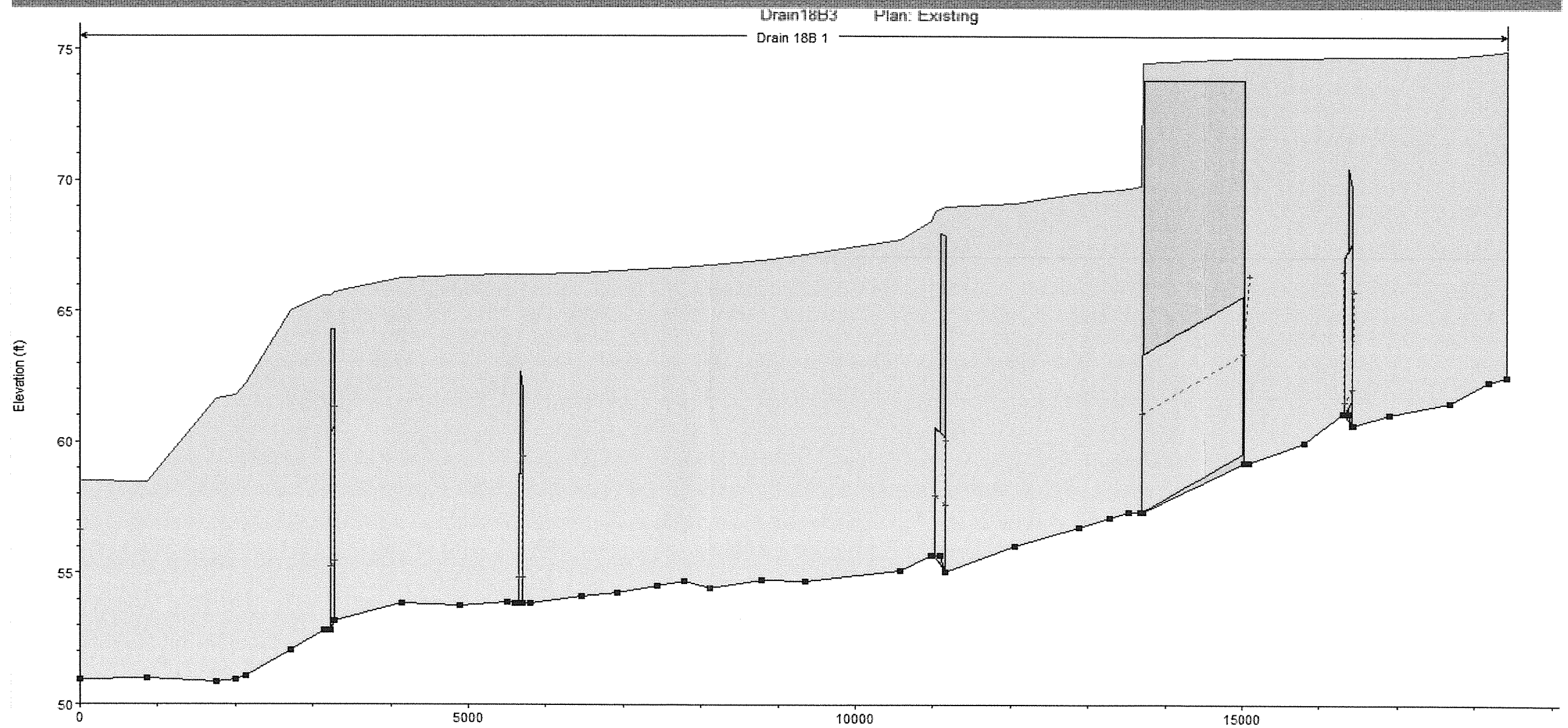
Channel has enough capacity for 10-year but the capacity is reduced because of backwater from structures.
10-year Flow = 2873 cfs

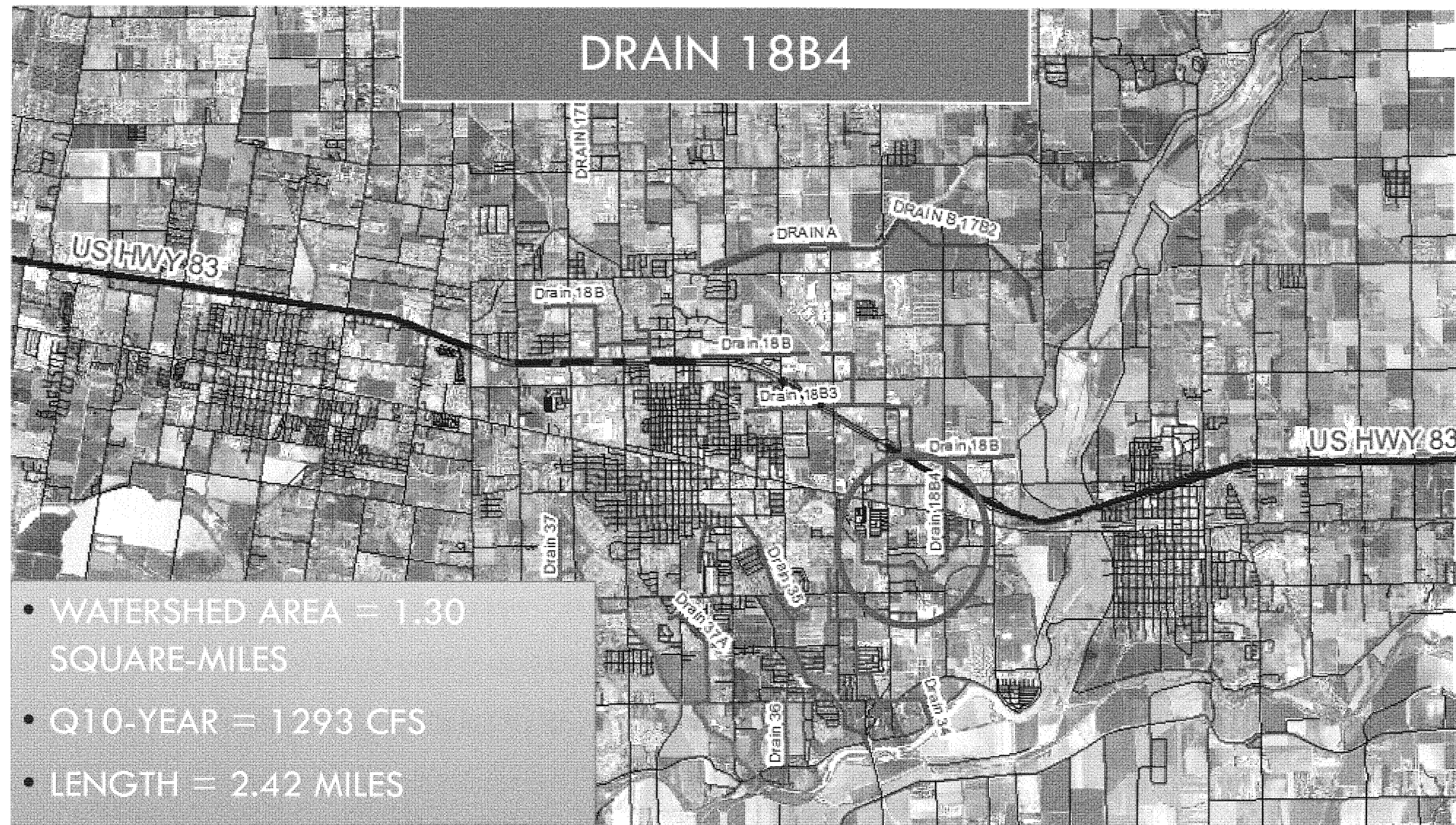
TYPICAL CROSSINGS- ALL 5 CROSSINGS ARE CULVERTS



Culverts Capacity less than 300 cfs
10-year Flow = 2,873 cfs

ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD





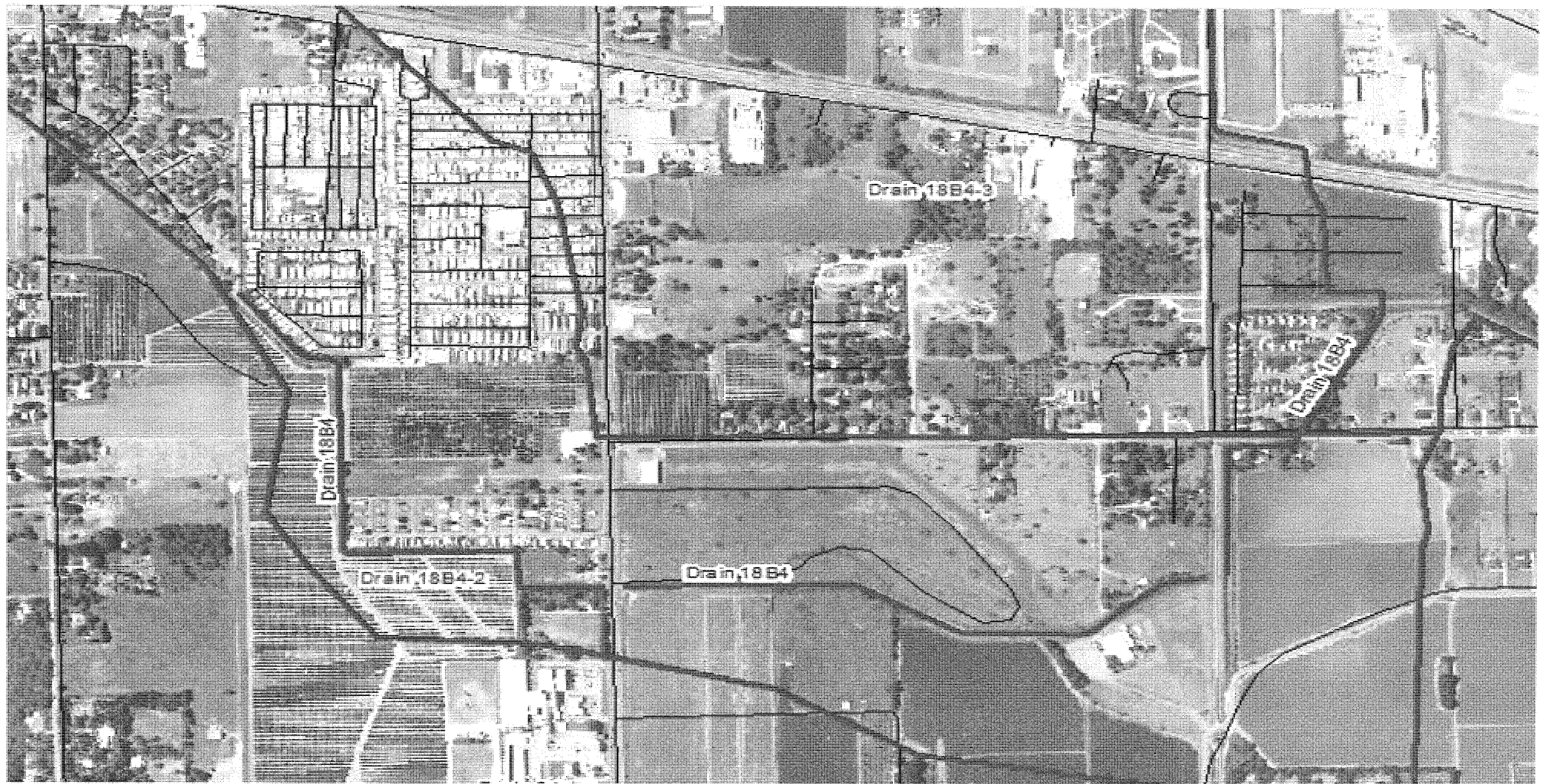
TYPICAL CHANNEL SECTION

Channel capacity for 10-year less than 300 cfs
10-year Flow = 1293 cfs

TYPICAL CROSSINGS- ALL 13 CROSSINGS ARE CULVERTS

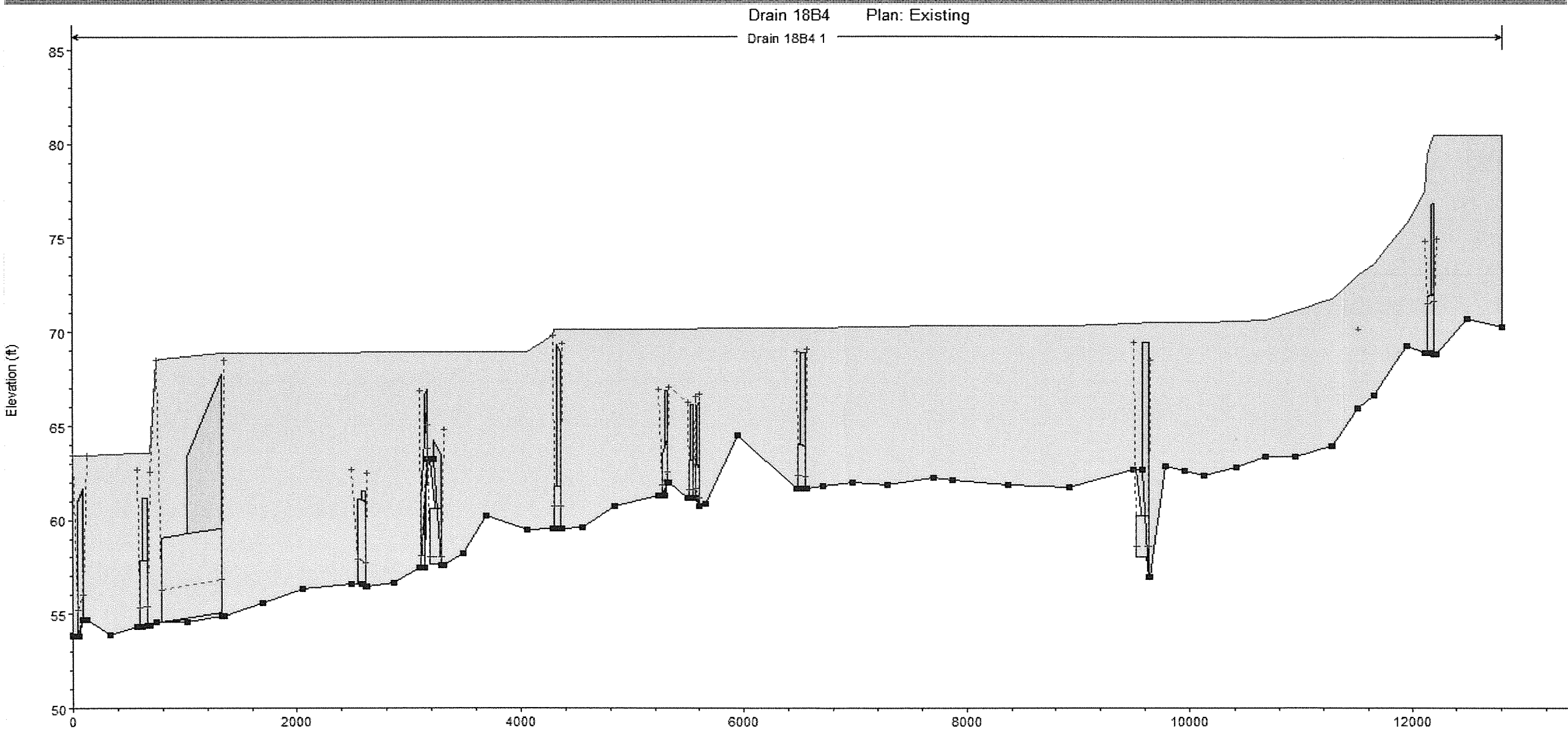


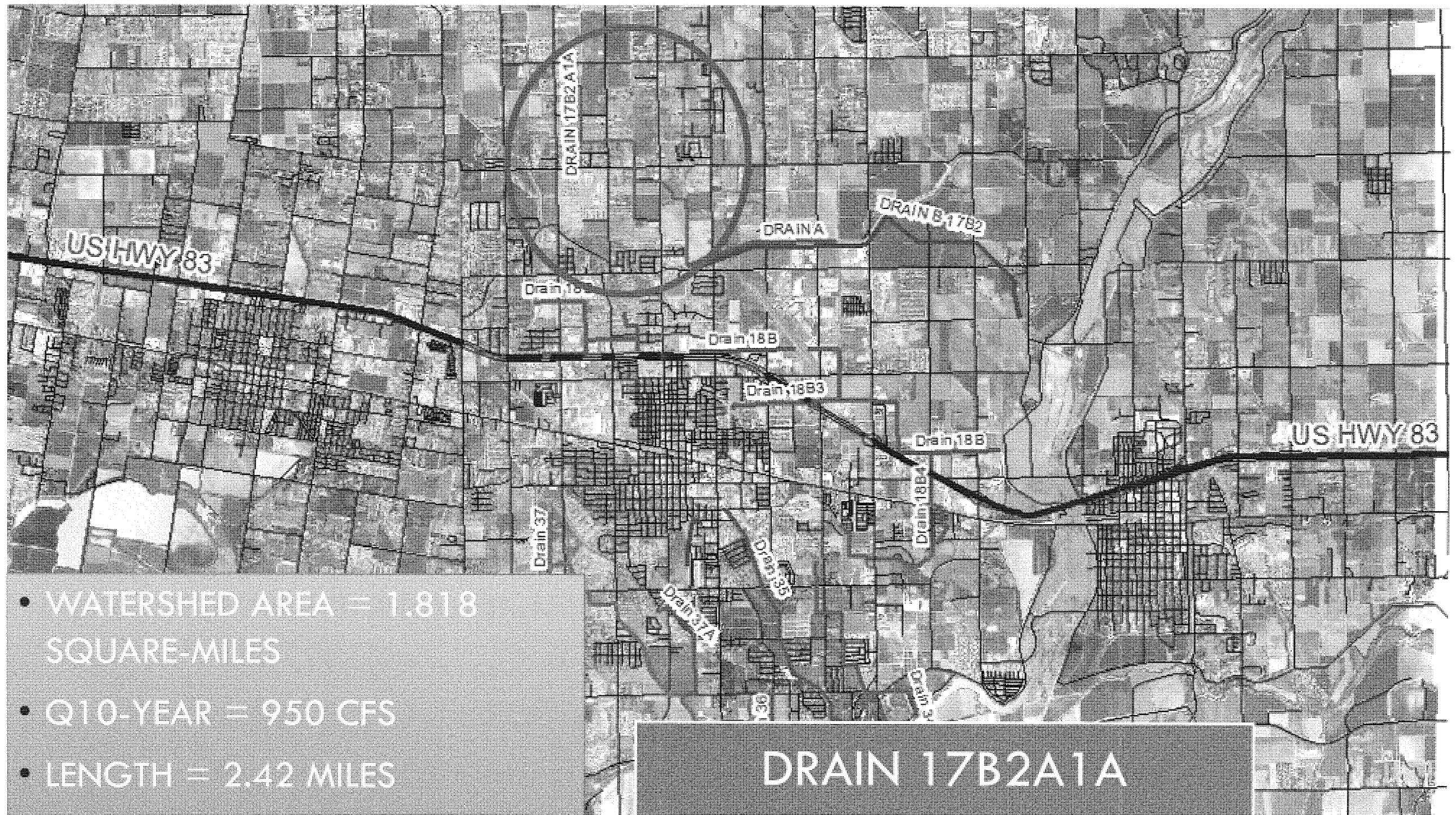
Culverts Capacity less than 50 cfs
10-year Flow = 1,293 cfs



