Prepared for the City of Taylor

CITY OF TAYLOR

DRAINAGE MASTER PLAN

AVO 36762
SEPTEMBER 2022 - FINAL

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CITY OF TAYLOR
DRAINAGE MASTER PLAN

REPORT

CITY OF TAYLOR
DRAINAGE MASTER PLAN
FOR THE
CITY OF TAYLOR, TEXAS

Prepared by

HALFF ASSOCIATES, INC.

AVO 36762
SEPTEMBER 2022 - FINAL

September 2, 2022 AVO 36762

Brian LaBorde
City Manager
City of Taylor

RE: City of Taylor – Drainage Master Plan - **FINAL**

Dear Mr. LaBorde:

Halff Associates, Inc., is pleased to submit the **FINAL** Drainage Master Plan study to the City of Taylor. This report includes documentation of drainage problem locations based on existing information, drainage complaints, known areas of flooding, and our hydrologic and hydraulic analyses, including a 2D rapid assessment. Based on this information, Halff prepared conceptual drainage solutions to address these issues and to prioritize them for future incorporation into the City's Capital Improvement Project (CIP) plan. Finally, this study includes our analysis of the existing drainage utility fee rate and identification of possible fee modifications that may be needed for funding of maintenance and drainage CIP projects.

Halff appreciates the opportunity to be of service to you and the City of Taylor on this important project. Please do not hesitate to contact me at scrawford@halff.com if you have any questions or concerns regarding this study.

Sincerely,

HALFF ASSOCIATES, INC.
TBPELS FIRM No. 312

Stephen Crawford

Stephen Crawford, P.E. CFM
Vice President

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EXECUTIVE SUMMARY

The City of Taylor has a history of riverine flooding problems along the major streams that flow through the city and local flooding problems due to undersized and inadequate drainage infrastructure to handle larger flood events. The population of Taylor has increased over time, with a current population of over 16,000. Increased development over time has led to more stormwater runoff, producing greater volumes of stormwater in local drainage systems and higher water surface elevations in local streams that, in turn, have created a greater flood risk to roadways, properties, and structures in the city. Additionally, newer development in the recent past has led to increased velocities in local streams that leave the channels more susceptible to flooding and erosion. As the City population grows and new development occurs, it is more important than ever that the City plan for flood risk.

This Drainage Master Plan includes a comprehensive evaluation of the existing drainage conditions, both riverine and local, throughout the city by developing a better understanding of the drainage infrastructure and its capacities. Based on our evaluation and simulations of flooding in the city, flood problem areas were identified, and conceptual flood mitigation solutions were developed. The Drainage Master Plan considered the current Municipal Drainage Utility System (MDUS) and Public Input Locations, along with riverine and 2D hydraulic model data, to help prioritize the conceptual drainage solutions. Drainage solutions developed in this plan have been ranked and prioritized, and they include opinions of probable construction cost for implementation into the City of Taylor's Capital Improvement Project (CIP) plan. The prioritized list of flood mitigation solutions is shown below with further descriptions in the Drainage Solutions section of the report.

Project No.	Local Project ID and Location	OPCC
1	Bull Branch & Donna Channel*	$6,032,385
2	Kimbro/Shaw Street - 2nd St	$5,188,110
3	Mallard Lane	$1,916,860
4	Annie Street - 2nd Street	$3,092,650
5	KBI Pond Improvements*	$227,180
6	Bel Air Drive	$1,057,490
7	Davis Street South - 2nd Street	$5,035,240
8	Burkett Street	$352,530
9	Velma Drive	$1,082,320
10	TH Johnson Drive	$597,800
11	Old Thorndale Road	$434,050
12	Tammi Lane	$1,151,740
13	Gabriel Street	$74,330
14	North Drive	$665,370
15	McLain Street	$857,630
16	Mariposa Lane	$594,630
17	Otis Street	$654,830
18	Travis Street	$670,690
19	Debus Drive	$1,229,870
20	Davis Street North	$74,190
21	Sandy Lane	$3,212,200
22	West Mustang Street	$593,930
23	North Main Street	$58,660
* Information provided by HDR, Inc.		**$34,854,685**

Additional drainage considerations for the City of Taylor include recommendations on alternative drainage solutions, such as regional and local detention, a storm drainage maintenance plan, and stream erosion. Local and/or regional detention is recommended to be evaluated as new development occurs in the City, but it should be noted that these detention areas should not be considered to solve existing drainage issues but instead to provide a solution that will provide a no adverse drainage impact for the incoming development. The recommendations on the storm drainage maintenance plan include routine and remedial actions on existing drainage systems and Capital Improvement Projects to replace deficient systems, such as those recommended in this Drainage Master Plan. Stream erosion recommendations focus on monitoring identified areas throughout the City that could lead to negative impacts on existing infrastructure and for new development areas.

Another key component of this Drainage Master Plan is the analysis of the City of Taylor's existing drainage utility fee rate and a determination of what fee modifications, if any, may be needed for funding of desired maintenance and drainage CIP projects. Information is provided in this study for the City's consideration. Recommendations from the Drainage Master Plan include:

1. Updating the impervious layer in the Drainage Utility billing to collect all potential revenue for drainage activities
2. Updating the City's utility billing system to include the new/updated billing accounts
3. Performing an annual review of the impervious layer and incorporating new or revised impervious area within the City's GIS layer and update the billing system accordingly
4. Reviewing and updating the Drainage Utility once every five years

Drainage utility fee updates, implementation or outreach is not included as part of the Drainage Master plan but can continue to be implemented based on the information presented and recommendations provided.

1.0 INTRODUCTION

The City of Taylor is located in Williamson County in the Brushy Creek watershed and encompasses an area of approximately 20.6 square miles. Taylor has experienced growth over time with more significant growth recently. As of the 2020 U.S. Census, it is estimated that over 16,000 people reside in the city limits. With a growing population in Williamson County and the introduction of large industries moving into the area, it is expected that population growth will continue an upward trend. As population growth and jobs move into the area, the watersheds in Taylor will become more urbanized. Today's flow patterns may change because of new development, and stormwater runoff could increase in local storm drainage systems and creeks. See **Figure 1.1** for a map of the City of Taylor and its local stream network.

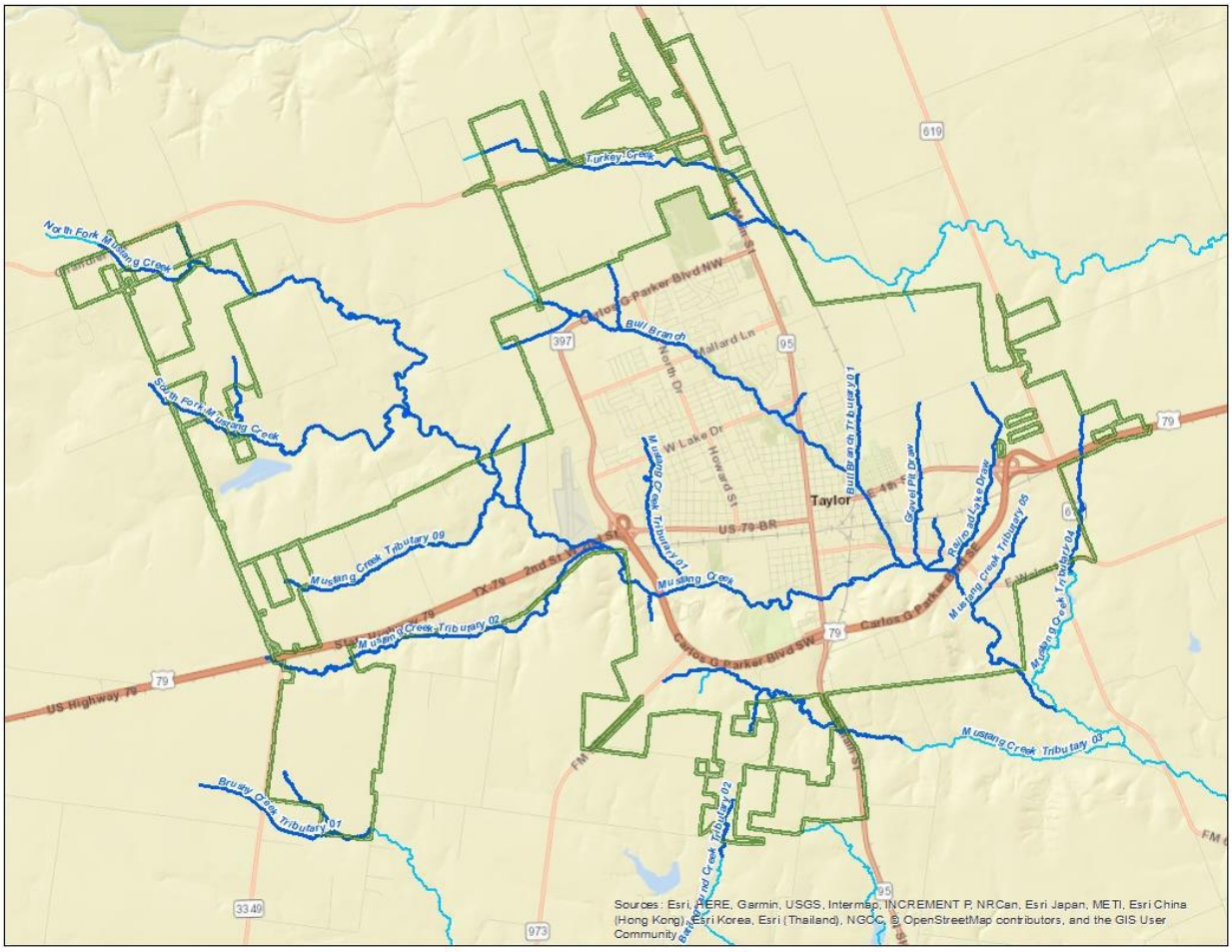


Figure 1.1 – City of Taylor and Local Stream Network

The City has a history of riverine and local flooding events. On May 25, 2015, the City of Taylor received a significant flood event while soils were saturated from previous rain events. This event caused flooding in the Bull Branch and Mustang Creek watersheds, and throughout the City, resulting in flood damages reported in 280 homes and an estimated $700,000 in flood damages incurred to city facilities, roadways, and properties. The City of Taylor has recently adopted local mitigation efforts to address flooding within the City. In 2019, the City enacted higher standards for their flood control ordinances, for the drainage criteria in their subdivision ordinance, and adopted a comprehensive drainage plan. These documented recent flooding events have provided evidence that the City's storm drainage infrastructure needs

attention and improvements. The method of addressing storm drainage infrastructure needs requires planning and prioritization so improvements can be performed strategically and within city funding and budget constraints. This Drainage Master Plan will identify specific prioritized drainage solutions that can be further analyzed and designed over time to meet the city's primary needs.

Flooding in the City of Taylor can occur either by local flooding along city streets and private properties or by riverine flooding along creek and channel corridors in the city. Local flooding is evident when streets flood or pond due to lack of sufficient drainage infrastructure. Local flooding can be shown by ponding of water in private properties or overflow of water as street flooding is trying to find its path to a downstream location. Large local flooding events can also damage homes. Riverine flooding is evident when floodwaters exceed channel banks and overtop local roadways. Floodplain areas often extend outside of existing channel banks. Properties and structures are often located in the fringes of the floodplain and are at risk when large flooding events occur.

To plan for drainage improvements more effectively and to consider regulatory measures aimed at minimizing adverse impacts from new projects, the City of Taylor is taking a proactive approach. As such, the City selected Halff Associates to prepare a Drainage Master Plan (DMP). The DMP was created to assist the City in evaluating the existing conditions of selected drainage infrastructure and to develop a drainage solutions Capital Improvement Project (CIP) plan to address identified flooding problems. This assessment includes a comprehensive inventory of existing data, hydrologic and hydraulic watershed model simulations, flooding problem area identification, and flood mitigation solutions.

Streams included in our hydrologic and hydraulic studies included Bull Branch and its tributaries, Mustang Creek and its tributaries, South Fork Mustang Creek and its tributaries, Turkey Creek and its tributaries, Railroad Lake Draw, Gravel Pit Draw, Brushy Creek Tributaries, and Battleground Creek Tributary. **Figure 1.2** is shown below with general limits of the major stream corridors in Taylor.

Figure 1.2 – Major Stream Corridors in the City of Taylor

1.1 NOAA ATLAS 14

The National Oceanic and Atmospheric Administration (NOAA) released Atlas 14, Volume 11 Precipitation-Frequency Atlas of the United States, Texas, in 2018. This study found increases in rainfall amounts in parts of Texas, including areas in Central Texas. The increases in rainfall amounts for the 100-year (1% Annual Chance Event or ACE) in Williamson County are shown below.

For this Master Plan, Halff utilized these new NOAA Atlas 14 rainfall values to help determine flood risks in the city and to help identify drainage problem locations. These new rainfall frequency values will help the City of Taylor better understand flood risk and more accurately plan and design infrastructure to minimize the threat of flooding in the city. **Figure 1.3** shows the differences in rainfall totals between the previous rainfall totals used for modeling and mapping of floodplains versus those of Atlas 14.

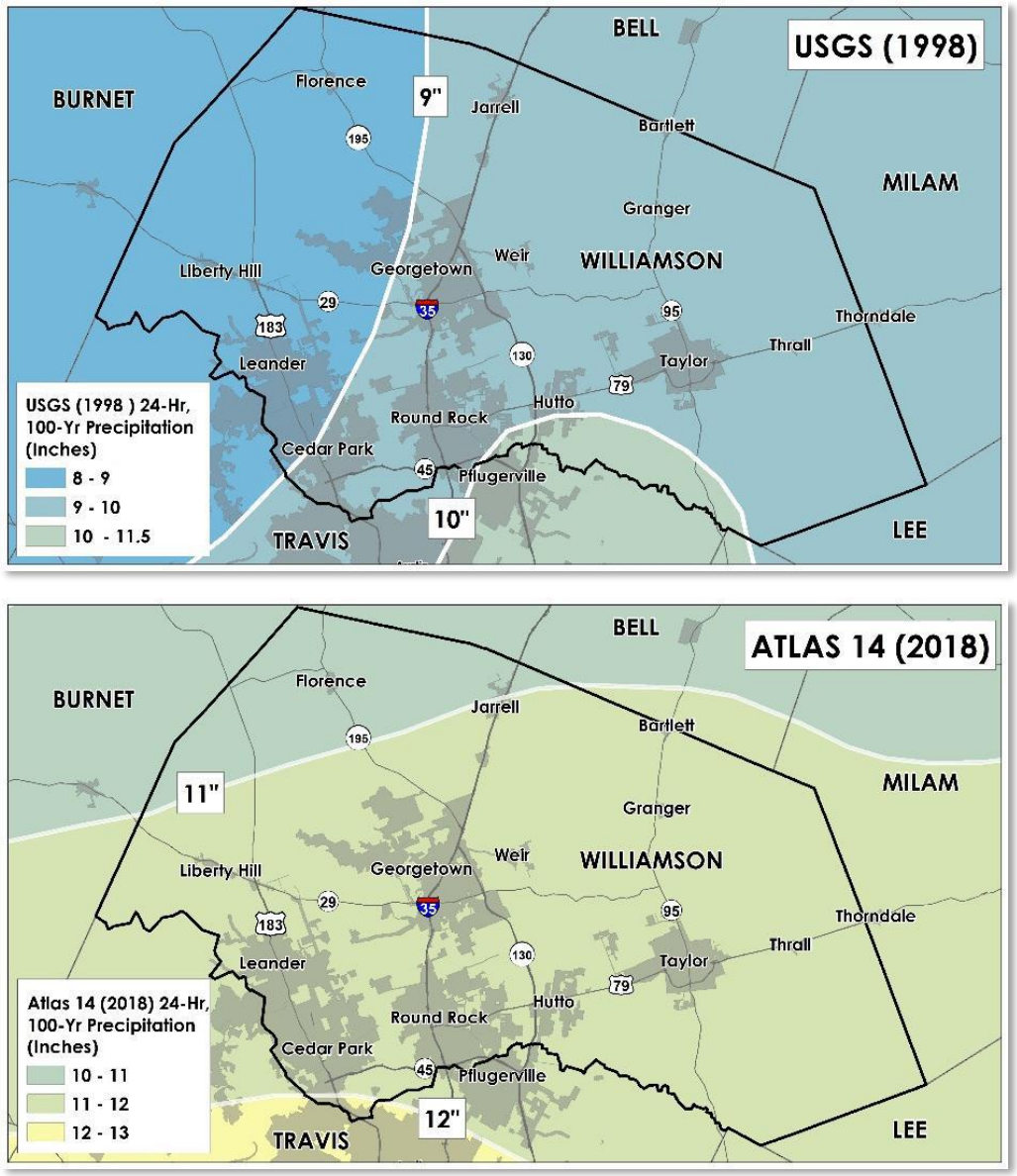


Figure 1.3 – Changes in 100-Yr Precipitation in Williamson County between USGS (1998) and NOAA Atlas 14 (2018)

When actual rainfall values are compared between USGS (1998) and NOAA Atlas 14 for various frequency storm events, it shows that the newer Atlas 14 values are significantly higher than the previous information available. For example, Atlas 14 100-year (1% ACE) rainfall is 11.1 inches over a 24-hour period, which is somewhere between a 100-year and 500-year event when compared to USGS rainfall amounts (#1 in **Table 1.1** below). When looking at the 25-year rainfall total for Atlas 14, it compares close to a 50-year rainfall total for USGS (#2 in **Table 1.1** below). To reflect flood risk more accurately in the City of Taylor, Halff utilized the rainfall totals shown in the more recent NOAA Atlas 14.

Frequency Event	Annual Chance Probability	Countywide Average 24-hour Precipitation Depths (inches)	
		USGS (1998)	ATLAS 14 (2018)
500-year	0.2%	12.9	16.1
100-year	1%	9.7	11.1
50-year	2%	8.5	9.5
25-year	4%	7.3	8.0
10-year	10%	5.9	6.3
5-year	20%	4.9	5.1
2-year	50%	3.4	3.9
1-year	100%	1.2	3.1

Table 1.1 – Comparison of Frequency Event Changes in 100-Yr Precipitation in Williamson County between USGS (1998) and NOAA Atlas 14 (2018)

1.2 PURPOSE AND GOAL OF THE DRAINAGE MASTER PLAN

The purpose and goal of the Drainage Master Plan (DMP) is to conduct a comprehensive evaluation of the existing drainage conditions throughout the City to develop an accurate and current understanding of the drainage infrastructure. This assessment will include a comprehensive inventory of existing data, updated Atlas 14 hydrologic and hydraulics watershed model simulation, drainage problem identification, and conceptual drainage solutions. These conceptual drainage solutions, including cost estimates, can then be implemented into the City's Capital Improvement Plan (CIP) to adequately plan to address flood risks. Additionally, this study includes our analysis of the existing drainage utility fee rate and identification of possible fee modifications that may be needed for funding of maintenance and drainage CIP projects.

The City of Taylor Drainage Master Plan (DMP) includes detailed narratives discussing Halff's procedures and findings, relevant figures and tables, and digital data developed for the master plan analysis.

2.0 DATA COLLECTION

Several types of existing data were obtained to provide an understanding of Taylor's existing drainage problems to achieve the project's primary objective of identifying and developing a prioritized list of drainage solutions. **Table 2.1** provides a summary of the data collected and their respective sources.

Data	Source	Notes
Field Reconnaissance	Halff	2020-2021
Soils	NRCS	SSURGO Data
Landuse	NLCD	2016 Data
Contours	TNRIS/Williamson County	2017
Terrain (DEM)	TNRIS/Williamson County	2017
NOAA Atlas 14 Rainfall	Williamson County	Subdivision Regulations
MDUS	Halff	2016-2017
City of Taylor Engineering Manual	City of Taylor	November 2009
Storm Drainage Master Plan	City of Taylor / Halff	February 2005
Taylor Downtown Master Plan	City of Taylor	April 2015
City of Taylor Parks and Recreation Master Plan	City of Taylor	2016
City of Taylor Zoning Map	City of Taylor	2019
FEMA Data	FEMA	Models, Flood Risk Reports, LOMC, LOMA
KBI Pond Technical Memorandum & Addendum	HDR	2022
The Grove - TH Johnson Development	Yalgo, LLC	Plans, Plats, Drainage Reports

Table 2.1 – Data Collected and Sources

2.1 DATA COLLECTION SUMMARY

Halff collected and catalogued all relevant GIS data including, but not limited to, terrain (LiDAR) data, land use, zoning, FEMA floodplain data, planimetrics, political boundaries, aerial imagery, available utility information, and parcel information. All GIS data gathered was organized in Geodatabase format for use during the Drainage Master Plan development and will be provided to the City.

Halff collected and reviewed the current City Master Plans including:

- Taylor Downtown Master Plan
- City of Taylor Parks and Recreation Master Plan
- City of Taylor Storm Drainage Master Plan

2.2 FIELD DATA COLLECTION

2.2.1 Field Reconnaissance

Halff conducted site visits of flood problem areas where access was available from public right-of-way (ROW) and for selected road crossings, storm drain outfalls, flumes, channels, and ponds. During the site visits and field reconnaissance, Halff geo-located features, prepared photographs, and recorded notes regarding the dimensions and conditions of the feature. Field data collection included obtaining recent information on the new TH Johnson roadway extension at Bull Branch, associated with The Grove development.

2.2.2 Field Surveys

Halff also conducted limited field surveys in select areas to verify existing channel and structure conditions. Field surveys were conducted along Bull Branch, Mustang Creek, Mustang Creek Tributary 1, Gravel Pit Draw, and Railroad Draw.

Due to budget constraints, structures on the outskirts of the City or simple structures that could be sufficiently modeled using field reconnaissance were not surveyed. All structures near a MDUS location or with recorded street flooding complaints were maintained as survey structures.

Halff performed surveys at 21 structures. The remaining structures that were initially identified for surveys were modeled using field reconnaissance information, estimated from aerial imagery, estimated by nearby structural components, estimated by as-builts, or estimated using engineering judgment. This survey and field information was used to verify and supplement information in the hydraulic models used for this study. **Figure 2.1** shows a photograph of one our survey locations at Bull Branch.

Figure 2.1 – Field survey location at Bull Branch & Davis Street

2.3 PUBLIC INPUT LOCATIONS

A major goal of this project was to determine the locations of where drainage issues are occurring in the City. Halff worked with the City of Taylor to establish various methods of obtaining citizen feedback during 2020 during the initial months of the Covid-19 pandemic.

2.3.1 Virtual Public Meeting Feedback

A virtual public meeting was held and was available for citizens to access between October 14, 2020 to November 30, 2020. Forty-nine (49) unique logins occurred, and four (4) additional flooding areas were identified that included photos and notes. **Figure 2.2** shows a screenshot of the Virtual Public Meeting Sign-In Screen. The Virtual Public Meeting was utilized to help get the message out about the Drainage Master Plan and to garner feedback from citizens during the Covid-19 pandemic when restrictions were in place and physical meetings were not an option. **Figure 2.3** shows a MDUS map used for the meeting.

Figure 2.2 – Sign-In Screenshot from Virtual Public Meeting

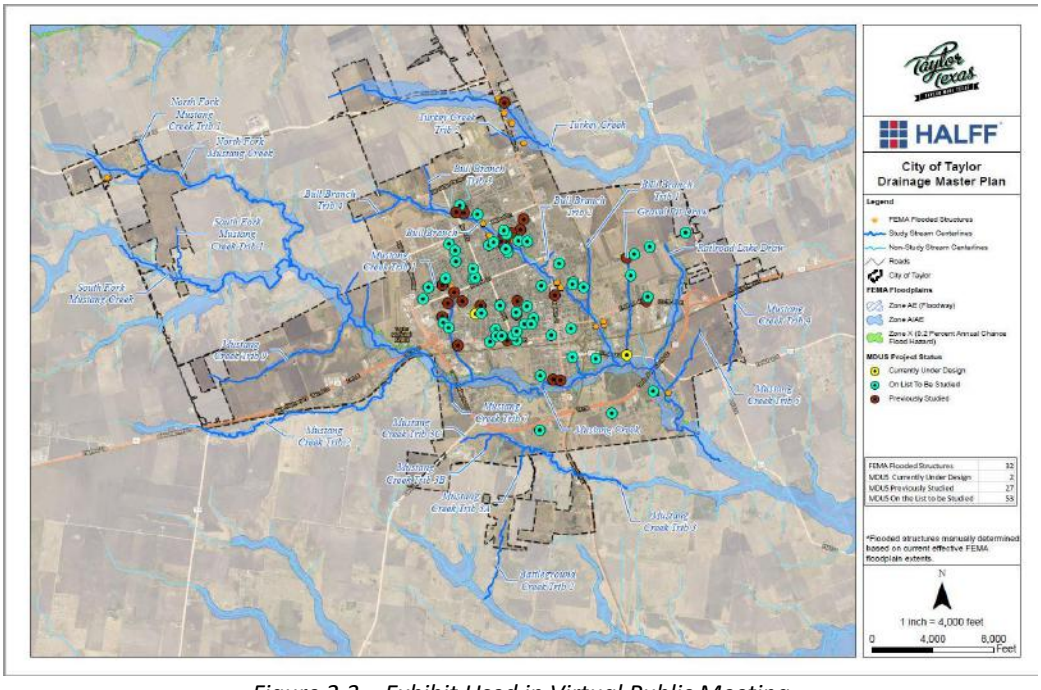


Figure 2.3 – Exhibit Used in Virtual Public Meeting

Resident Input

Another method utilized to obtain resident feedback was the Resident Questionnaire that was provided via Survey Monkey. Through the survey and additional correspondence, thirty-two (32) questionnaire responses and seventeen (17) direct emails were logged that included descriptions of flooding, videos and notes. The residential questionnaire is shown below.

RESIDENT QUESTIONNAIRE

CITY OF TAYLOR – DRAINAGE MASTER PLAN

The City of Taylor has a history of flooding and erosion concerns due to inadequate drainage and increased urbanization. The City has requested Halff Associates to prepare a Drainage Master Plan that will result in a plan to more effectively address drainage improvements. As part of the development of the Drainage Master Plan, we are seeking public input to identify areas of flood concern within the City. These areas, in combination with detailed modeling, will be the basis of developing local drainage solutions.

Name:_____Phone:_____

Address: _____

Email: _____

1. Is your residence within the FEMA regulated floodplain?
   ☐ Yes ☐ No ☐ Unsure
2. Have flood waters entered your home and/or business?
   ☐ Yes ☐ No
3. If Yes, when did you most recently experience flood waters within your home and/or business?_____
   _____
4. Where did the water come from?
   ☐ River ☐ Street ☐ Unsure
5. What was the depth of flood waters that entered your home and/or business? (in feet or inches, or just a general explanation such as ankle high or knee high)
   _____
   _____
6. When you have experienced flooding, was it during small rain events or big rain events?
   _____
   _____
7. Do you have photos or videos from the flooding you would like to provide?
   Please send your photos, videos, or any questions, to Katherine Smith by email at ksmith@halff.com or at (512) 777-4623.

https://www.surveymonkey.com/r/BRJC7TQ

2.4 MUNICIPAL DRAINAGE UTILITY SYSTEM (MDUS)

Prior to the development of this Drainage Master Plan, Halff and the City of Taylor developed a comprehensive inventory of existing drainage infrastructure concerns focused on local flood risk. Thirty-five (35) Municipal Drainage Utility System (MDUS) locations were identified. The information from the MDUS locations, along with the hydrologic and hydraulic analyses that were developed with this study, helped Halff identify drainage problem locations and helped us better understand the types of drainage solutions that could be implemented to address these problems.

2.5 DATA POINTS COLLECTED FOR THE DRAINAGE MASTER PLAN

Based on the feedback gathered from the City, from the MDUS data, and from the citizens based on the input from the virtual public meeting and residential questionnaire, Halff began to define where issues were occurring in the city. All data points, including MDUS locations and Public Input locations, were mapped into a GIS geodatabase, as shown in **Figure 2.4** below.

Data points showed that there were 65 locations with structure flooding issues, 41 locations with property flooding issues, 16 locations with street flooding issues, and 1 location noted for an erosion issue.

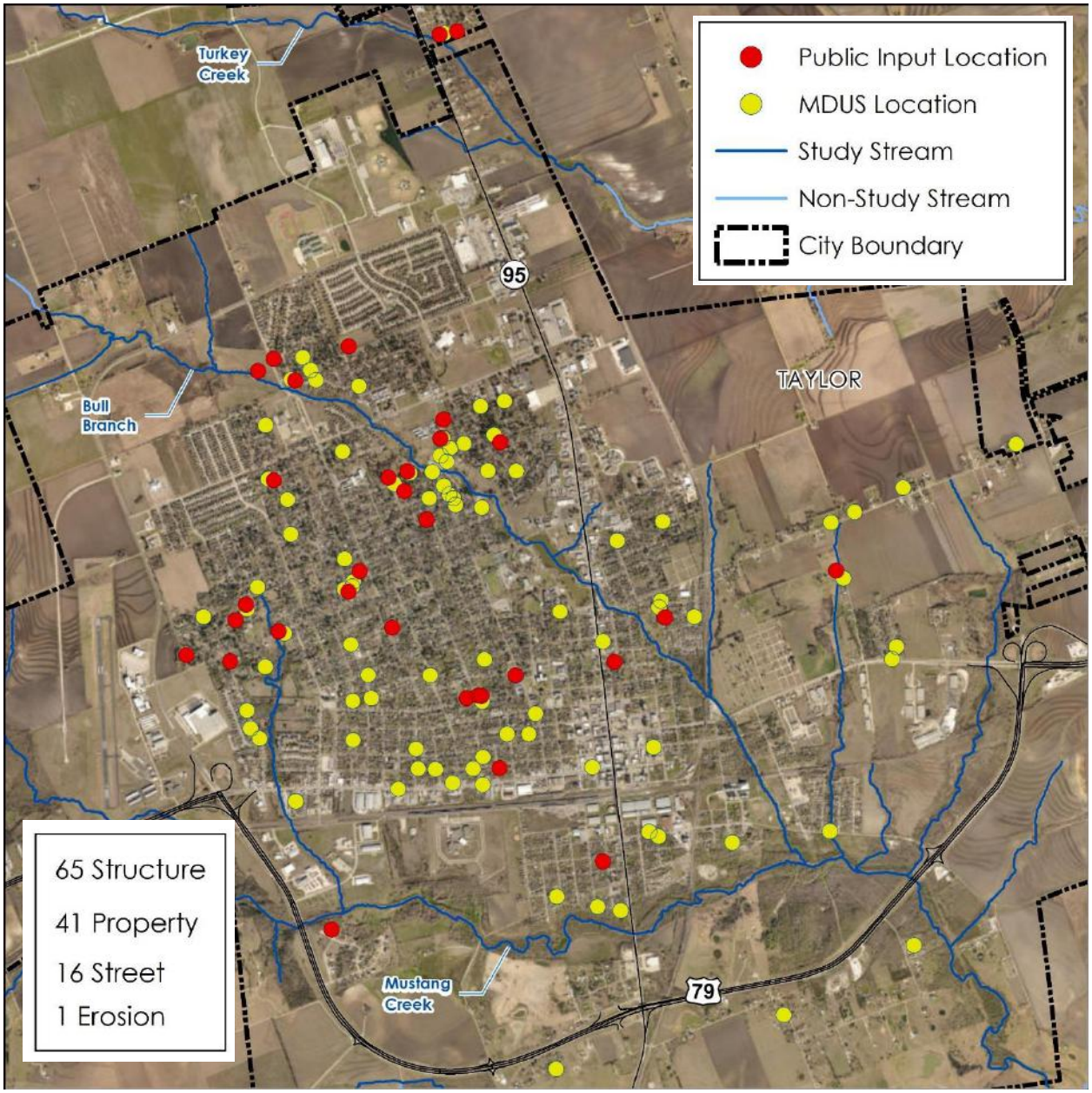


Figure 2.4 – City of Taylor Map Showing Public Input and MDUS Locations

Utilizing the data collection Halff received and the Public feedback, Halff began the process of Drainage Problem Identification, discussed in Section 3.0.