HOMES LOCATED NEXT TO THE CREEK IS A CAUSE FOR CONCERN

ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD





TYPICAL CHANNEL SECTION U/S

TYPICAL CHANNEL SECTION D/S

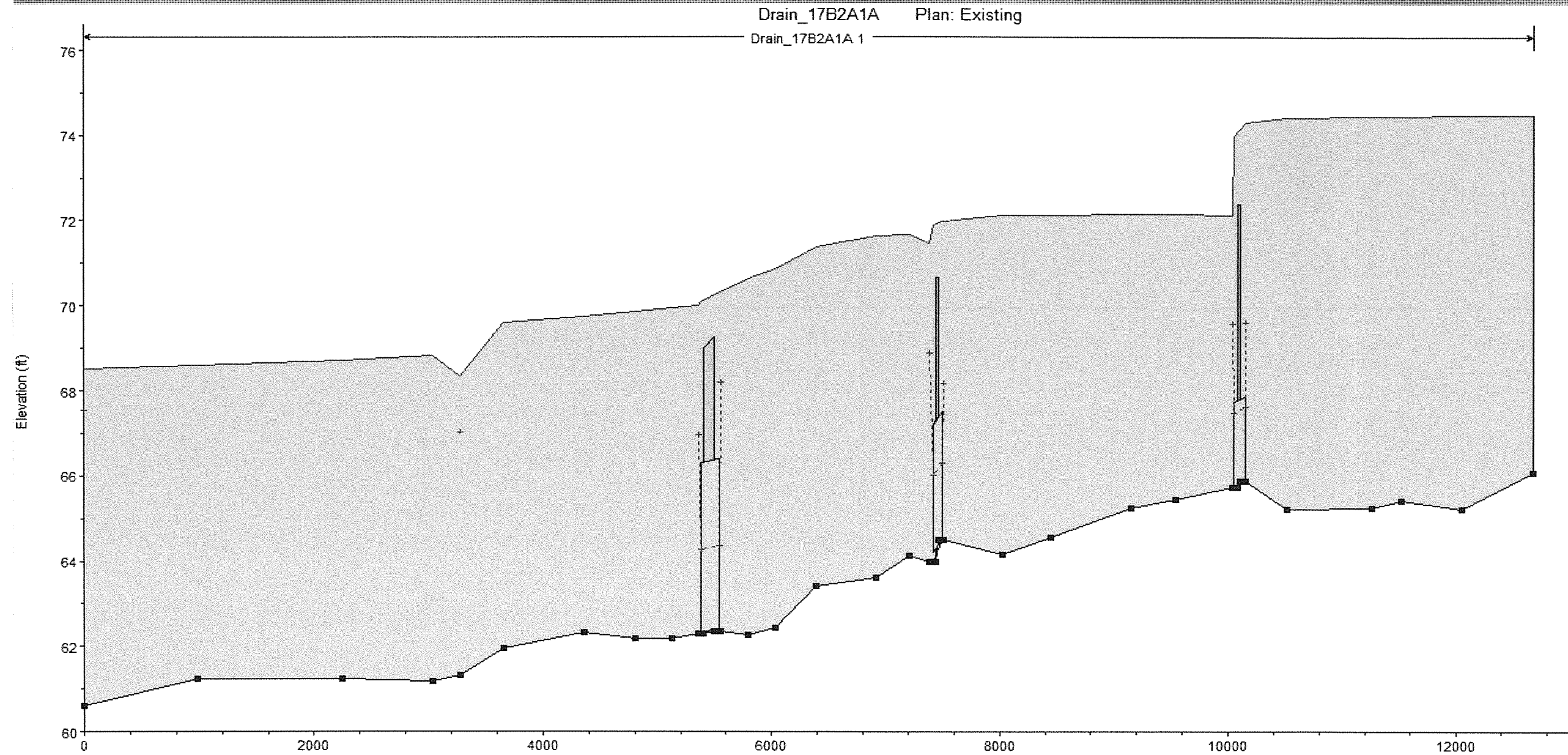
U/S channel reach has 10-yr capacity; D/S reach does not have capacity; Capacity less than 250 cfs.
10-year Flow = 950 cfs

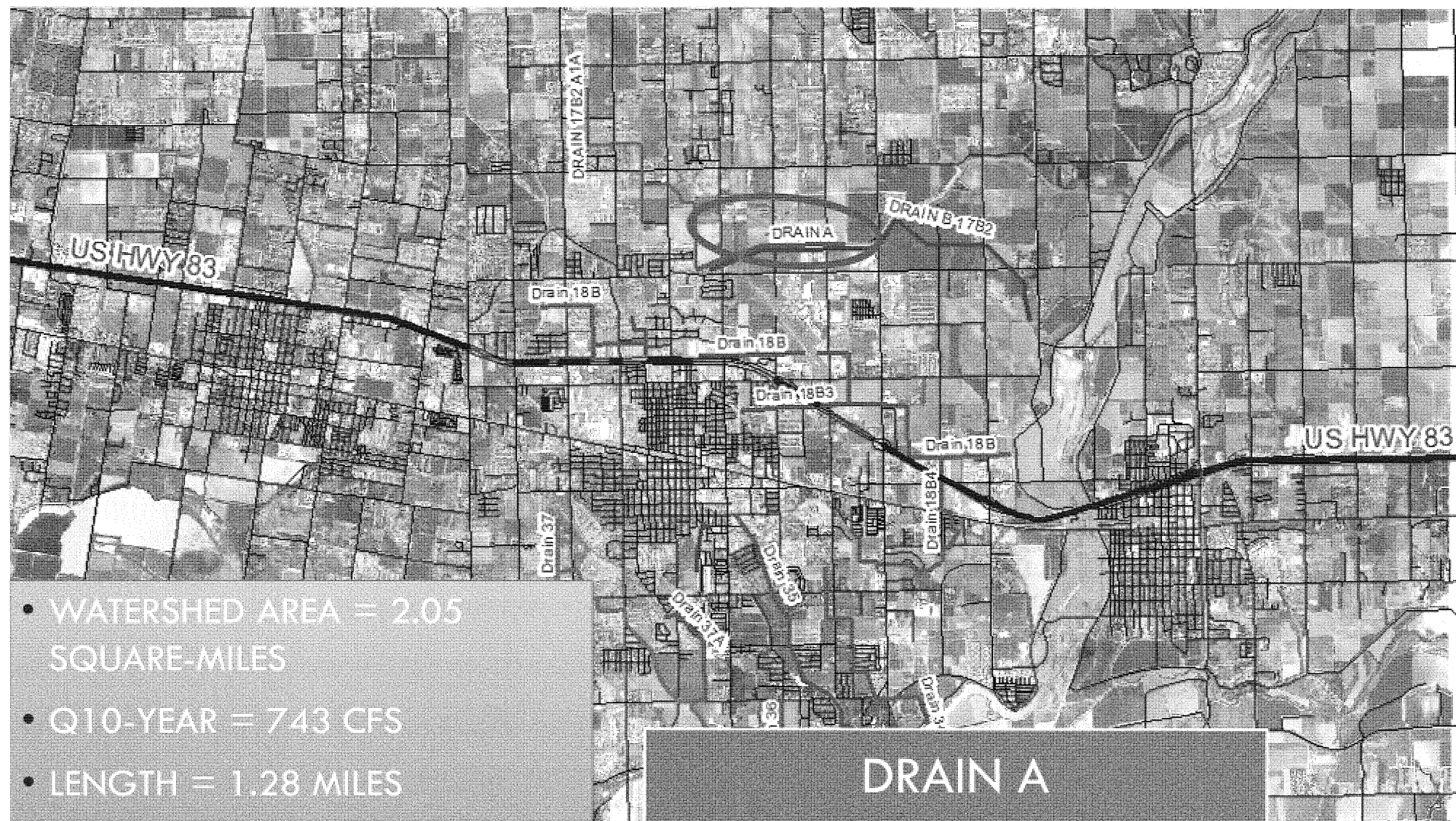
TYPICAL CROSSINGS- ALL 13 CROSSINGS ARE CULVERTS

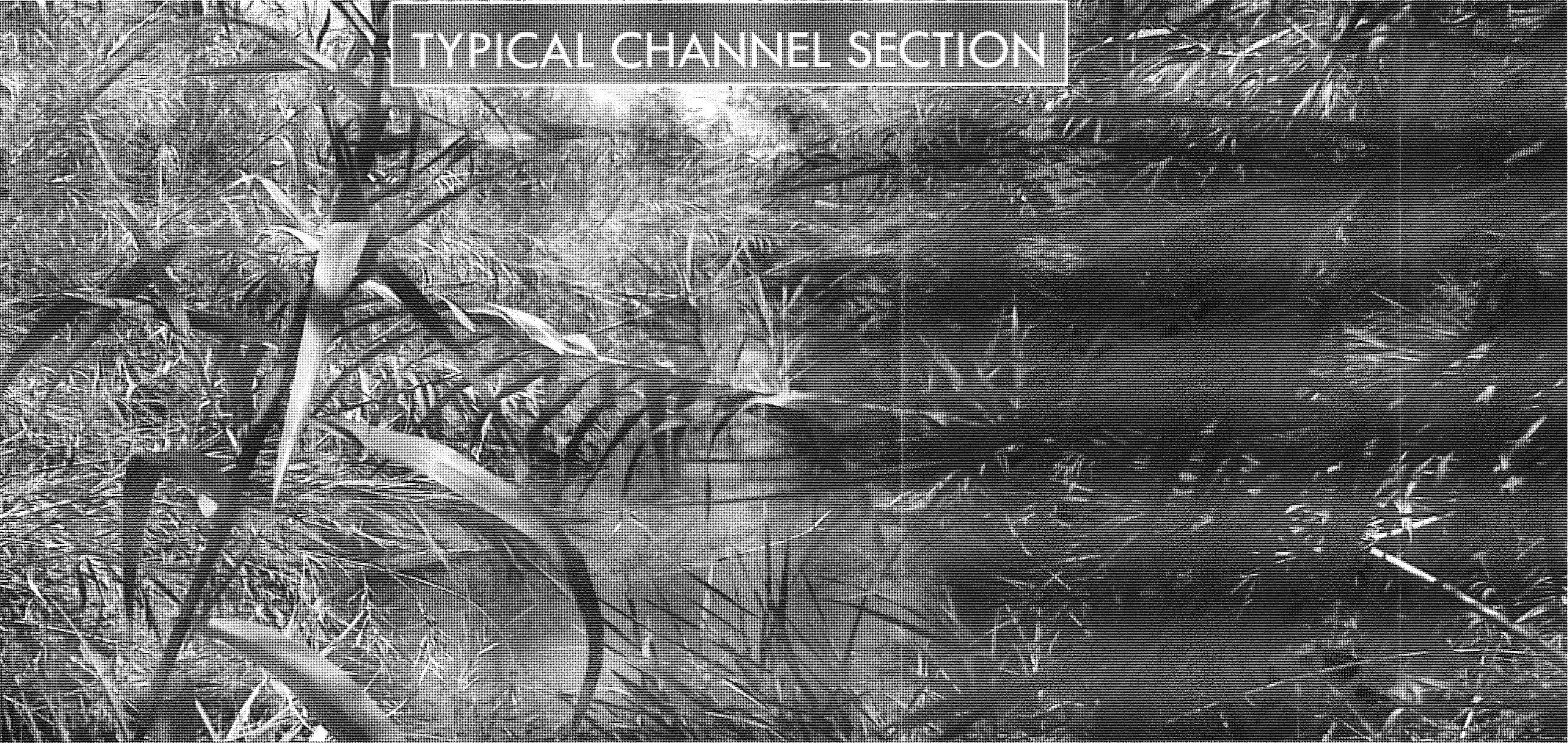


Culverts Capacity less than 50 cfs; Completely blocked by vegetation.
10-year Flow = 950 cfs

ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD



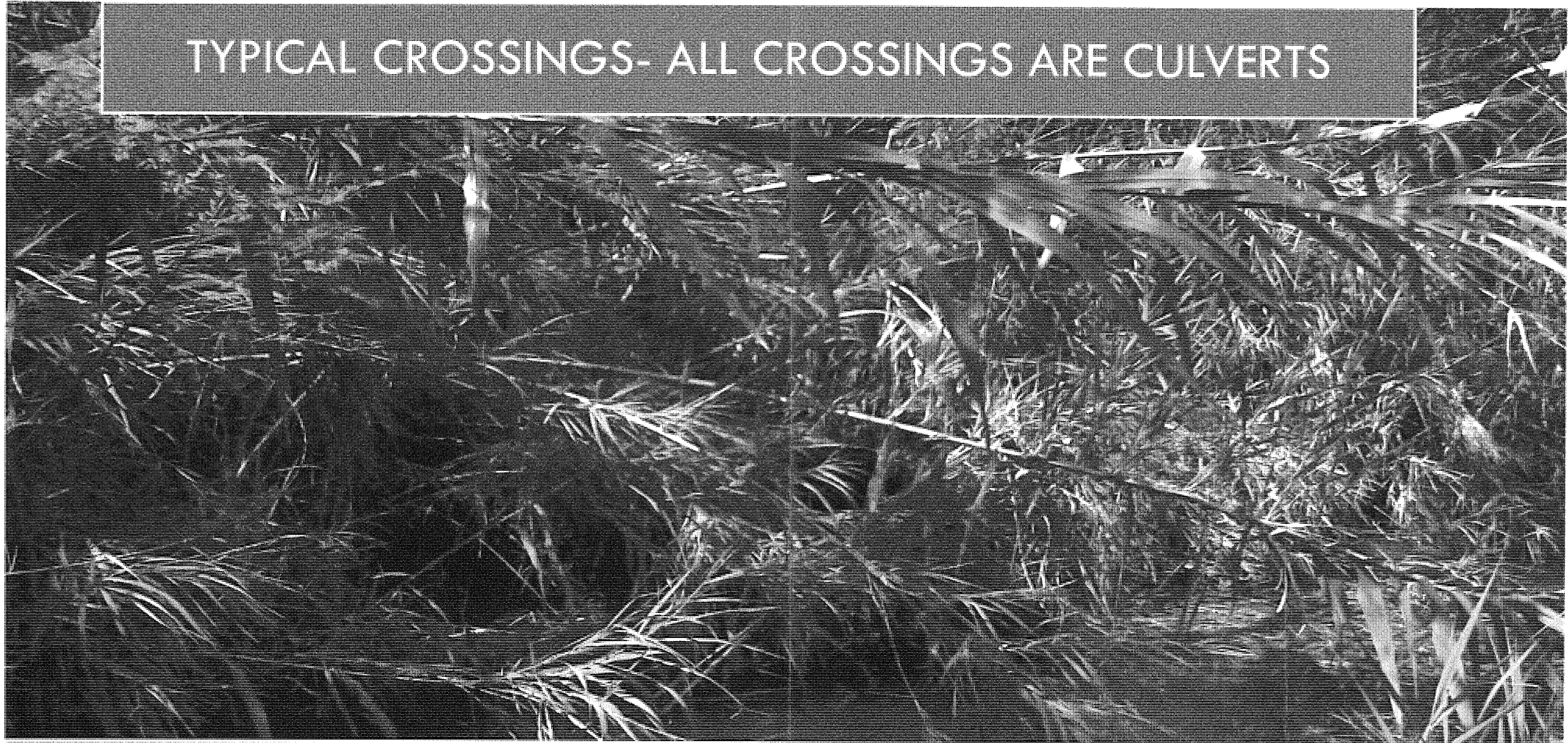


A black and white photograph showing a cross-section of a grassy channel. The channel is filled with dense, tall grasses. A white rectangular box with a thin black border is positioned in the upper left quadrant of the image, containing the text 'TYPICAL CHANNEL SECTION'.

TYPICAL CHANNEL SECTION

Capacity less than 250 cfs.
10-year Flow = 743 cfs

TYPICAL CROSSINGS- ALL CROSSINGS ARE CULVERTS

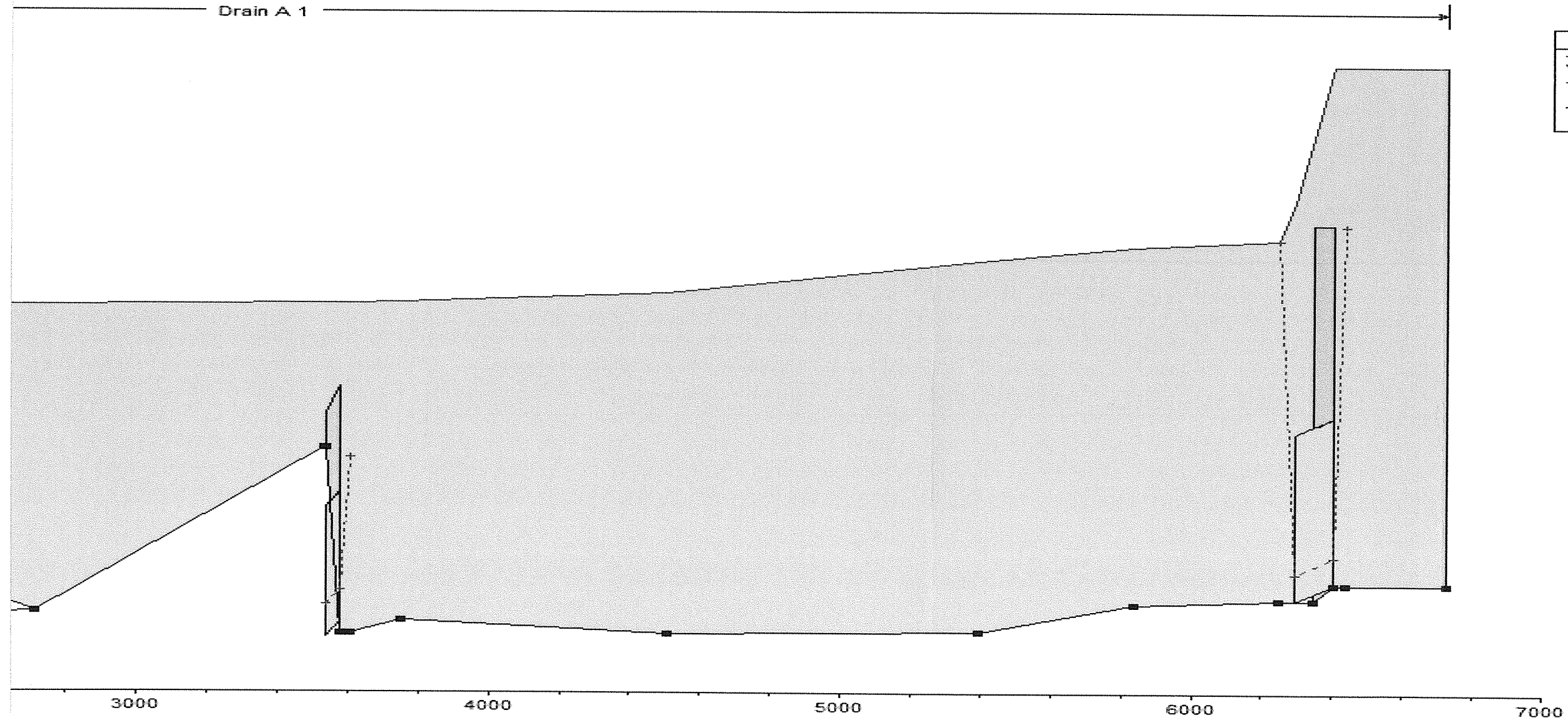


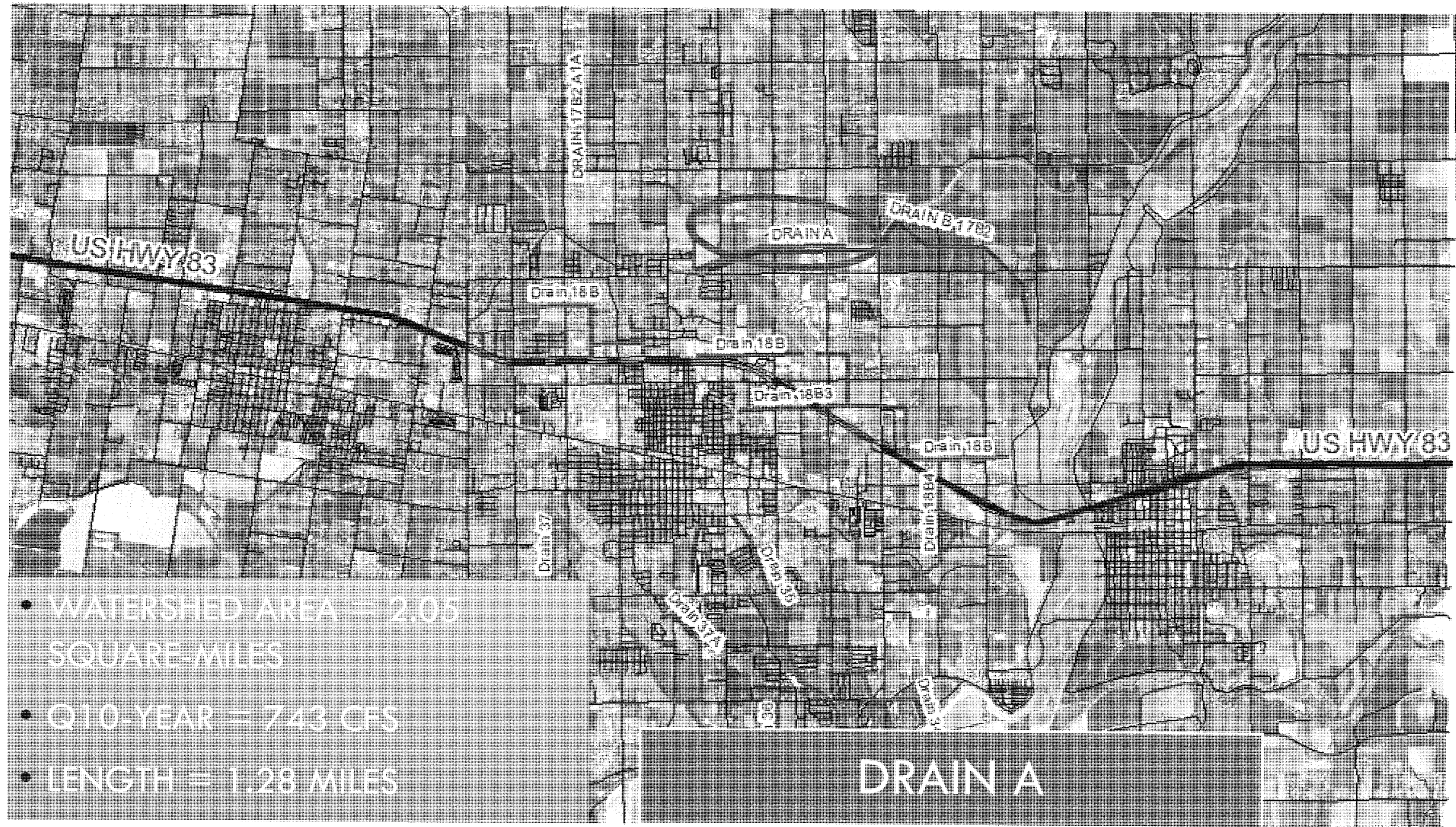
Culverts Capacity less than 10 cfs; Completely blocked by vegetation.
10-year Flow = 743 cfs

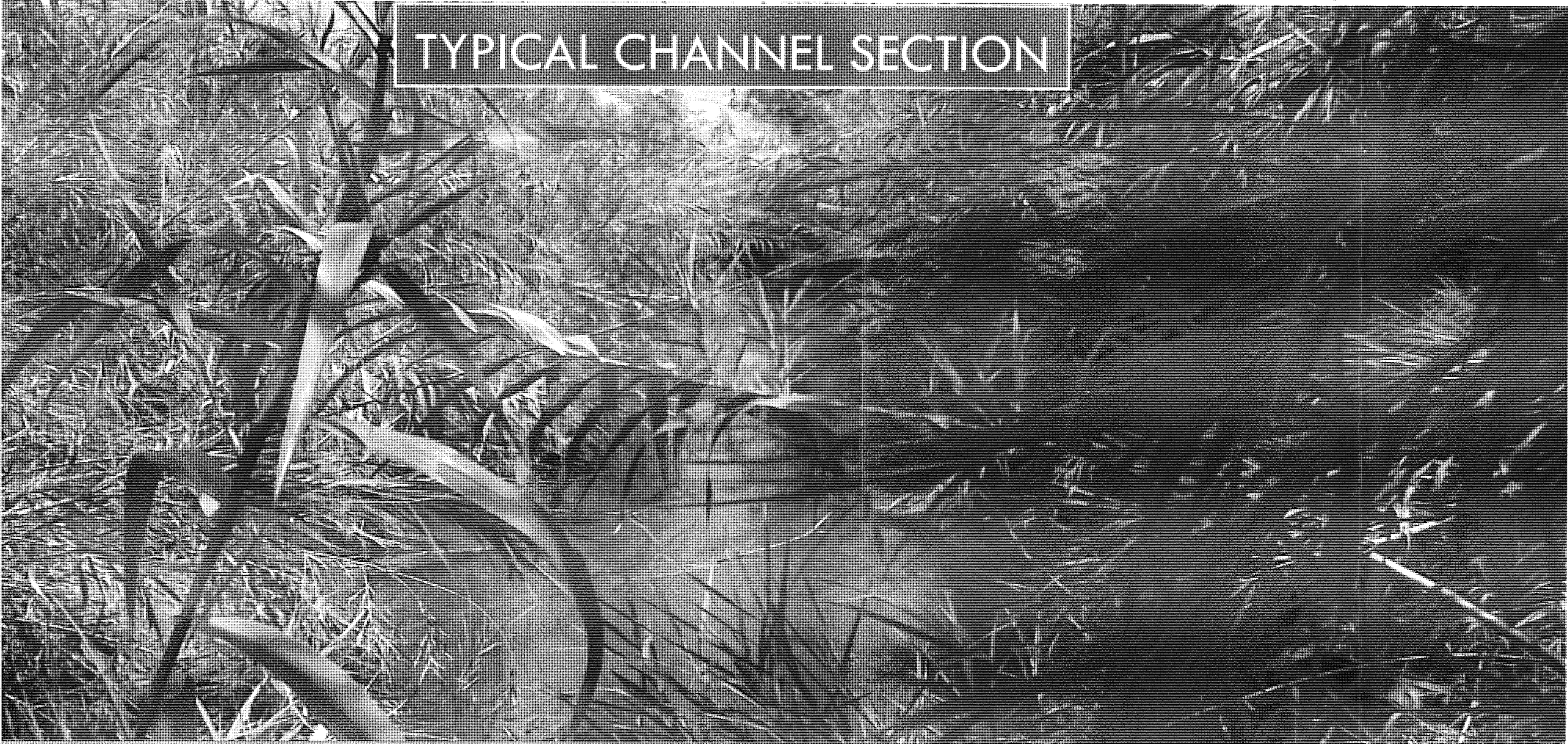
ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD

DrainA Plan: Existing
Drain A 1

Leg	
WS	—
Crit	- - -
Gro	■



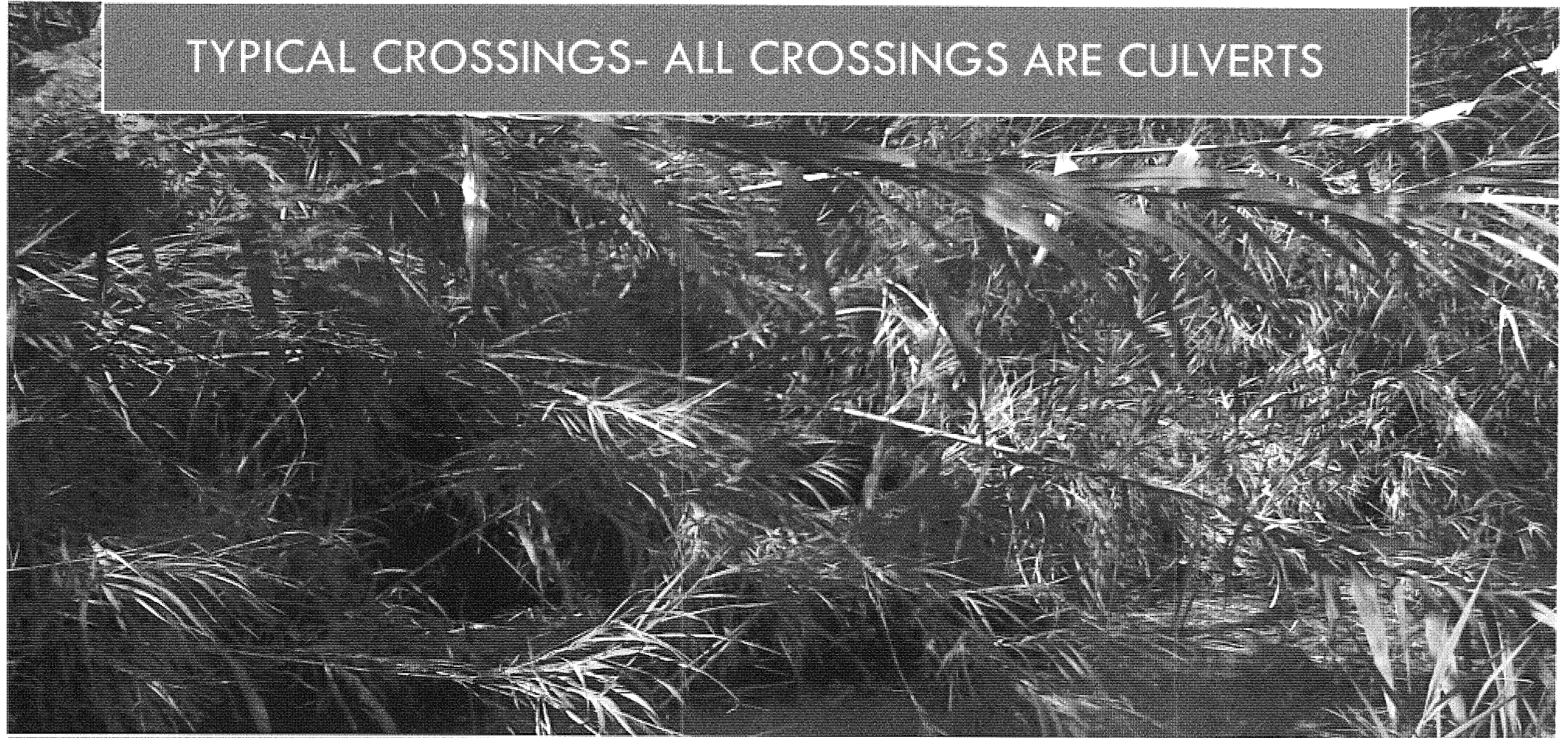




TYPICAL CHANNEL SECTION

Capacity less than 250 cfs.
10-year Flow = 743 cfs

TYPICAL CROSSINGS- ALL CROSSINGS ARE CULVERTS

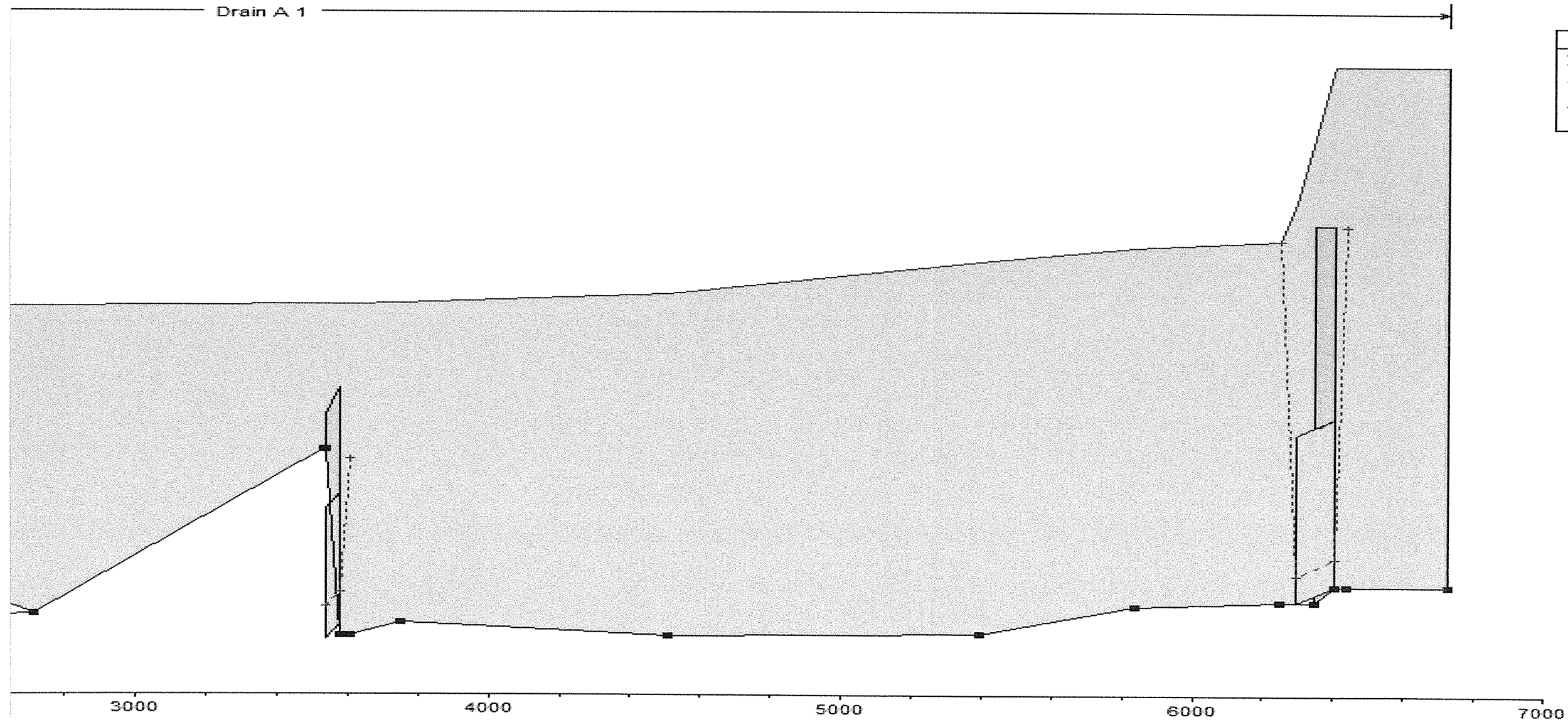


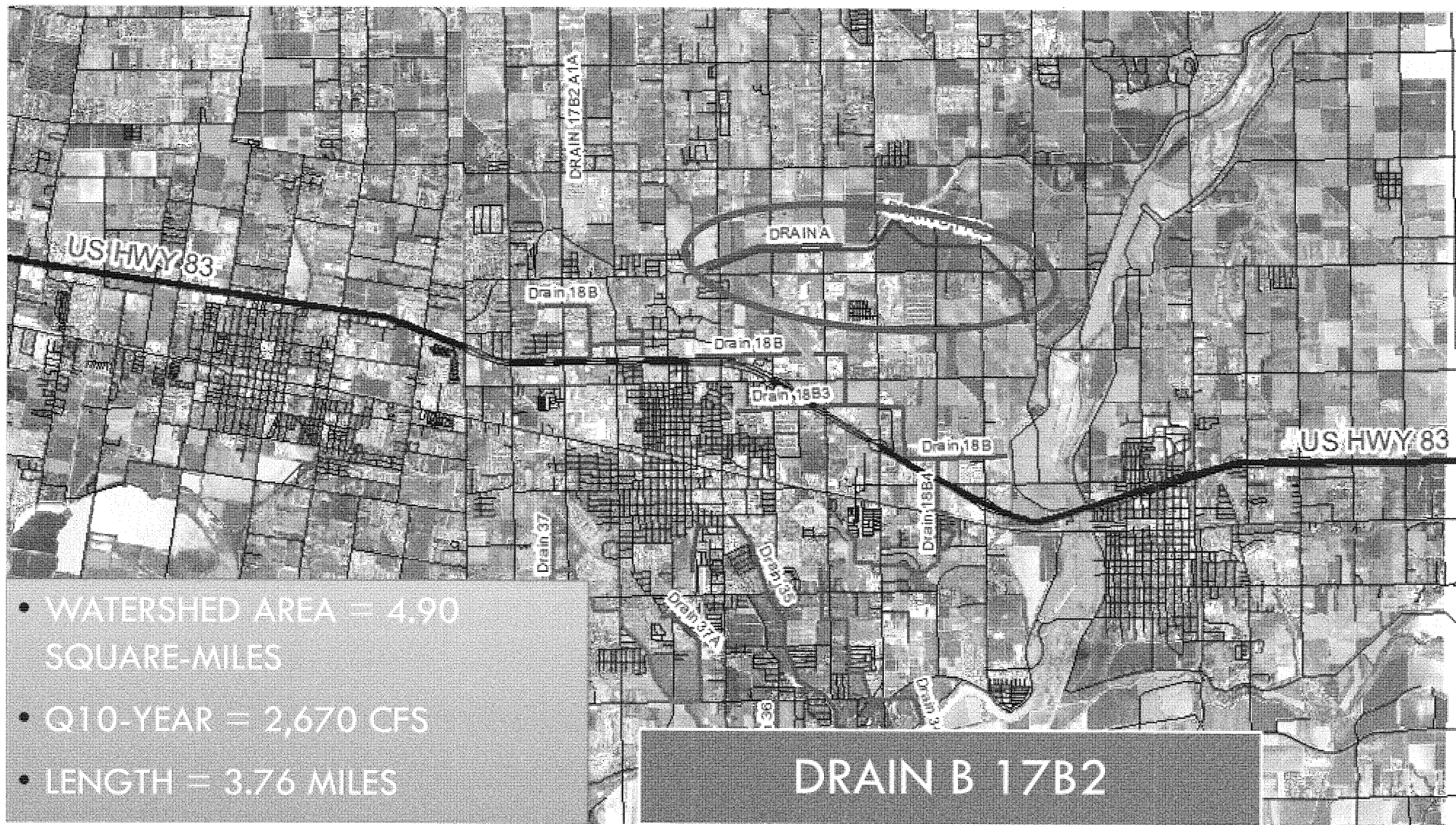
Culverts Capacity less than 10 cfs; Completely blocked by vegetation.
10-year Flow = 743 cfs

ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD

DrainA Plan: Existing
Drain A 1

Leg
WS
Crit
Gro

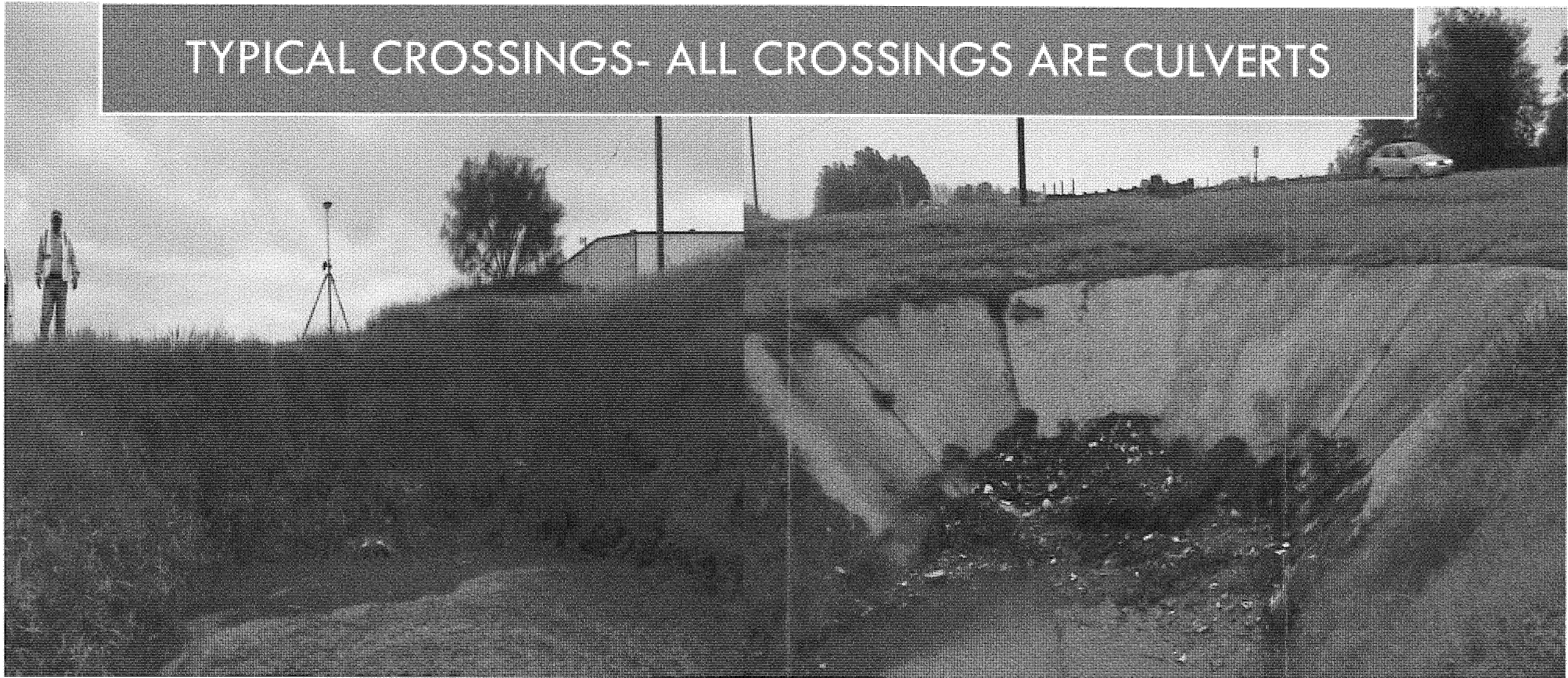




TYPICAL CHANNEL SECTION

Capacity less than 400 cfs.
10-year Flow = 2,670 cfs

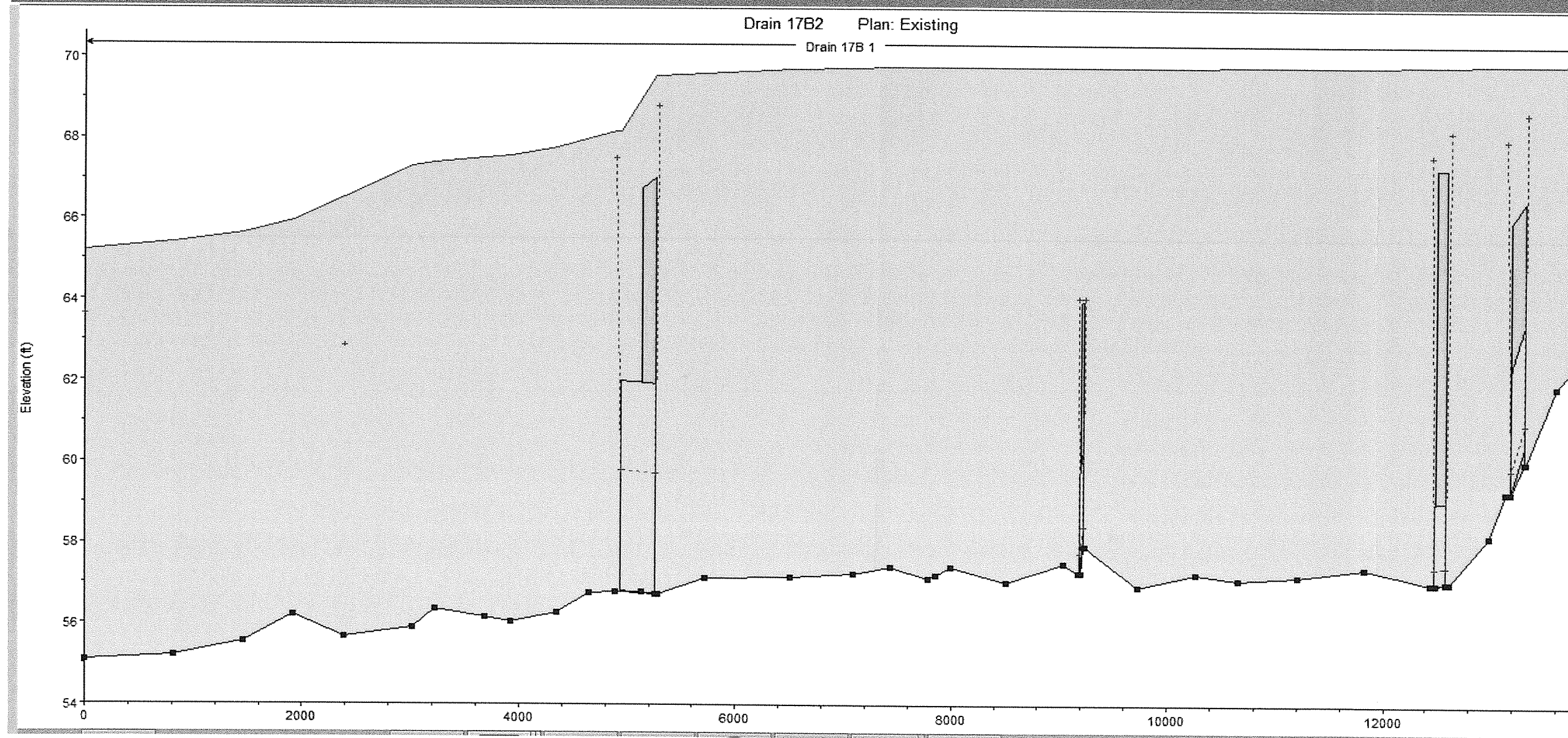
TYPICAL CROSSINGS- ALL CROSSINGS ARE CULVERTS

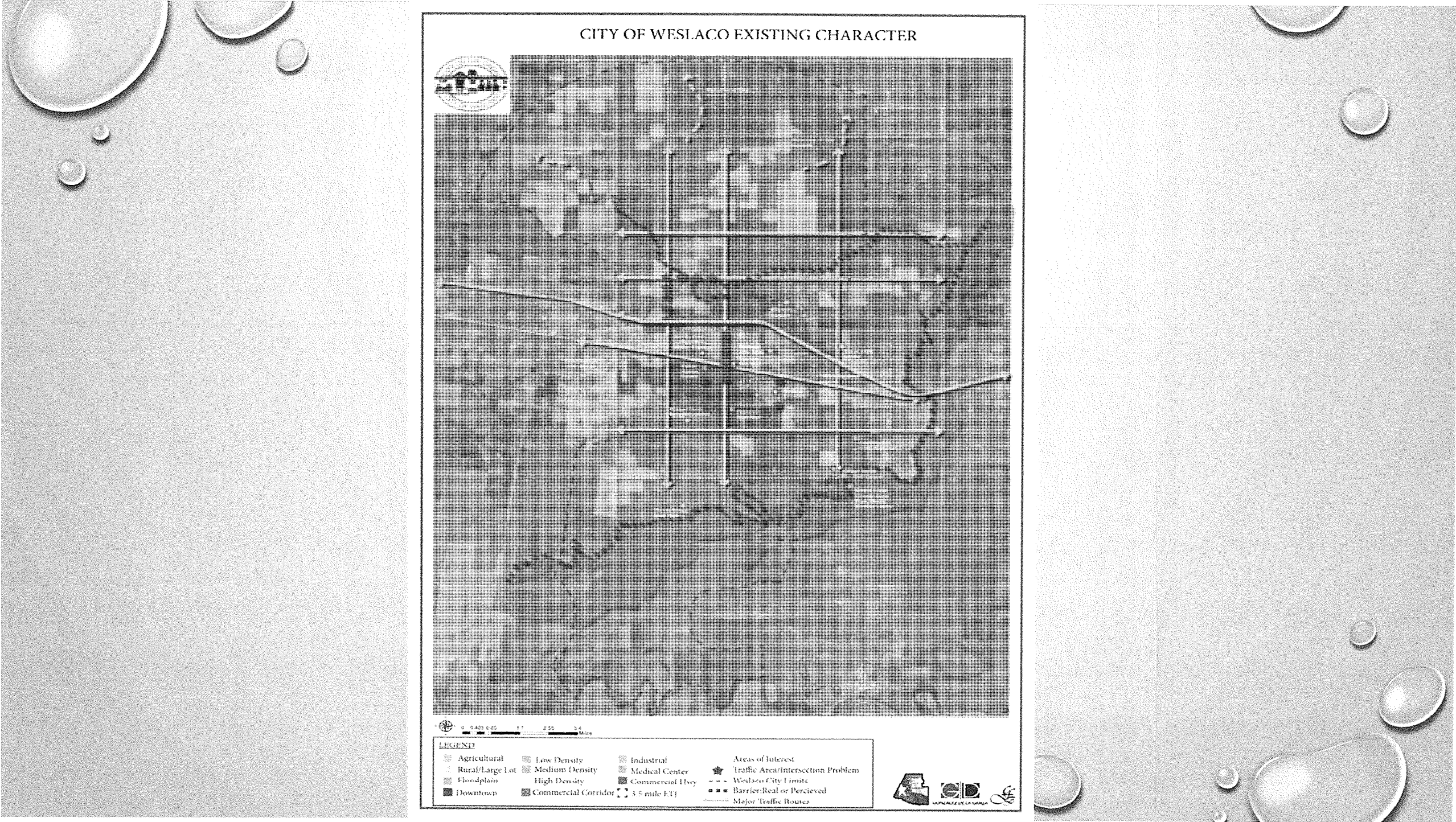


Culverts Capacity less than 180 cfs; Completely blocked by vegetation / trash.