3.0 DRAINAGE PROBLEM IDENTIFICATION

3.1 DRAINAGE PROBLEM IDENTIFICATION OVERVIEW

Based on the information collected and documented in the Data Collection phase, Halff began the process of identifying flooding and drainage issues in the city. The process for determining drainage problem areas focused on both analyzing riverine and local flood risk. The processes for determining existing riverine flood risk and local flood risk are described below.

3.2 RIVERINE FLOOD RISK

3.2.1 Model Development

Halff prepared hydraulic analyses for streams within the City of Taylor using a steady-state 1D hydraulic model (HEC-RAS), updated to NOAA Atlas 14 rainfall data, to identify riverine flood risk along city streams, including Bull Branch and tributaries, Mustang Creek and tributaries, South Fork Mustang Creek and tributaries, North Fork Mustang Creek and tributaries, Turkey Creek and tributaries, Railroad Lake Draw, Gravel Pit Draw, Brushy Creek tributaries, and Battleground Creek Tributary.

Figure 3.1 – Major Stream Corridors in the City of Taylor

Hydraulic models were prepared and updated with field survey and field reconnaissance data. Limited road crossing surveys were performed to verify and update hydraulic models accordingly. Halff utilized past survey data from previous projects with the City of Taylor to further supplement the hydraulic model information used for the project. Field reconnaissance was performed for specific crossing locations that were not surveyed to get approximate dimensions for structures to further inform the hydraulic models, as noted in Section 2.0.

Models were executed for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year flood events. 100-year (1% ACE) floodplains were developed to identify flood risks including areas of potential erosion, high velocity locations, road overtopping locations, and property flooding areas. Bull Branch was of specific interest to the City of Taylor since it is the primary stream that traverses the most developed parts of the City. Multiple roadway crossings are present along Bull Branch. Based on the hydraulic model results and flood profile shown in **Figure 3.2**, multiple crossings are shown to be overtopped in a 100-year flood event.

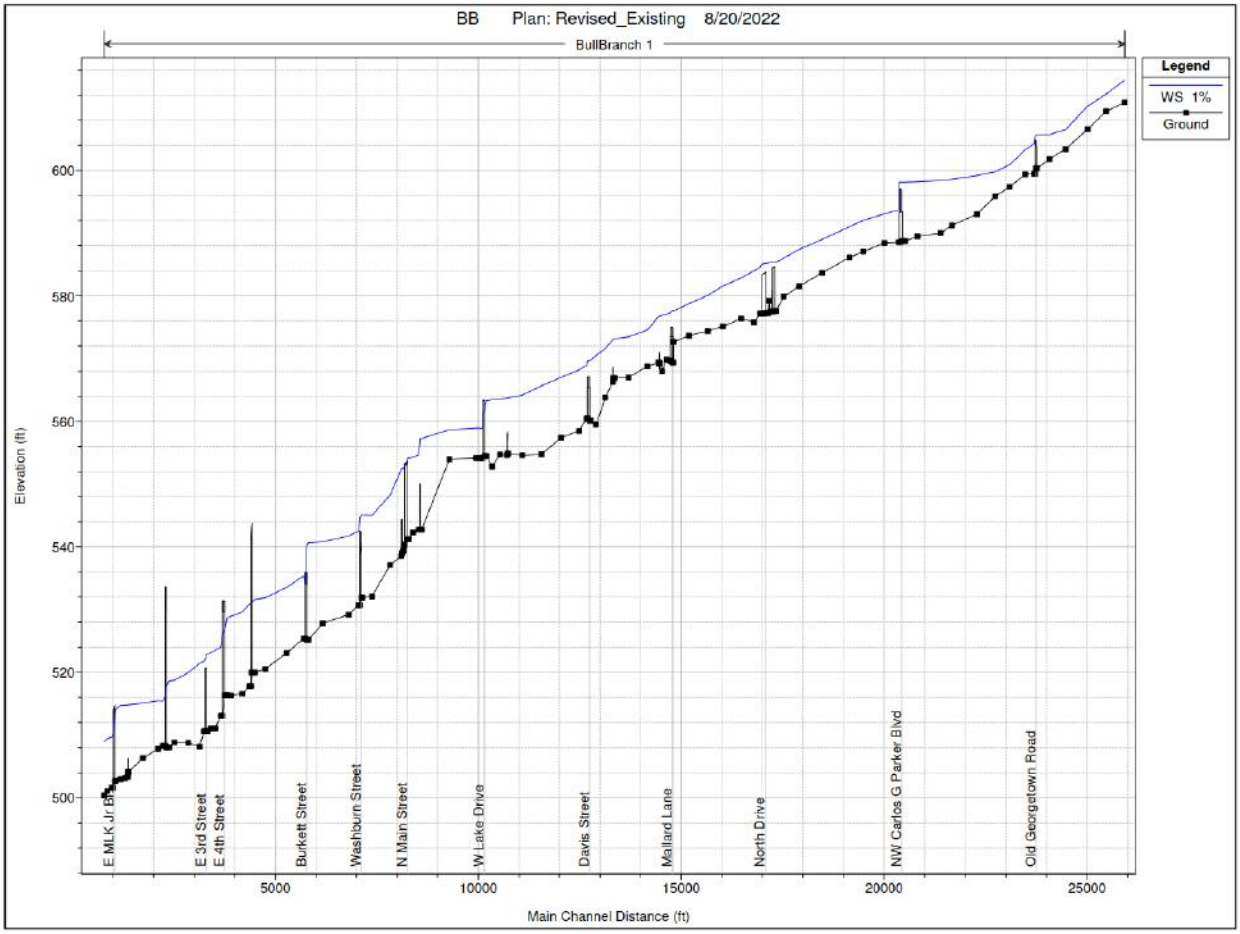


Figure 3.2 – 100-year (1% ACE) Flood Profile along Bull Branch

3.3 LOCAL FLOOD RISK

Halff prepared a high-level 2D rapid assessment utilizing 2017 LiDAR terrain information and a 2D hydraulic model to identify local flood risk, including areas of ponding, street flooding, property flooding, and overflows across streets and properties that are not tied to a local river or stream. Inflows included a rain-on-mesh analysis utilized an HEC-HMS basin analysis for the entire 2D area to determine excess rainfall for the 25-year (4% ACE) and 100-year (1% ACE) flood events. Upstream inflow hydrographs were also taken along Bull Branch.

A few images from the high-level 2D rapid assessment are shown in **Figures 3.3** and **Figure 3.4** below. In general, the 2D rapid assessment shows general flow paths and inundation depths across the City. Shallow depths of flooding less than 0.5' along streets may be contained in the right-of-way, but in many areas, it is evident that flows are not generally contained in drainage paths and either travel across properties or pond in properties as they make their way to confluence with downstream stream.

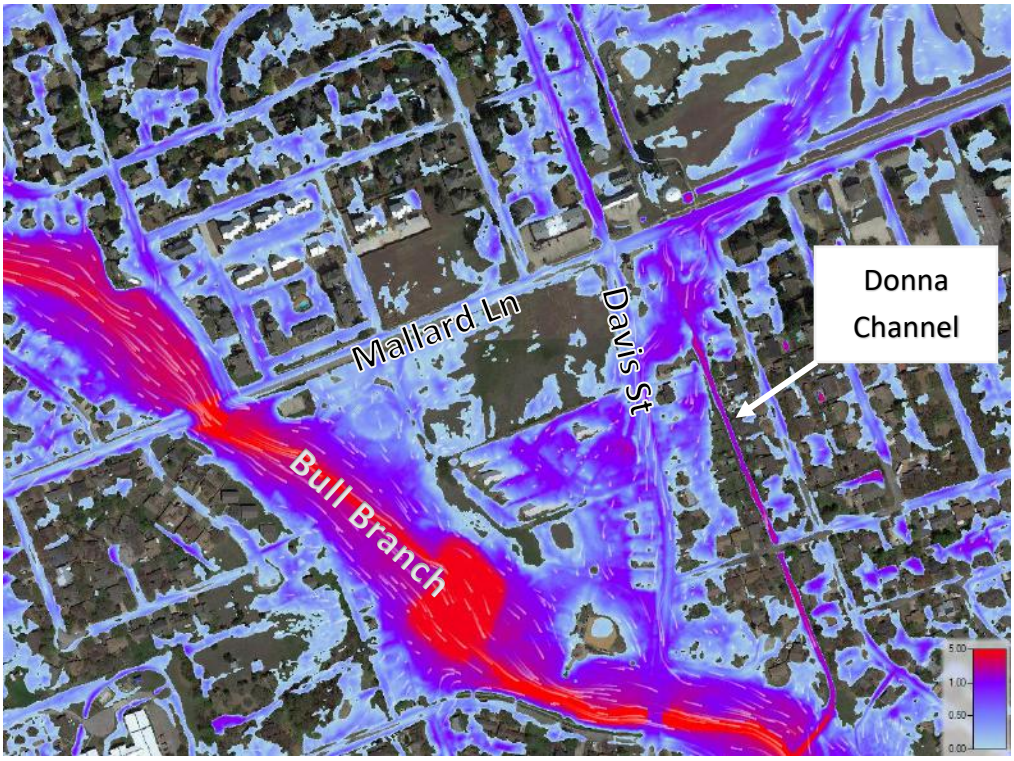


Figure 3.3 – 2D Rapid Assessment Inundation Depths along Bull Branch near Mallard Lane and the Donna Channel

Figure 3.4 – 2D Rapid Assessment Inundation Depths along W 2nd St near Annie, Shaw & Davis Streets

3.4 CONCENTRATED FLOODING AREAS

Local flood risk 2D mapping (25-year) and riverine flood mapping (100-year) was overlayed onto the MDUS and Public Input Locations to start narrowing the focus of the drainage problem identification. Halff identified Concentrated Flooding Areas to help understand where "hot spot" drainage problem locations exist in the City. As shown in Figure 3.5 below, Some of the Concentrated Flooding Areas exist along Bull Branch (multiple locations), W 2nd Street near Annie-Kimbro/Shaw-Davis Streets, Gravel Pit Road near Old Thorndale Road, Sandy Lane near Hwy 95, and Tammi Lane. Understanding these key locations helped Halff begin to develop potential drainage solution locations.

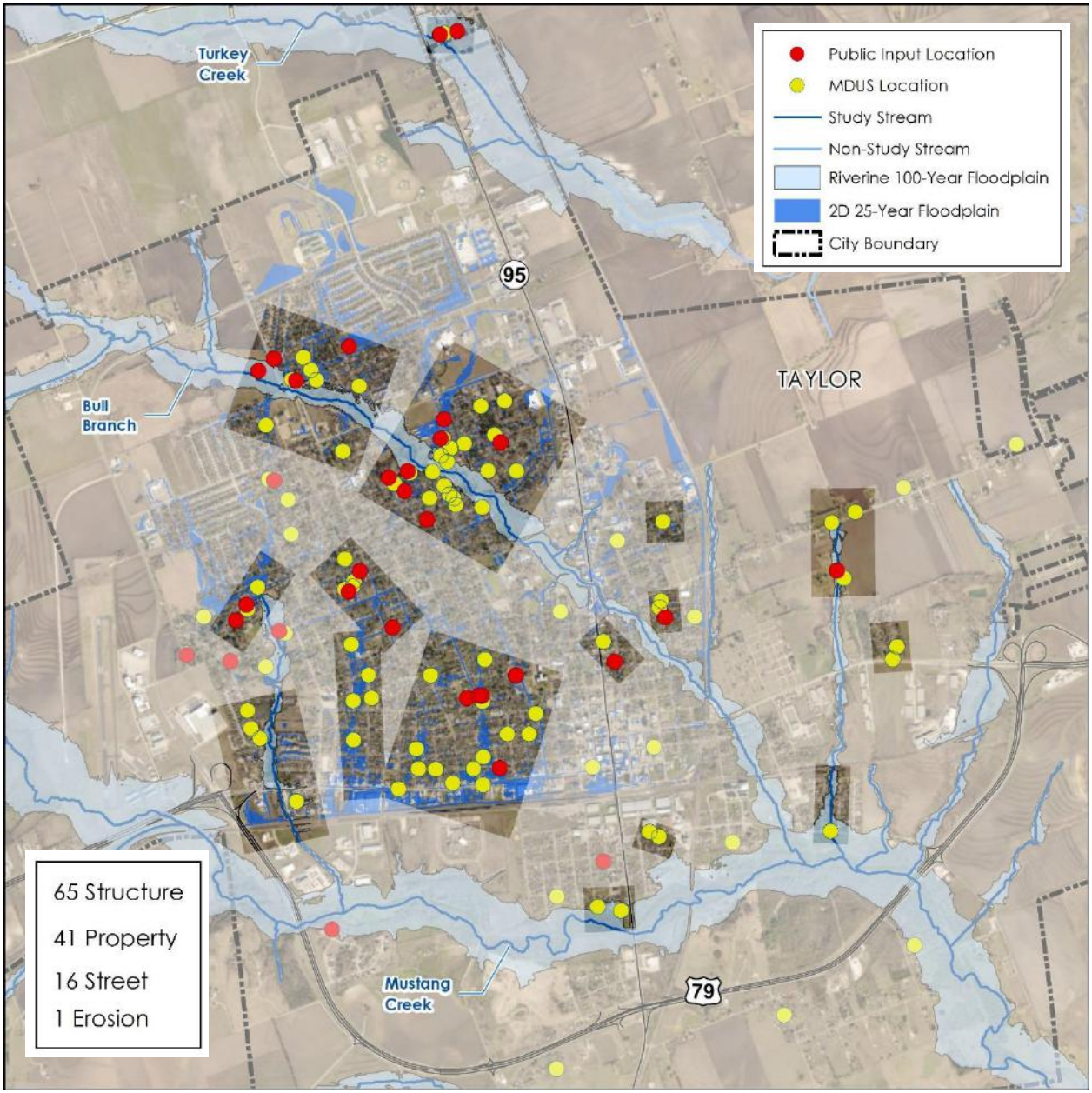


Figure 3.5 – Concentrated Flooding Areas – Public Input and MDUS Locations overlayed onto Riverine and Local Floodplain Mapping

3.5 GOALS FOR DRAINAGE PROBLEM IDENTIFICATION

Utilizing the Concentrated Flooding Areas, 2D Rapid Assessment flood mapping (25-year), and riverine floodplain mapping (100-year), Halff began to identify specific drainage problems. Halff focused the goals for analyzing drainage problems by considering Section 8 of the Subdivision Ordinance (Drainage Design and Analysis Criteria) that states:

1. Streets, curbs, gutters, inlets and storm drains shall be designed to intercept, contain and transport all runoff from the 25-year frequency storm.
2. The public drainage system shall be designed to convey the 100-year frequency storm within the defined public rights-of-way or drainage easements.
3. Detention Policy: No increase in site discharge, No offsite adverse impacts (Required downstream drainage assessment); Required policy for properties greater than ½ acre

From Table 8-6: Design Recurrence Interval for various Drainage also states that:

1. Closed Storm Drain System: 25-year with 100-year positive overflow in streets such that the depth of flow in the street does not exceed the right-of-way or drainage easement
2. Closed Storm Drain Systems and Inlets at Street Low Point or Sag: 100-year with positive overflow
3. Culverts and Bridges: 100-year
4. Concrete-lined Channels: 100-year
5. Earthen Channels: 100-year

Using these criteria, Halff developed 22 specific drainage problems in which we developed conceptual drainage solutions shown in **Table 3.1** and further evaluated in Section 4.0.

Drainage Problem Location	Description
Donna Channel near Mallard Lane	Undersized channel and stormwater flows impacting streets & properties
Kimbro/Shaw Street - 2nd St	Undersized storm drainage system and property/local street flooding
Mallard Lane	Residential property and local street flooding
Annie Street - 2nd Street	Undersized storm drainage system and property/local street flooding
Bel Air Drive	Residential property and local street flooding
Davis Street South - 2nd Street	Undersized storm drainage system and property/local street flooding
Burkett Street	Residential property flooding
Velma Drive	Residential property and local street flooding
TH Johnson Drive	Residential property and local street flooding
Old Thorndale Road	Residential property and roadway flooding
Tammi Lane	Local street flooding and ponding along residential properties
Gabriel Street	Residential property and local street flooding
North Drive	Local street flooding
McLain Street	Residential property and local street flooding
Mariposa Lane	Ponding along neighborhood streets and ponding in residential properties
Otis Street	Local street ponding and residential property flooding
Travis Street	Ponding in residential properties and local street flooding
Debus Drive	Ponding along residential street; inadequate drainage away from properties
Davis Street North	Ponding along residential street; inadequate drainage away from properties
Sandy Lane	Property flooding along Turkey Creek
West Mustang Street	Property flooding along Mustang Creek
North Main Street	Ponding along residential streets; inadequate drainage away from properties

Table 3.1 – Conceptual Drainage Solution Locations and Descriptions of Issues Discovered

4.0 DRAINAGE SOLUTIONS

Based on the Concentrated Flooding Areas, Halff narrowed the focus from overall flooding areas to specific drainage solutions to solve identified flooding issues, including both structural and non-structural measures. Structural solutions include storm drain improvements, channel improvements, road crossing improvements, and channels/ditch improvements. Non-structural solutions include voluntary property buy-outs. Voluntary buy-outs may be necessary when no reasonable structural improvement solution is available to solve a flooding issue, either due to project limitations or costs.

4.1 SOLUTIONS FOR RIVERINE FLOOD RISK

Riverine Flood Risk along Bull Branch

Riverine flood risk solutions focused on Bull Branch since it generally flows through the most developed areas in the City of Taylor. When these roadways overtop during flood events, flood risk increases and becomes a threat to vehicles that are traveling along these roadways. Thirteen (13) roadway crossings are currently located along Bull Branch, with most roadways being overtopped by a higher frequency (lower flow) flood event. These roadway crossings have less than 100-year (1% ACE) flood capacity. Three crossings – E MLK Jr Blvd, East 4th Street, and the new TH Johnson Extension have greater than 100-year (1% ACE) capacity. **Table 4.1** shows a list of each of the roadway crossings along Bull Branch and the associated flood event that overtops the existing structures.

Roadway Crossing	Existing Structure	Flood Event Overtopped By
E MLK Jr Blvd	125’ wide bridge	500-year
East 3rd Street	60' wide bridge	2-Year
East 4th Street	100’ wide bridge	Passes all events
Burkett Street	50' wide bridge	25-Year
Washburn Street	Five 10'x8' RCBs	50-Year
North Main Street (Hwy 95)	120' wide bridge	25-Year
West Lake Drive	70' wide bridge	50-Year
Davis Street	Three 12'x5' RCBs	2-Year
Mallard Lane	Twelve 8'x4' RCBs	2-Year
North Drive	Five 11'x6' RCBs	25-Year
TH Johnson Extension	Six 8'x7' RCBs	500-Year
NW Carlos G Parker Blvd	Four 8'x5' RCBs	25-Year
Old Georgetown Road	Four 48” CMPs	5-Year

Table 4.1 – Bull Branch – Roadway Crossings and Overtopping Flood Events

Riverine Flood Solutions along Bull Branch

For the roadway crossings that do not have 100-year (1% ACE) flood capacity, Halff investigated solutions for proposed structures that would provide additional flood capacity; however, some proposed structures and the associated improvements had limitations that would prevent an achievable 100-year solution. The reasons for the limitations were primarily the length of road that would need to be elevated and its impacts to other side streets and neighborhoods. **Table 4.2** shows a list of proposed structure solutions and the proposed passing flood event that would be achieved. **Appendix A** includes a **Riverine Project Overview** map of the referenced locations in this table.

Roadway Crossing	Existing Structure	Flood Event Overtopped By	Roadway Crossing - Proposed Structure	Proposed Passing
E MLK Jr Blvd	125' wide bridge	500-year	No structure improvements needed	N/A
East 3rd Street	60' wide bridge	2-Year	Two span, 100' wide bridge Widened the opening 75' to the east Raised east side of the road by 2.14', 370 LF Cannot raise the road higher due to intersection w/ driveways	50-Year
East 4th Street	100' wide bridge	Passes all events	No structure improvements needed	N/A
Burkett Street	50' wide bridge	25-Year	Two spans, 100' wide bridge Raised road by 0.67', approx. 200 LF cannot raise the road higher due to intersection w/ driveways	50-Year
Washburn Street	Five 10'x8' RCBs	50-Year	One span, 50' wide bridge Channel benching - approx. 1240' LF DS of Washburn St crossing. Stops at US side of Burkett St crossing. Only on the north side of the stream. Cannot raise the road due to intersection w/ driveways	50-Year
North Main Street (Hwy 95)	120' wide bridge	25-Year	Cannot raise the road due to the intersection w/ West 12th Street Propose flood monitoring gages during storm events; No change to road	Recommend Flood Monitoring
West Lake Drive	70' wide bridge	50-Year	East side of the road is overtopped probably due to backwater from City Lake. Cannot raise the road due to driveways Propose flood monitoring gages during storm events; No change to road	Recommend Flood Monitoring
Davis Street	Three 12'x5' RCBs	2-Year	Two spans, 100' wide bridge Raised road by 1', approx. 260 LF Widened the structure opening 80' to the north to fit the new bridge Channel benching - approx. 1600' LF DS of the crossing Existing roads intersecting Davis Street prohibit further raising	10-Year
Mallard Lane	Twelve 8'x4' RCBs	2-Year	Three spans, 150' wide bridge Widened the structure opening 60' to the west to fit the new bridge Channel benching - approx. 550' LF DS of the crossing Cannot raise the road because of the intersections of Bull Run & Sunny Lane with Mallard Lane	5-Year
North Drive	Five 11'x6' RCBs	25-Year	Road elevation is low at intersections; unable to raise the road	Recommend Flood Monitoring
TH Johnson Extension	Six 8'x7' RCBs	500-Year	No structure improvements needed	N/A
NW Carlos G Parker Blvd	Four 8'x5' RCBs	25-Year	Seven 8'x5' reinforced concrete box culverts (added three more culverts to the existing culverts)	100-Year
Old Georgetown Road	Four 48" CMPs	5-Year	Five 8'x4' reinforced concrete box culverts Raised road by 0.47 feet, approx. 350 linear feet (LF) cannot raise the road higher due to constrictions (intersection w/ driveway)	100-Year

Table 4.2 – Bull Branch – Roadway Crossing Proposed Structures & Proposed Passing Flood Event

City Direction on Proposed Riverine Solutions

Halff held a workshop with City Council on September 22, 2021, to discuss the solutions for riverine flood risk along Bull Branch. The goals set by the City of Taylor were for all roadway crossings to achieve City criteria to pass the 100-year (1% ACE) flood event. The table above lists the reasons why not all roadway crossings can be improved to meet the City's criteria, as the results of these significant improvements would negatively impact other local roadways, businesses, and sub-divisions. Halff also noted that the cost to construct these improvements would be considerable.

After the City Council workshop, follow-up coordination occurred internally to the City with Fire and Police Departments. City staff direction was that they can service the City under existing conditions if NW Carlos G Parker Blvd and North Main Street (Hwy 95) remain operational. Each of these streets have 10-year (10% ACE) capacity. The Police Department expressed concerns regarding the Mallard Lane crossing (less than 2-year capacity). The Police Department has to utilize personnel during road closures at this crossing, which limits the resources they have for other needs. Currently, the proposed improvements at Mallard Lane would only provide a 5-year flood capacity. Any improvements that would result in larger flood capacities would result in significant impacts to other local roadways and properties, resulting in a cost-prohibitive solution. Both the Fire and Police Departments would like to further investigate flood monitoring, flood gates, auto-closures for Mallard Lane and other similar riverine crossings that are overtopped by frequent flooding events.

NW Carlos G Parker Blvd at Bull Branch

NW Carlos G Parker Blvd has two crossings – Bull Branch and a Tributary to Bull Branch. Both crossings pass the 10-year flood event. For the Bull Branch crossing, to pass the 100-year flood event would require approximately 7-8'x5' reinforced concrete box culverts. This could be constructed by adding three additional boxes to the existing 4-8'x5' box culverts. For the Tributary to Bull Branch, the 100-year flood event overtops the road by approximately 0.8' in the right overbank (towards Bull Branch) with minimal velocities (approximately 0.4 ft/s). Instead of structural improvements at this crossing, Halff would recommend flood monitoring since the overtopping and flow of water over the road is minimal during a large flood event. Halff recommends that if improvements are desired at NW Carlos G Parker Blvd, a more detailed analysis be performed to better understand the required additional capacity and constructability of the project, including needed utility relocations, structural components, shoring/stabilization of existing culverts during construction and traffic control/re-routing during construction.

North Main Street (Highway 95)

North Main Street (Highway 95) consists of a 120' wide bridge at the Bull Branch crossing. This crossing passes the 10-year flood event. The overtopping of the roadway generally occurs in the overbank near the City of Taylor Maintenance Facility, with 100-year depths close to 2.7' in this area. Raising the roadway to accommodate a larger flooding event would impact the intersection at West 12th Street, and it would impact the Maintenance Facility, the National Reserve and Williamson County EMS properties and structures. Also providing additional flood capacity underneath the roadway is limited by the lake located on the upstream (west) side. Halff recommends flood monitoring and barricading during larger flood events, as needed, at this location instead of structural improvements due to these adverse impacts to adjacent roadways, properties and structures.

4.2 SOLUTIONS FOR LOCAL FLOOD RISK

Based on the 2D Rapid Assessment, drainage problem determinations, and the concentrated flooding area determinations as described in Section 3.0, Halff developed local flood risk solutions (non-riverine) and presented these solutions to City staff and City Council. A public meeting was held, and citizen feedback was obtained on the proposed solution locations before finalizing. Halff utilized the feedback from the City and the public to update and finalize the recommended drainage solutions. Additionally, HDR, Inc. (HDR) provided information to Halff on two projects for incorporation into this Drainage Master Plan.

4.2.1 Local Drainage Solution Development

Halff evaluated twenty-two conceptual local drainage solutions to address flooding. The conceptual solutions were both structural and non-structural. Structural solutions included storm drainage improvements, street improvements, channel improvements, and drainage ditch improvements. Non-structural solutions included voluntary buy-out options where a structural option was deemed infeasible and/or cost prohibitive. Additionally, HDR provided additional information on one of the twenty-two solutions, and they also provided information for an additional solution for the KBI pond at TH Johnson, bringing the total to twenty-three solutions that were developed and prioritized.

4.2.2 Prioritization Matrix for Local Solutions

Halff developed a prioritization matrix, vetted through City staff, to help prioritize and rank the conceptual drainage solutions. The prioritization matrix includes the following categories: number of properties improved, City priority, Public Input Points Addressed, and Project Cost. Each category was broken into three points, depending on the quantity of properties addressed, City priority (Low to High), quantity of public input points addressed, and size of project (less than $1 million to greater than $2 million). Each point was then applied a percentage weight, totaling 100%. The matrix is shown in **Table 4.3** below.

Percent Weight	Category for Prioritization	Points
50%	Properties Improved	
	0-24	1
	25-49	2
	50+	3
30%	City Priority	
	High	3
	Medium	2
	Low	1
15%	Public Input Points Addressed	
	0-2	1
	3-6	2
	7+	3
5%	Project Cost	
	>$2M	1
	$1M-$2M	2
	<$1M	3

Table 4.3 – Prioritization Matrix for Local Drainage Solutions

4.2.3 Prioritization of Local Solutions

Table 4.4 provides the results of the prioritization of the twenty-three conceptual local drainage solutions. This table also shows the City Council district where each project would be located.

Project No.	Local Project ID and Location		OPCC	Homes/ Properties Improved	Public Input Points Addressed	Council District	Score
1	BB_05	Bull Branch & Donna Channel*	$ 6,032,385	50	9	4	2.90
2	MC_07	Kimbro/Shaw Street - 2nd St	$ 5,188,110	55	8	2	2.90
3	BB_11	Mallard Lane	$ 1,916,860	70	4	3	2.80
4	MC_06	Annie Street - 2nd Street	$ 3,092,650	60	3	2	2.75
5	(HDR Study)	KBI Pond Improvements*	$ 227,180	59	1	4	2.55
6	BB_03	Bel Air Drive	$ 1,057,490	25	5	4	2.30
7	MC_08	Davis Street South - 2nd Street	$ 5,035,240	40	4	2	2.25
8	BB_10	Burkett Street	$ 352,530	15	3	1	1.85
9	BB_08	Velma Drive	$ 1,082,320	25	1	4	1.85
10	BB_01	TH Johnson Drive	$ 597,800	9	2	4	1.70
11	GPD_01	Old Thorndale Road	$ 434,050	6	3	1	1.55
12	MC_01	Tammi Lane	$ 1,151,740	15	3	3	1.50
13	MC_02	Gabriel Street	$ 74,330	4	2	4	1.40
14	MC_02	North Drive	$ 665,370	15	1	4	1.40
15	MC_05	McLain Street	$ 857,630	24	1	4	1.40
16	GPD_02	Mariposa Lane	$ 594,630	22	2	1	1.40
17	BB_12	Otis Street	$ 654,830	17	0	4	1.40
18	MC_04	Travis Street	$ 670,690	16	1	2	1.40
19	MC_03	Debus Drive	$ 1,229,870	40	3	2	1.70
20	BB_06	Davis Street North	$ 74,190	7	4	4	1.25
21	TC_01	Sandy Lane	$ 3,212,200	12	3	4	1.15
22	MC_09	West Mustang Street	$ 593,930	20	2	1	1.10
23	BB_13	North Main Street	$ 58,660	20	2	2	1.10
* Information provided by HDR, Inc.			**$ 34,854,685**	**626**	**67**		

	Council District 1
	Council District 2
	Council District 3
	Council District 4

Table 4.4 – Prioritization of Conceptual Local Drainage Solutions

Projects 19 through 23 represent projects that were included based on MDUS information or were primarily voluntary buyouts. These were included as conceptual drainage solutions, but ranked as the last projects based on feedback from the City that they should be considered not as high priority. The voluntary buy-out projects are Sandy Lane and West Mustang Street. Debus Drive, Davis Street North, and North Main Street projects are from the MDUS. **Appendix A** includes a **Local Project Overview** map of the referenced locations in this table.

4.2.4 Prioritization of Local Solutions Based on Project Cost Range

Table 4.5 provides the results of the prioritization of the twenty-three conceptual local drainage solutions, broken down further by project cost range. By prioritizing by a cost range provides the City flexibility when developing Capital Improvement Projects (CIPs) based on allowable resources and available funding. Prioritized projects were ranked further based on Small projects (less than $1 million), Medium projects (between $1 million to $2 million), and Large projects (greater than $2 million). For Medium and Large projects, the City may want to explore funding options such as grants, loans, or bond funds.