10-year Flow = 2,670 cfs

ALL CULVERTS INUNDATED FOR 10-YEAR FLOOD





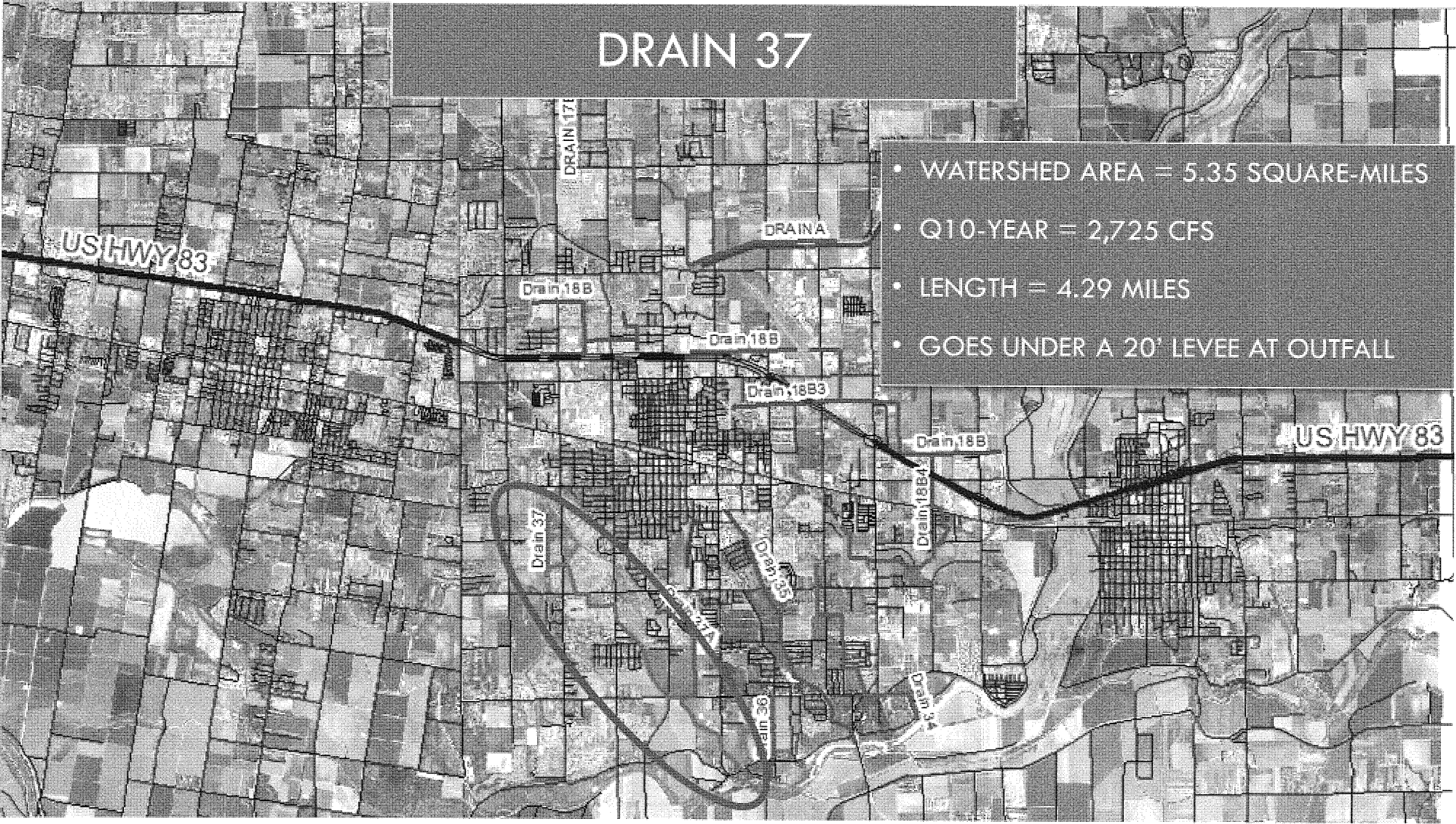
SUMMARY

- VIRTUALLY ALL DRAINAGE STRUCTURES HAVE LESS CAPACITY THAN A 10 YEAR STORM
- MOST CHANNELS ARE LESS CAPACITY THAN A 10 YEAR STORM
- CHANNELS CAN BE IMPROVED TO INCREASE CAPACITY
- STRUCTURES MUST BE REPLACED TO ACCOMMODATE THE INCREASE CAPACITY
- ADDITIONAL STORM SEWER IN PROBLEMATIC AREAS MUST BE ADDED
- REGIONAL DETENTION WILL ONLY BE EFFECTIVE AFTER 10 YEAR STORM IMPROVEMENTS

PROPOSED DRAINAGE IMPROVEMENTS

NOVEMBER 19, 2014



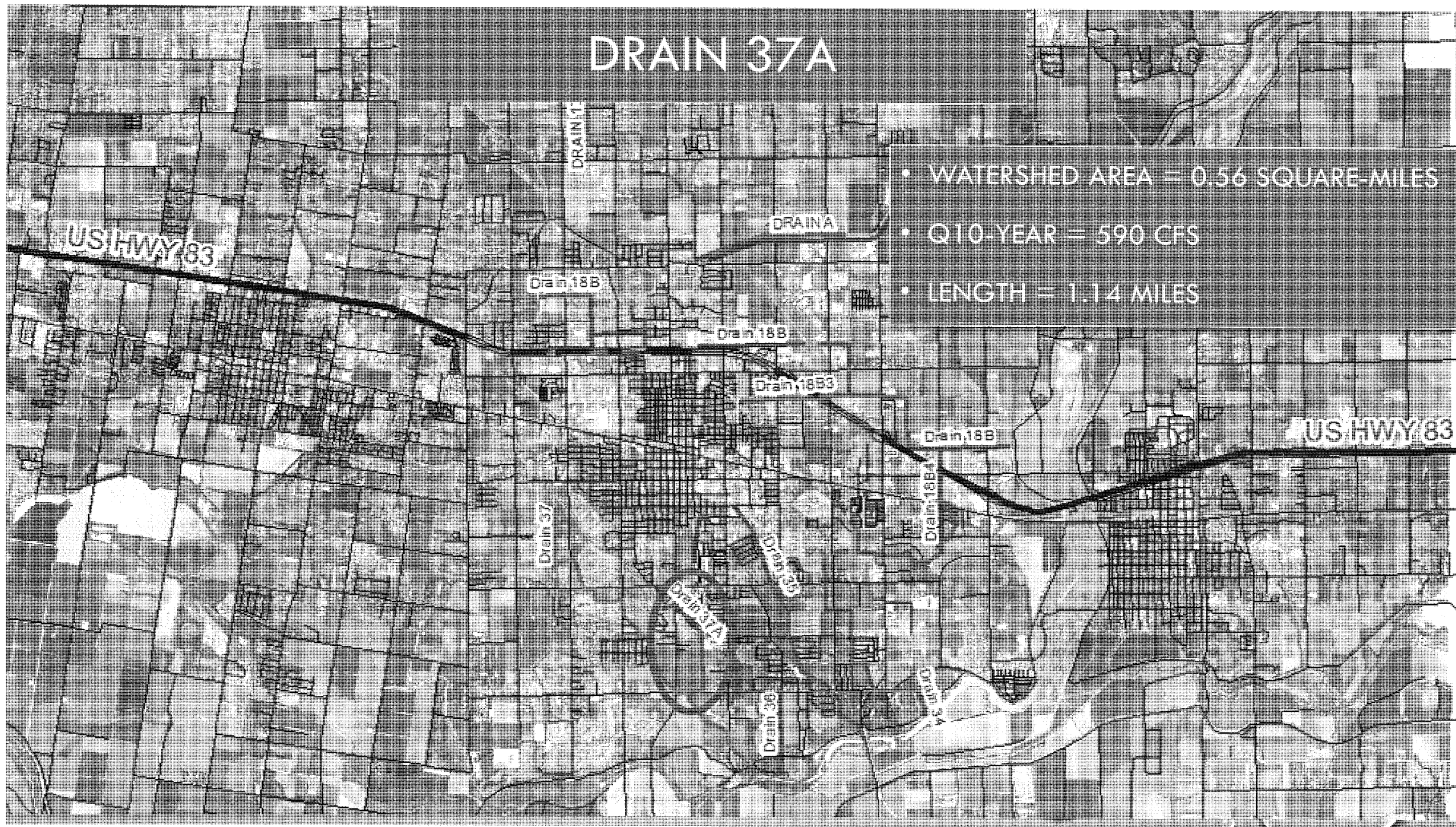


PROPOSED IMPROVEMENTS- DRAIN 37

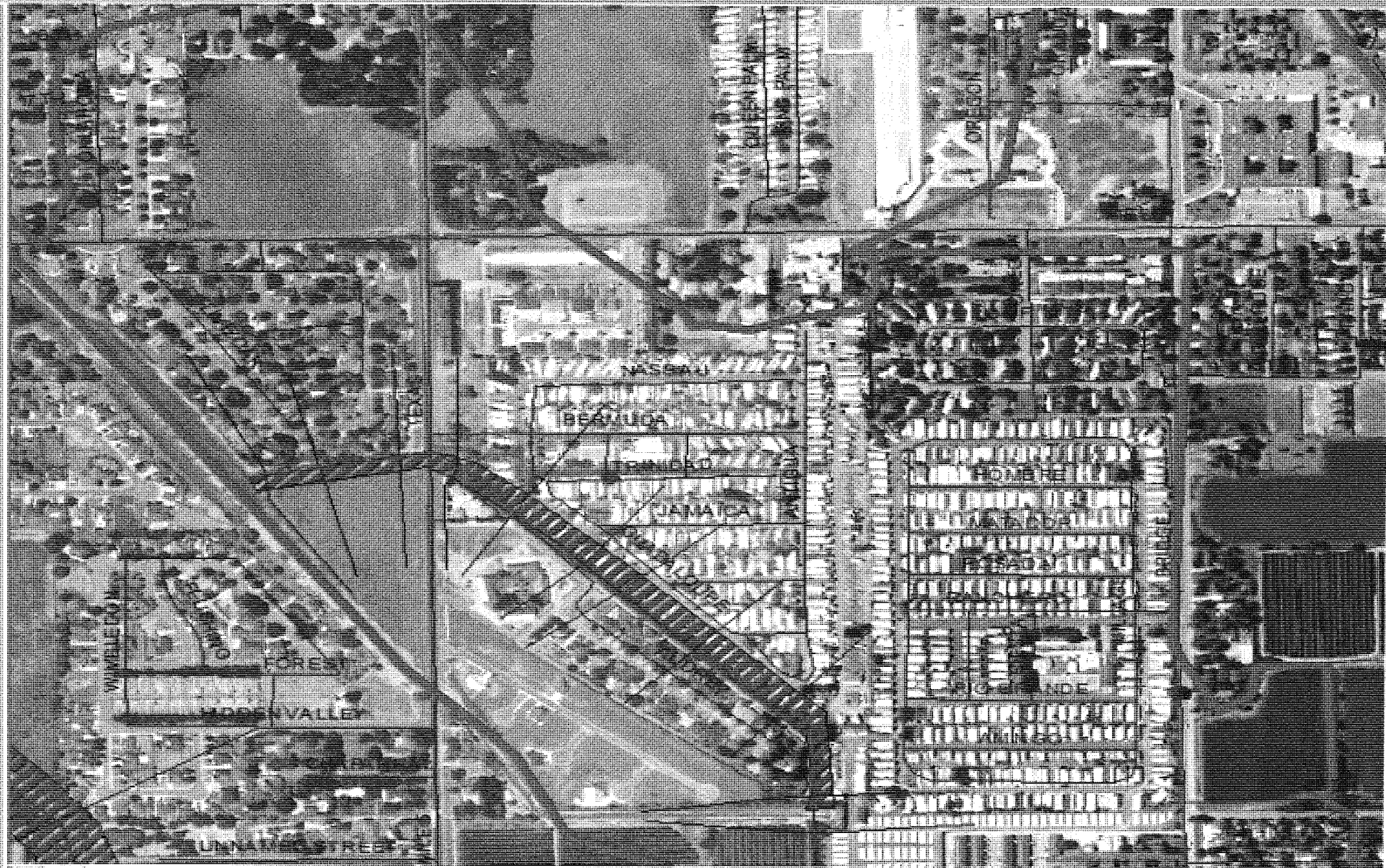
PROPOSED SOLUTION

1. REGIONAL DETENTION FOR 10-YR AND UP TO 50-YR
2. PROPOSE A 100-FOOT CHANNEL BOTTOM FOR THE ENTIRE CHANNEL TO CAPTURE 10-YR
3. ALL 12 STRUCTURES NEED UPGRADES TO TAKE 10-YEAR FLOWS.
4. BUYOUTS NECESSARY ALONG THE CHANNEL WHERE HOMES ARE TOO CLOSE TO DRAIN FOR PROPOSED CHANNEL IMPROVEMENTS.





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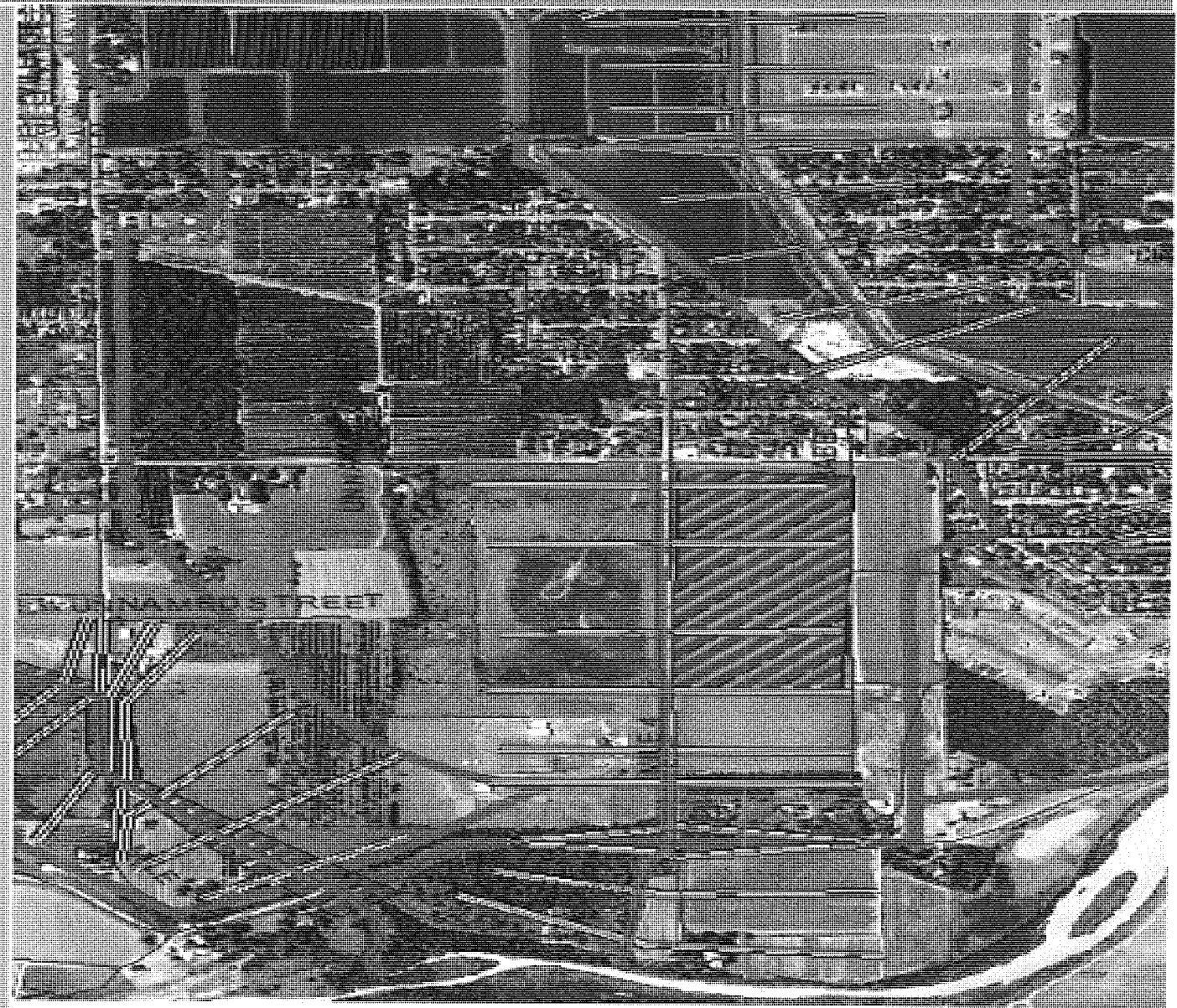
DRAIN 36

- WATERSHED AREA = 0.892 SQUARE-MILES
- Q10-YEAR = 328 CFS
- LENGTH = LESS THAN A MILE
- GOES UNDER A 20' TALL LEVEE AT THE CONFLUENCE.