SMALL (LESS THAN $1M)		
Local Project ID and Location		**OPCC**
(HDR Study)	KBI Pond Improvements	$ 227,180
BB_10	Burkett Street	$ 352,530
BB_01	TH Johnson Drive	$ 597,800
GPD_01	Old Thorndale Road	$ 434,050
MC_02	Gabriel Street	$ 74,330
MC_02	North Drive	$ 665,370
MC_05	McLain Street	$ 857,630
GPD_02	Mariposa Lane	$ 594,630
BB_12	Otis Street	$ 654,830
MC_04	Travis Street	$ 670,690
BB_06	Davis Street North	$ 74,190
MC_09	West Mustang Street	$ 593,930
BB_13	North Main Street	$ 58,660
MEDIUM ($1M > $2M)		
Local Project ID and Location		**OPCC**
BB_11	Mallard Lane	$ 1,916,860
BB_03	Bel Air Drive	$ 1,057,490
BB_08	Velma Drive	$ 1,082,320
MC_01	Tammi Lane	$ 1,151,740
MC_03	Debus Drive	$ 1,229,870
LARGE (GREATER THAN $2M)		
Local Project ID and Location		**OPCC**
BB_05	Donna Channel	$ 6,032,385
MC_07	Kimbro/Shaw St - 2nd St	$ 5,188,110
MC_06	Annie Street - 2nd Street	$ 3,092,650
MC_08	Davis St South - 2nd St	$ 5,035,240
TC_01	Sandy Lane	$ 3,212,200

Table 4.5 – Prioritization of Conceptual Local Drainage Solutions Based On Project Cost Range

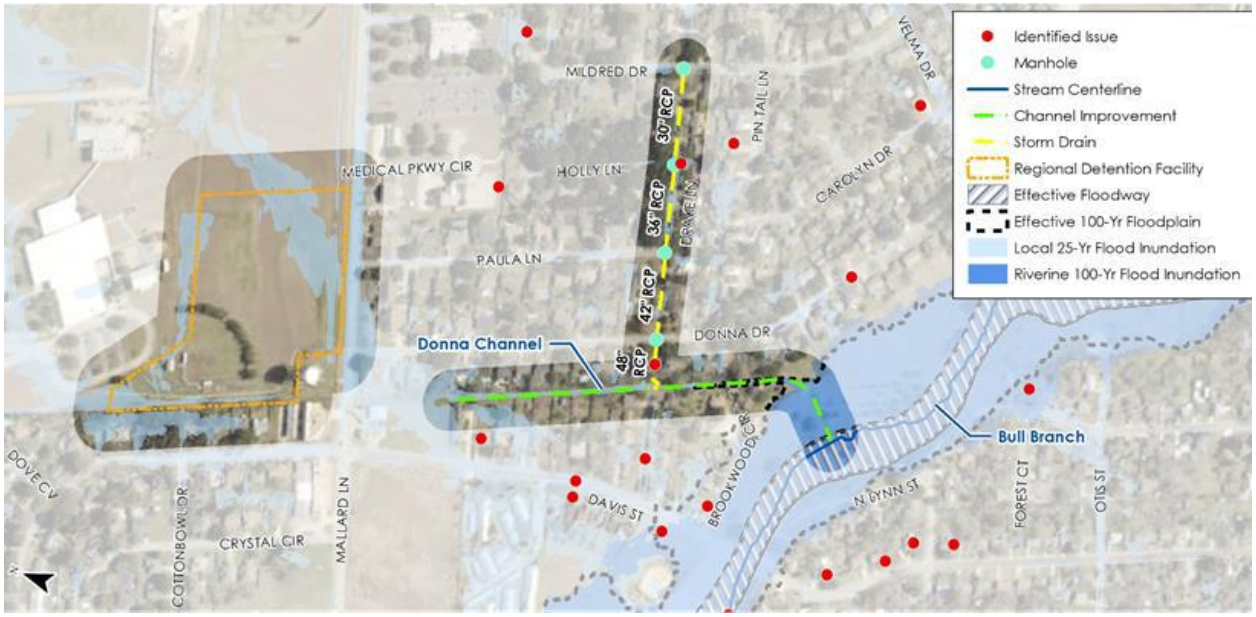
4.3 DRAINAGE SOLUTION SUMMARIES

The following pages of Section 4.0 provide proposed project summaries for each of the solutions identified in **Table 4.4**. Conceptual Drainage Solution Fact Sheets and Opinions of Probable Construction Costs (OPCCs) are included in **Appendix B**. These Fact Sheets and OPCCs can be easily shared with City Council members, City staff, or citizens if requested.

The KBI Pond project report, provided by HDR, is provided in **Appendix C** for incorporation into the Drainage Master Plan.

BULL BRANCH DETENTION & DONNA CHANNEL IMPROVEMENTS

The Bull Branch Detention and Donna Channel Improvements project is generally located along Mallard Lane and Donna Drive, east of Davis Street. The channel is situated between residential homes south of Mallard Lane and generally flows south, crossing Drake Lane, until its confluence with Bull Branch. Based on historical records, public input on local flooding and Halff's assessment of the local 25-year flood inundation, the Donna Channel is currently undersized during larger storm events. Stormwater that is not contained in the channel will exceed channel banks and flow west towards Davis Street until it reaches Bull Branch to the south, inundating properties along its path to the creek.



FLOOD PROTECTION MEASURES

Flood protection measures to mitigate uncontrolled flows for the Donna Channel include a three-phase approach:

1. Phase I – A 10 to 15-acre regional detention facility is proposed to be located on the school property of TH Johnson Elementary and will serve as a dual-use facility for stormwater detention and school recreation.
2. Phase II – Donna Channel improvements will consist of enhancing roughly 2,000 linear feet of existing channel from the new regional detention facility to its confluence at Bull Branch, including replacing the existing cross culvert at Drake Lane. The purpose of these improvements will be to provide increased capacity to the channel and to accommodate flows from the regional detention facility.
3. Phase III – A new storm drain system along Drake Lane with pipe sizes ranging from 30" RCP to 48" RCP. This storm drain system would begin at Mildred Drive and connect at the Donna Channel cross culvert west of Donna Drive. The purpose of this phase is to capture overland flows directed to Drake Lane and convey them in an underground drainage system to the improved Donna Channel constructed in Phase II. Once all three phases are complete, the Bull Branch Detention & Donna Channel Improvements will be able to accommodate a local 25-year storm event.

BENEFITS

The following benefits will be provided by the three-phase approach to implement improvements to alleviate flooding along the Donna Channel:

1. Alleviates ponding of Davis Street, Mallard Lane and Drake Lane during larger storm events
2. Relieves the existing capacity concerns for the Donna Channel
3. Reduces private property flood concerns along streets in the vicinity of the improvements and those private properties along the Donna Channel
4. Phased construction of the improvements allows for the City to budget the improvements with flexibility

CHALLENGES

Challenges will be faced as the Bull Branch Detention & Donna Channel improvements are implemented, including impacts to local residents during construction that may include limited access to neighborhood streets and driveways and possible re-routing of traffic along Mallard Lane, Davis Street and Drake Lane. Additional challenges would include obtaining potential drainage easements along the Donna Channel and at TH Johnson Elementary that would be required to implement the project and future maintenance of the storm drainage systems and channel improvements within city right-of-way and drainage easements.

SUMMARY

The Bull Branch Detention & Donna Channel Improvements flood mitigation solution will address nine public input points, benefit up to 50 structures in the vicinity, and improve storm drainage conveyance with over 1,500 linear feet of channel improvements and over 3.000 linear feet of storm drainage improvements. Local thoroughfares and neighborhood streets will also be improved due to new drainage systems that will result in less ponding of water during and after storm events.

NOTE: Halff utilized information from a recent GLO-MIT grant submittal for this project prepared by the City of Taylor and HDR

KIMBRO STREET AND SHAW STREET STORM DRAINAGE SYSTEM

The Kimbro Street and Shaw Street Storm Drainage System improvements will be located along 2nd Street and north along Shaw Street to W 5th Street, connected by channel to W 6th Street, and then continuing north along Kimbro Street to Cecelia Street. The system will collect drainage along this corridor that will flow south to 2nd Street and then south of 2nd Street to two separate outfalls into the drainage channel located along the north side of the railroad. The new storm drain system will tie into the existing 2nd Street storm drain system.

FLOOD PROTECTION MEASURES

Both Kimbro Street and Shaw Street experience significant ponding during large storm events from W 8th Street to 2nd Street. Flood protection measures to mitigate 25-year Atlas 14 flows include improvements north of 2nd Street and from 2nd Street to the south. These improvements can be phased as a cost savings measure if the south improvements from 2nd Street to the railroad drainage ditch are implemented first:

1. 2nd Street to the railroad drainage ditch – With 25-year Atlas 14 flows, the 2nd Street storm drain system does not have capacity and will be accepting new storm drainage system flows at the Shaw Street intersection. Therefore, a new storm drain system is needed to relieve flow from 2nd Street. This system will convey flow along 2nd Street from Shaw Street to Victoria Street and flow along Howard Street towards the railroad drainage ditch. Flows from 2nd Street will also be conveyed to the railroad drainage ditch along the 2nd Street system between Shaw and Park Street. Pipe sizes range from a 24" RCP to a 5'x3' RCB. Channel improvements to the railroad ditch are also needed.
2. North of 2nd Street – A new storm drain system will begin at Kimbro Street and Cecelia Street. The system will follow Kimbro Street to W 6th Street and will connect into an open channel between W 6th Street and W 5th Street. The system will continue south along Shaw Street until it connects to the existing storm drainage system in 2nd Street. Pipe sizes range from a 36" RCP to a 8' x 4' RCB.

BENEFITS

The following benefits will be provided by the Kimbro Street and Shaw Street Storm Drainage Improvements:

1. Increase storm drainage capacity in the system along 2nd Street and to the north along Shaw Street and Kimbro Street to Cecelia Street
2. Alleviates ponding along local streets where the storm drainage system improvements will be implemented
3. Reduces private property flood concerns along streets in the vicinity of the improvements
4. Phased construction of the improvements north and south of 2nd Street allows for the City to budget the improvements with flexibility

CHALLENGES

Challenges will be faced as the Kimbro Street and Shaw Street storm drainage improvements are implemented, including impacts to local residents during construction that may include limited access to neighborhood streets and driveways and possible re-routing of traffic along local streets. Additional challenges would include performing storm drainage improvements within TxDOT ROW along 2nd Street, requiring coordination with TxDOT to plan for these improvements and to determine the process and permitting that will be required. Additional challenges would include future maintenance of the storm drainage system and improvements to the railroad drainage ditch.

SUMMARY

The Kimbro Street and Shaw Street storm drainage improvements will address eight public input points, benefit up to 85 structures in the vicinity, and improve storm drainage conveyance with over 5,250 linear feet of storm drainage improvements. Local thoroughfares and neighborhood streets will also be improved due to new storm drainage systems that will result in less ponding of water during and after storm events.

MALLARD LANE STORM SEWER SYSTEM

The Mallard Lane Storm Sewer System project is located along Summit Circle, Kingston Circle, Mallard Lane, and Greenlawn Drive. The project includes new storm drainage systems, concrete flumes and a new drainage channel that drain into Bull Branch downstream of the Greenlawn Drive and Oaklawn Drive intersection. Based on Halff's 25-year flood analysis, the proposed system primarily addresses residential property and local street flooding along Greenlawn Drive, Mallard Lane, and various locations near Hillcrest Drive, Kingston Circle and Summit Circle.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate ponding issues include installation of concrete flumes that will carry flow from the Summit and Kingston cul-de-sacs to Mallard Lane. Additionally, a storm drainage system will convey drainage along Mallard Lane and Greenlawn Drive that will direct flows into Bull Branch. The proposed storm drain system would consist of 3'x3' RCBs to 6'x3' RCBs with inlets along Mallard Lane and Greenlawn Drive. From Oaklawn Drive, channel regrading is needed to carry flow from the end of Oaklawn Drive to Bull Branch. The new drainage channel will have 4:1 side slopes, a channel slope of 0.5%, and a minimum 6-foot bottom width.

Project improvements would include approximately 1,620 linear feet of storm drainage, inlets, storm drain manholes and 490 linear feet of channel improvements.

BENEFITS

The following benefits will be provided with the Mallard Lane Storm Sewer System project:

1. Alleviates ponding along Greenlawn Drive, Mallard Lane, Summit Circle and Kingston Circle during larger storm events
2. Increases the capacity of the storm drainage system in this area
3. Reduces private property flood concerns, especially at low lying areas near Summit Circle and Kingston Circle
4. Phased construction is an option for this project and would allow for the City to budget the improvements with flexibility

CHALLENGES

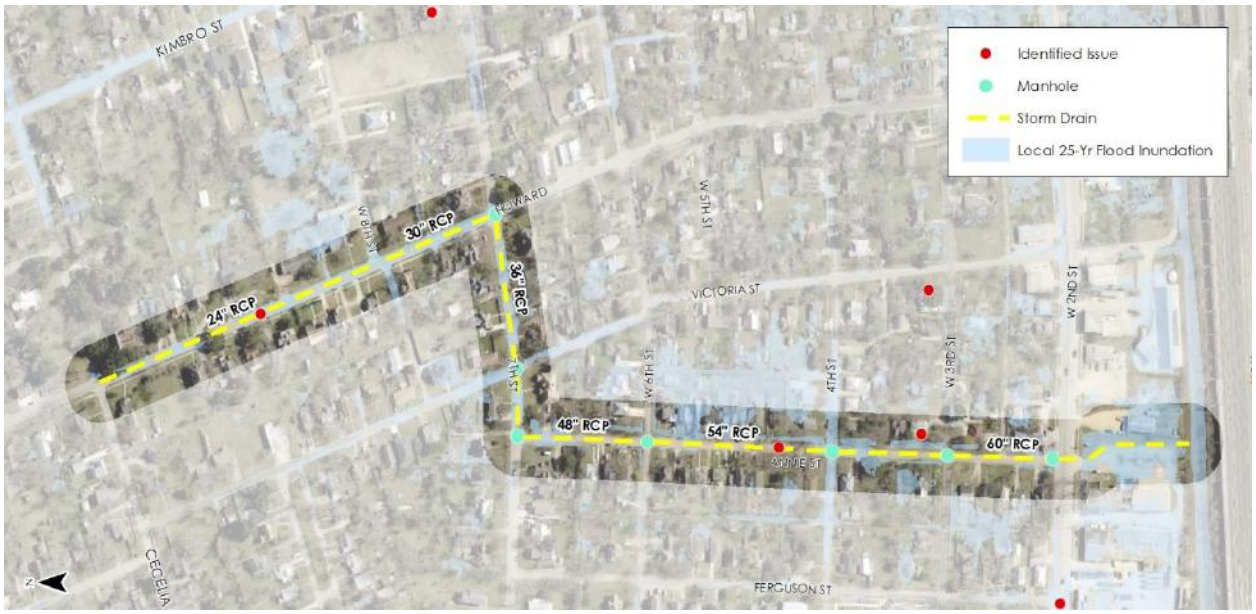
Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction. Additional challenges would include possible drainage easements that would be required from TISD to implement the open channel portion of the project, access to Bull Branch Creek during construction and future maintenance of the storm drainage system and open channel.

SUMMARY

The Mallard Lane Storm Sewer System flood mitigation solution will address four public input points, benefit up to 70 structures, and improve storm drainage conveyance in this area. Neighborhood streets and access will be improved due to new drainage systems that will result in less ponding of water during and after storm events. Residential properties will also experience reduced stormwater inundation during larger storm events.

ANNIE STREET STORM DRAINAGE SYSTEM

The Annie Street Storm Drainage System improvements will be located north of 2nd Street along Annie Street to W 7th Street, then along W 7th Street to Howard Street, and then along Howard Street north to Cecelia Street. The system will collect drainage along this corridor that will flow south of 2nd Street to an outfall into the drainage channel located along the north side of the railroad.



FLOOD PROTECTION MEASURES

Annie Street, Victoria Street and Howard Street experience significant ponding during large storm events north of 2nd Street and rainfall in these areas do not have a clear route to the 2nd Street storm drainage system. Flood protection measures to mitigate 25-year Atlas 14 flows include improvements north of 2nd Street and south of 2nd Street.

A storm drain system is proposed starting at the intersection of Howard St and Cecelia St., and discharging in the railroad drainage ditch. Pipe sizes range from a 24" RCP to a 60" RCP. The existing outfall for Annie St. is an existing storm drain system along 2nd St., designed for the 10-yr storm event using USGS rainfall. A new outfall will bypass the 2nd St. storm drain system and carry the Atlas 14, 25-year storm event to the railroad drainage ditch. The proposed system will reduce flooding and allow a clear route for flow to get to the receiving drainage channel. Phased construction can be performed for the sections south of W 7th Street and the sections along W 7th Street and north along Howard Street to Cecelia Street. Since this system will not connect directly into the 2nd Street storm drainage system, it is not recommended to phase improvements south of 2nd Street.

BENEFITS

The following benefits will be provided by the Annie Street Storm Drainage Improvements:

1. Alleviates ponding along local streets where the storm drainage system improvements will be implemented
2. Reduces private property flood concerns along streets in the vicinity of the improvements
3. Phased construction of the improvements north and south of W 7th Street allows for the City to budget the improvements with flexibility

CHALLENGES

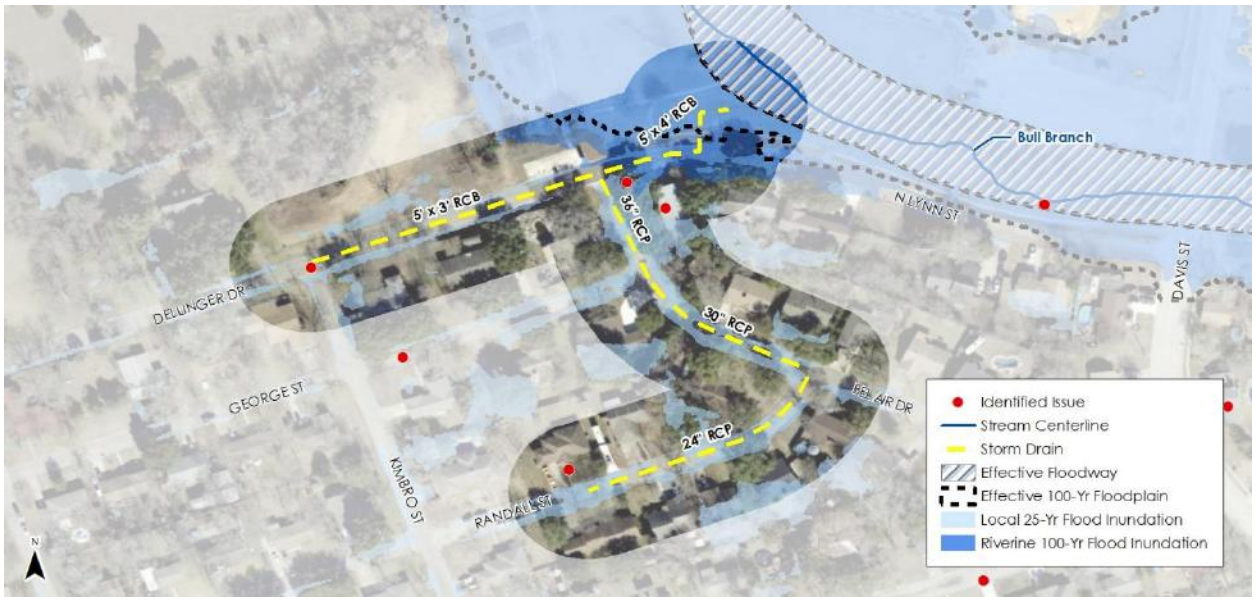
Challenges will be faced as the Annie Street storm drainage improvements are implemented, including impacts to local residents during construction that may include limited access to neighborhood streets and driveways and possible re-routing of traffic along local streets. Additional challenges would include performing storm drainage improvements within TxDOT ROW along 2nd Street, requiring coordination with TxDOT to plan for these improvements and to determine the process and permitting that will be required. Additional challenges would include future maintenance of the storm drainage system and improvements to the railroad drainage ditch.

SUMMARY

The Annie Street storm drainage improvements will address three public input points, benefit up to 85 structures in the vicinity, and improve storm drainage conveyance with over 3,790 linear feet of storm drainage improvements. Local thoroughfares and neighborhood streets will also be improved due to new storm drainage systems that will result in less ponding of water during and after storm events.

BEL-AIR DRIVE STORM SEWER SYSTEM

The Bel-Air Drive Storm Sewer System project is located along Bel Air Drive, Randall Street, Dellinger Drive, and N Lynn Street. The project includes new storm drainage systems that drain into Bull Branch after the intersection of Bel-Air Drive, Dellinger Drive, and N Lynn Street. Based on Halff's 25-year flood analysis, the proposed system primarily addresses residential property and local street flooding along Bel-Air Drive from N Lynn Street to Randall Street. The roads contain shallow dips, which makes them susceptible to ponding and flooding during rain events.



FLOOD PROTECTION MEASURES

Flood protection measures to mitigate ponding and overland flow issues include installation of a storm drainage system to redirect runoff from the low lying and ponding areas to Bull Branch. The proposed storm drain system would consist of a 24" RCP along Randall Street to Bel-Air Drive and a 36" RCP along Bel-Air Drive to the Dellinger Street/N Lynn Street intersection. A 5'x3' RCB and 5'x4' RCB along Dellinger Street and N Lynn Street will convey discharges into Bull Branch. Rock riprap will be required for erosion protection at the storm drainage outfall.

Project improvements would include approximately 1,365 linear feet of storm drainage, inlets, storm drain manholes and an outfall structure with erosion protection.

BENEFITS

The following benefits will be provided with the Bel-Air Drive Storm Sewer System project:

1. Alleviates ponding along Bel-Air Drive, Dellinger Drive, N Lynn Street and Randall Street during larger storm events
2. Increases the capacity of the storm drainage system in this area
3. Reduces private property flood concerns along Travis Street and Franklin Street
4. Phased construction is an option for this project and would allow for the City to budget the improvements with flexibility

CHALLENGES

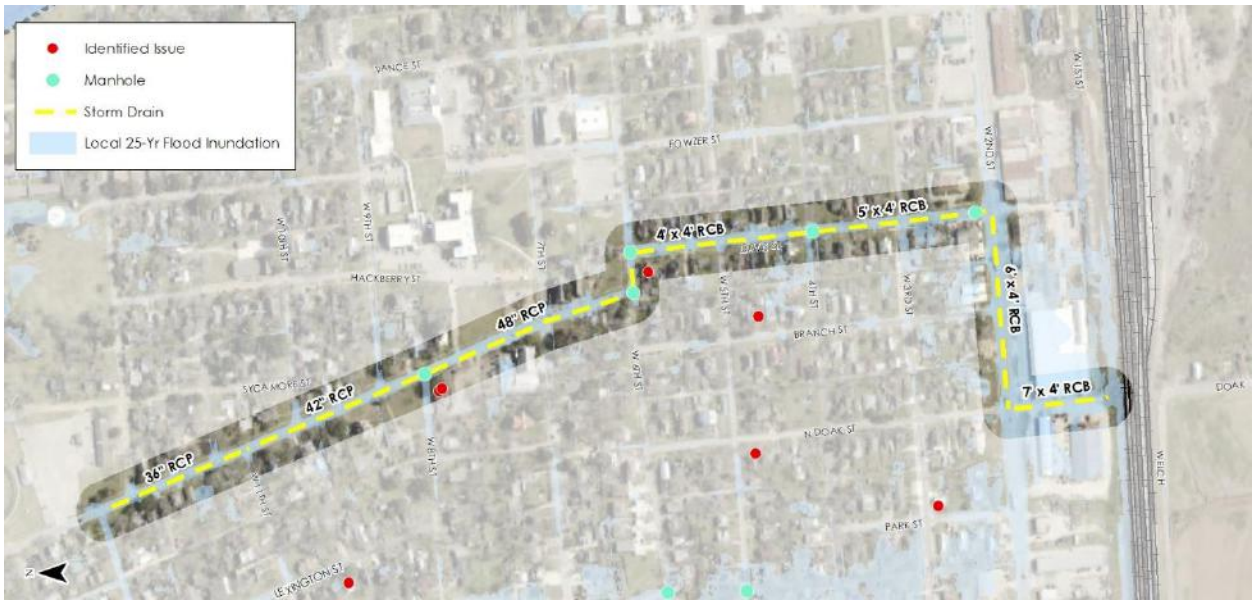
Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction. Additional challenges would include possible drainage easements that would be required to implement the project, access to Bull Branch Creek during construction and future maintenance of the storm drainage system and storm drain outfall.

SUMMARY

The Bel-Air Drive Storm Sewer System flood mitigation solution will address five public input points, benefit up to 25 structures, and improve storm drainage conveyance in this area. Neighborhood streets and access will be improved due to new drainage systems that will result in less ponding of water during and after storm events. Residential properties will also experience reduced stormwater inundation during larger storm events.

DAVIS STREET SOUTH STORM DRAINAGE SYSTEM

The Davis Street South Storm Drainage System improvements will be located along 2nd Street and north along Davis Street to W 8th Street. The system will collect drainage along this corridor that will flow south to 2nd Street and then south of 2nd Street to an outfall into the drainage channel located along the north side of the railroad. The new storm drain system will tie into the existing 2nd Street storm drain system.



FLOOD PROTECTION MEASURES

Davis Street experiences significant ponding during large storm events from W 8th Street to 2nd Street. Flood protection measures to mitigate 25-year Atlas 14 flows include improvements north of 2nd Street and from 2nd Street to the south. These improvements can be phased as a cost savings measure if the south improvements from 2nd Street to the railroad drainage ditch are implemented first:

1. 2nd Street to the railroad drainage ditch – With 25-year Atlas 14 flows, the 2nd Street storm drain system does not have capacity and will be accepting new storm drainage system flows at the Davis Street intersection. Therefore, a new storm drain system is needed to relieve flow from 2nd Street. This system will convey flow along 2nd Street from Davis Street to Doak Street and connect south at the railroad drainage ditch. Box culvert sizes range from 6'x4' RCB to 7'x4' RCB. Channel improvements to the railroad ditch are also needed.
2. North of 2nd Street – A new storm drain system will begin at Davis Street and W 8th Street. The system will follow Davis Street to W 6th Street and then from W 6th Street to the south until it connects into the 2nd Street drainage system. Pipe sizes range from a 48" RCP to a 5'x4' RCB.

BENEFITS

The following benefits will be provided by the Davis Street South Storm Drainage Improvements:

1. Increase storm drainage capacity in the system along 2nd Street and to the north along Davis Street to W 8th Street
2. Alleviates ponding along local streets where the storm drainage system improvements will be implemented
3. Reduces private property flood concerns along streets in the vicinity of the improvements

4. Phased construction of the improvements north and south of 2nd Street allows for the City to budget the improvements with flexibility

CHALLENGES

Challenges will be faced as the Davis Street storm drainage improvements are implemented, including impacts to local residents during construction that may include limited access to neighborhood streets and driveways and possible re-routing of traffic along local streets. Additional challenges would include performing storm drainage improvements within TxDOT ROW along 2nd Street, requiring coordination with TxDOT to plan for these improvements and to determine the process and permitting that will be required. Additional challenges would include future maintenance of the storm drainage system and improvements to the railroad drainage ditch.

SUMMARY

The Davis Street storm drainage improvements will address four public input points, benefit up to 65 structures in the vicinity, and improve storm drainage conveyance with over 4,685 linear feet of storm drainage improvements. Local thoroughfares and neighborhood streets will also be improved due to new storm drainage systems that will result in less ponding of water during and after storm events.

BURKETT STREET RE-PROFILING

The Burkett Street Re-Profiling project is located along Burkett Street, south of Old Thorndale Road and near Bull Branch. The project includes re-grading of roadside ditches along Burkett Street, replacing driveway culverts, and adding two cross culverts to navigate flow east across Burkett Street. Based on Halff's 25-year flood analysis, the proposed system primarily addresses residential property flooding along Burkett Street.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate ponding issues include re-grading the roadside ditches along Burkett Street and replacing driveway culverts. Additionally, two cross culverts will be added to navigate flow east along Burkett Street. One crossing culvert would consist of 2-18" RCPs on the south side of Davidson Drive. The other crossing, on the north side of Lenora Drive, would consist of a 4'x2' RCB. A new outfall ditch is proposed west of Lenora Drive instead of continuing the drainage south along Burkett Street. This drainage ditch would consist of a 4-foot bottom width, 4:1 side slopes and an average depth of 1.5 feet.

Project improvements would include two new culvert crossings and 975 feet of drainage ditch improvements.

BENEFITS

The following benefits will be provided with the Burkett Street Re-Profiling project:

1. Alleviates ponding along Burkett Street during larger storm events
2. Increases the capacity of the drainage system in this area
3. Reduces private property flood concerns along Burkett Street

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction. Additional challenges would include possible drainage easements that would be required to implement the drainage ditch improvements from Burkett Street to Bull Branch, and future maintenance of the storm drainage system and open channel.

SUMMARY

The Burkett Street re-profiling flood mitigation solution will address three public input points, benefit up to 15 structures, and improve drainage conveyance in this area. Neighborhood streets and access will be improved due to new drainage systems that will result in less ponding of water during and after storm events. Residential properties will also experience reduced stormwater inundation during larger storm events.

VELMA DRIVE STORM SEWER SYSTEM

The Velma Drive Storm Sewer System project is located along Velma Drive and a segment of Holly Springs Drive from Velma Drive to Dahlberg Blvd. The project includes two new storm drainage systems that connect into existing drainage channels in the area. Based on Halff's 25-year flood analysis, the proposed system primarily addresses residential property and local street flooding along Velma Drive and Holly Springs Drive.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate local street and residential ponding issues along Holly Springs Drive include installation of a storm drainage system that consists of a 4'x2' RCB and inlets from Dahlberg Blvd to the existing drainage channel located south of Velma Drive. This will reduce the amount of surface flow on Velma Drive. A second storm drainage system includes a 30" RCP to 48" RCP with inlets on Velma Drive beginning at Pin Tail Lane, extending south into the channel at Donna Drive. The existing channel and the crossing at Donna Drive have the capacity to handle the discharge from both systems.

Project improvements would include approximately 1,500 linear feet of storm drainage, inlets, and storm drain manholes.

BENEFITS

The following benefits will be provided with the Velma Drive Storm Sewer System project:

1. Alleviates ponding along Velma Drive and Holly Springs Drive during larger storm events
2. Increases the capacity of the storm drainage system in this area
3. Reduces private property flood concerns
4. Phased construction is an option for this project and would allow for the City to budget the improvements with flexibility

CHALLENGES

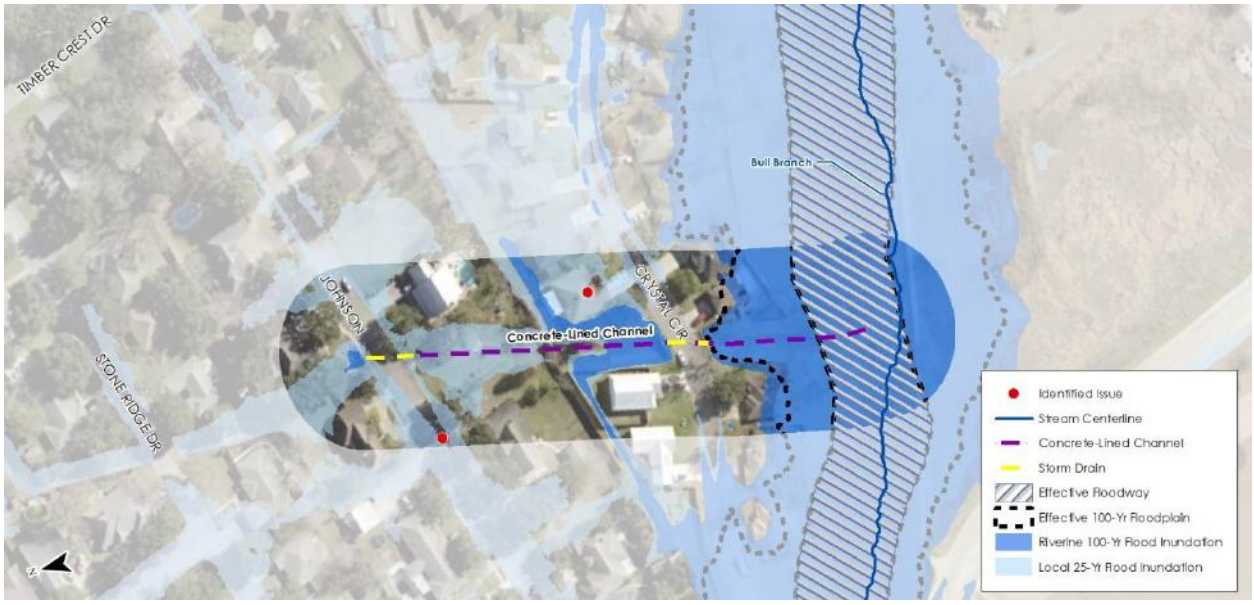
Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction. Additional challenges would include possible drainage easements and future maintenance of the storm drainage system.

SUMMARY

The Velma Drive Storm Sewer System flood mitigation solution will address one public input point, benefit up to 25 structures, and improve storm drainage conveyance in this area. Neighborhood streets and access will be improved due to new drainage systems that will result in less ponding of water during and after storm events. Residential properties will also experience reduced stormwater inundation during larger storm events.

TH JOHNSON DRIVE DRAINAGE IMPROVEMENTS

The TH Johnson Drive Drainage Improvements project is located at TH Johnson Drive and south at Crystal Circle. The project includes new culvert improvements and a rectangular concrete lined channel that drains into Bull Branch. Based on Halff's 25-year flood analysis, the proposed system primarily addresses residential property and local flooding south of TH Johnson Drive to Crystal Circle.



FLOOD PROTECTION MEASURES

Flood protection measures to mitigate flooding issues include connecting the two 36" RCPs from the KB-1 pond into the downstream end of the existing 7'x3' RCBs at TH Johnson Drive. A new 500-foot long rectangular concrete-lined channel south of TH Johnson Drive that would connect into Bull Branch. Additional three (3) 6'x3' RCB culverts would be installed at Crystal Circle.

Project improvements would include approximately 60 feet of culvert improvements and 500 linear feet of concrete-lined channel improvements.

BENEFITS

The following benefits will be provided with the TH Johnson Drive Drainage Improvements project:

1. Alleviates ponding and runoff at TH Johnson Drive and south of TH Johnson Drive along the improvement location during larger storm events
2. Increases the capacity of the drainage system in this area
3. Reduces structure flooding concerns

CHALLENGES

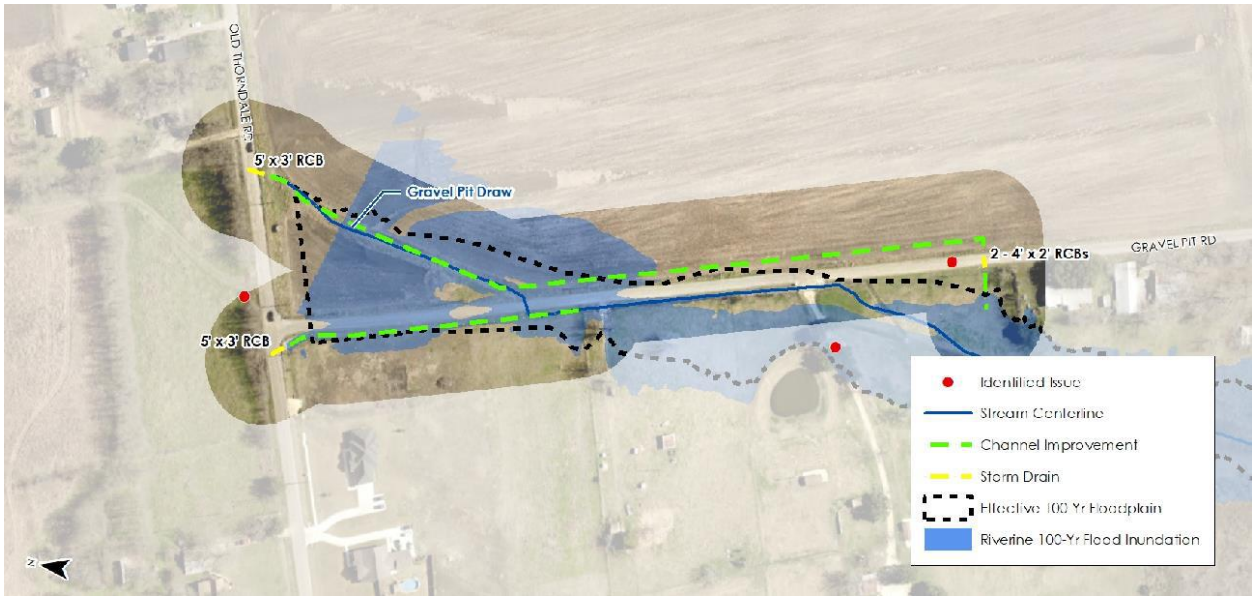
Challenges that will be faced to implement this project include the impacts to access to the residential homes and roadways during construction. Local residential homes would be in close proximity to the adjacent construction of the concrete-lined channel. Additional challenges would include possible drainage easements that would be required to implement the channel improvements, access to Bull Branch Creek during construction and future maintenance of the storm drainage system and open channel.

SUMMARY

The TH Johnson Drive drainage improvements solution will address two public input points, benefit up to 9 structures, and improve drainage conveyance in this area. Neighborhood, collector and arterial streets and access will be improved due to new drainage systems that will result in less ponding of water during and after storm events. Residential properties will also experience reduced stormwater inundation during larger storm events.

OLD THORNDALE ROAD DRAINAGE IMPROVEMENTS

The Old Thorndale Road Drainage Improvements project is located along Old Thorndale Road and Gravel Pit Road. Two cross culverts exist along Old Thorndale Road in this area that are undersized, with both overtopping during large rain events. The ditches conveying flow south of Old Thorndale Road into Gravel Pit Draw are also undersized and flood Gravel Pit Road. Based on Halff's 25-year flood analysis, the proposed solution primarily addresses a flooding situation along Gravel Pit Road and reduces private property flooding west of Gravel Pit Road.



FLOOD PROTECTION MEASURES

Flood protection measures to mitigate the flooding issues along Gravel Pit Draw and Gravel Pit Road include replacing the existing cross culverts along Old Thorndale Road with a 5'x3' RCB at each location. Additionally, roadside ditches will need to be regraded, including approximately 500' of regrading on the west side of Gravel Pit Road and 1,180' of regrading on the east side of Gravel Pit Road. A new cross culvert, 2-4'x2' RCBs, crossing Gravel Pit Road is also proposed. Regrading ditches and constructing the cross culverts will mitigate road overtopping.

BENEFITS

The following benefits will be provided with the Old Thorndale Road Drainage Improvements project:

1. Increases the capacity of the open channel and culvert system in this area, specifically along Gravel Pit Road
2. Alleviates ponding at Gravel Pit Road
3. Reduces private property flood concerns along the west side of Gravel Pit Road

CHALLENGES

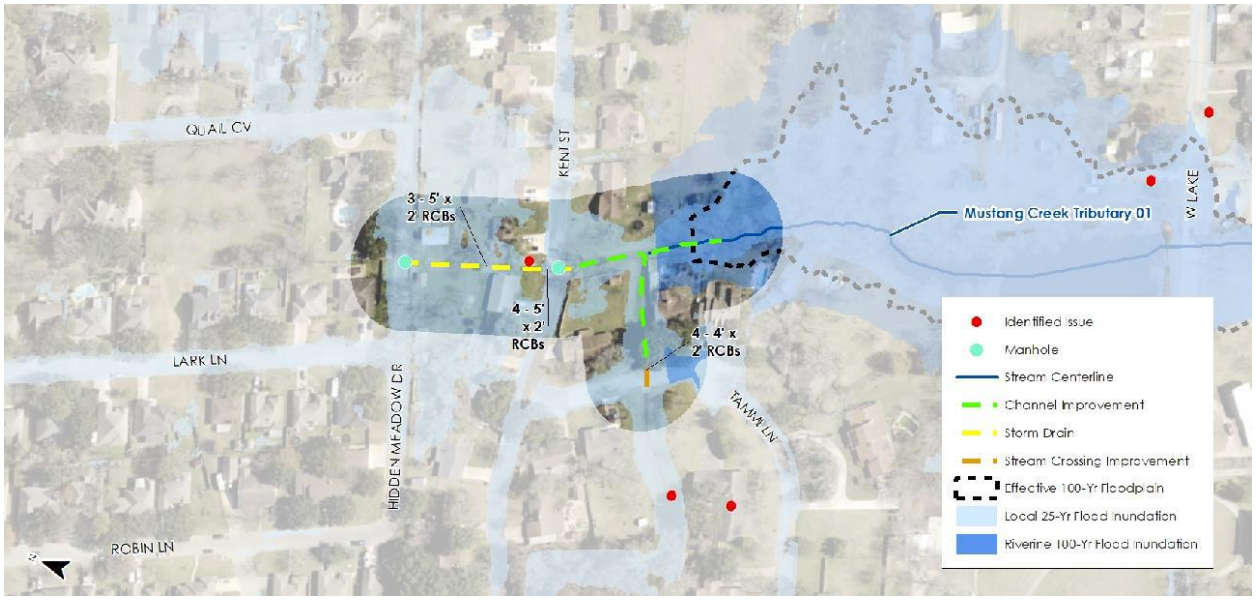
Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction, potential easements needed for the ditch regrading, and future maintenance of the drainage improvements.

SUMMARY

The Old Thorndale Road Drainage Improvements flood mitigation solution will address 3 public input points, benefit up to 6 structures and alleviate roadway and private property flooding concerns in this area. Local roadways and access will be improved due to the new drainage improvements that will result in less ponding of water and flooding in this area during and after storm events.

TAMMI LANE IMPROVEMENTS

The Tammi Lane Improvements project is located near Tammi Lane, Kent Street and Hidden Meadow Drive. This area experiences significant ponding in the general vicinity where the two open channels meet south of Ken Street and east of Tammi Lane. This creates a ponding effect that extends north of Kent Street to Hidden Meadow Drive. Based on Halff's 25-year flood analysis, the proposed solution primarily addresses local street flooding along these three streets and addresses potential ponding at residential structures.



FLOOD PROTECTION MEASURES

The open channel crossing Tammi Lane has a flat slope and low capacity leading to overtopping of Tammi Lane and flooding the nearby area. Flood protection measures to mitigate these flooding issues include channel improvements starting from 330 feet downstream to Tammi Lane with approximately 160 feet immediately downstream being a rectangular concrete-lined channel. Replacing the existing cross culverts with 4-4'x2' RCBs and raising the road approximately 0.15 feet will pass the 24-year storm event at Tammi Lane. Additionally, to alleviate ponding along Hidden Meadow Drive and Kent Street, 3-5'x2' RCBs and inlets along these roadways are needed (from Hidden Meadow Drive to Kent Street) and an additional 5'x2' RCB is needed from Kent Street to the outfall on the south side (total of 4-5'x2' RCBs at Kent Street).

BENEFITS

The following benefits will be provided with the Tammi Lane Improvements project:

1. Relieves existing storm drainage capacity concerns
2. Reduces frequent overtopping and reduces depth of overtopping for local roads, including Tammi Lane, Kent Street and Hidden Meadow Drive
3. Provides increased channel conveyance
4. Alleviates roadway ponding

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction, future maintenance of the improved culverts and open channels, and obtaining any required easements for the new drainage system and channel improvements.

SUMMARY

The Tammi Lane Improvements flood mitigation solution will address three public input points, benefit up to 15 structures, and improve local storm drainage and channel conveyance in this area. Neighborhood streets and access will be improved due to new street improvements and increased conveyance of the storm drainage system, culverts and open channels in the area.

GABRIEL STREET ROAD IMPROVEMENTS

The Gabriel Street Road Improvements project is located along Gabriel Street between Wallace Street and Fisher Street. Gabriel Street experiences ponding on the road during storm events, which is caused by the crown shape of the road. Based on Halff's 25-year flood analysis, the proposed solution primarily addresses residential property and local street flooding along Gabriel Street.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate local street and residential ponding issues along Gabriel Street include regrading the west side of Gabriel Street to convey flow into the existing concrete flume that connects to Castlewood Court to the east.

BENEFITS

The following benefits will be provided with the Gabriel Street Road Improvements project:

1. Alleviates ponding along Gabriel Street during larger storm events
2. Reduces private property flood concerns

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction.

SUMMARY

The Gabriel Street Road Improvements flood mitigation solution will address two public input points, benefit up to 4 structures, and improve local storm drainage conveyance in this area. Neighborhood streets and access will be improved due to new street regrading that will result in less ponding of water during and after storm events. Residential properties will also experience reduced stormwater inundation during larger storm events.

NORTH DRIVE STORM DRAIN IMPROVEMENTS

The North Drive Storm Drain Improvements project is located along North Drive between Wallace Street and W Lake Drive. North Drive experiences significant ponding on the road during storm events. Based on Halff's 25-year flood analysis, the proposed solution primarily addresses local street flooding along North Drive.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate local street flooding issues along North Drive include the installation of a storm drain system that connects to the existing storm drain system on West Lake Drive. During project design, further analysis is needed for the West Lake Drive storm drain system to determine its capacity and possible upsizing. The capacity of the existing storm drain system must be checked to ensure that it can handle new flows from the improved North Drive system.

Improvements include 650 linear feet of 5'x2' RCB and associated inlets to capture stormwater flows.

BENEFITS

The following benefits will be provided with the North Drive Storm Drain System project:

1. Relieves existing storm drainage capacity concerns
2. Increases the capacity of the storm drainage system
3. Alleviates ponding along North Drive

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction and potential limitations and/or restrictions of the West Lake Drive storm drain system and connections to that system.

SUMMARY

The North Drive Storm Drain Improvements flood mitigation solution will address one public input point, benefit up to 15 structures, and improve local storm drainage conveyance in this area. Neighborhood streets and access will be improved due to new street regrading and the addition of inlets that will result in less ponding of water during and after storm events.

McLAIN STREET STORM DRAIN IMPROVEMENTS

The McLain Street Storm Drain Improvements project is located along McLain Street between Howard Street and Mills Street. McLain Street experiences significant ponding on the road during storm events. Based on Halff's 25-year flood analysis, the proposed solution primarily addresses local street flooding along McLain Street and for local residential properties, especially closer to Mills Street.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate local street flooding issues along McLain Street include the installation of a storm drain system that connects to the existing storm drain system on Mills Street as an extension of the Edmonds Street project. New pipe sizes along McLain Street would range between 36" RCP to 48" RCP to accommodate flows. Improvements include 1330 linear feet of storm drain and associated inlets to capture stormwater flows.

BENEFITS

The following benefits will be provided with the McLain Street Storm Drain System project:

1. Increases the capacity of the storm drainage system along McLain Street
2. Alleviates ponding along McLain Street
3. Reduces private property flood concerns, especially those closer to Mills Street

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction and future maintenance of the storm drainage system.

SUMMARY

The McLain Street Storm Drain Improvements flood mitigation solution will address one public input point, benefit up to 24 structures, and improve local storm drainage conveyance in this area. Neighborhood streets and access will be improved due to the new storm drainage system and the addition of inlets that will result in less ponding of water during and after storm events.

MARIPOSA LANE STORM DRAIN IMPROVEMENTS

The Mariposa Lane Storm Drain Improvements project is located at Mariposa Lane, Mockingbird Lane and East 4th Street. Survey data shows low points on Mariposa Lane and Mockingbird Lane that causes a flooding scenario. Based on Halff's 25-year flood analysis, the proposed solution primarily addresses the ponding scenario that can lead to this potential flooding hazard.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate the flooding issues between Mariposa Lane and Mockingbird Lane include the installation of inlets at the intersections of each street near East 4th Street and culverts that connect these inlets downstream (south) of East 4th Street. The culverts range in size from 3'x2' to 4'x2'. The culverts will discharge local flows north of East 4th Street into the existing cross culvert under 4th Street. Constructing the cross culverts will promote positive drainage while enhancing road safety during storm events.

BENEFITS

The following benefits will be provided with the Mariposa Lane Storm Drain System project:

1. Relieves existing capacity concerns of the cross culvert system at East 4th Street in this location
2. Alleviates ponding between Mariposa Lane and Mockingbird Lane, north of East 4th Street
3. Reduces private property flood concerns between Mariposa Lane and Mockingbird Lane

CHALLENGES

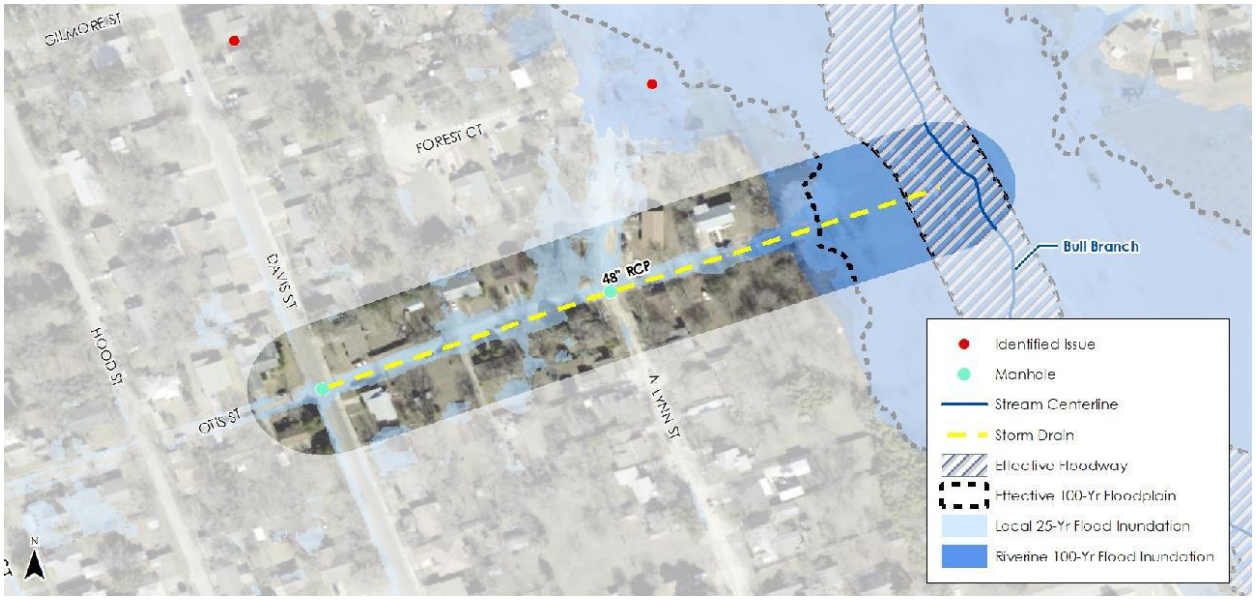
Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction, right-of-way needs from TxDOT to implement the project, and future maintenance of the storm drainage system.

SUMMARY

The Mariposa Lane Storm Drain Improvements flood mitigation solution will address two public input points, benefit up to 22 structures, and alleviate existing storm drainage capacity concerns in this area. Neighborhood streets and access will be improved due to the new storm drainage system and the addition of inlets that will result in less ponding of water and flooding in this area during and after storm events.

OTIS STREET STORM DRAIN IMPROVEMENTS

The Otis Street Storm Drain Improvements project is located along Otis Street between Davis Street and Bull Branch. Otis Street's topography in this area makes the street prone to ponding during rain events. Consequently, the runoff flows towards private residential properties. Based on Halff's 25-year flood analysis, the proposed solution primarily addresses ponding along Otis Street and reduces private property flooding along Otis Street.



FLOOD PROTECTION MEASURES

Flood protection measures to mitigate the flooding issues along Otis Street include the installation of a storm drainage system starting at Davis Street with an outfall into Bull Branch. Approximately 870 linear feet of 48" RCP will be needed to convey stormwater flows to Bull Branch. The proximity to the creek allows for efficient drainage during rain events. Since flow will be concentrated into Bull Branch, rock riprap will be required to protect the channel at the outfall.

BENEFITS

The following benefits will be provided with the Otis Street Storm Drain System project:

1. Alleviates ponding between Davis Street and Bull Branch along Otis Street
2. Reduces private property flood concerns along Otis Street

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction, potential easements needed for the outfall structure, and future maintenance of the storm drainage system and outfall.

SUMMARY

The Otis Street Storm Drain Improvements flood mitigation solution will benefit up to 17 structures and alleviate roadway and private property flooding concerns in this area. Neighborhood streets and access will be improved due to the new storm drainage system that will result in less ponding of water and flooding in this area during and after storm events. The system will connect directly into Bull Branch, which is adjacent to the east end of Otis Street.

TRAVIS STREET AND FRANKLIN STREET STORM SEWER SYSTEM

The Travis Street and Franklin Street Storm Sewer System project is located south of W 2nd Street, north of Welch and the railroad, west of Sloan Street and east of Mustang Creek Tributary 1. Travis Street and Franklin Street form a loop road south of W 2nd Street that primarily serves residential homes and a few small businesses. Based on historical records, public input on local flooding and Halff's assessment of the local 25-year flood inundation, Travis Street and Franklin Street experience ponding from inadequate roadside ditches that generally drain south to the drainage ditch along the railroad. The ponding and overland flow from the 25-year flood analysis inundates yards along Travis Street and Franklin Street and impacts some residential homes along Franklin Street.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate ponding and overland flow issues include re-grading the roadside ditches along Travis Street and Franklin Street that would connect into a storm drain system. The proposed storm drain system would consist of a 24" RCP from Franklin Street to Travis Street and a 30" RCP until it discharges into the railroad drainage ditch south of Travis Street. Rock riprap will be required for erosion protection at the storm drainage outfall. The re-grading of roadside ditches will aid in navigating flow toward the new storm drainage system that will outfall to the railroad drainage ditch.

Project improvements would include approximately 250 linear feet of storm drainage, 800 linear feet of roadside ditch improvements, inlets, storm drain manholes and an outfall structure with erosion protection.

BENEFITS

The following benefits will be provided with the Travis Street and Franklin Street project:

1. Alleviates ponding along Travis Street and Franklin Street during larger storm events
2. Increases the capacity of the storm drainage system in this area, including improved roadside ditches and underground storm drainage for conveyance
3. Reduces private property flood concerns along Travis Street and Franklin Street
4. Phased construction is an option for this project and would allow for the City to budget the improvements with flexibility

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction. Additional challenges would include obtaining potential drainage easements that would be required to implement the project and future maintenance of the roadside ditches, storm drainage system and storm drain outfall.

SUMMARY

The Travis Street and Franklin Street Storm Sewer System flood mitigation solution will address one public input point, benefit up to 16 structures, and improve storm drainage conveyance in this area. Neighborhood streets and access will be improved due to new drainage systems that will result in less ponding of water during and after storm events. Residential properties will also experience reduced stormwater inundation during larger storm events.

DEBUS DRIVE RE-PROFILING

The Debus Drive Re-Profiling project is located along Debus Drive, south of Lee Street, to Mustang Creek Tributary 1. Deterioration of Debus Drive is a result of ponding. Rainfall runoff collects at existing gutters; however, the gutters are shallow and do not have enough capacity.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate the flooding issues in this area include reprofiling the road and constructing a storm drainage system from Lee Street to approximately 150' south of Thomas Street. A full reconstruction of Debus Drive along with the storm drainage system will redirect flow away from residences and towards a tributary of Mustang Creek.

The project includes up to 1,500 linear feet of curb and gutter improvements, 175 linear feet of storm drain, and conveyance of storm drain and street flows to Mustang Creek Tributary 1.

BENEFITS

The following benefits will be provided with the Debus Drive Re-Profiling project:

1. Alleviates roadway ponding along Debus Drive
2. Reduces private property flood concerns in the area
3. Phased construction allows for budget flexibility

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction, future maintenance of the roadway and drainage system, and potential drainage easements that may be needed for the re-profiling.

SUMMARY

The Debus Drive Re-Profiling solution will address 3 public input points, benefit up to 40 structures and alleviates roadway and private property flooding concerns in this area. Neighborhood streets and access will be improved due to the roadway re-profiling with a result of less ponding of water in this area and increased conveyance along the roadway system by adding a storm drainage system.

NORTH DAVIS STREET RE-PROFILING

The North Davis Street Re-Profiling project is located along North Davis Street between North Lynn Street and Gilmore Street. Residents along the east side of Davis Street reported roadway runoff flooding private property. Previous analyses show the roadway is overlayed with asphalt, leaving a shallow gutter depth. This enables runoff to flow to the lower elevated households.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate the flooding issues in this area include reconstruction of the curb and gutter along the east side of the road. A higher curb will allow runoff to be conveyed to a discharge point near Bull Branch. Similarly, regrading driveways is recommended to reduce ponding and redirect runoff. Surrounding sidewalks will also require re-grading to complement the new driveways. The re-profiling of Davis Street will reduce ponding and deflect runoff toward Bull Branch.

The project includes up to 1,600 linear feet of curb and gutter improvements.

BENEFITS

The following benefits will be provided with the North Davis Street Re-Profiling project:

1. Alleviates roadway ponding of North Davis Street
2. Reduces private property flood concerns in the area
3. Phased construction allows for budget flexibility

CHALLENGES

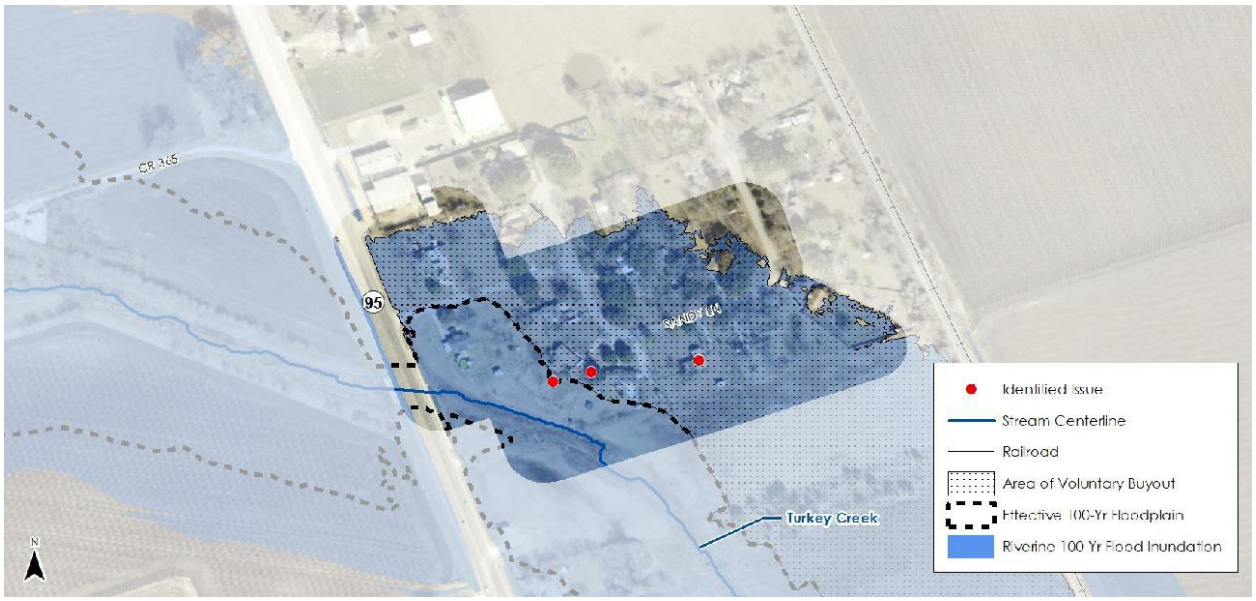
Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction and potential roadway easements that may be needed for the re-profiling.

SUMMARY

The North Davis Street Re-Profiling solution will address 4 public input points, benefit up to 7 structures and alleviates roadway and private property flooding concerns in this area. Neighborhood streets and access will be improved due to the roadway re-profiling with a result of less ponding of water in this area and increased conveyance along the roadway system.

SANDY LANE VOLUNTARY BUYOUTS

The Sandy Lane Voluntary Buyouts solution involves voluntary property buyouts for a subdivision located along Highway 95 and Sandy Lane. These properties are located within the Turkey Creek Atlas 14 100-year floodplain. No practical solution exists to reduce the floodplain extents at this location. Based on Halff's 25-year flood analysis, the proposed solution will not reduce the floodplain limits at this location, but it would improve the health, safety and welfare of local residents in this area. Further analysis would be required to determine functionality of the neighborhood if homes were removed and to determine general access/safety of the neighborhood during flood events.



FLOOD PROTECTION MEASURES

Flood protection measures would only include voluntary property buy-outs.

BENEFITS

The following benefits will be provided with the Sandy Lane Voluntary Buyouts project:

1. Reduces private property flood concerns by voluntary removal of homes that are located in the Turkey Creek Atlas 14 100-year floodplain

CHALLENGES

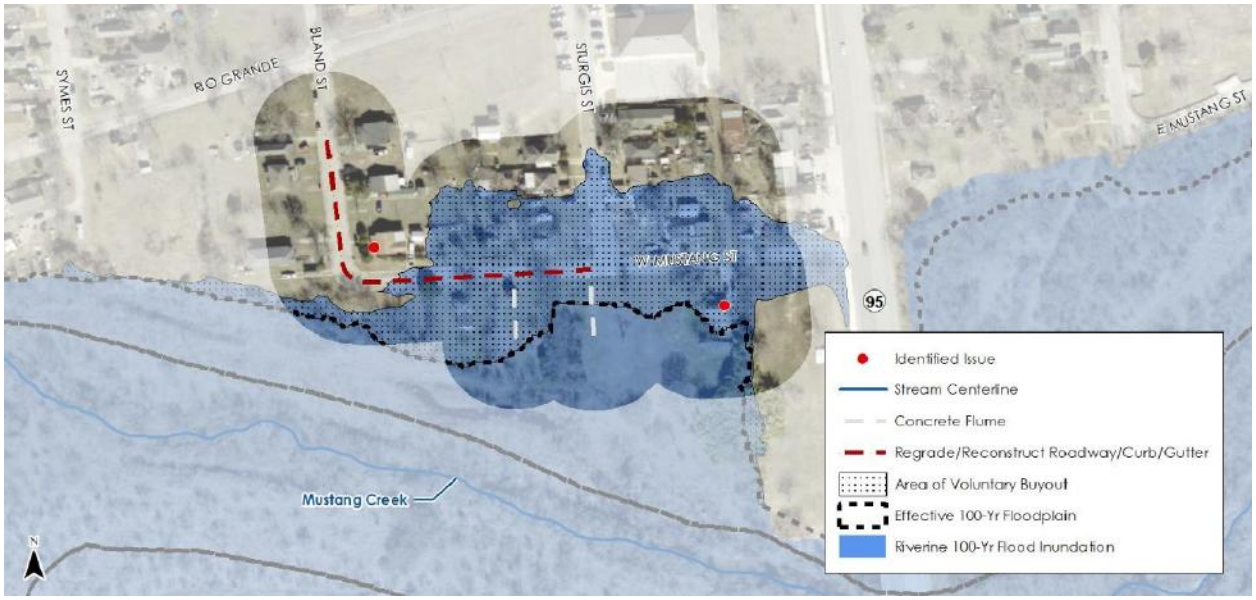
Challenges that will be faced to implement this project include the voluntary nature of the property acquisitions. Each property may have different challenges regarding voluntary buyouts. Also, the functionality of the neighborhood and access/safety of the remaining properties during flood events will need to be considered.