PROPOSED IMPROVEMENTS- DRAIN 36

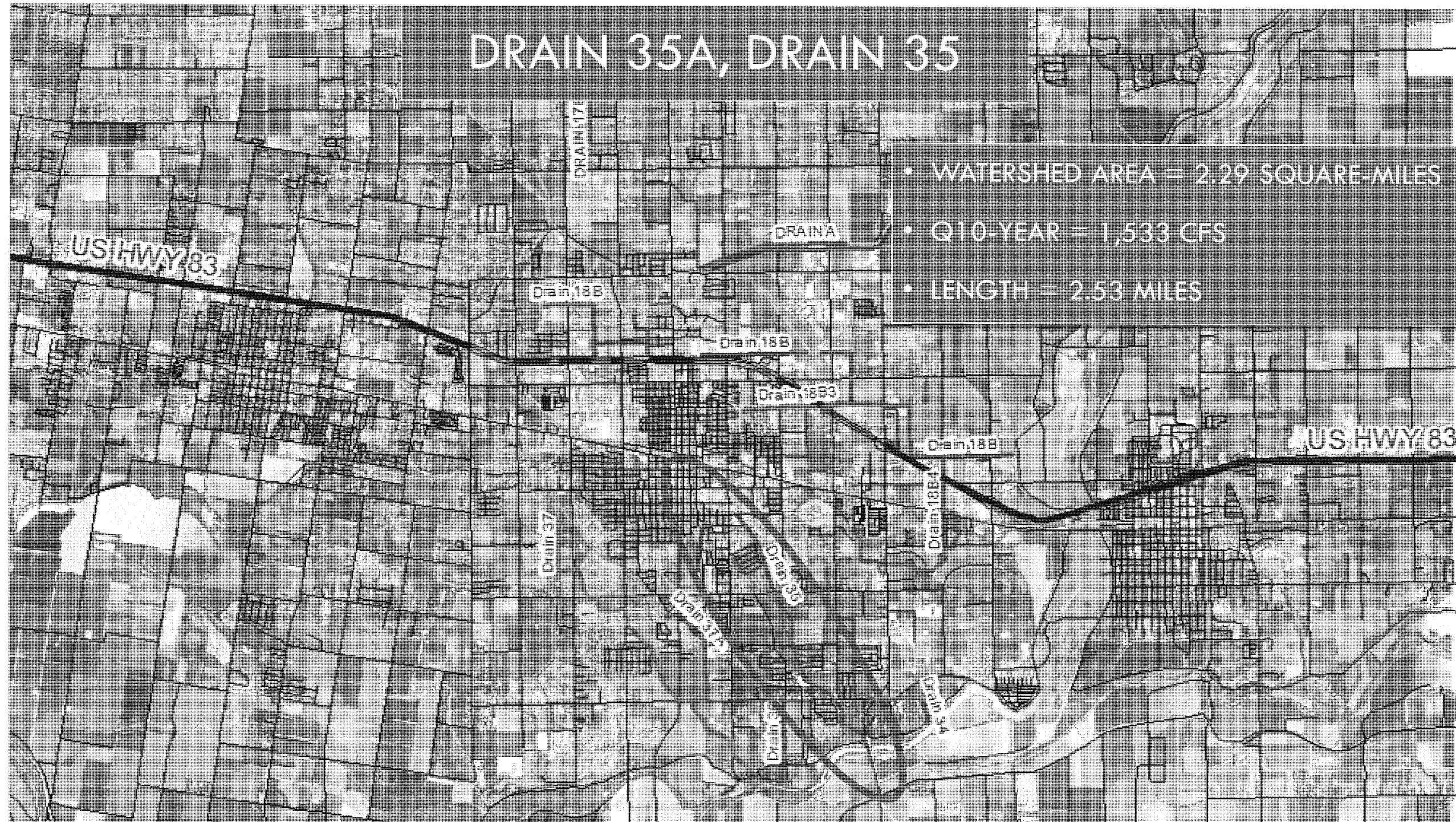
PROPOSED SOLUTION

1. CHANNEL HAS CAPACITY TO HANDLE 10-YR AND ABOVE IF STRUCTURES ARE REPLACED WITH LARGER CULVERTS.
2. ALL 3 STRUCTURES ON THE DRAIN NEED UPGRADES TO TAKE 10-YEAR FLOWS.
3. NATURALLY OCCURRING FLOODPLAIN ON THE LEFT OVER BANK NEEDS TO BE USED FOR REGIONAL DETENTION OF 10-YR AND 50-YR STORMS.

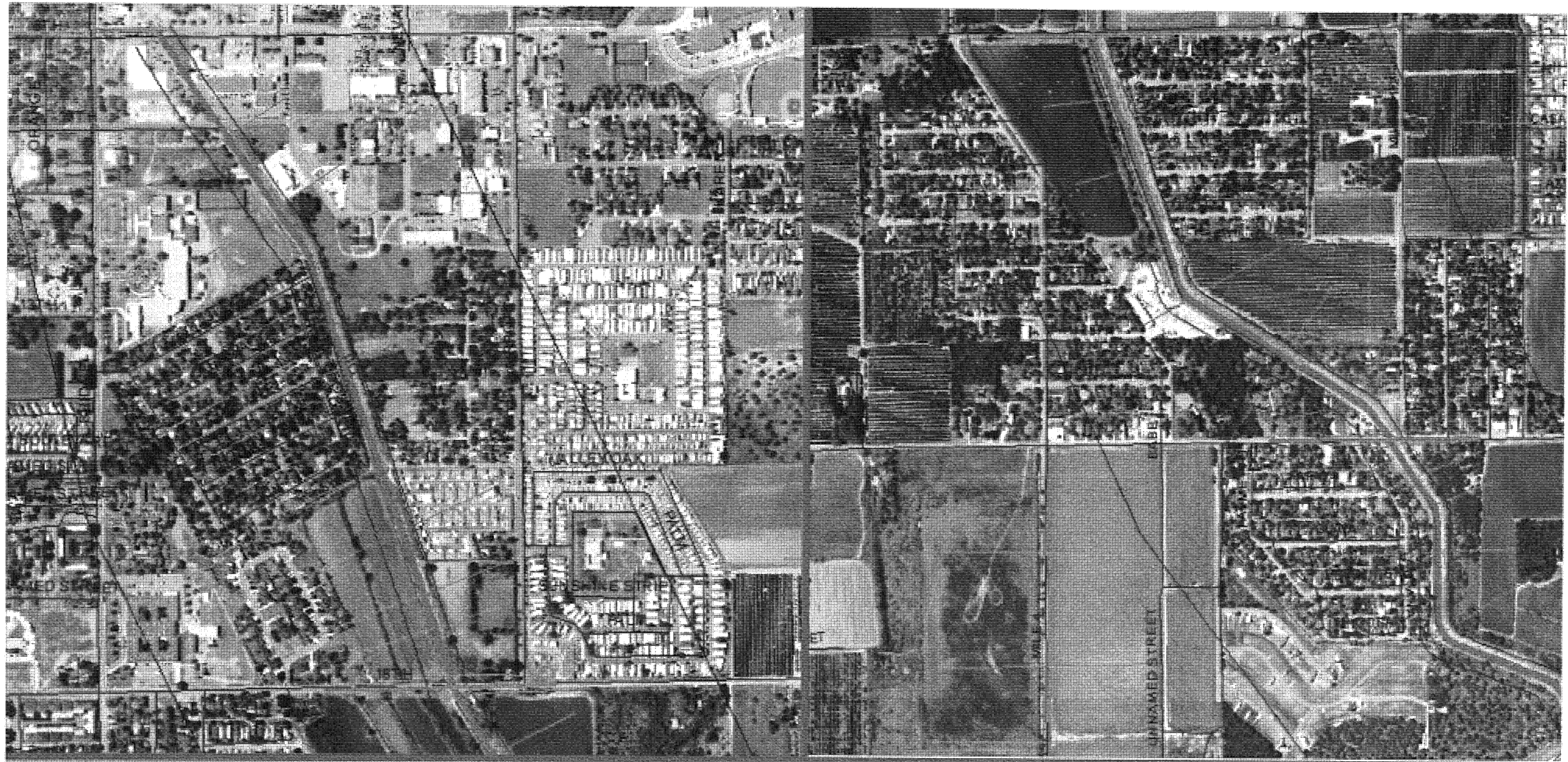


DRAIN 35A, DRAIN 35

- WATERSHED AREA = 2.29 SQUARE-MILES
- Q10-YEAR = 1,533 CFS
- LENGTH = 2.53 MILES







SEVERAL HOMES NEXT TO THE DRAIN 35;
POTENTIAL FOR SIGNIFICANT FLOODING IN UPPER REACH.

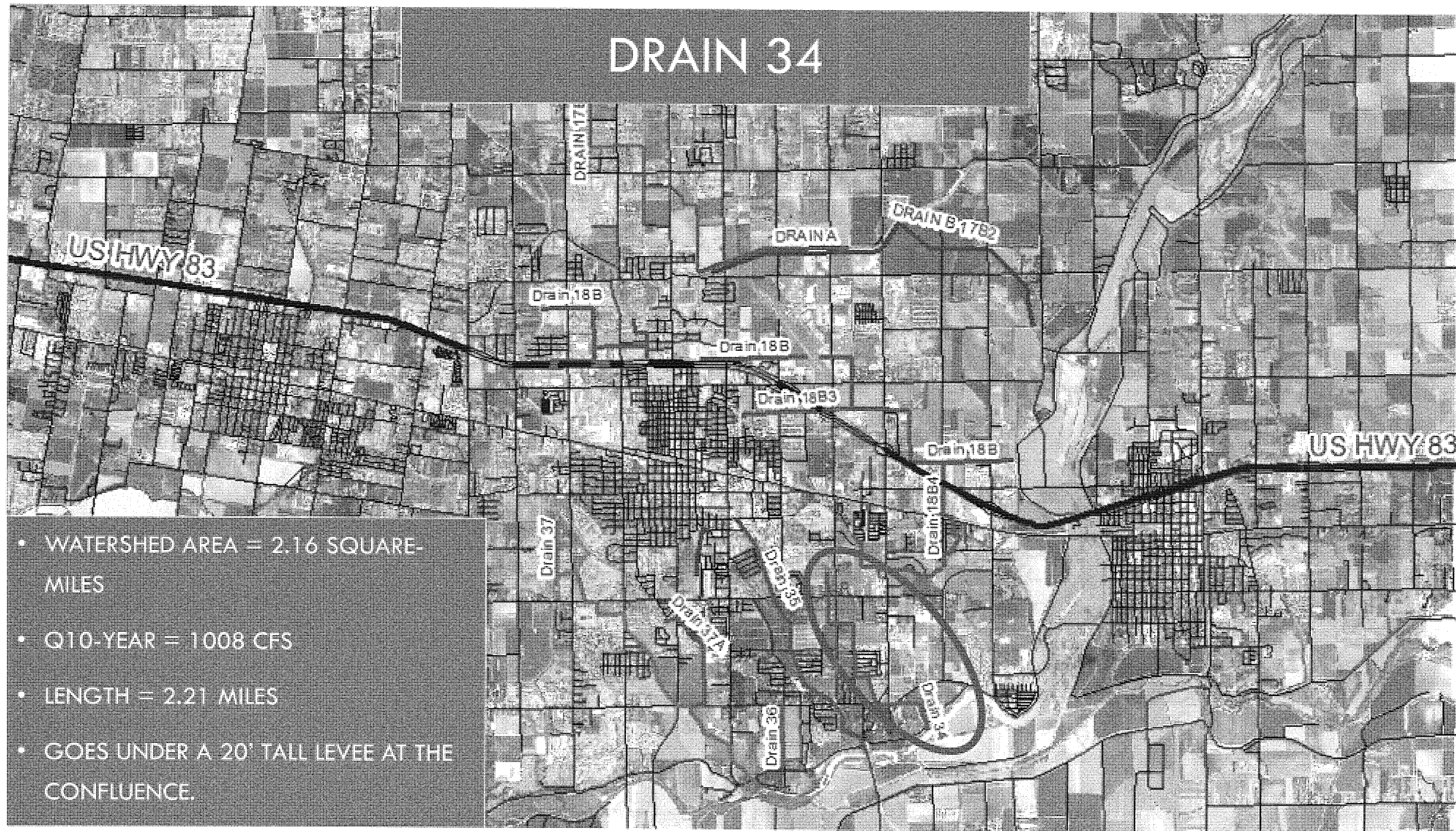
PROPOSED IMPROVEMENTS- DRAIN 35A, DRAIN 35

PROPOSED SOLUTION

1. BUYOUTS OF HOMES DOWNSTREAM OF CEMETERY ON DRAIN 35 A, HOMES NEXT TO DRAIN 35 ARE NECESSARY.
2. USE THESE BUYOUT SPACES TO PUT A PARK FOR REGIONAL DETENTION.
3. ONLY THE MOST UPSTREAM STRUCTURE ON DRAIN 35 AND THE ONE UNDER LEVEE WHERE IT OUTFALLS TO NEEDS TO BE REPLACED TO CARRY 10-YEAR FLOW.
4. STORMDRAIN CONNECTING DRAIN 35A AND DRAIN 35 NEEDS TO GO INTO PROPOSED DETENTION POND / PARK.



Map navigation icons: a square, a circle, a magnifying glass, a double arrow, and a left arrow.