SUMMARY

The Sandy Lane Voluntary Buyouts project will address 3 public input points and benefit up to 12 structures (due to removal). Challenges will be faced due to the voluntary nature of the buyouts and determining the functionality and access/safety of the remaining structures in the neighborhood during flood events.

WEST MUSTANG STREET IMPROVEMENTS

The West Mustang Street Improvements project is located along West Mustang Street and Bland Street, near Sturgis Street and Mustang Creek. Private property on Mustang Street lies within the updated Atlas 14 100-year floodplain. Ponding is shown to occur along Bland Street south of Rio Grande Street due to pavement failures. This ponding exacerbates existing roadway deterioration.



FLOOD PROTECTION MEASURES

Flood protection measures to mitigate the flooding issues along West Mustang Street include a combination of voluntary buyouts and curb and gutter reconstruction along Bland Street and Mustang Street. Driveway approaches where there is ponding will also be reconstructed. Additionally, two concrete drainage flumes will be built on Mustang Street to direct flow out of the street and towards Mustang Creek. Voluntary buyouts are recommended for six properties that are impacted by the Atlas 14 100-year floodplain.

BENEFITS

The following benefits will be provided with the West Mustang Street Improvements project:

1. Alleviates roadway ponding along West Mustang Street and Sturgis Street
2. Promotes positive drainage in the area away from residential properties
3. Reduces private property flood concerns in the area

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction, potential easements needed for the flumes, and future maintenance of the roadways and maintenance of the flumes to ensure any erosion is mitigated over time. Another challenge will be the voluntary buyout process for the residential properties.

SUMMARY

The West Mustang Street Improvements flood mitigation solution will benefit 2 public input points, up to 20 structures and alleviate roadway and private property flooding concerns in this area. Neighborhood streets and access will be improved due to the new storm drainage system that will result in less ponding of water and flooding in this area during and after storm events. The system will connect tie the drainage more directly into Mustang Creek.

NORTH MAIN STREET RE-PROFILING

The North Main Street Re-Profiling project is located along North Main Street, Porter Street, E 8th Street, E 9th Street, and E 10th Street. During storm events, residents of North Main Street have reported flooding. The existing curb and gutter have either deteriorated or been reduced by asphalt overlay. Runoff easily overtops and floods private property.

FLOOD PROTECTION MEASURES

Flood protection measures to mitigate the flooding issues in this area includes re-grading the curb and gutter on Main Street and Porter Street spanning from E 8th Street to E 10th Street. Driveways will also require re-grading. Re-grading of North Main Street and Porter Street will transport runoff away from private property while increasing road safety.

The project includes up to 2,000 linear feet of curb and gutter improvements.

BENEFITS

The following benefits will be provided with the North Main Street Re-Profiling project:

1. Alleviates roadway ponding of North Main Street and Porter Street
2. Reduces private property flood concerns in the area

CHALLENGES

Challenges that will be faced to implement this project include the impacts to access to the residential homes during construction, future maintenance of the roadways and right-of-way coordination with TxDOT.

SUMMARY

The North Main Street Re-Profiling solution will address 2 public input points, benefit up to 20 structures and alleviates roadway and private property flooding concerns in this area. Neighborhood and arterial streets and access will be improved due to the roadway re-profiling with a result of less ponding of water in this area and increased conveyance along the roadway system.

5.0 ADDITIONAL DRAINAGE CONSIDERATIONS

Additional drainage considerations for the City of Taylor include recommendations on alternative drainage solutions such as regional and local detention, storm drainage maintenance plan, and stream erosion.

5.1 REGIONAL DETENTION AND LOCAL DETENTION

Other drainage alternatives that were considered included Regional Detention and Local Detention for their overall benefits in possible flood reduction in local watersheds. For Regional Detention, Bull Branch was the most significant stream considered for evaluation. However, due to constraints from various roadway crossings and the proximity of development close to the channel, regional detention along Bull Branch was unlikely to provide a significant reduction in flooding.

For future development in the upper watershed of Bull Branch (north and northwest of existing development), local detention (project specific) and/or regional detention alternatives could be investigated to ensure that new development does not cause adverse flood impacts into downstream, developed areas. However, this detention would only be considered viable to mitigate increased flows from the new developments and may not provide a significant reduction downstream.

For Local Detention, limited space is available to implement this scenario retroactively after development occurs. However, where space is available and flooding is a concern, it is recommended that local detention should be evaluated for all new developments, including studies to ensure that timing of peak flows from new developments do not adversely impact flows and flood elevations along adjacent creek corridors.

5.2 STORM DRAINAGE MAINTENANCE PLAN

The City of Taylor currently uses maintenance crews to clean channels of debris, silt and nuisance trees that may impact drainage conveyance. Maintenance crews may also help with the removal of water from streets, parking areas and other drainage facilities that convey or collect of stormwater runoff. Minor repairs to storm drainage system components, including outfalls, flumes and inlets can also be performed by maintenance crews. These repairs are performed along City right-of-way and in dedicated drainage easements.

For these facilities to function as deigned and constructed, they must be properly maintained. Poor or nonexistent maintenance can result in additional flooding problems that could affect other portions of the storm drainage system.

Consideration should be made in the design process as to the maintenance of these facilities. Reasonable access for maintenance personnel and equipment should be considered. For example, in storm drain design, proper access spacing can provide a relatively easy way to clear sediment and debris blockage or isolate a portion of the system for repairs. In large detention or retention design, provisions for a sediment trap and machinery access can greatly reduce maintenance costs.

The City's Drainage Utility Fee currently cannot cover all maintenance and operation costs that are needed to maintain the entire City's drainage system. However, as additional funding opportunities are pursued by the City for Capital Improvement Projects, the use of funding from the Drainage Utility Fee may transition from infrastructure to maintenance. Increasing the amount of storm drainage maintenance that

the City performs would require additional funding and resources. Until more resources and funding are available, Halff recommends a course of action for maintenance of existing and future storm drainage facilities throughout the City.

5.2.1 Categories for Maintenance

Maintenance of public storm drainage facilities usually falls into three categories:

1. Routine – Activities which happen on a periodic basis, which may be driven by the passage of time, not the specific deterioration of the system. Can include the following:
    a. Keeping water courses free from accumulations of debris and vegetation and storm drains free of silt, sand, and debris
    b. Correcting malfunctioning parts of a system, including settlement and breaks
    c. Potential Stream erosion locations – Periodic inspection to ensure conditions are not threatening City infrastructure (see Section 5.3 below)
    d. Detention facilities – Periodic inspection to identify restrictions on drainage by the accumulation of debris and siltation and by failed or damaged infrastructure. Critical facilities should be identified and checked after storm events.
2. Remedial – Corrects specific deficiencies in the existing system without upgrading its capacity
3. Capital Improvement Projects – Replaces deficient systems with larger or improved designs. These improvements become new drainage systems.

Note: For maintenance of private storm water management facilities, the City should provide routine notifications to private owners, home-owners associations, etc. to ensure that they are maintaining these facilities per City ordinances. Utilizing City GIS databases that specifically delineate locations of public and private storm water management facilities would help to assist with this process.

5.2.2 City Maintenance Program Recommendations

Based on funding and available resources, Halff recommends that the City develop a maintenance program that follows the following guidelines.

1. Review all new plans and permit applications to ensure compliance with City design criteria, master plans and sound engineering judgment in design (performed during the design plan review stage)
2. Effectively inspect all construction of these facilities to ensure compliance with design criteria, conditions and plans
3. Train maintenance crews to be able to respond effectively to the full range of drainage and flooding maintenance complaints and activities
4. Develop and maintain an up-to-date GIS-based inventory of the storm drainage system, including storm drainage lines, inlets, outfalls, flumes, channels, and detention/retention ponds located in the City. Break out GIS layers to identify facilities that are public or privately-owned
5. Develop and implement a prioritized remedial maintenance program based on documented needs and a rotation period for maintenance/inspection of storm drainage facilities (i.e. 1-year, 2-year, 3-year or 5-year review)
6. Provide adequate staff, equipment and resources needed for maintenance operations
7. Develop and implement operations and maintenance financing mechanisms within City budgets, including the Drainage Utility Fee
8. Establish policies to enforce compliance with the City's Maintenance Program

5.3 STREAM EROSION

Halff evaluated the riverine hydraulic models, developed for this study, for stream erosion potential. Hydraulic model outputs were reviewed for high channel velocities and compared to current stream conditions in the field using recent aerial photography. When evaluating various potential stream erosion locations, the focus was where structures, trails, roadways, and/or utility lines were in proximity. Based on our overall evaluation, stream erosion potential exists in the locations shown in **Table 5.1** below. These areas exhibit stream erosion, either through model velocities for high flow (100-year) and lower flow/more frequent (2-year) events or through observations of erosion along outside channel bends where velocities are higher.

Erosion ID	Channel Velocity 100 Year (ft/s)	Channel Velocity 2 Year (ft/s)	Notes
South Fork Mustang Creek at CR 369	7.75	5.57	Erosion downstream of CR 369
South Fork Mustang Creek at Private Drive	6.51	5.37	Erosion noted along private drive DS of CR 369
Mustang Creek Tributary 2 at US 79	2.38	7.22	Erosion upstream of US 79, a TxDOT highway
Mustang Creek south of E MLK/Dolan St	4.84	4.34	Erosion noted; public overhead utility
Bull Branch downstream of City Lake	4.28	2.41	Erosion at the outlet of City Lake
Bull Branch 820 ft downstream of Burkett St	6.61	6.92	Erosion adjacent to a natural trail
Bull Branch 560 ft upstream of Burkett St	4.85	6.31	Erosion adjacent to a natural trail
Bull Branch 450 ft upstream of Washburn St	10.12	10.45	Erosion near to Old Thorndale Rd/Porter St; Utility line
Bull Branch 120 ft upstream of E 4th St	6.48	6.03	Erosion upstream of a pedestrian bridge and E 4th St

Table 5.1 – Locations of Potential Erosion

Based on Halff's review, the locations identified as having potential erosion are not a threat to current City infrastructure. However, with increased development over time, the potential for stream erosion issues can increase as more flow is introduced into the channel. Some areas along South Fork Mustang Creek appear to be highly erosive south of CR 369; however, no infrastructure exists in these areas. If future development occurs in this area, the stream erosion potential should be considered for any infrastructure that crosses or is in proximity to the creek.

Halff's recommendation for this current Drainage Master Plan is that the City should continue to monitor these locations periodically to ensure they are not expanding, shifting, or increasing. Monitoring can be performed on a yearly basis or after major storm events. If stream erosion conditions worsen, then the City should take corrective actions.

Aerial images showing the general locations of stream erosion potential from Table 5.1 are included in **Figures 5.1 through 5.4**.

Figure 5.1 – Locations of Potential Erosion along South Fork Mustang Creek

Figure 5.2 – Location of Potential Erosion along Mustang Creek Tributary 2

Figure 5.3 – Location of Potential Erosion along Mustang Creek

Figure 5.4 – Locations of Potential Erosion along Bull Branch

6.0 DRAINAGE UTILITY FEE RATE STUDY

This chapter of the report describes Halff's evaluation of the existing Drainage Utility Fee for the City of Taylor. The basis of the Drainage Utility Fee is impervious area for non-residential parcels and a flat fee for residential parcels, which is also based on impervious area. For this study, Halff updated the City's impervious area layer, projected revenue based on various fee rates, and developed a high-level budget model to assist capital planning. The following sections describe Halff's analysis and recommendations for maintaining the Drainage Utility and implementing future fee changes.

6.1 STORMWATER UTILITY GIS DATA DEVELOPMENT

The existing Drainage Utility Study for the City of Taylor was completed in 2010 by Halff Associates, Inc. to promote the City's use of Drainage Utility fees to fund drainage improvement projects, maintenance of existing drainage infrastructure, personnel, and other related expenses. The 2010 study included the delineation of all non-residential impervious area, the development of an equivalent residential unit (ERU) which is a tool by which to bill non-residential parcels, and a community matching exercise between parcels and billing units. The 2010 study determined 1 ERU equals 2,500 square feet of impervious area.

Since the City of Taylor has undergone significant expansion and development since 2010, an update of the City's impervious layer was performed. Halff collected the following data in support of the 2022 impervious area update:

- Williamson County Appraisal District Parcel Data
- City's current impervious delineation (2010 Halff Study)
- Recent aerial imagery from Nearmap.com

Halff considered three GIS impervious layers for all non-residential parcels within the City:

- 2010 Impervious Area – impervious area for non-residential parcels defined in the 2010 study
- Additional Impervious Area – captured additional impervious area on previously developed non-residential parcels included in the 2010 study.
- New Impervious Area – captured new impervious area on previously undeveloped non-residential parcels since 2010

The City is currently billing 514 non-residential parcels, equivalent to approximately 8,500 ERUs. The impervious area update indicated an additional 3,347 non-residential ERUs, according to 2022 aerial imagery, that are not being billed as of March 2022. The existing, additional, and new non-residential impervious areas can be seen in **Appendix D**.

6.2 PROJECTED REVENUE BASED ON VARIOUS FEES

Revenue projections were developed over the next 5 years based on the updated impervious layer at various fee rates through fiscal year (FY) 2027. Baseline residential and non-residential ERUs were determined using the March 2022 billing report provided by the City. The City currently bills just under 5,900 residential ERUs and approximately 8,500 non-residential ERUs. The following assumptions were used to compute the "Revenue Projections" in **Appendix D**:

- A 10% reduction was applied to additional non-residential ERUs based on the updated impervious layer to account for potential accounts that are unmatched or are exempt. The additional ERUs included for the yearly revenue projections = 3,347 * 0.9 = **3,012**.
- Future residential and non-residential ERUs were projected using the average annual growth rate between the 2010 and 2022 rate studies.
- A 10% reduction was applied to the projected yearly revenue increases to account for unpaid/contested billing and other unforeseen contingencies.

The current Drainage Utility Fee for the City of Taylor is $3.00 per ERU and the current ERUs were back calculated from the charges indicated in the March 2022 Billing Report. The residential ERUs are related to the City's water billing accounts, which are regularly validated and updated. For that reason, the residential ERUs are considered to be up to date for FY 2022.

The non-residential ERUs increased by approximately 3,000 units since 2010, bringing the non-residential ERU total for the City of Taylor to 11,518. Implementing the updated non-residential impervious area alone, at the current Drainage Utility Fee of $3.00, would result in approximately $98,000 in additional revenue for the City.

Projections for annual revenue based on various Drainage Utility Fee rates ($3.00, $4.00 & $5.00) can be seen in the "Revenue Projections" attachment in **Appendix D**.

6.3 COST OF SERVICE BUDGET & CAPITAL PLANNING

For Texas municipalities, the Texas Legislature authorized cities to adopt local drainage utilities, as ordained within Subchapter C of Texas Local Government Code 552 (LGC 552). Eligible expenses that make up the cost of service for this type of utility are defined in Section 552.044 (2).

The City provided a list of expenses the Drainage Department expects to initiate within the next 5 years in addition to current expenditures. The list of expenses and anticipated costs is shown in **Table 6.1**. This list of expenses was used to determine approximate drainage utility fees to accomplish the goals of the Drainage Department.

Expense Type	Description	Unit Cost	Analysis Type
Personnel	Drainage Crew Lead	$22.00	Hourly
Personnel	Drainage Operator I	$18.00	Hourly
Equipment	Crew Truck	$38,000.00	Lump Sum
Equipment	Grade-all	$200,000.00	Lump Sum
Equipment	Dump Truck	$110,000.00	Lump Sum
Equipment	Sweeper	$140,000.00	Lump Sum
Equipment	Jet Machine	$35,000.00	Lump Sum
Projects	Small CIP	$492,000.00	Lump Sum
Projects	Medium CIP	$1,288,000.00	Lump Sum
Projects	Large CIP	$3,652,000.00	Lump Sum
Projects	SWU Update Study	$30,000.00	Lump Sum

Table 6.1 – Anticipated Expenses for the City of Taylor

A simple budget model was developed to project income based on rates of $3.00, $4.00, and $5.00 per ERU and applying the increased ERUs based on updated impervious area. The current expenditures of approximately $510,000 per year were subtracted from the calculated revenue to determine the

remaining budget to fund the additional expenses in Table 6.1. Three scenarios were analyzed for capital planning purposes by either maintaining or raising the Drainage Utility Fee.

- A rate of $3.00 allowed new equipment to be acquired for drainage activities and increased maintenance of existing infrastructure, however, the increase was still not enough to support additional personnel or fund CIP projects within the next 5 years.
- A rate of $4.00 supported hiring new drainage personnel, acquiring new equipment, and funding additional maintenance activities, however, even small CIP projects could not be supported by the Drainage Utility fund.
- A rate of $5.00 allows the City to acquire additional personnel and either acquire additional equipment or perform CIP projects. This is predominantly caused by the average cost of a CIP project in the City of Taylor.

See Appendix X for example 5-year capital plans at drainage utility fees of $3.00, $4.00, and $5.00.

The sample additional revenue and expenditures detailed above are solely for example. It is within the City's discretion to fund any of the expenditures desired, according to the needs of the public. For example, the City may decide a small CIP supersedes the need for additional equipment and accelerate the CIP schedule while delaying other expenditures. The scenarios described are intended to fund as many items as possible, however, priorities of the City, Council, and/or public are subject to change. The budget model developed to test these scenarios accompanies this report in **Appendix E**.

The average storm water utility rate fee in the State of Texas (for cities that charge them) is $5.62 per ERU. Comparable cities to the City of Taylor are shown in **Figure 6.1** and **Figure 6.2** with their storm water utility rate fees.

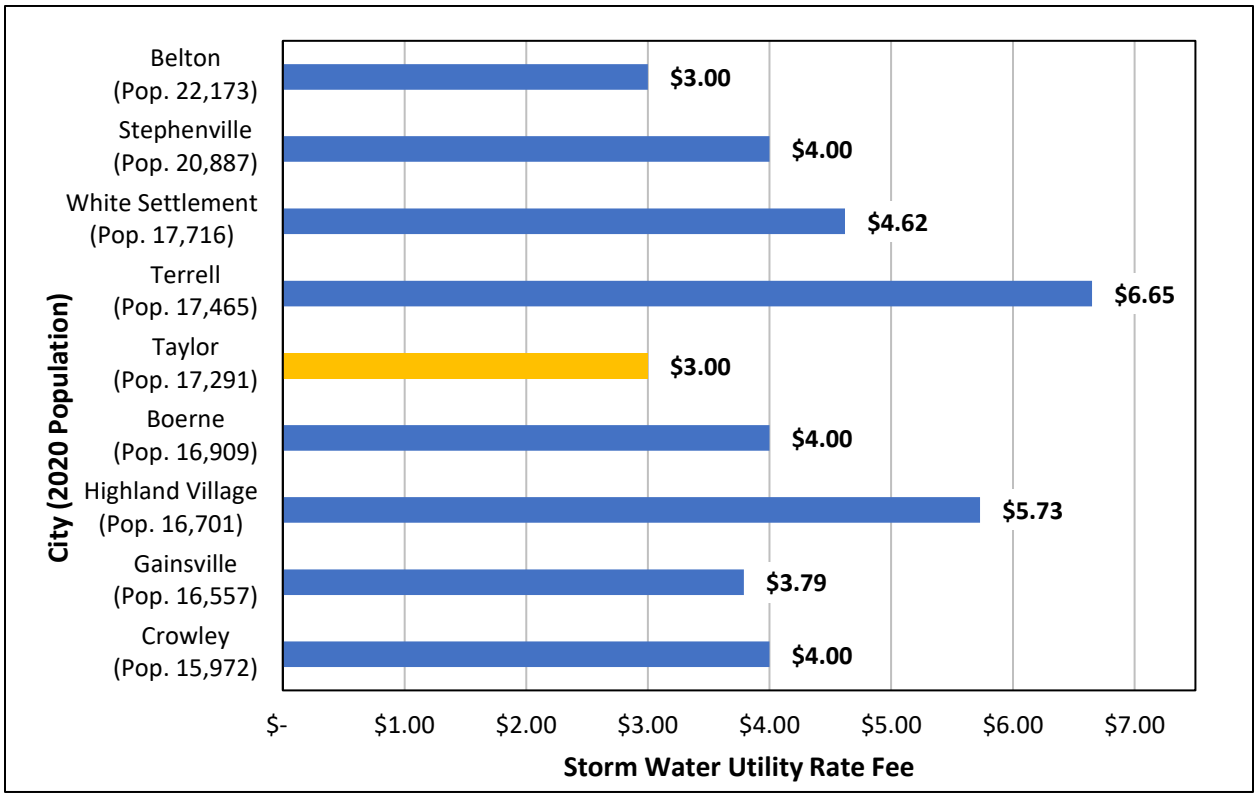


Figure 6.1 – City of Taylor and Comparable Cities by Population & Storm Water Utility Rate Fees

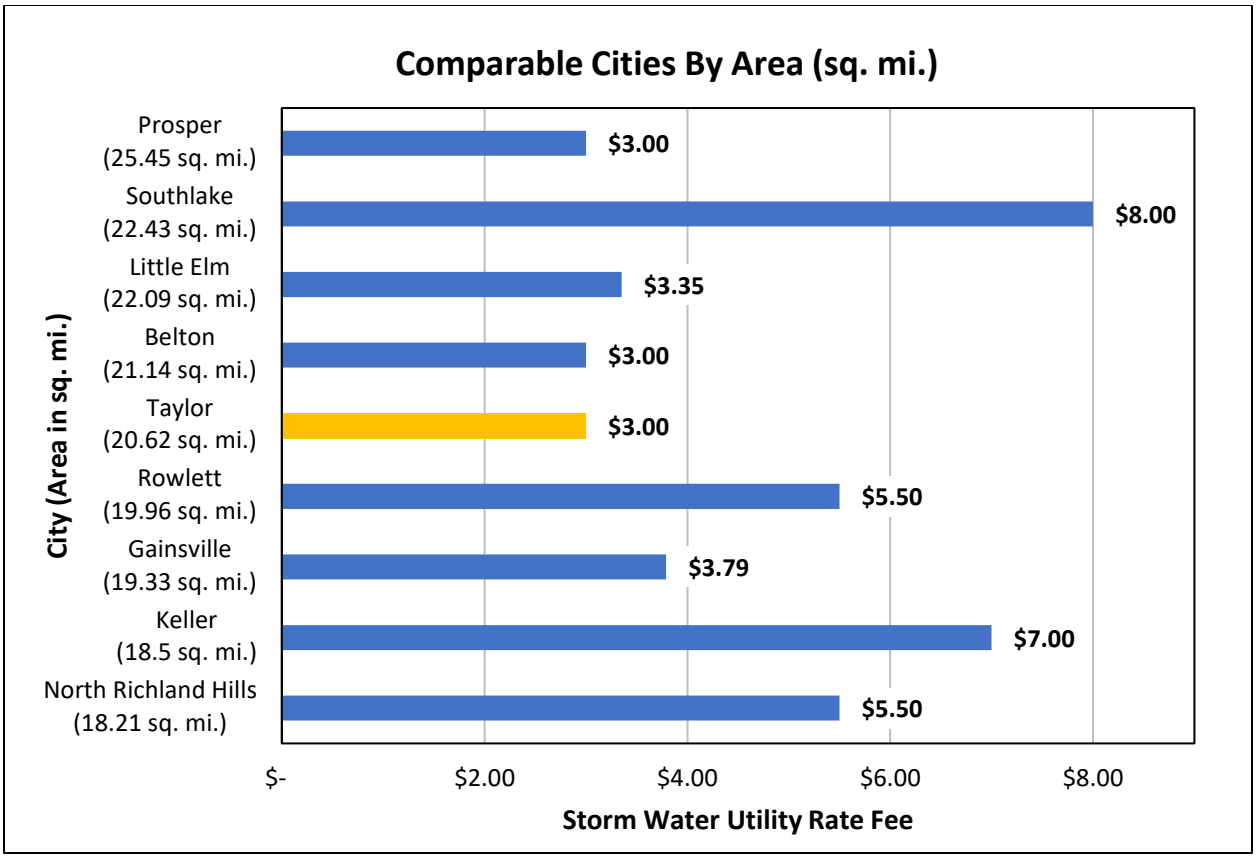


Figure 6.2 - City of Taylor and Comparable Cities by Area & Storm Water Utility Rate Fees

6.4 STORMWATER UTILITY FEE CHANGE IMPLEMENTATION

It is recommended that the City implement the updated impervious layer in their Drainage Utility billing to collect all potential revenue for drainage activities. Updating the billing service to utilize the updated impervious layer will require a matching exercise between the identified, non-residential impervious sites and the appraisal district data. Ultimately, the City's utility billing system will need to be updated to include the new/updated billing accounts.

Halff recommends that the City perform an annual review of the impervious layer and incorporate new or revised impervious area within the City's GIS layer and update the billing system accordingly. A review and update of the Drainage Utility is recommended once every five years.

APPENDICES

APPENDIX A

FIGURES

- RIVERINE PROJECT OVERVIEW
- LOCAL PROJECT OVERVIEW
- EROSION LOCATION OVERVIEW

Riverine Project Overview

Proposed Project
Old Georgetown Road
Existing LOS: 2-Yr
Proposed LOS: 100-Yr

Proposed Project
NW Carlos G Parker Boulevard
Existing LOS: 10-Yr
Proposed LOS: 100-Yr

TH Johnson Drive
Existing LOS: 100-Yr

North Drive
Existing LOS: 10-Yr
Proposed: Flood Monitoring

Proposed Project
Mallard Lane
Existing LOS: Less than 2-Year
Proposed LOS: 5-Year

Proposed Project
Davis Street
Existing LOS: Less than 2-Year
Proposed LOS: 10-Year

Proposed Project
West Lake Drive
Existing LOS: 25-Year
Proposed: Flood Monitoring

Proposed Project
North Main Street
Existing LOS: 10-Year
Proposed: Flood Monitoring

Proposed Project
Washburn Street
Existing LOS: 25-Year
Proposed LOS: 50-Year

Proposed Project
Burkett Street
Existing LOS: 10-Year
Proposed LOS: 50-Year

East Fourth Street
Existing LOS: 100-Year

Proposed Project
East Third Street
Existing LOS: Less than 2-Year
Proposed LOS: 50-Year

Turkey Creek
Gravel Pit Draw
Bull Branch
Mustang Creek

Taylor

TH JOHNSON DR
HIGHLAND DR
TURNER
619
NORTH DR
MALLARD LN
E LAKE
OLD THORNDALE RD
MEADOW LN
W LAKE
KIMBRO ST
DAVIS ST
CECELIA ST
VICTORIA ST
7TH ST
4TH ST
E 4TH ST
W 2ND ST
JUSTIN LN
HERMANN SONS RD
79
112

N
0 650 1,300
Feet

Railroad
Stream Centerline
Roadway
Local Flooding - 25 yr
100-yr Riverine Floodplain
City of Taylor

Proposed Level of Service
5-Year
10-Year
25-Year
50-Year
100-Year

Improvement Impacts
25-Year
100-Year

Local Project Overview

Proposed Project
TH Johnson Drive

Proposed Project
Donna Channel & Bull Branch Detention
(Three Phases)

Proposed Project
Mallard Lane

Proposed Project
Velma Drive

Proposed Project
Bel Air Drive

Proposed Project
Davis Street North

Proposed Project
Otis Street

Proposed Project
Castlewood Court

Proposed Project
Tammi Lane

Proposed Project
North Drive

Proposed Project
Kimbro Street

Proposed Project
Old Thorndale Road

Proposed Project
Burkett Street

Proposed Project
Mariposa Lane

Proposed Project
McLain Street

Proposed Project
North Main Street

Proposed Project
Davis Street South

Proposed Project
Debus Drive

Proposed Project
Annie Street

Proposed Project
Travis Street

Proposed Project
West Mustang Street

Taylor

Turkey Creek

Gravel Pit Draw

Bull Branch

Mustang Creek

County Road 367

397

NORTH DR

TH JOHNSON DR

HIGHLAND DR

TURNER

619

MALLARD LN

E LAKE

OLD THORNDALE RD

JUSTIN LN

MEADOW LN

W LAKE

KIMBRO ST

DAVIS ST

VICTORIA ST

7TH ST

4TH ST

W 2ND ST

E 4TH ST

79

95

112

HERMANN SONS RD

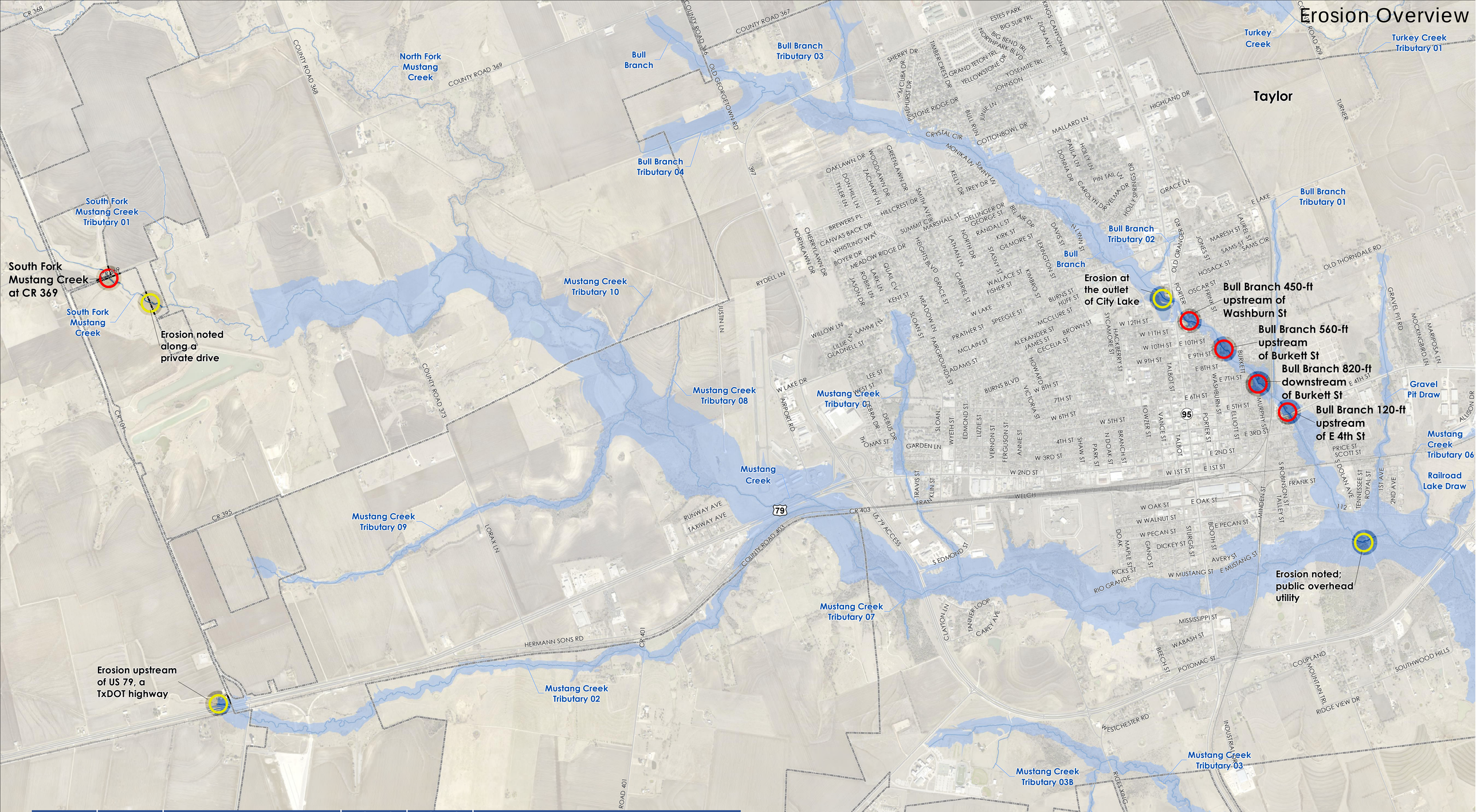
N

0 650 1,300 Feet

Identified Issue
Stream Centerline
Railroad
Roadway
Local Flooding - 25 yr
100-yr Riverine Floodplain
City of Taylor

Proposed Improvements
Area of Voluntary Buyout
Channel Improvement
Concrete Flume
Regrade/Reconstruct Roadway/Curb/Gutter
Roadside Ditch Improvement
Storm Drain
Regional Detention Facility

Erosion Overview



Stream ID	Rank	Erosion ID	Channel Velocity 100-Year (ft/s)	Channel Velocity 2-Year (ft/s)	Notes
SFMC	TBD	South Fork Mustang Creek at CR 369	7.75	5.57	Erosion downstream of CR 369
BB	TBD	Bull Branch downstream of City Lake	4.28	2.41	Erosion at the outlet of City Lake
BB	TBD	Bull Branch 820 ft downstream of Burkett St	6.61	6.92	Erosion adjacent to a natural trail
BB	TBD	Bull Branch 560 ft upstream of Burkett St	4.85	6.31	Erosion adjacent to a natural trail
BB	TBD	Bull Branch 450 ft upstream of Washburn St	10.12	10.45	Erosion adjacent to Old Thorndale Rd and Porter St; Utility pipe
BB	TBD	Bull Branch 120 ft upstream of E 4th St	6.48	6.03	Erosion upstream of a pedestrian bridge and E 4th St
SFMC			6.51	5.37	Erosion noted along a private drive
MC_T02			2.38	7.22	Erosion upstream of US 79, a TxDOT highway
MC			4.84	4.34	Erosion noted; public overhead utility

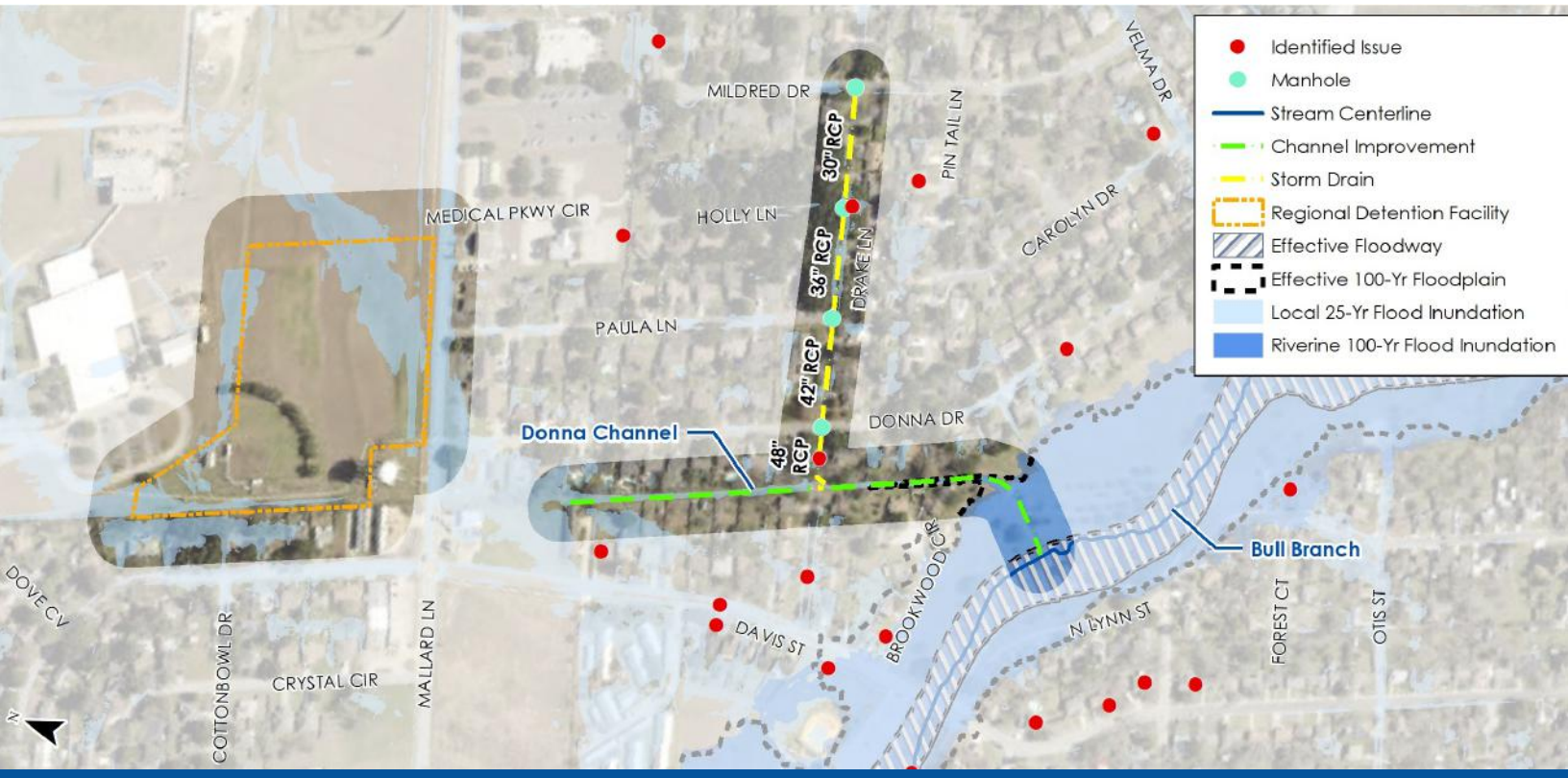
APPENDIX B

CONCEPTUAL DRAINAGE SOLUTIONS

- FACT SHEETS
- OPINIONS OF PROBABLE CONSTRUCTION COST

CITY OF TAYLOR MASTER DRAINAGE PLAN

BULL BRANCH DETENTION & DONNA CHANNEL



PROJECT DESCRIPTION:

The Donna Channel is currently undersized and stormwater flows will exceed channel banks. Water not captured by the channel will flow toward Davis St. until it reaches Bull Branch. To mitigate uncontrolled flow for the Donna Channel, a regional detention facility, a new storm drain system and channel improvements are proposed as a three-phase solution. Phase I includes a regional detention facility located on the school property of TH Johnson Elementary. Phase II includes Donna Channel improvements and a new cross culvert at Drake St. Phase III includes a new storm drain system along Drake St, with pipe sizes ranging from 30" RCP to 48" RCP.

BENEFITS

- Alleviates ponding of Davis Street, Mallard Lane, and Drake Lane
- Relieves existing capacity concerns for the Donna Channel
- Reduces private property flood concerns
- Phased construction allows for budget flexibility

CHALLENGES

- Construction impact to residents
- Future maintenance & easement needs

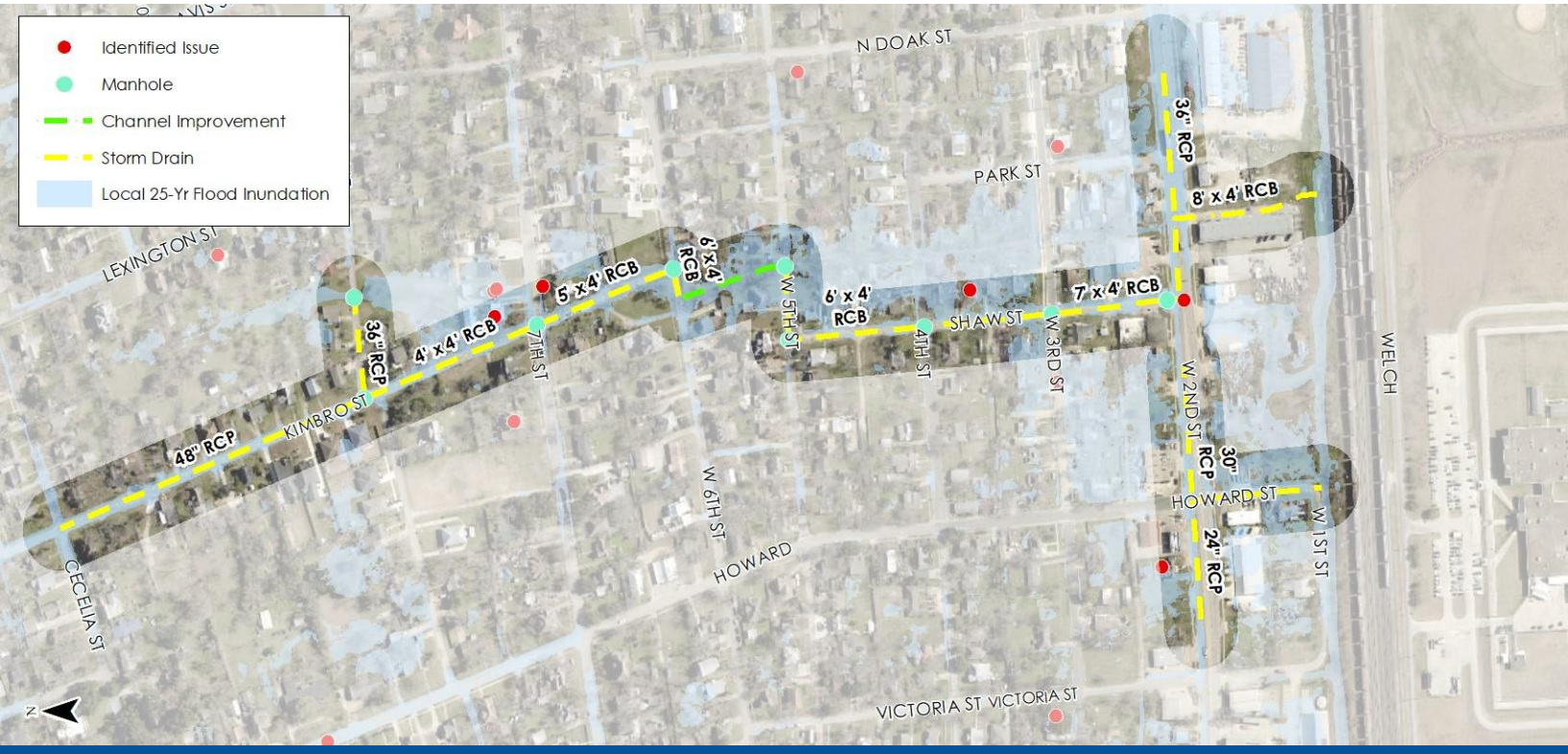
QUICK FACTS

- **9** Public Input Points Addressed
- **50** Structures Benefited
- **3,600** Feet of Storm Drain
- **2,000** Feet of Channel Improvements
- Road Improvements:
  - Increases conveyance by adding a storm sewer system
- Project Cost Estimate: **$6,032,385**

****Note: Some information provided by HDR per a recent grant application****

CITY OF TAYLOR MASTER DRAINAGE PLAN

KIMBRO AND SHAW STREET STORM SEWER SYSTEM



PROJECT DESCRIPTION:

Kimbro St. and Shaw St. experience significant ponding from 8th St. to 2nd St. A storm drain system is proposed starting at the intersection of Kimbro St. and Cecelia St. and tying into the existing 2nd St storm drain system. Pipe sizes range from a 36" RCP to a 8' x 4' RCB.

With 25-yr Altas 14 flows, the 2nd St storm drain system does not have capacity. A new storm drain system is needed to relieve flow off 2nd St. This system will convey flow along 2nd St from Shaw St to Victoria St and flow from Howard St. The new system will outfall into the railroad drainage ditch. Pipe sizes range from a 24" RCP to a 5' x 3' RCB. Channel improvements to the railroad drainage ditch are also needed.

BENEFITS

- Increase capacity of system
- Alleviates ponding off streets
- Reduces private property flood concerns
- Phased construction allows for budget flexibility

CONSTRAINTS

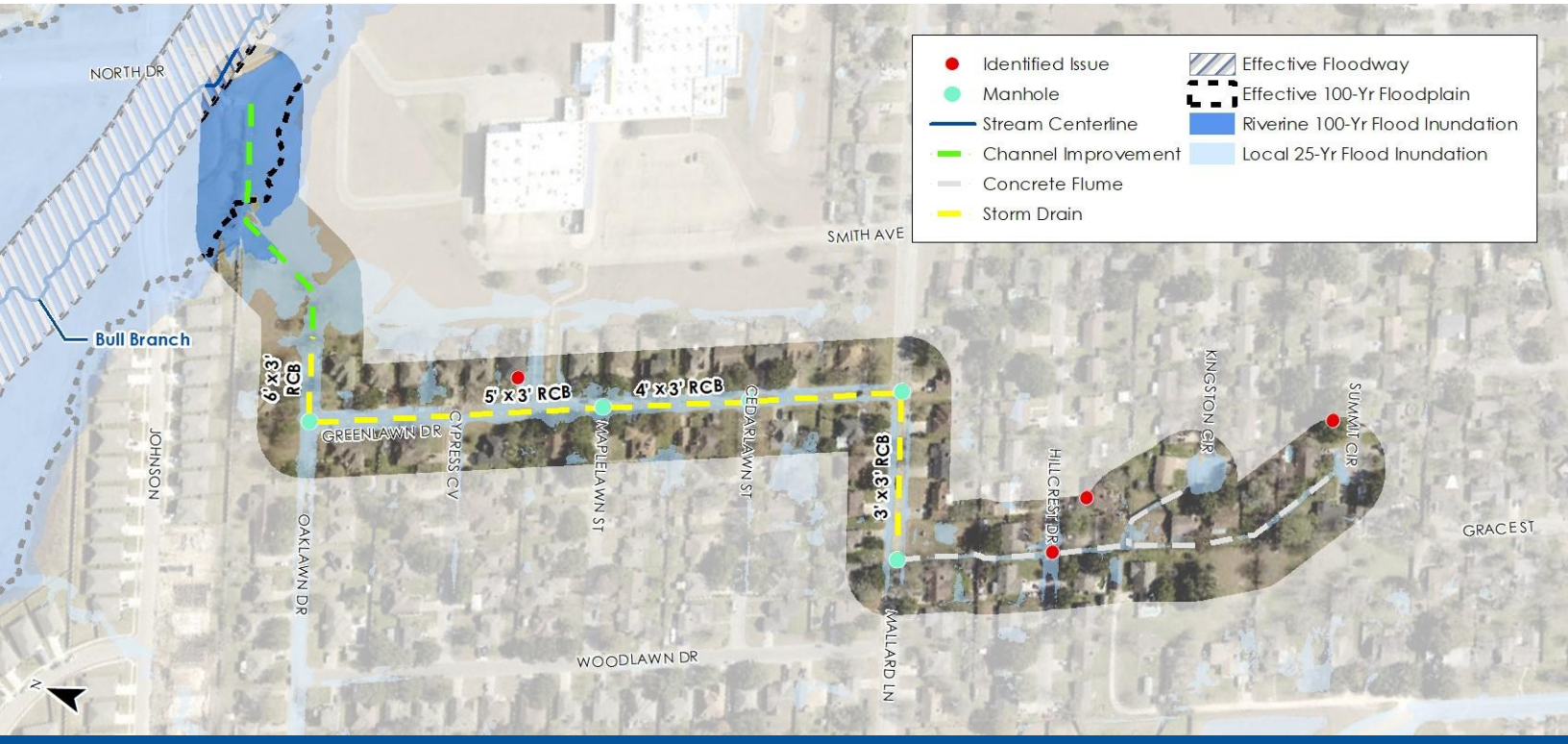
- Construction impact to residents
- Future maintenance
- Easements and access to TxDOT ROW

QUICK FACTS

- **8** Public Input Point Addressed
- **85** Structures Benefited
- **5250** Feet of Storm Drain
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 5,188,110**

CITY OF TAYLOR MASTER DRAINAGE PLAN

MALLARD LANE STORM SEWER SYSTEM



PROJECT DESCRIPTION:

Summit Cir., Kingston Cir., Mallard Ln., and Greenlawn Dr. all experience ponding during rain events. To direct flow into Bull Branch, a series of concrete flumes, a storm sewer system, and a new drainage channel are proposed. The concrete flumes will carry flow from the Summit and Kingston cul-de-sacs to Mallard Ln. A storm sewer system with pipe sizes ranging from a 3' x 3' RCB to a 6' x 3' RCB with inlets along Mallard Ln. and Greenlawn Dr. will direct flow to the end of Oaklawn Dr. Channel regrading is needed to carry flow from the end of Oaklawn Dr. to Bull Branch. The new drainage channel will have 4:1 side slopes, a slope of 0.5%, and varying top widths, with a minimum 6 foot bottom width.

BENEFITS

- Alleviates roadway ponding
- Reduces private property flood concerns
- Increases capacity of system
- Phased construction

CONSTRAINTS

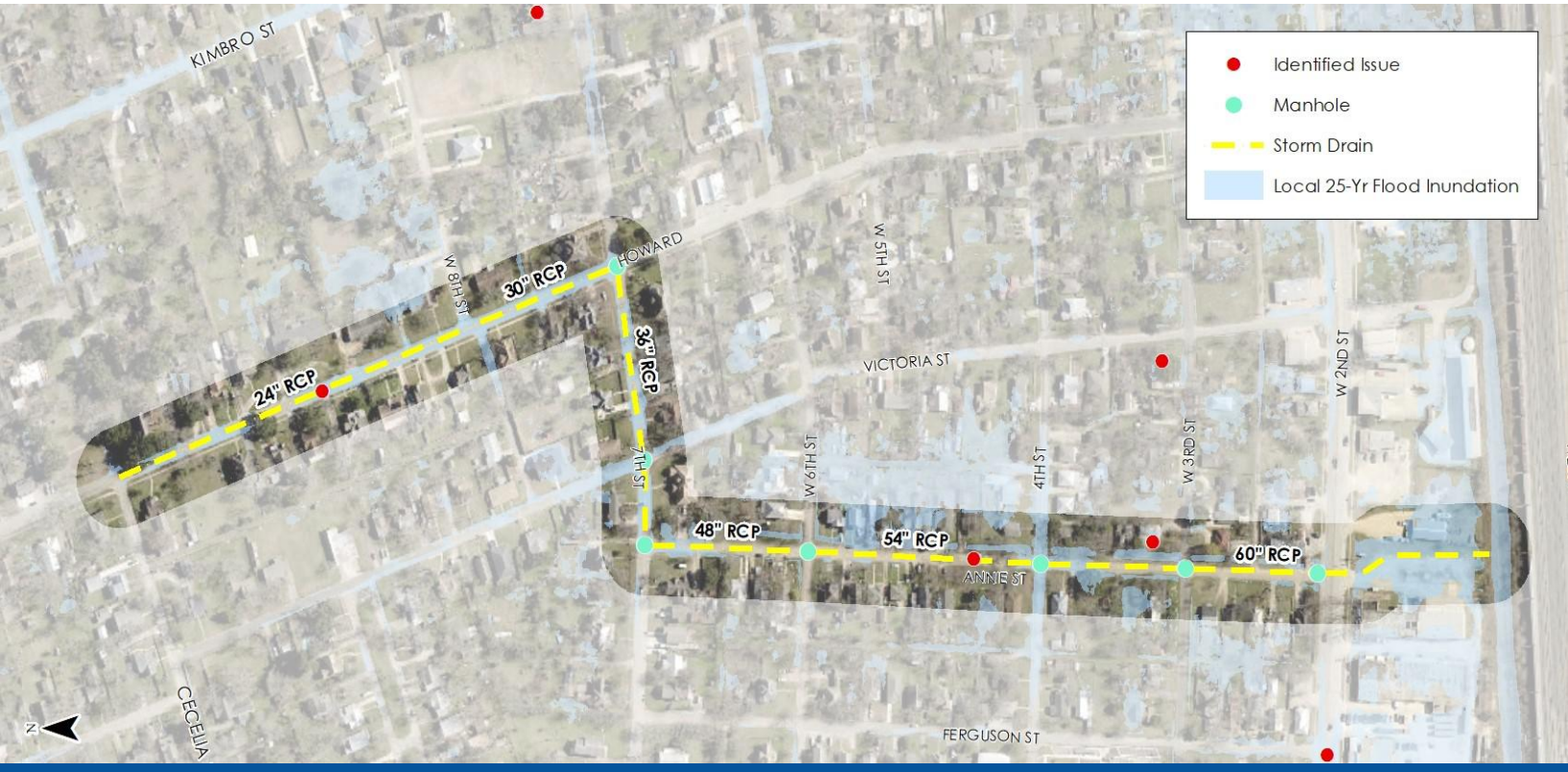
- Construction impact to residents
- Future maintenance
- Restricted access to Bull Branch Creek
- Easement from TISD

QUICK FACTS

- **4** Public Input Points Addressed
- **70** Structures Benefited
- **1620** Feet of Storm Drain
- **490** Feet of Channel Improvements
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 1,916,860**

CITY OF TAYLOR MASTER DRAINAGE PLAN

ANNIE STREET STORM SEWER SYSTEM



PROJECT DESCRIPTION:

Annie St. experiences ponding during large rain events and rainfall runoff does not have a clear route to the 2nd St storm drain system. A storm drain system is proposed starting at the intersection of Howard St and Cecelia St., and discharging in the railroad drainage ditch. Pipe sizes range from a 24" RCP to a 60" RCP. The existing outfall for Annie St. is an existing storm drain system along 2nd St., designed for the 10-yr storm event using USGS rainfall. A new outfall will bypass the 2nd St. storm drain system and carry the Atlas 14, 25-yr storm event to the railroad drainage ditch. The proposed system will reduce flooding and allow a clear route for flow to get to the receiving stream.

BENEFITS

- Alleviates roadway ponding and increases conveyance
- Reduces private property flood concerns
- Phased construction allows for budget flexibility

CONSTRAINTS

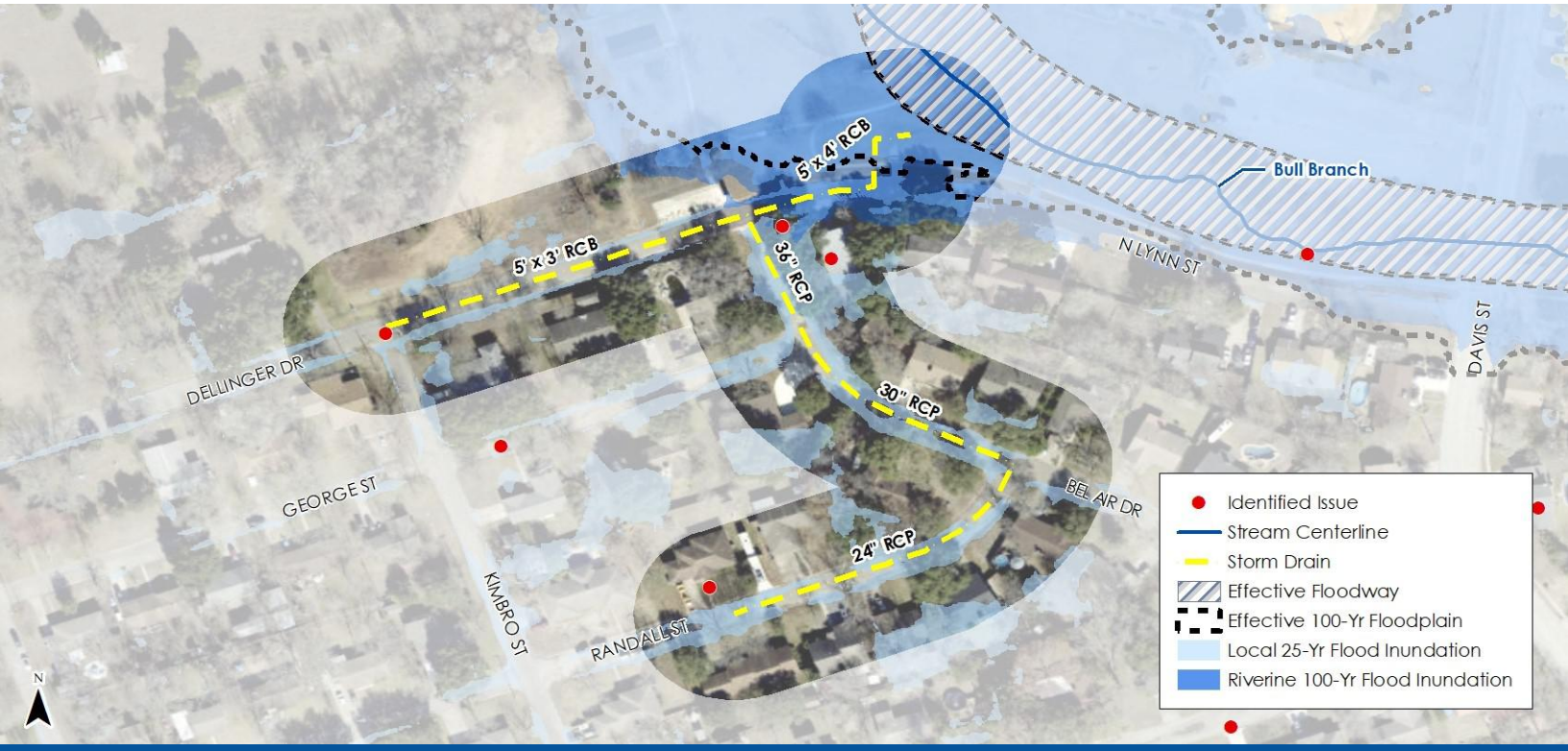
- Construction impact to residents
- Future maintenance
- Easement to Railroad drainage ditch

QUICK FACTS

- **3** Public Input Point Addressed
- **85** Structures Benefited
- **3790** Feet of Storm Drain
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 3,092,650**

CITY OF TAYLOR MASTER DRAINAGE PLAN

BEL AIR DRIVE STORM SEWER SYSTEM



PROJECT DESCRIPTION:

There is noticeable ponding along Bel-Air Street from North Lynn Street to Randall Street that continues west along Randall Street. These roads contain shallow dips, which make them susceptible to ponding and flooding during rain events. To combat the flooding, a storm sewer system is proposed to redirect runoff to Bull Branch. Pipe sizes range from a 24" RCP to a 5' x 4' RCB and include inlets along Bel Air Drive, Dellinger Drive, and Randall Street. Rock riprap will be required at the outfall to protect the creek from erosion. Constructing a storm sewer system will diminish flooding of private property and promote positive drainage into Bull Branch.

BENEFITS

- Alleviates ponding along Bel Air Drive, Dellinger Drive, North Lynn Street, and Randall Street
- Reduces private property flood concerns
- Phased construction and budget flexibility

CONSTRAINTS

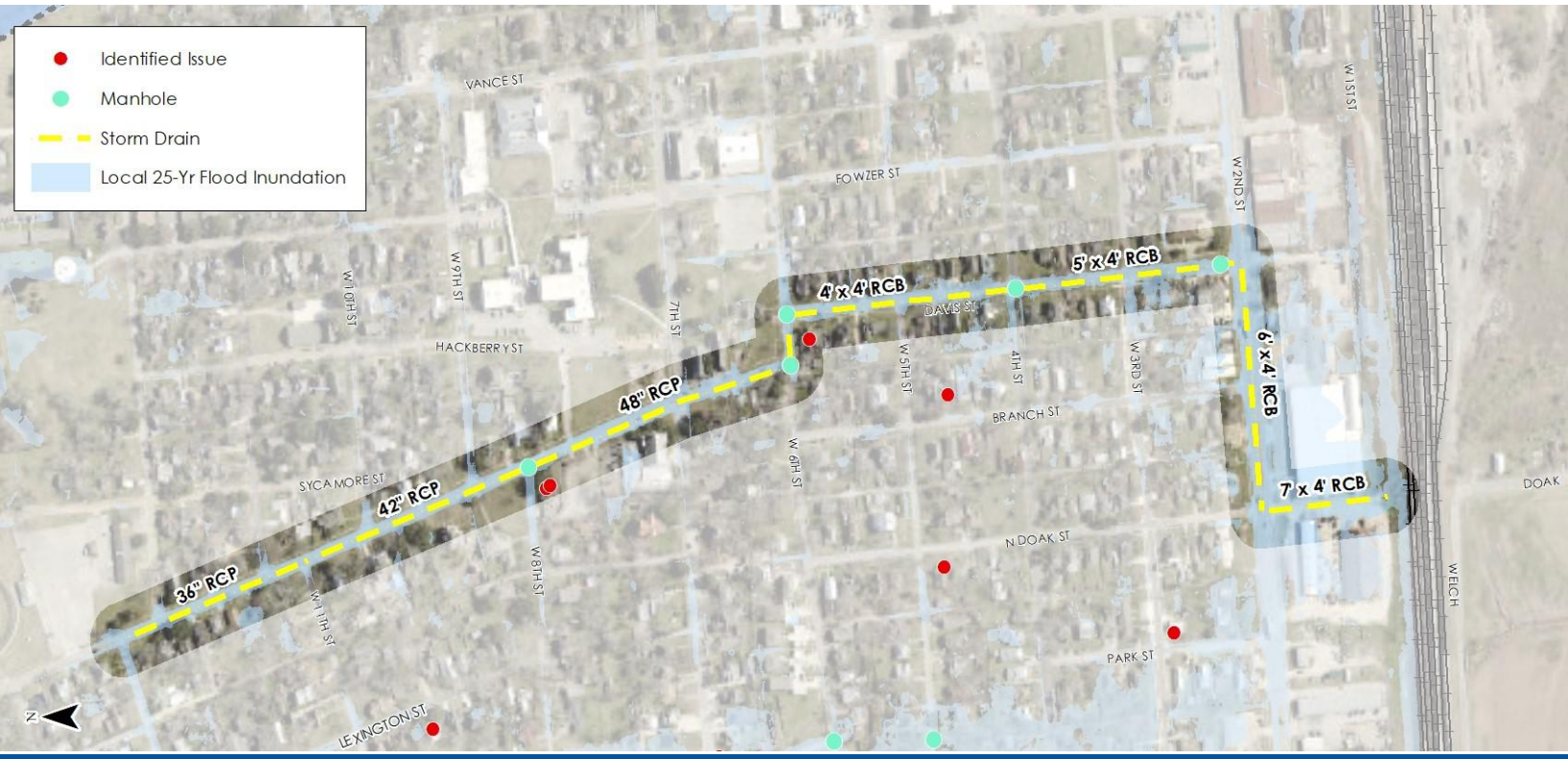
- Construction impact to residents
- Restricted access to Bull Branch Creek
- Future maintenance

QUICK FACTS

- **5** Public Input Points Addressed
- **25** Structures Benefited
- **1365** Feet of Storm Drain
- Road Improvements:
  - Increases conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 1,057,490**

CITY OF TAYLOR MASTER DRAINAGE PLAN

DAVIS STREET STORM SEWER SYSTEM



PROJECT DESCRIPTION:

Davis Street experiences ponding from 8th street to 2nd Street. To reduce this ponding, a storm drain system is proposed on Davis Street from Brown St to 2nd St. Pipe sizes range from a 36" RCP to a 7' x 4' RCB. A new outfall is needed because the existing storm sewer system on 2nd St. lacks the capacity to handle the 25-yr Atlas 14 rainfall event. The new outfall will run along 2nd St from Davis St to Doak St and outfall into the railroad drainage ditch. A new storm sewer system will reduce ponding along Davis St and relieve capacity concerns for the existing 2nd St storm sewer system.