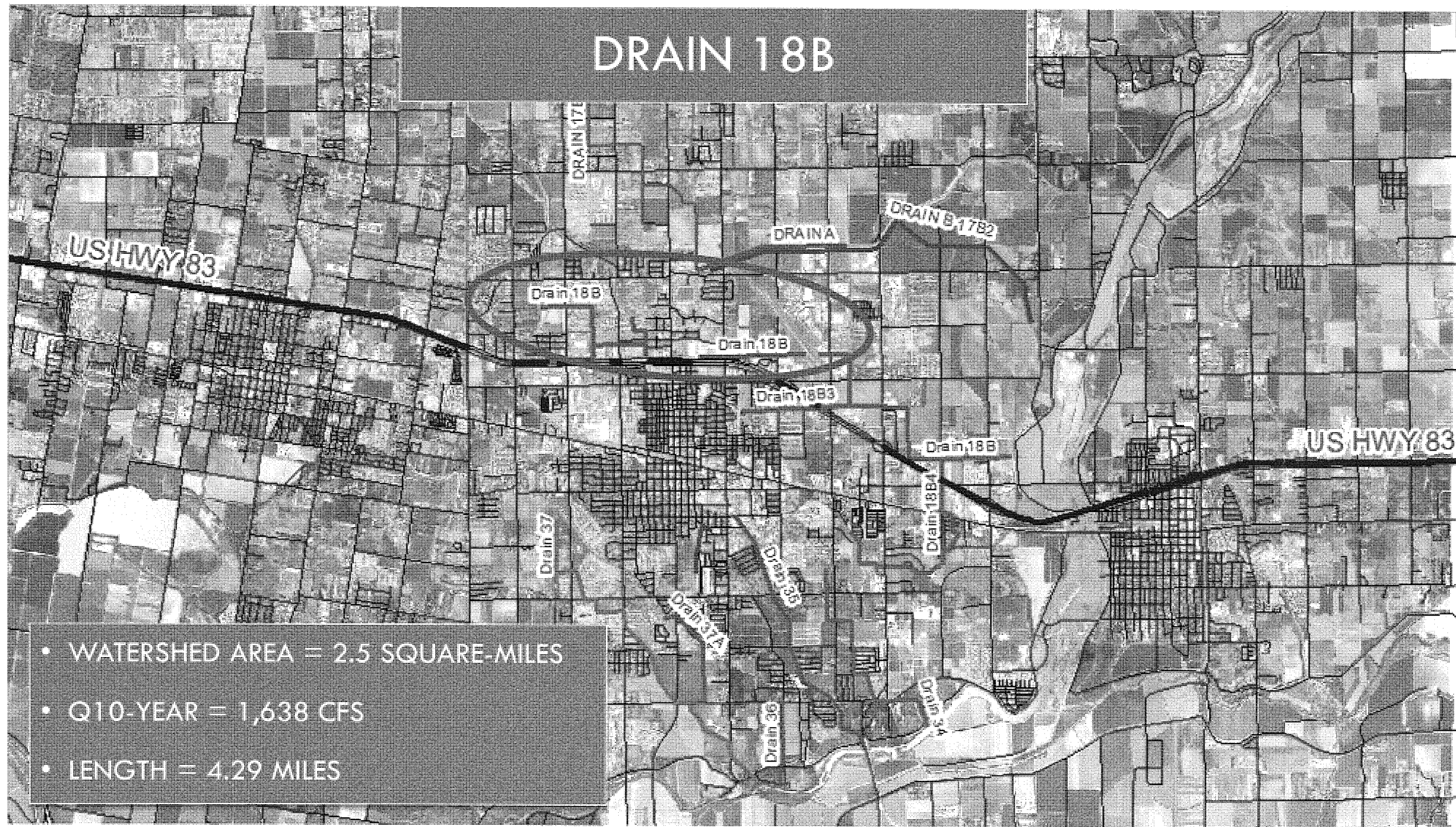


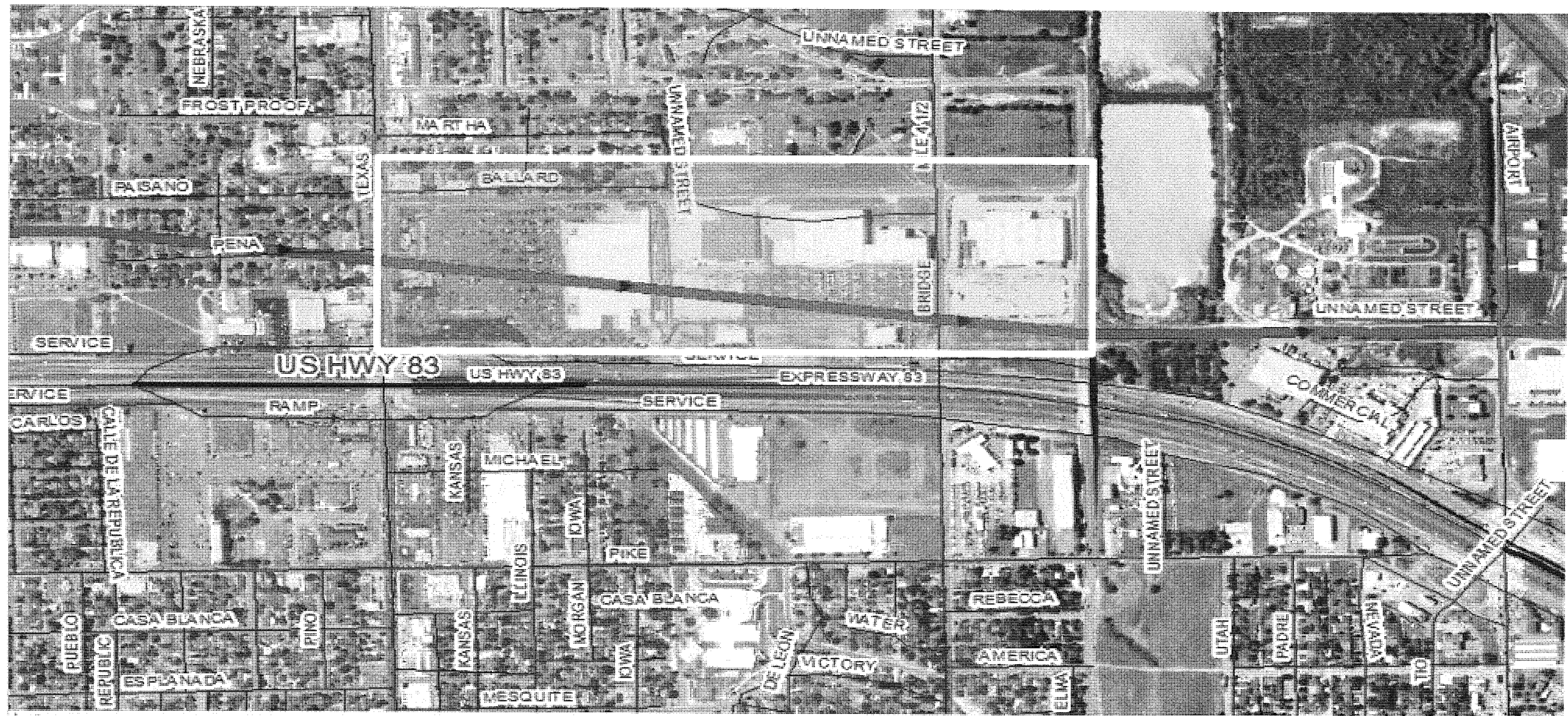
PROPOSED IMPROVEMENTS- DRAIN 34

PROPOSED SOLUTION

1. CHANNEL NEEDS TO BE DEEPEMED 3-FEET AND WIDENED TO ABOUT A 50-FOOT BOTTOM WIDTH.
2. ALL 7 STRUCTURES ON THE DRAIN NEED UPGRADES TO TAKE 10-YEAR FLOWS.
3. TWO OPEN SPACES WERE IDENTIFIED FOR REGIONAL DETENTION TO OFFSET INCREASES IN FLOWS DOWNSTREAM FROM CHANNEL IMPROVEMENTS.







LONG STORMDRAIN RUNS UNDERGROUND FOR OVER A MILE. LOT OF OVERLAND FLOODING IN THIS AREA.

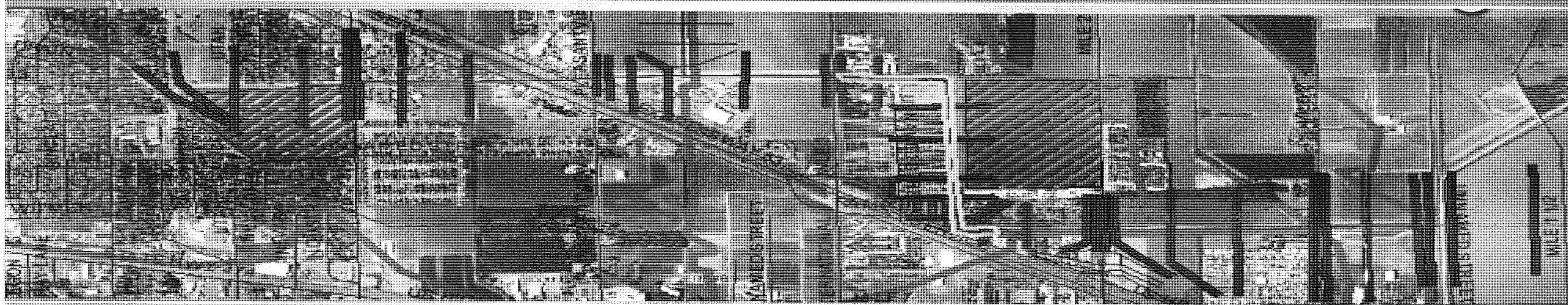
PROPOSED IMPROVEMENTS- DRAIN 18B

- **PROPOSED SOLUTION**
 1. CHANNEL NEEDS TO BE WIDENED TO ABOUT A 50 TO 100-FOOT BOTTOM WIDTH FOR THE ENTIRE LENGTH.
 2. ALL 7 STRUCTURES ON THE DRAIN NEED UPGRADES TO TAKE 10-YEAR FLOWS.
 3. THREE OPEN SPACES WERE IDENTIFIED FOR REGIONAL DETENTION TO OFFSET INCREASES IN FLOWS DOWNSTREAM FROM CHANNEL IMPROVEMENTS AND TO OFFSET 50-YEAR FLOWS.
 4. THIS BASIN WILL NEED A STORMSEWER NETWORK WITH INLETS AND UNDERGROUND STORMDRAINS.

- **PROPOSED SOLUTION**
 1. CHANNEL NEEDS TO BE WIDENED TO ABOUT A 50 TO 100-FOOT BOTTOM WIDTH FOR THE ENTIRE LENGTH.
 2. ALL 7 STRUCTURES ON THE DRAIN NEED UPGRADES TO TAKE 10-YEAR FLOWS.
 3. THREE OPEN SPACES WERE IDENTIFIED FOR REGIONAL DETENTION TO OFFSET INCREASES IN FLOWS DOWNSTREAM FROM CHANNEL IMPROVEMENTS AND TO OFFSET 50-YEAR FLOWS.
 4. THIS BASIN WILL NEED A STORMSEWER NETWORK WITH INLETS AND UNDERGROUND STORMDRAINS.

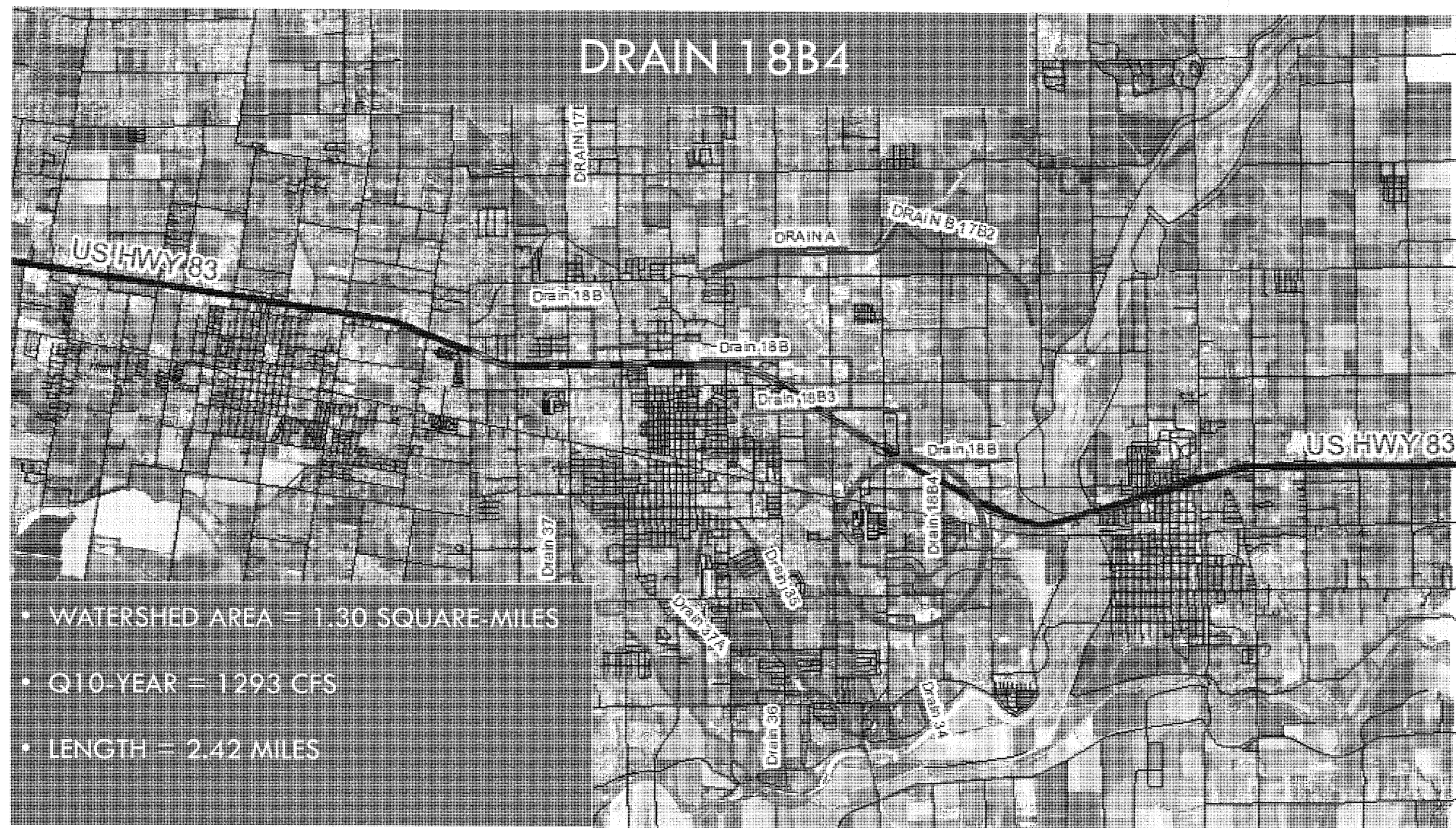


PROPOSED IMPROVEMENTS- DRAIN 18B3



- PROPOSED SOLUTION

1. TWO AREAS WERE IDENTIFIED FOR REGIONAL DETENTION.
2. MOST OF THE CHANNEL HAS CAPACITY FOR 10-YR. PROPOSING LIMITED CHANNEL IMPROVEMENTS.
3. UPGRADE ALL CROSSINGS TO CARRY 10-YEAR FLOW.

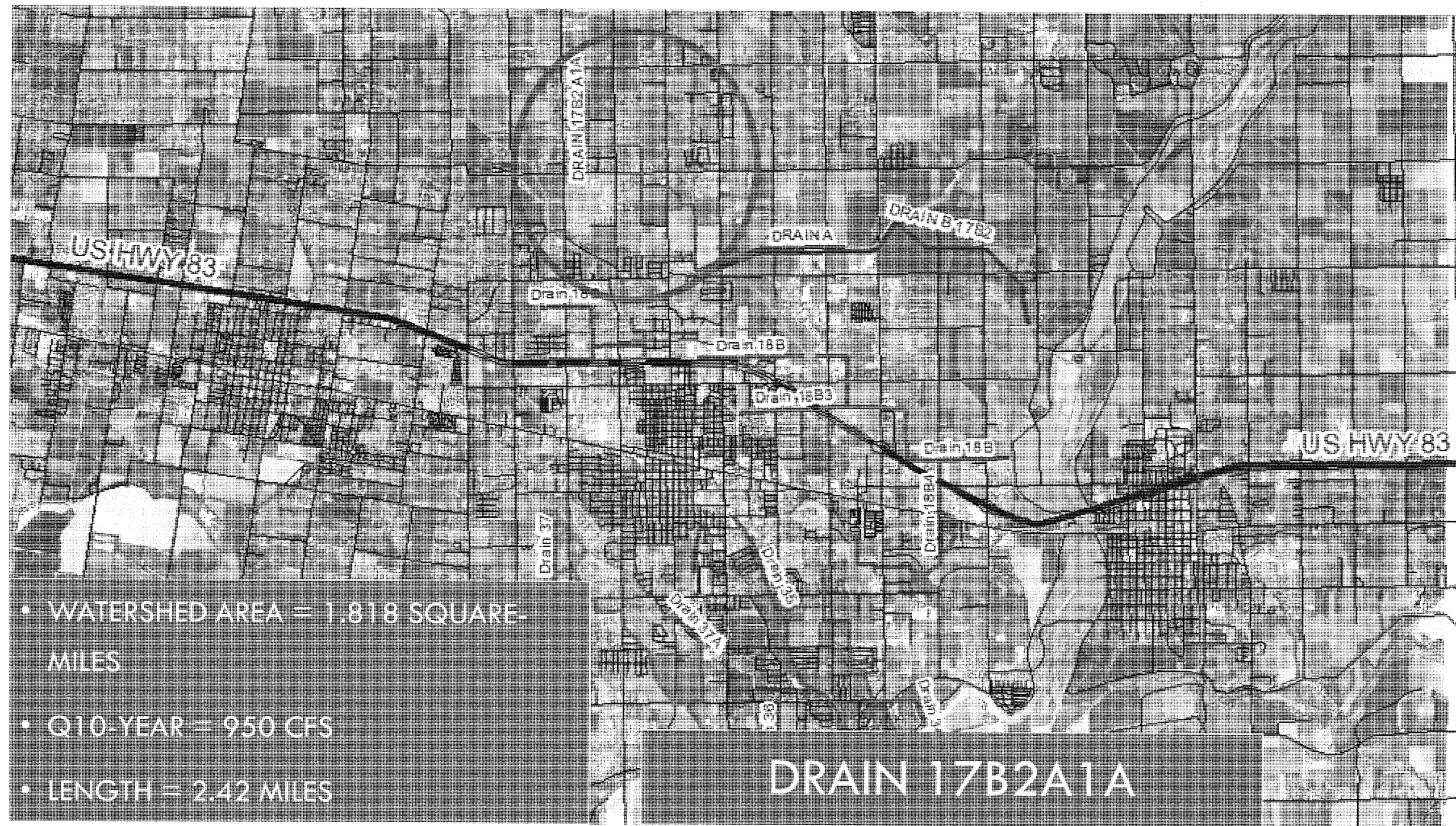


PROPOSED IMPROVEMENTS- DRAIN 18B4

PROPOSED SOLUTION

1. ONE AREA WAS IDENTIFIED FOR REGIONAL DETENTION OF 10- AND 50-YR FLOWS.
2. 50 FOOT CHANNEL BOTTOM IS PROPOSED FOR ALMOST THE ENTIRE DRAIN.
3. UPGRADE ALL 13 CROSSINGS TO CARRY 10-YEAR FLOW.