BENEFITS

- Increase capacity of system
- Alleviates ponding of Davis Street
- Reduces private property flood concerns
- Phased construction allows for budget flexibility

CONSTRAINTS

- Construction impact to residents
- Future maintenance
- Easements and access to TxDOT ROW

QUICK FACTS

- **4** Public Input Point Addressed
- **65** Structures Benefited
- **4685** Feet of Storm Drain
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 5,035,240**

CITY OF TAYLOR MASTER DRAINAGE PLAN

BURKETT STREET RE-PROFILING

PROJECT DESCRIPTION:

Residents along Burkett St. reported ponding of private property. Most of the flow to Burkett St. comes from the east and is conveyed south along roadside ditches until it discharges into Bull Branch. The proposed solution re-grades the roadside ditches along Burkett St. and replaces driveway culverts. Additionally adding two cross culverts to navigate flow east across Burkett St. One crossing consists of 2 – 18" RCPs, on the south side of Davidson Dr. and the other, a 4' x 2' RCB, on the north side of Lenora Dr. A new outfall ditch is proposed west of Lenora Dr. versus continuing flow south along Burkett Street. This outfall channel will have a 4-foot bottom width, 4:1 side slopes, and 1.5 feet of depth.

BENEFITS

- Alleviates ponding of Burkett Street
- Reduces private property flood concerns
- Increases capacity of system

CONSTRAINTS

- Construction impact to residents
- Easements
- Future maintenance

QUICK FACTS

- **3** Public Input Points Addressed
- **15** Structures Benefited
- **2** New Culvert Crossings
- **975** Feet of Drainage Ditch Improvements
- Road Improvements:
  - Increased conveyance by re-grading ditches
- Project Cost Estimate: **$ 352,530**

CITY OF TAYLOR MASTER DRAINAGE PLAN

VELMA DRIVE STORM SEWER SYSTEM

PROJECT DESCRIPTION:

Velma Dr. and a segment of Holly Springs Dr. from Velma Dr. to Dahlberg Blvd. experiences ponding during rain events. To alleviate the ponding, two storm sewer systems are proposed. The first system will be placed along Holly Springs Dr. from Dahlberg Blvd. to the channel located south of Velma Dr. This will reduce the amount of surface flow on Velma Dr. This system consists of a 4' x 2' RCB and inlets . The second system is on Velma Dr. beginning at Pin Tail Ln. extending south into the channel at Donna Dr. This system ranges from a 30" RCP to a 48" RCP with inlets along the road. The existing channel and the crossing at Donna Dr. have the capacity to handle the discharge from both systems.

BENEFITS

- Alleviates ponding of Velma Drive
- Reduces private property flood concerns
- Phased construction

CONSTRAINTS

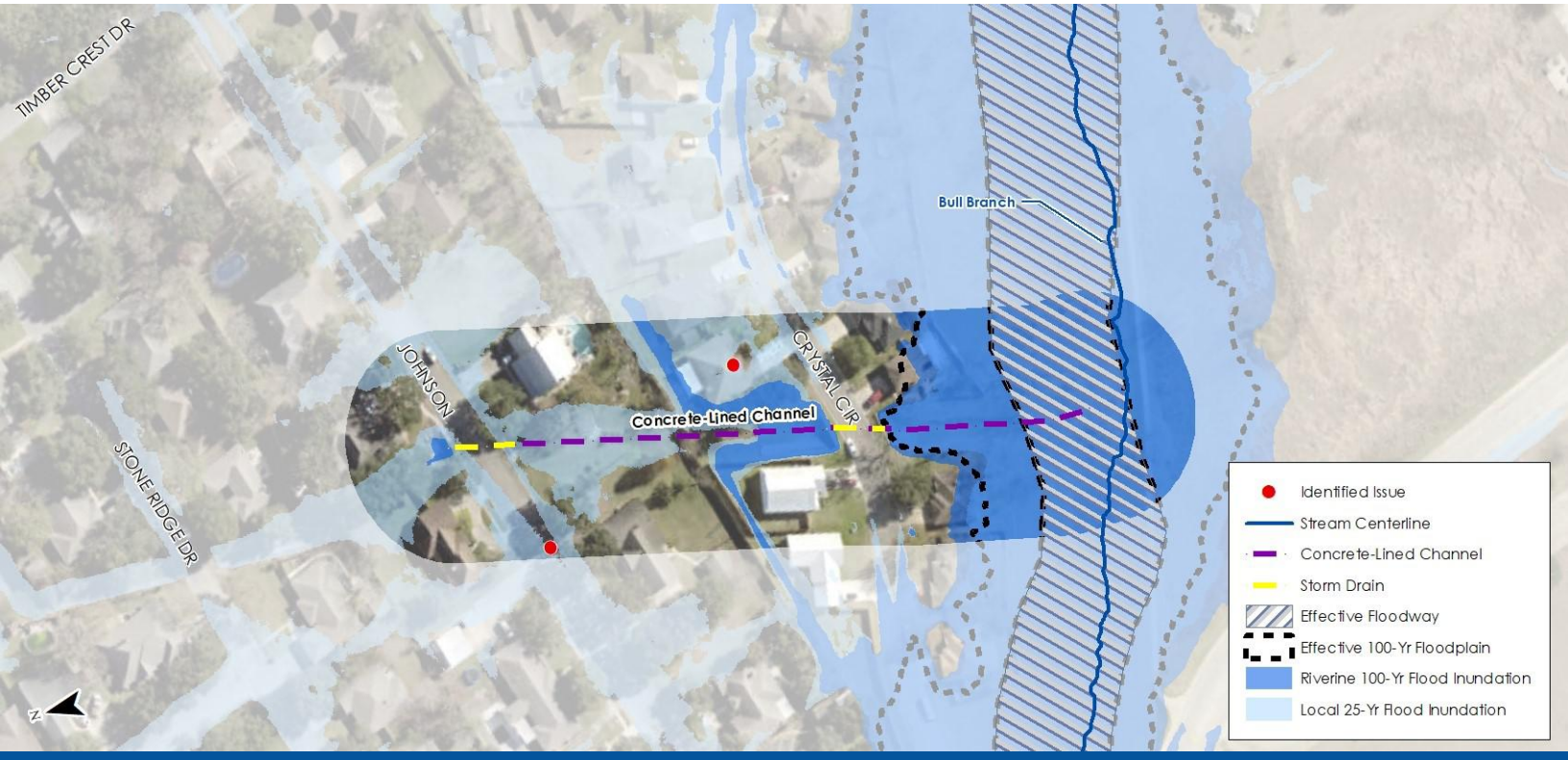
- Construction impact to residents
- Future maintenance
- Restricted access to Donna Channel
- Easement

QUICK FACTS

- **1** Public Input Point Addressed
- **25** Structures Benefited
- **1500** Feet of Storm Drain
- Road Improvements:
  - Increases conveyance by adding a storm sewer systems
- Project Cost Estimate: **$ 1,082,320**

CITY OF TAYLOR MASTER DRAINAGE PLAN

TH JOHNSON DRIVE



PROJECT DESCRIPTION:

During large storm events, water exceeds channel banks for the crossing at TH Johnson Dr. Runoff overtops the road and flows west, down TH Johnson Dr, toward Pine Hurst Dr, flooding private properties. The existing cross drainage structure at TH Johnson Dr is two (2) 7' x 3' RCBs outfalling into three CMP arch pipes before discharging into an open channel. A detention pond is located east of the channel with two (2) 36" RCPs discharging into the channel. The proposed solution is to tie the two 36" RCPs into the downstream end of the 7' x 3' RCBs. Additionally, a 500-ft rectangular concrete lined channel (20-ft wide, 3-ft deep) will be constructed from TH Johnson Drive to Bull Branch with three (3) 6' x 3' RCB culverts at Crystal Circle.

BENEFITS

- Relieve existing capacity concerns
- Reduces structure flooding concerns
- Alleviates runoff along TH Johnson Drive

CONSTRAINTS

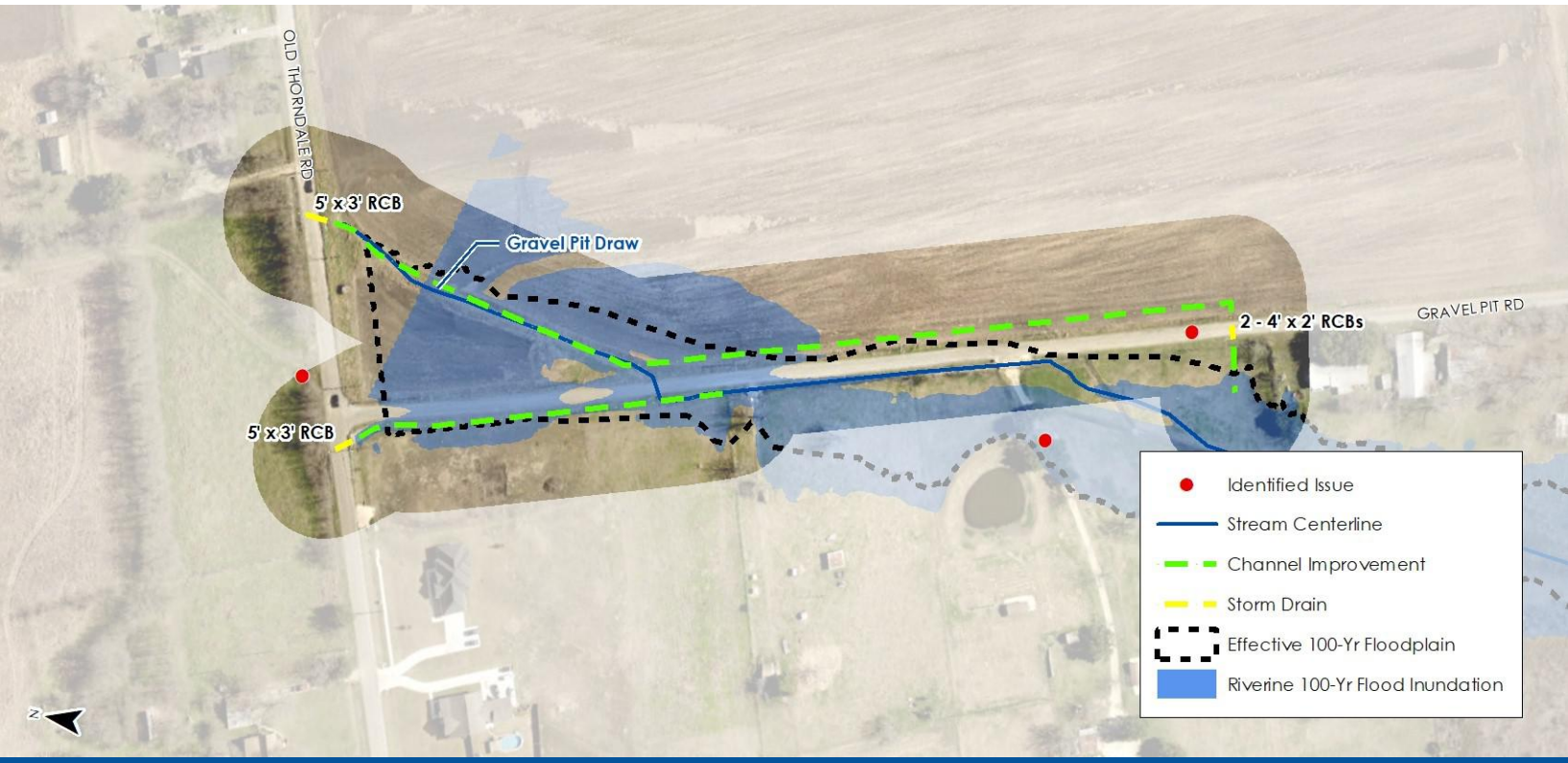
- Construction impact to residents
- Future maintenance
- Easements

QUICK FACTS

- **2** Public Input Points Addressed
- **9** Structures Benefited
- **60** Feet of Culvert
- **500** Feet of Channel Improvements
- Road Improvements:
  - Increased storm water conveyance
- Project Cost Estimate: **$ 597,800**

CITY OF TAYLOR MASTER DRAINAGE PLAN

OLD THORNDALE ROAD



PROJECT DESCRIPTION:

There are two cross culverts along Old Thorndale Road near Gravel Pit Rd. that are undersized, with both overtopping during large rain events. The ditches conveying flow south of Old Thorndale into Gravel Pit Draw are also undersized and flood Gravel Pit Rd. and a resident's driveway. The proposed solution is to replace the existing cross culverts along Old Thorndale Road with a 5' x 3' RCB at each location. Additionally, regrade the roadside ditches, approximately 500' on the west side of Gravel Pit Road and 1180' on the east side of Gravel Pit Road. A new cross culvert, 2 - 4' x 2' RCBs, crossing Gravel Pit Rd is also proposed. Regrading ditches and constructing the cross culverts will mitigate road overtopping.

BENEFITS

- Increases capacity of system
- Reduces private property flood concerns
- Alleviates ponding near Gravel Pit Road

CONSTRAINTS

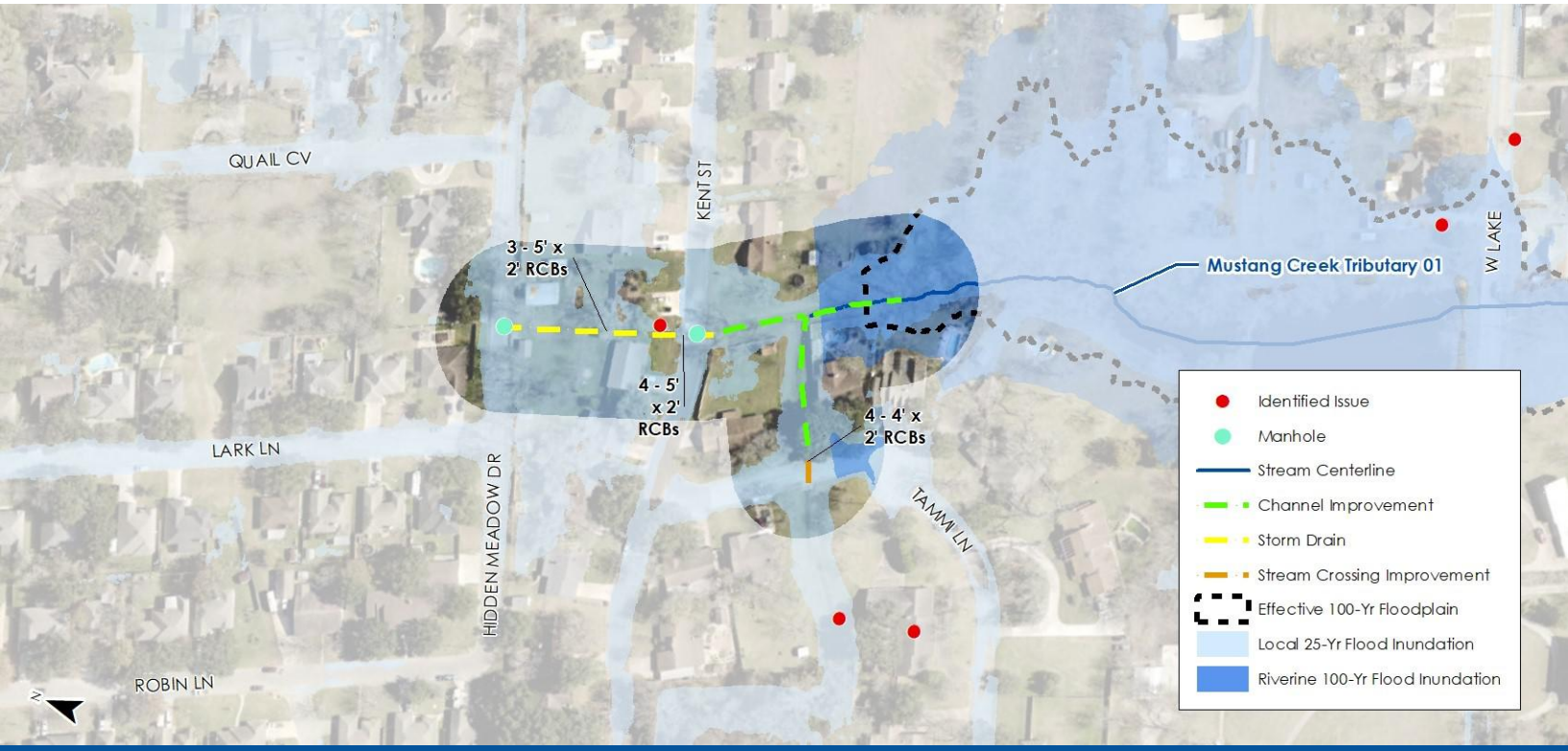
- Construction impact to residents
- Future maintenance
- Easements

QUICK FACTS

- **3** Public Input Points Addressed
- **6** Structures Benefited
- **2** Replaced Culvert Crossings
- **1680** Feet of Drainage Ditch Improvements
- Road Improvements:
  - Increased conveyance by re-grading ditches
- Project Cost Estimate: **$ 434,050**

CITY OF TAYLOR MASTER DRAINAGE PLAN

TAMMI LANE



PROJECT DESCRIPTION:

The channel crossing Tammi Ln. has a flat slope and low capacity leading to overtopping of Tammi Ln. and flooding the nearby area. Channel improvements starting from 330 ft downstream to Tammi Ln. with approximately 160 ft immediately downstream being a rectangular concrete lined channel. Replacing the existing cross culverts with 4 - 4' x 2' RCBs and raising the road 0.15 ft will pass the 25-yr storm event below Tammi Ln. Additionally, to alleviate ponding along Hidden Meadow Dr. and Kent St., 3 - 5' x 2' RCBs and inlets along the roadways are needed from Hidden Meadow Dr. to Kent St. and an additional 5' x 2' RCB is needed from Kent St. to the outfall.

BENEFITS

- Relieve existing capacity concerns
- Reduce frequent overtopping
- Reduce depth of overtopping
- Provide increased channel conveyance
- Alleviates roadway ponding

CONSTRAINTS

- Construction impact to residents
- Future maintenance
- Easements

QUICK FACTS

- **3** Public Input Points Addressed
- **15** Structures Benefited
- **265** Feet of Culvert
- **280** Feet of Channel Improvements
- Road Improvements:
  - Increased conveyance by improving Tammi Ln culvert
  - Increased conveyance by upsizing storm drain
- Project Cost Estimate: **$ 1,151,740**

CITY OF TAYLOR MASTER DRAINAGE PLAN

GABRIEL STREET ROAD IMPROVEMENTS

PROJECT DESCRIPTION:

Gabriel Street experiences ponding on the road during storm events, which is caused by the crown shape of the road. The proposed solution regrades the west side of Gabriel Street to convey flow into the existing concrete flume that connects to Castlewood Court.

BENEFITS

- Alleviates ponding of Gabriel Street

CONSTRAINTS

- Construction impacts to residents

QUICK FACTS

- **2** Public Input Points Addressed
- **4** Structures Benefited
- Road Improvements:
  - Increased conveyance by regrading the street
- Project Cost Estimate: **$ 74,330**

CITY OF TAYLOR MASTER DRAINAGE PLAN

NORTH DRIVE STORM DRAIN IMPROVEMENTS

PROJECT DESCRIPTION:

North Drive ponds significantly during storm events between West Lake Drive and Wallace Street. Installing a storm drain system along North Drive that connects to the existing storm sewer system on West Lake Drive will significantly reduce ponding. During design an analysis is needed for the West Lake Drive storm drain system to determine it's capacity and possible upsizing. The capacity of the existing storm sewer system must be checked to insure it can handle the flow from North Drive.

BENEFITS

- Relieves existing capacity concerns
- Increases capacity of system
- Alleviates ponding of North Drive

CONSTRAINTS

- Construction impacts to residents
- West Lake Drive storm drain system

QUICK FACTS

- **1** Public Input Points Addressed
- **15** Structures Benefited
- **650** Feet of Storm Drain
- Road Improvements:
  - Increased conveyance by regrading the street
- Project Cost Estimate: **$ 665,370**

CITY OF TAYLOR MASTER DRAINAGE PLAN

MCLAIN STREET STORM SEWER SYSTEM

PROJECT D ESCRIPTION:

McLain Street experiences significant ponding from Mills Street to Howard Street. A storm drain system with pipe sizes ranging from a 36" RCP to a 48" RCP will alleviate the ponding. The proposed storm drain system will tie into the storm sewer system along Mills Street as an extension of the Edmonds Street project.

BENE FITS

- Increases capacity of McLain Street
- Alleviates ponding of McLain Street
- Reduces private property flood concerns

CONSTRAINTS

- Construction impact to residents
- Future maintenance

QUICK FACTS

- **1** Public Input Point Addressed
- **24** Structures Benefited
- **1330** Feet of Storm Drain
- Road Improvements:
  - Increased conveyance by adding a storm drain system
- Project Cost Estimate: **$ 857,630**

CITY OF TAYLOR MASTER DRAINAGE PLAN

MARIPOSA LANE STORM SEWER SYSTEM

PROJECT DESCRIPTION:

Residents have reported flooding at the intersections of Mockingbird Lane and Mariposa Lane with East 4th Street. Survey data shows low points on both streets that causes ponding. To combat this ponding, inlets at the intersections and culverts are proposed. The culverts range in size from 3' x 2' to 4' x 2' and extend under East 4th Street. The culverts will discharge into the existing cross culvert under 4th Street. Constructing the cross culverts will promote positive drainage while enhancing road safety during rain events.

BENEFITS

- Reduces private property flood concerns
- Alleviates ponding of Mockingbird Lane and Mariposa Lane
- Relieves existing capacity concerns

CONSTRAINTS

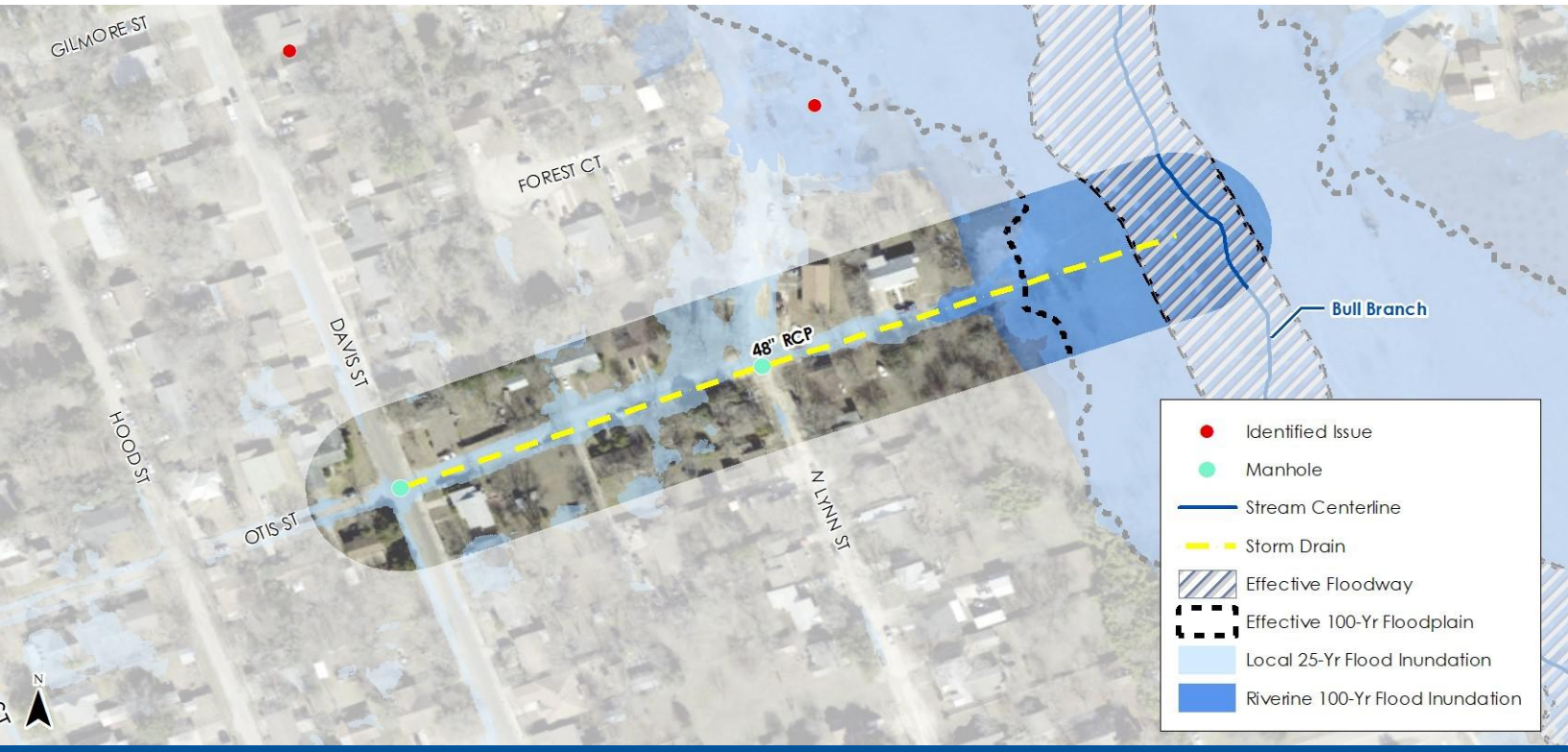
- Construction impact to residents
- ROW needs from TXDOT
- Future Maintenance

QUICK FACTS

- **2** Public Input Points Addressed
- **22** Structures Benefited
- **2** New Culverts
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 594,630**

CITY OF TAYLOR MASTER DRAINAGE PLAN

OTIS STREET STORM SEWER SYSTEM



PROJECT DESCRIPTION:

Otis Street's topography make's it prone to ponding during rain events. Consequently, the runoff flows toward private property. An installation of a storm sewer system would redirect runoff into Bull Branch in a controlled manner versus traveling overland toward the north through private properties. The storm sewer system will start at Davis Street and outfall into Bull Branch. A 48" RCP is sufficient to convey flow to Bull Branch. The proximity to the creek allows for efficient drainage during rain events. Since flow will be concentrated into Bull Branch, rock riprap will be required to protect the channel.

BENEFITS

- Alleviates ponding of Otis Street
- Reduces private property flood concerns

CONSTRAINTS

- Construction impact to residents
- Future maintenance
- Easement for outfall

QUICK FACTS

- **17** Structures Benefited
- **870** Feet of Storm Drain
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 654,830**

CITY OF TAYLOR MASTER DRAINAGE PLAN

TRAVIS AND FRANKLIN STREET STORM SEWER SYSTEM

PROJECT DESCRIPTION:

During rain events, Travis Street and Franklin Street experience ponding from inadequate roadside ditches. Flow from the roadside ditches travels overland until it reaches the drainage ditch along the railroad. The proposed solution regrades the roadside ditches along Travis Street and Franklin Street draining into a storm drain system. The storm drain system consists of a 24" RCP from Franklin Street to Travis Street and discharging into the railroad drainage ditch as a 30" RCP. Rock riprap will be required to protect the channel at the outfall. The regrading of roadside ditches will aid in navigating flow toward the railroad drainage ditch.

BENEFITS

- Alleviates ponding on Travis and Franklin Street
- Increase capacity of system
- Reduces private property flood concerns
- Phased construction

CONSTRAINTS

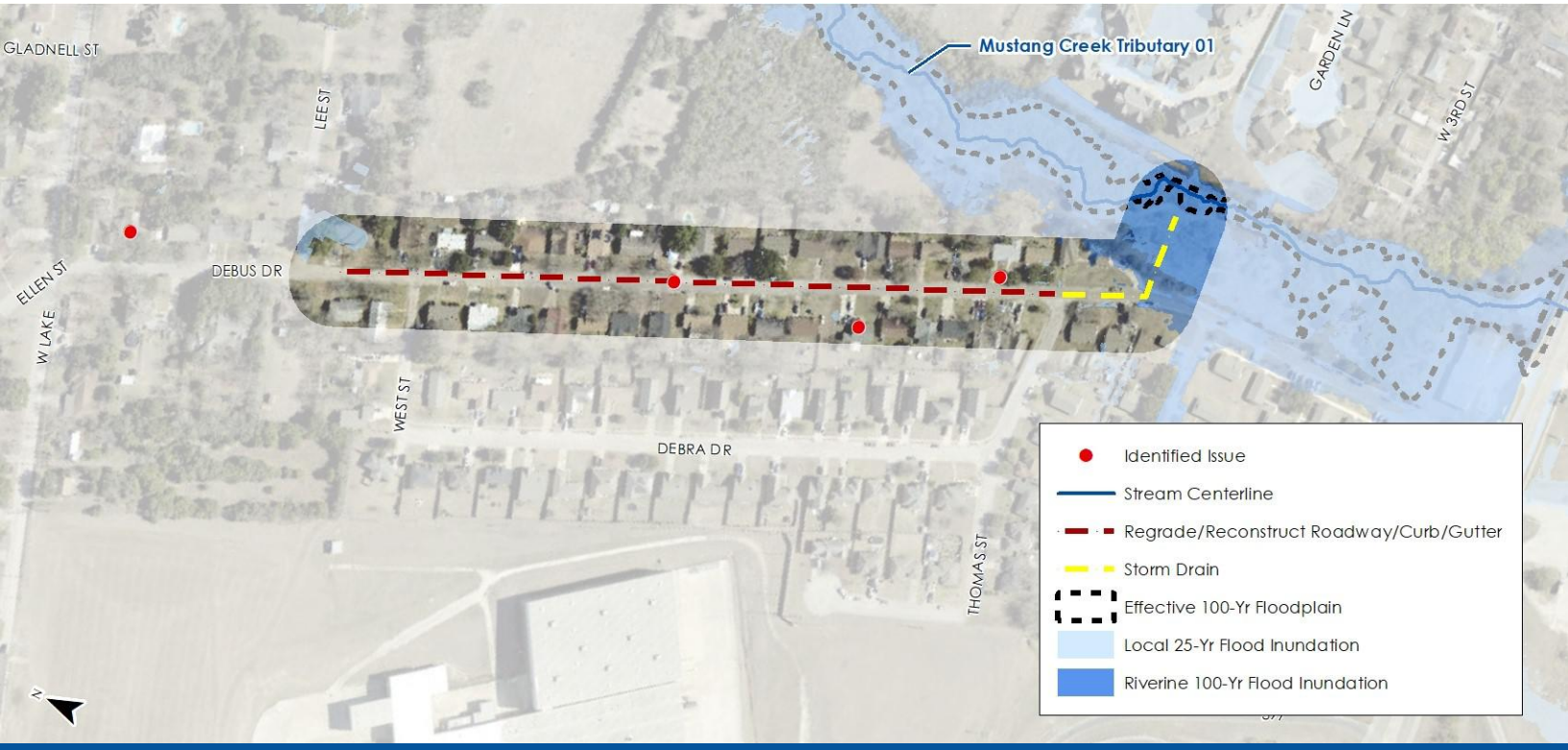
- Construction impact to residents
- Future maintenance
- Easements

QUICK FACTS

- **1** Public Input Point Addressed
- **16** Structures Benefited
- **250** Feet of Storm Drain
- **790** Feet of Roadside Ditch Improvements
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
- Project Cost Estimate: **$ 670,690**

CITY OF TAYLOR MASTER DRAINAGE PLAN

DEBUS DRIVE RE-PROFILING



PROJECT DESCRIPTION:

Deterioration of Debus Drive is a result of ponding. Rainfall runoff collects at existing gutters however, the gutters are shallow and don't have enough capacity. The proposed solution is to reprofile the road and construct a storm sewer system from Lee Street to approximately 150' south of Thomas Street. A full reconstruction of Debus Drive along with a storm sewer system will redirect flow away from residencies and towards a tributary of Mustang Creek.