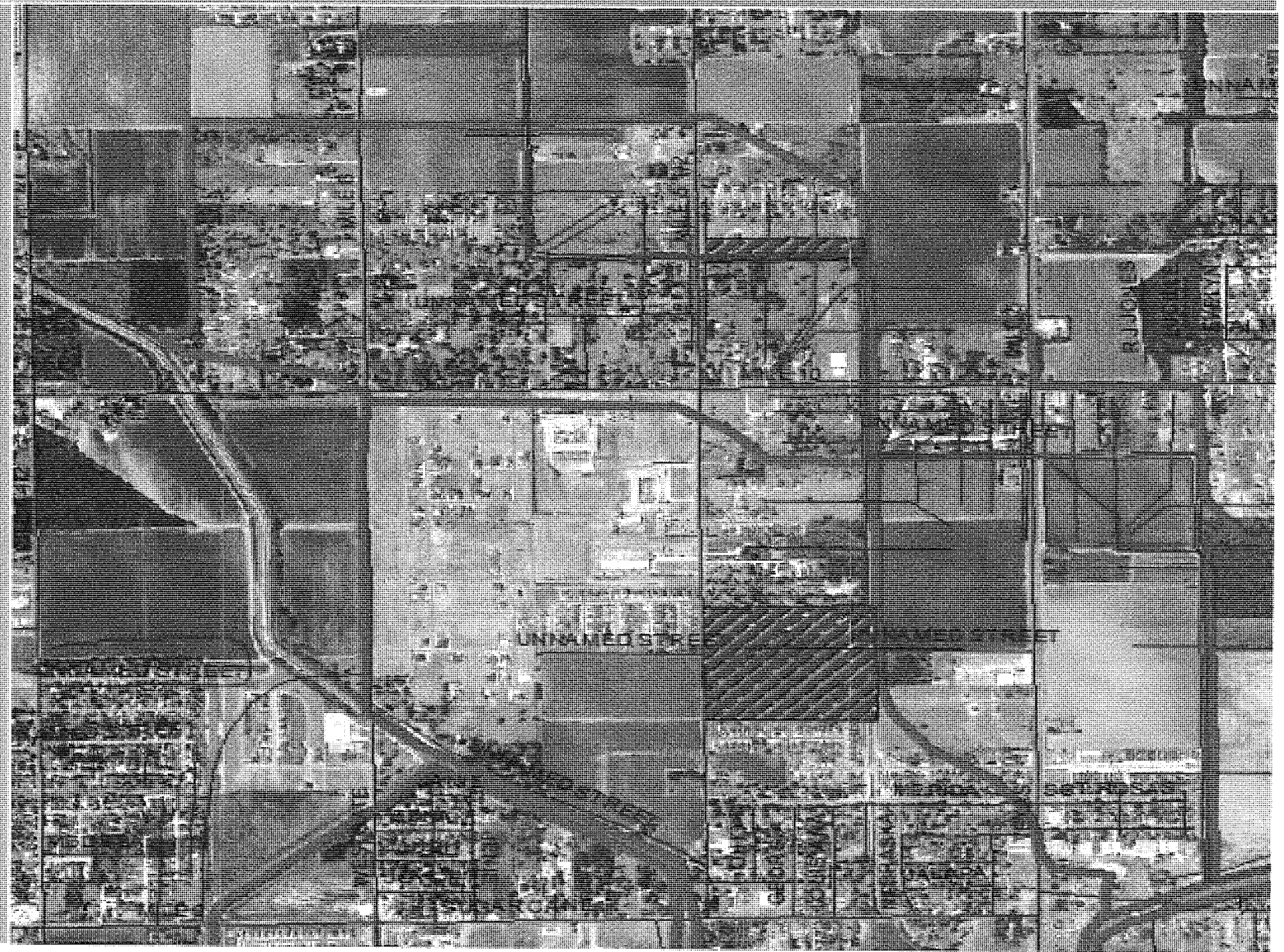


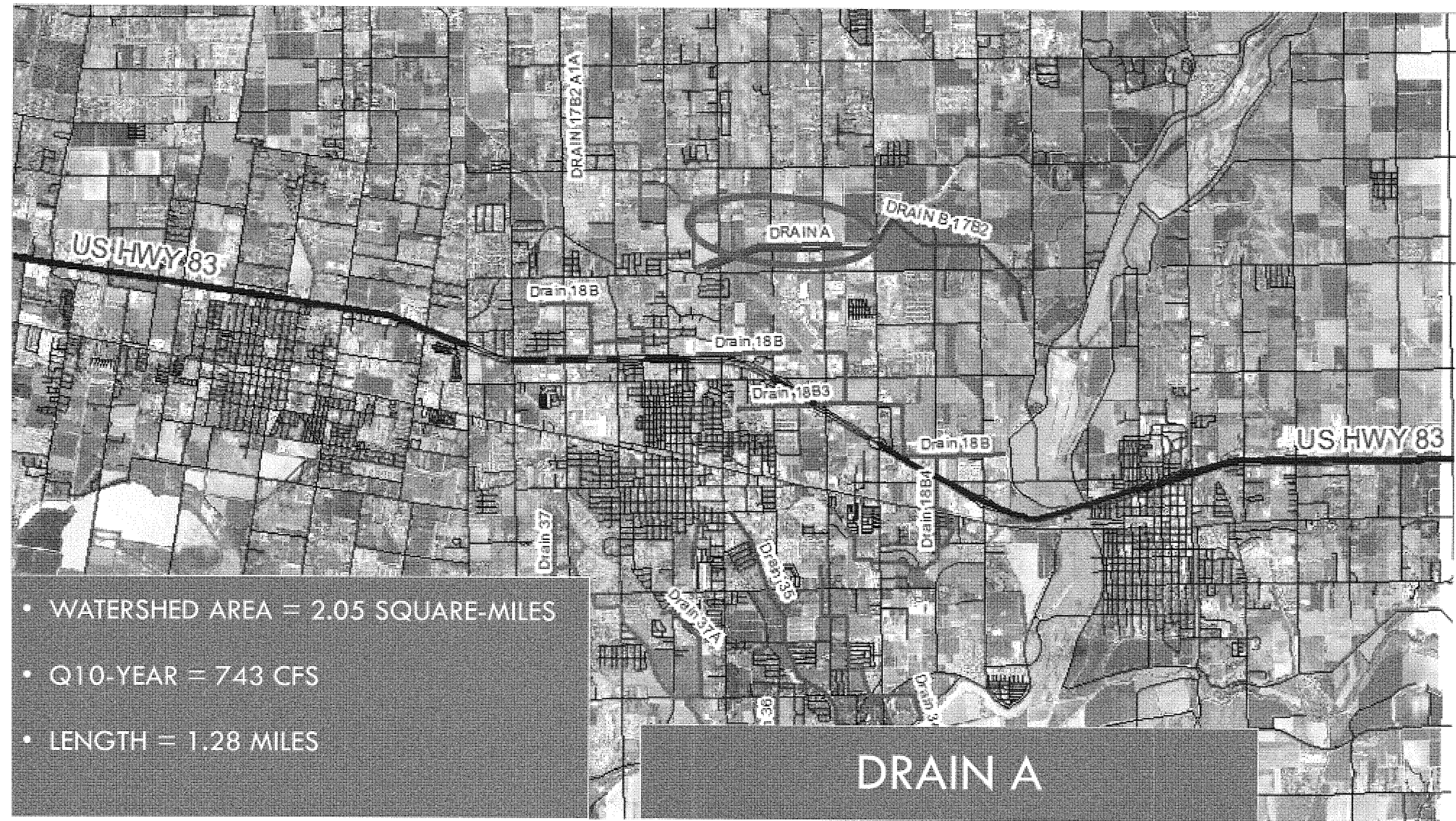


PROPOSED IMPROVEMENTS- DRAIN 17B2A1A

PROPOSED SOLUTION

1. ONE AREA WAS IDENTIFIED FOR REGIONAL DETENTION OF 10- AND 50-YR FLOWS OF MOST OF THE SUB-BASIN.
2. 50 FOOT CHANNEL BOTTOM IS PROPOSED ON A LIMITED SECTION OF THE DRAIN AS SHOWN.
3. UPGRADE ALL 3 CROSSINGS TO CARRY 10-YEAR FLOW.



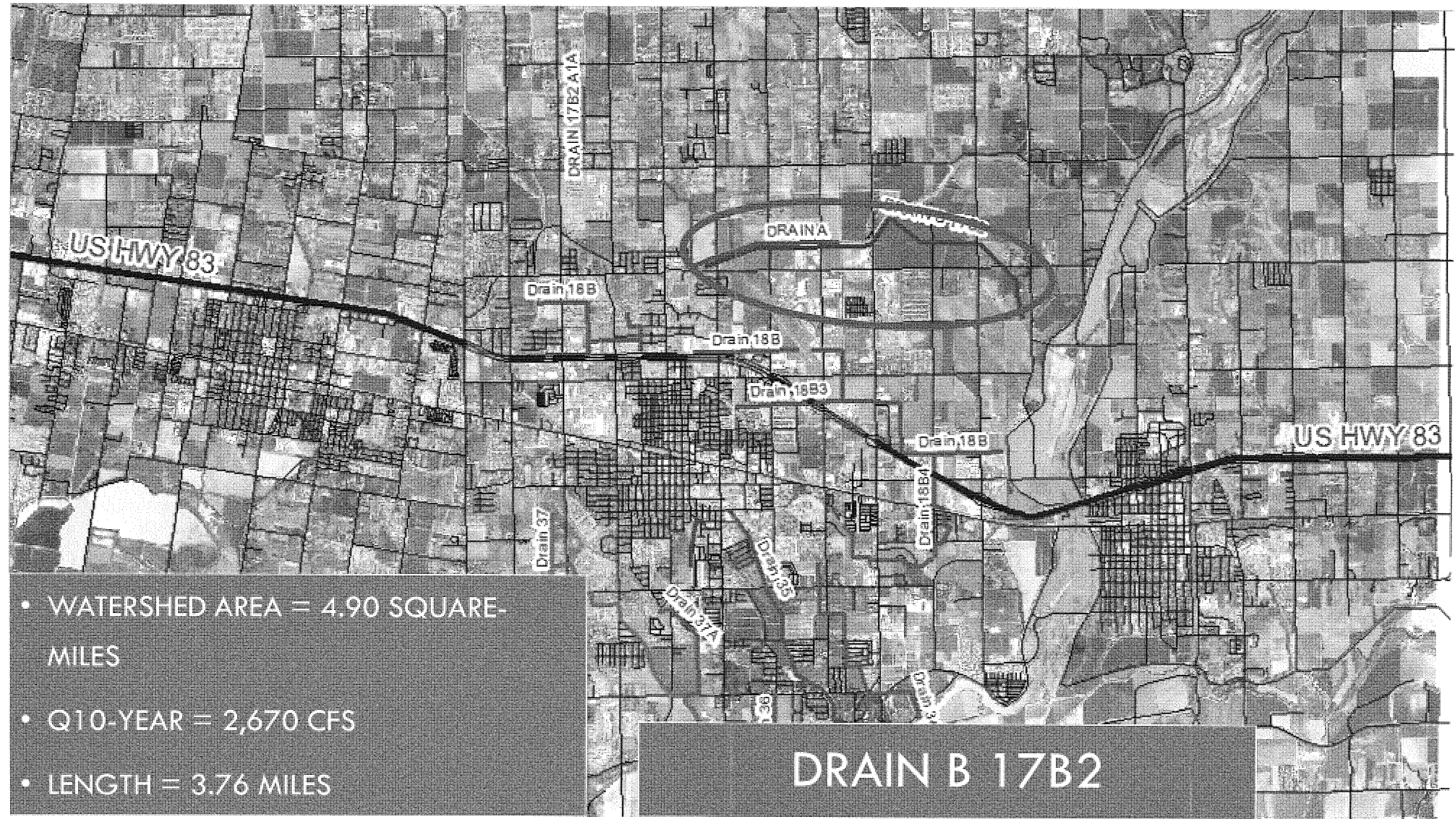


PROPOSED IMPROVEMENTS- DRAIN A

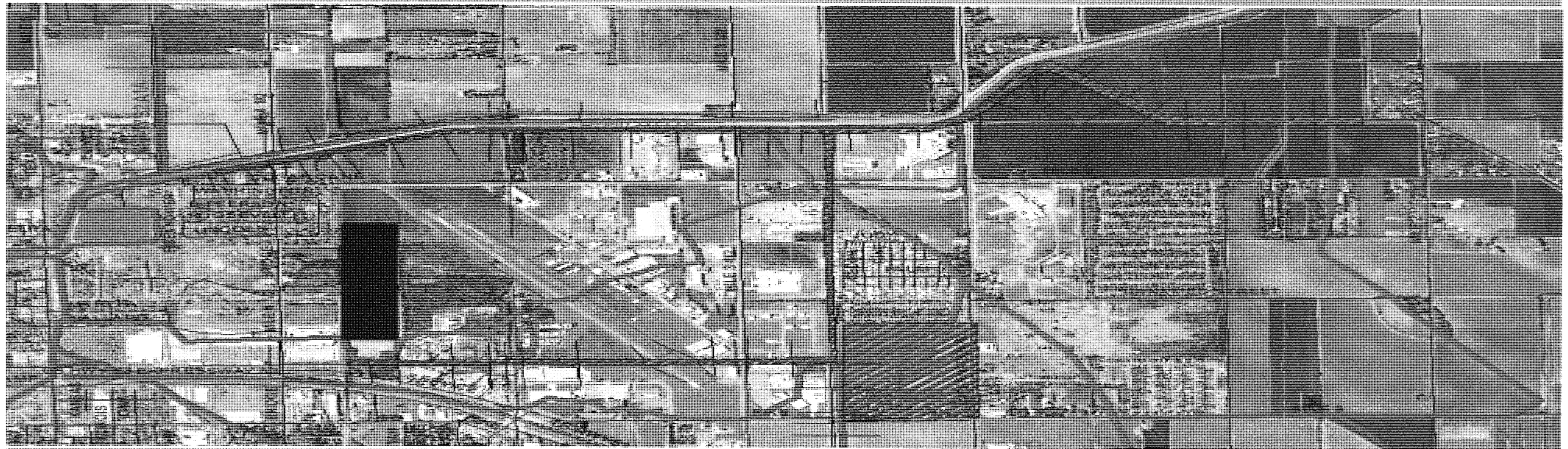
PROPOSED SOLUTION

1. IMPROVEMENTS ON DRAIN 17B2A1A UPSTREAM WILL HELP DRAIN A.
2. LIMITED CHANNEL WIDENING FOR ABOUT 1000 FEET, 50-FOOT WIDE CHANNEL BOTTOM.
3. UPGRADE ALL 2 CROSSINGS TO CARRY 10-YEAR FLOW.
4. MAINTENANCE IS REQUIRED ON THIS CHANNEL AS THERE IS LOT OF GROWTH AND VEGETATION.





PROPOSED IMPROVEMENTS- DRAIN B 17B2

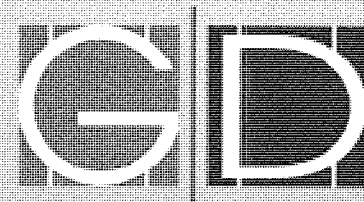


PROPOSED SOLUTION

1. CHANNELIZATION FOR THE ENTIRE DRAIN 100 FOOT BOTTOM ON THE LOWER HALF REACH; 50 FOOT BOTTOM ON THE UPPER HALF.
2. UPGRADE ALL 6 CROSSINGS TO CARRY 10-YEAR FLOW.
3. A REGIONAL DETENTION IDENTIFIED ON TRIBUTARY (18B) WILL OFFSET INCREASES IN DISCHARGES DOWNSTREAM.
4. EXISTING PONDS ON AIRPORT PROPERTY WILL BE FILLED.

Stream Name	Detention Area (acres)
Drain 37	80
Drain 36	36
Drain 35A – Drain 35	152
Drain 34 (Upstream)	32
Drain 34 (downstream)	15
Drain 18B (Most Upstream)	12
Drain 18B (Middle)	18
Drain 18B (Downstream)	75
Drain 18B3 (Upstream)	42
Drain 18B3 (Downstream)	61
Drain 18B4	45
Drain 17B2 A1A	35

DISCUSSION



GONZALEZ DE LA GARZA



City of Weslaco
Emergency Management Organization