BENEFITS

- Alleviates ponding of Debus Drive
- Phased construction and budget flexibility
- Reduces private property flood concerns

CONSTRAINTS

- Construction impact to residents
- Easement
- Future Maintenance

QUICK FACTS

- **3** Public Input Points Addressed
- **40** Structures Benefited
- **175** Feet of Storm Drain
- **1,500** Feet Curb and Gutter Improvements
- Road Improvements:
  - Increased conveyance by adding a storm sewer system
  - Increased conveyance by improving curb and gutter
- Project Cost Estimate: **$ 1,229,870**

CITY OF TAYLOR MASTER DRAINAGE PLAN

NORTH DAVIS STREET RE-PROFILING

PROJECT DESCRIPTION:

Residents along the east side of Davis St. reported roadway runoff flooding private property. Previous analyses show the roadway is overlayed with asphalt, leaving a shallow gutter depth. This enables runoff to flow to the lower elevated households. To reduce runoff from Davis St., reconstruction of the curb and gutter along the east side of the road is recommended. A higher curb will allow runoff to be conveyed to a discharge point near Bull Branch. Similarly, regrading driveways is recommended to reduce ponding and redirect runoff. Surrounding sidewalks will also require re-grading to complement the new the driveways. The re-profiling of Davis St. will reduce ponding and deflect runoff toward Bull Branch.

BENEFITS

- Alleviates ponding of North Davis Street
- Reduces private property flood concerns
- Phased construction and budget flexibility

CONSTRAINTS

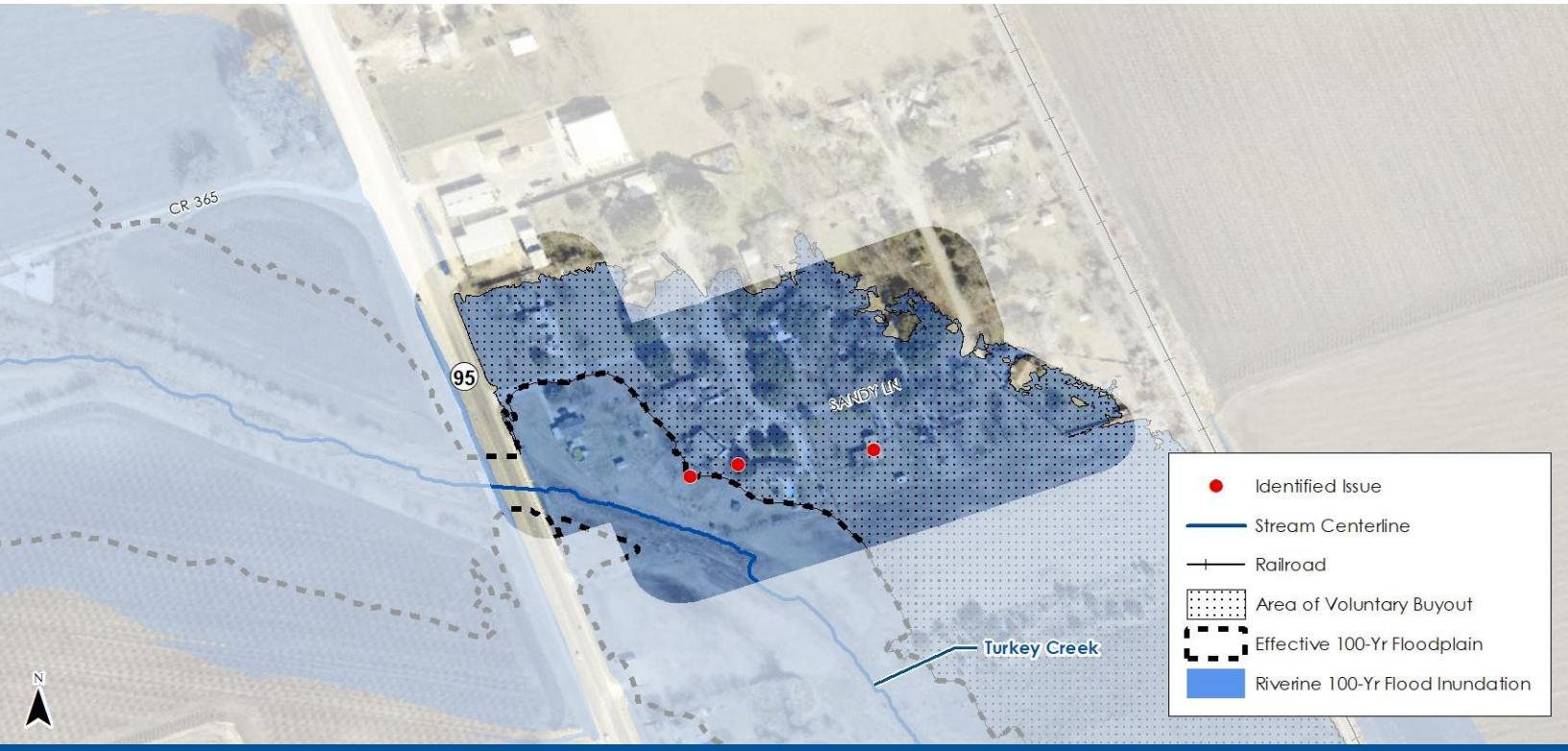
- Construction impact to residents
- Easements

QUICK FACTS

- **4** Public Input Points Addressed
- **7** Structures Benefited
- **1600** Feet Curb and Gutter Improvements
- Road Improvements:
  - Increased conveyance by re-grading curb and gutter
- Project Cost Estimate: **$ 74,190**

CITY OF TAYLOR MASTER DRAINAGE PLAN

SANDY LANE VOLUNTARY BUYOUTS



PROJECT D ESCRIPTION:

Private property on Sandy Lane lies within the updated Atlas 14 100-yr floodplain. The recommendation is for voluntary buy outs for these homes in the floodplain. Further analysis would be required to determine the functionality of the neighborhood if homes were removed from this area and to determine general access/safety of the neighborhood during flood events.

BENEFITS

- Reduces private property flood concerns

CONSTRAINTS

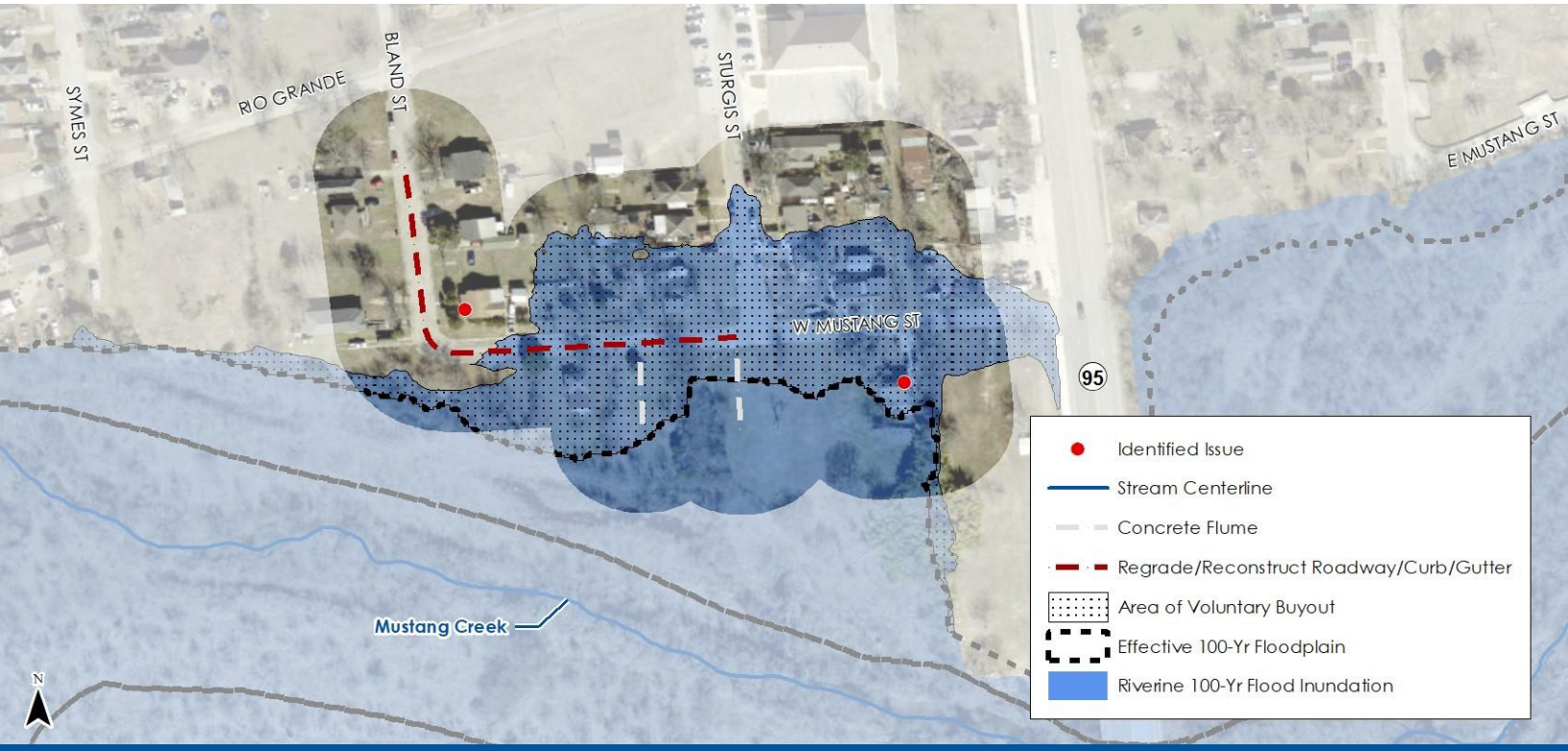
- Voluntary nature of the acquisitions

QUICK FACTS

- **3** Public Input Point Addressed
- Project Cost Estimate: **$ 3,212,200**
- **12** Structures Benefited

CITY OF TAYLOR MASTER DRAINAGE PLAN

WEST MUSTANG STREET IMPROVEMENTS



PROJECT D ESCRIPTION:

Private property on Mustang Street lies within the updated Atlas 14 100-yr floodplain. The recommendation is for voluntary buy outs for these homes in the floodplain.

In addition, there is ponding along Bland Street south of Rio Grande Street due to pavement failures. This ponding exacerbates existing roadway deterioration. To alleviate the problem, curb and gutter reconstruction along Bland Street and Mustang Street is proposed. Driveway approaches where there is ponding will also be reconstructed. Additionally, two concrete drainage flumes will be built on Mustang Street to direct flow out of the street and to the receiving stream.

BENE FITS

- Alleviates roadway ponding
- Promotes positive drainage
- Reduces private property flood concerns

CONSTRAINTS

- Road access limited during construction
- Easement for flumes
- Future maintenance

QUICK FACTS

- **2** Public Input Point Addressed
- **20** Structures Benefited
- **560** Feet Curb and Gutter Improvements
- **2** New Concrete Flume Outfalls
- Road Improvements:
  - Increased conveyance by curb and gutter reconstruction
- Project Cost Estimate: **$ 593,930**

CITY OF TAYLOR MASTER DRAINAGE PLAN

NORTH MAIN STREET RE-PROFILING

PROJECT DESCRIPTION:

During storm events, residents of North Main Street have reported flooding. The existing curb and gutter have either deteriorated or been reduced by asphalt overlay. Runoff easily overtops and floods private property. The proposed solution includes re-grading the curb and gutter on Main Street and Porter Street spanning from 8th Street to 10th Street. Driveways will also require re-grading. Re-grading of North Main Street and Porter Street will transport runoff away from private property while increasing road safety.

BENEFITS

- Alleviates ponding of North Main Street and Porter Street
- Reduce private property flood concerns

CONSTRAINTS

- Construction impact to residents
- Future maintenance
- ROW from TXDOT

QUICK FACTS

- **2** Public Input Points Addressed
- **20** Structures Benefited
- **2,000** feet curb and gutter improvements
- Road Improvements:
  - Increased conveyance by re-grading the road
- Project Cost Estimate: **$ 58,660**

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 05 Bull Branch-Donna Channel

DATE PREPARED: 6/10/2022

PREPARED BY:

HA PROJ. NO.:

Summary of BB 05 Bull Branch-Donna Channel

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	0	$ 13.50	$ -
2		GEOGRID (TYPE 2)	SY	0	$ 3.50	$ -
3		FLEX BASE (12 IN)	CY	0	$ 65.00	$ -
4		PRIME COAT	GAL	0	$ 5.00	$ -
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	0	$ 9.00	$ -
					SUB-TOTAL	**$ -**
DRAINAGE						
6		ROW PREP	STA	0.0	$ 4,000.00	$ -
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ -**
					TOTAL	**$ -**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ -
Road Improvements	$ -
Traffic Control (1%)	$ -
Erosion and Sediment Control (0.5%)	$ -
Utility Adjustments (5%)	$ -
Mobilization	$ -
Preliminary Total	$ -
Contingency (30%)	$ -
Design/Soft Costs (15%)	$ -
Overall Preliminary Project Total (provided by HDR per the FIF and GLO-MIT funding budgets)	**$ 6,032,383.50**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 07 Kimbro Street

DATE PREPARED: 6/10/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36762.001

Summary of MC 07 Kimbro Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	3840	$ 13.50	$ 51,834.00
2		GEOGRID (TYPE 2)	SY	3840	$ 3.50	$ 13,438.44
3		FLEX BASE (12 IN)	CY	7617	$ 65.00	$ 495,114.63
4		PRIME COAT	GAL	960	$ 5.00	$ 4,799.44
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	3840	$ 9.00	$ 34,556.00
					SUB-TOTAL	**$ 599,742.52**
DRAINAGE						
6		ROW PREP	STA	36.1	$ 4,000.00	$ 144,320.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	239	$ 110.00	$ 26,290.00
11		48" RCP STORM DRAIN	LF	496	$ 155.00	$ 76,880.00
12		5'X4' RBC STORM DRAIN	LF	876	$ 415.00	$ 363,540.00
13		6'X4' RBC STORM DRAIN	LF	936	$ 675.00	$ 631,800.00
14		7'X4' RBC STORM DRAIN	LF	1061	$ 820.00	$ 870,020.00
15		OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
16		CHANNEL IMPROVEMENTS	SY	1334	$ 35.00	$ 46,690.00
17		STORM INLET	EA	39	$ 6,500.00	$ 253,500.00
18		STORM MANHOLE	EA	13	$ 4,200.00	$ 54,600.00
					SUB-TOTAL	**$ 2,482,640.00**
					TOTAL	**$ 3,082,382.52**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 2,482,640
Road Improvements	$ 599,740
Traffic Control (1%)	$ 30,820
Erosion and Sediment Control (0.5%)	$ 15,410
Utility Adjustments (5%)	$ 124,130
Mobilization	$ 325,270
Preliminary Total	$ 3,578,010
Contingency (30%)	$ 1,073,400
Design/Soft Costs (15%)	$ 536,700
Overall Preliminary Project Total	**$ 5,188,110**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 11 Mallard Lane

DATE PREPARED: 6/10/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 11 Mallard Lane

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	1504	$ 13.50	$ 20,302.50
2		GEOGRID (TYPE 2)	SY	1504	$ 3.50	$ 5,263.61
3		FLEX BASE (12 IN)	CY	2506	$ 65.00	$ 162,921.30
4		PRIME COAT	GAL	376	$ 5.00	$ 1,879.86
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	1504	$ 9.00	$ 13,535.00
					SUB-TOTAL	**$ 203,902.27**
DRAINAGE						
6		ROW PREP	STA	16.2	$ 4,000.00	$ 64,760.00
7		CONCRETE	CY	381	$ 550.00	$ 209,550.00
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		3'X3' RBC STORM DRAIN	LF	300	$ 215.00	$ 64,500.00
11		4'X3' RBC STORM DRAIN	LF	588	$ 299.00	$ 175,812.00
12		5'X3' RBC STORM DRAIN	LF	579	$ 337.00	$ 195,123.00
13		6'X3' RBC STORM DRAIN	LF	152	$ 365.00	$ 55,480.00
14		OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
15		CHANNEL EXCAVATION	CY	976	$ 12.00	$ 11,712.00
16		CHANNEL IMPROVEMENTS	SY	862	$ 35.00	$ 30,170.00
17		STORM INLET	EA	14	$ 6,500.00	$ 91,000.00
18		STORM MANHOLE	EA	5	$ 4,200.00	$ 21,000.00
					SUB-TOTAL	**$ 934,107.00**
					TOTAL	**$ 1,138,009.27**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 934,110
Road Improvements	$ 203,900
Traffic Control (1%)	$ 11,380
Erosion and Sediment Control (0.5%)	$ 5,690
Utility Adjustments (5%)	$ 46,710
Mobilization	$ 120,180
Preliminary Total	$ 1,321,970
Contingency (30%)	$ 396,590
Design/Soft Costs (15%)	$ 198,300
Overall Preliminary Project Total	**$ 1,916,860**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 06 Annie Street

DATE PREPARED: 6/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of MC 06 Annie Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	3311	$ 13.50	$ 44,695.50
2		GEOGRID (TYPE 2)	SY	3311	$ 3.50	$ 11,587.72
3		FLEX BASE (12 IN)	CY	6682	$ 65.00	$ 434,354.07
4		PRIME COAT	GAL	828	$ 5.00	$ 4,138.47
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	3311	$ 9.00	$ 29,797.00
					SUB-TOTAL	**$ 524,572.77**
DRAINAGE						
6		ROW PREP	STA	37.9	$ 4,000.00	$ 151,480.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	865	$ 70.00	$ 60,550.00
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	373	$ 110.00	$ 41,030.00
11		42" RCP STORM DRAIN	LF	390	$ 130.00	$ 50,700.00
12		48" RCP STORM DRAIN	LF	169	$ 155.00	$ 26,195.00
13		54" RCP STORM DRAIN	LF	382	$ 210.00	$ 80,220.00
14		60" RCP STORM DRAIN	LF	1608	$ 400.00	$ 643,200.00
15		OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	33	$ 6,500.00	$ 214,500.00
18		STORM MANHOLE	EA	9	$ 4,200.00	$ 37,800.00
					SUB-TOTAL	**$ 1,320,675.00**
					TOTAL	**$ 1,845,247.77**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 1,320,680
Road Improvements	$ 524,570
Traffic Control (1%)	$ 18,450
Erosion and Sediment Control (0.5%)	$ 9,230
Utility Adjustments (5%)	$ 66,030
Mobilization	$ 193,900
Preliminary Total	$ 2,132,860
Contingency (30%)	$ 639,860
Design/Soft Costs (15%)	$ 319,930
Overall Preliminary Project Total	**$ 3,092,650**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 03 Bel Air Drive

DATE PREPARED: 6/10/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 03 Bel Air Drive

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	1144	$ 13.50	$ 15,450.00
2		GEOGRID (TYPE 2)	SY	1144	$ 3.50	$ 4,005.56
3		FLEX BASE (12 IN)	CY	1876	$ 65.00	$ 121,911.11
4		PRIME COAT	GAL	286	$ 5.00	$ 1,430.56
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	1144	$ 9.00	$ 10,300.00
					SUB-TOTAL	**$ 153,097.22**
DRAINAGE						
6		ROW PREP	STA	13.6	$ 4,000.00	$ 54,560.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	342	$ 70.00	$ 23,940.00
9		30" RCP STORM DRAIN	LF	248	$ 85.00	$ 21,080.00
10		36" RCP STORM DRAIN	LF	165	$ 110.00	$ 18,150.00
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		5'X3' RBC STORM DRAIN	LF	387	$ 337.00	$ 130,419.00
14		5'X4' RBC STORM DRAIN	LF	222	$ 415.00	$ 92,130.00
15		OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
16		CHANNEL IMPROVEMENTS	SY	267	$ 35.00	$ 9,345.00
17		STORM INLET	EA	14	$ 6,500.00	$ 91,000.00
18		STORM MANHOLE	EA	5	$ 4,200.00	$ 21,000.00
					SUB-TOTAL	**$ 476,624.00**
					TOTAL	**$ 629,721.22**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 476,620
Road Improvements	$ 153,100
Traffic Control (1%)	$ 6,300
Erosion and Sediment Control (0.5%)	$ 3,150
Utility Adjustments (5%)	$ 23,830
Mobilization	$ 66,300
Preliminary Total	$ 729,300
Contingency (30%)	$ 218,790
Design/Soft Costs (15%)	$ 109,400
Overall Preliminary Project Total	**$ 1,057,490**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 08 Davis Street South

DATE PREPARED: 6/10/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of MC 08 Davis Street South

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	4551	$ 13.50	$ 61,442.25
2		GEOGRID (TYPE 2)	SY	4551	$ 3.50	$ 15,929.47
3		FLEX BASE (12 IN)	CY	8847	$ 65.00	$ 575,076.06
4		PRIME COAT	GAL	1138	$ 5.00	$ 5,689.10
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	4551	$ 9.00	$ 40,961.50
					SUB-TOTAL	**$ 699,098.38**
DRAINAGE						
6		ROW PREP	STA	46.9	$ 4,000.00	$ 187,400.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		36" RCP STORM DRAIN	LF	595	$ 110.00	$ 65,450.00
9		42" RCP STORM DRAIN	LF	727	$ 130.00	$ 94,510.00
10		48" RCP STORM DRAIN	LF	849	$ 155.00	$ 131,595.00
11		4'X4' RBC STORM DRAIN	LF	135	$ 325.00	$ 43,875.00
12		5'X4' RBC STORM DRAIN	LF	702	$ 415.00	$ 291,330.00
13		6'X4' RBC STORM DRAIN	LF	1293	$ 675.00	$ 872,775.00
14		7'X4' RBC STORM DRAIN	LF	384	$ 820.00	$ 314,880.00
15		OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
16		CHANNEL IMPROVEMENTS	SY	889	$ 35.00	$ 31,115.00
17		STORM INLET	EA	32	$ 6,500.00	$ 208,000.00
18		STORM MANHOLE	EA	10	$ 4,200.00	$ 42,000.00
					SUB-TOTAL	**$ 2,297,930.00**
					TOTAL	**$ 2,997,028.38**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 2,297,930
Road Improvements	$ 699,100
Traffic Control (1%)	$ 29,970
Erosion and Sediment Control (0.5%)	$ 14,990
Utility Adjustments (5%)	$ 114,900
Mobilization	$ 315,690
Preliminary Total	$ 3,472,580
Contingency (30%)	$ 1,041,770
Design/Soft Costs (15%)	$ 520,890
Overall Preliminary Project Total	**$ 5,035,240**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 10 Burkett Street

DATE PREPARED: 6/10/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 10 Burkett Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	73	$ 13.50	$ 990.00
2		GEOGRID (TYPE 2)	SY	73	$ 3.50	$ 256.67
3		FLEX BASE (12 IN)	CY	90	$ 65.00	$ 5,850.00
4		PRIME COAT	GAL	18	$ 5.00	$ 91.67
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	73	$ 9.00	$ 660.00
					SUB-TOTAL	**$ 7,848.33**
DRAINAGE						
6		ROW PREP	STA	0.9	$ 4,000.00	$ 3,600.00
7		18" RCP STORM DRAIN	LF	120	$ 55.00	$ 6,600.00
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X2' RBC STORM DRAIN	LF	30	$ 288.00	$ 8,640.00
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		END TREATMENT	EA	7	$ 15,000.00	$ 105,000.00
16		CHANNEL IMPROVEMENTS	SY	1752	$ 35.00	$ 61,320.00
17		CHANNEL EXCAVATION	CY	125	$ 12.00	$ 1,500.00
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ 186,660.00**
					TOTAL	**$ 194,508.33**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 186,660
Road Improvements	$ 7,850
Traffic Control (1%)	$ 1,950
Erosion and Sediment Control (0.5%)	$ 970
Utility Adjustments (5%)	$ 9,330
Mobilization	$ 20,680
Preliminary Total	$ 227,440
Contingency (30%)	$ 68,230
Design/Soft Costs (25%)	$ 56,860
Overall Preliminary Project Total	**$ 352,530**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 08 Velma Drive

DATE PREPARED: 6/10/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 08 Velma Drive

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	1229	$ 13.50	$ 16,594.50
2		GEOGRID (TYPE 2)	SY	1229	$ 3.50	$ 4,302.28
3		FLEX BASE (12 IN)	CY	1944	$ 65.00	$ 126,349.17
4		PRIME COAT	GAL	307	$ 5.00	$ 1,536.53
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	1229	$ 9.00	$ 11,063.00
					SUB-TOTAL	**$ 159,845.47**
DRAINAGE						
6		ROW PREP	STA	14.9	$ 4,000.00	$ 59,480.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	246	$ 85.00	$ 20,910.00
10		36" RCP STORM DRAIN	LF	320	$ 110.00	$ 35,200.00
11		42" RCP STORM DRAIN	LF	288	$ 130.00	$ 37,440.00
12		48" RCP STORM DRAIN	LF	122	$ 155.00	$ 18,910.00
13		4'X2' RBC STORM DRAIN	LF	511	$ 288.00	$ 147,168.00
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	2	$ 15,000.00	$ 30,000.00
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	17	$ 6,500.00	$ 110,500.00
18		STORM MANHOLE	EA	6	$ 4,200.00	$ 25,200.00
					SUB-TOTAL	**$ 484,808.00**
					TOTAL	**$ 644,653.47**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 484,810
Road Improvements	$ 159,850
Traffic Control (1%)	$ 6,450
Erosion and Sediment Control (0.5%)	$ 3,220
Utility Adjustments (5%)	$ 24,240
Mobilization	$ 67,860
Preliminary Total	$ 746,430
Contingency (30%)	$ 223,930
Design/Soft Costs (15%)	$ 111,960
Overall Preliminary Project Total	**$ 1,082,320**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 01 TH Johnson

DATE PREPARED: 6/10/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 01 TH Johnson

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	147	$ 13.50	$ 1,980.00
2		GEOGRID (TYPE 2)	SY	147	$ 3.50	$ 513.33
3		FLEX BASE (12 IN)	CY	244	$ 65.00	$ 15,888.89
4		PRIME COAT	GAL	37	$ 5.00	$ 183.33
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	147	$ 9.00	$ 1,320.00
					SUB-TOTAL	**$ 19,885.56**
DRAINAGE						
6		ROW PREP	STA	6.4	$ 4,000.00	$ 25,400.00
7		CONCRETE	CY	222	$ 650.00	$ 144,444.44
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		6'X3' RBC STORM DRAIN	LF	180	$ 365.00	$ 65,700.00
15		END TREATMENT	EA	2	$ 15,000.00	$ 30,000.00
16		CHANNEL IMPROVEMENTS	SY	1278	$ 35.00	$ 44,730.00
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ 310,274.44**
					TOTAL	**$ 330,160.00**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 310,270
Road Improvements	$ 19,890
Traffic Control (1%)	$ 3,300
Erosion and Sediment Control (0.5%)	$ 1,650
Utility Adjustments (5%)	$ 15,510
Mobilization	$ 35,060
Preliminary Total	$ 385,680
Contingency (30%)	$ 115,700
Design/Soft Costs (25%)	$ 96,420
Overall Preliminary Project Total	**$ 597,800**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

GPD 01 Old Thorndale Road

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of GPD 01 Old Thorndale Road

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	115	$ 13.50	$ 1,552.50
2		GEOGRID (TYPE 2)	SY	115	$ 3.50	$ 402.50
3		FLEX BASE (12 IN)	CY	178	$ 65.00	$ 11,591.67
4		PRIME COAT	GAL	29	$ 5.00	$ 143.75
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	115	$ 9.00	$ 1,035.00
					SUB-TOTAL	**$ 14,725.42**
DRAINAGE						
6		ROW PREP	STA	1.1	$ 4,000.00	$ 4,200.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
11		4'X2' RBC STORM DRAIN	LF	60	$ 288.00	$ 17,280.00
12		5'X3' RBC STORM DRAIN	LF	75	$ 337.00	$ 25,275.00
13		6'X4' RBC STORM DRAIN	LF	0	$ 675.00	$ -
14		END TREATMENT	EA	6	$ 15,000.00	$ 90,000.00
15		CHANNEL EXCAVATION	CY	1260	$ 12.00	$ 15,120.00
16		CHANNEL IMPROVEMENTS	SY	2089	$ 35.00	$ 73,115.00
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ 224,990.00**
					TOTAL	**$ 239,715.42**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 224,990
Road Improvements	$ 14,730
Traffic Control (1%)	$ 2,400
Erosion and Sediment Control (0.5%)	$ 1,200
Utility Adjustments (5%)	$ 11,250
Mobilization	$ 25,460
Preliminary Total	$ 280,030
Contingency (30%)	$ 84,010
Design/Soft Costs (25%)	$ 70,010
Overall Preliminary Project Total	**$ 434,050**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

MC 01 Tammi Lane

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.000

Summary of MC 01 Tammi Lane

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	709	$ 13.50	$ 9,570.00
2		GEOGRID (TYPE 2)	SY	709	$ 3.50	$ 2,481.11
3		FLEX BASE (12 IN)	CY	945	$ 65.00	$ 61,437.04
4		PRIME COAT	GAL	177	$ 5.00	$ 886.11
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	709	$ 9.00	$ 6,380.00
					SUB-TOTAL	**$ 80,754.26**
DRAINAGE						
6		ROW PREP	STA	3.3	$ 4,000.00	$ 13,000.00
7		CONCRETE	CY	160	$ 550.00	$ 88,000.00
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 288.00	$ -
13		4'X2' RBC STORM DRAIN	LF	120	$ 288.00	$ 34,560.00
14		5'X2' RBC STORM DRAIN	EA	920	$ 406.00	$ 373,520.00
15		OUTLET STRUCTURE	EA	3	$ 15,000.00	$ 45,000.00
16		CHANNEL IMPROVEMENTS	SY	545	$ 35.00	$ 19,075.00
17		STORM INLET	EA	3	$ 6,500.00	$ 19,500.00
18		STORM MANHOLE	EA	2	$ 4,200.00	$ 8,400.00
					SUB-TOTAL	**$ 601,055.00**
					TOTAL	**$ 681,809.26**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 601,060
Road Improvements	$ 80,750
Traffic Control (1%)	$ 6,820
Erosion and Sediment Control (0.5%)	$ 3,410
Utility Adjustments (5%)	$ 30,050
Mobilization	$ 72,210
Preliminary Total	$ 794,300
Contingency (30%)	$ 238,290
Design/Soft Costs (15%)	$ 119,150
Overall Preliminary Project Total	**$ 1,151,740**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 02 Gabriel Street

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of MC 02 Gabriel Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	200	$ 13.50	$ 2,700.00
2		GEOGRID (TYPE 2)	SY	200	$ 3.50	$ 700.00
3		FLEX BASE (12 IN)	CY	133	$ 65.00	$ 8,666.67
4		PRIME COAT	GAL	50	$ 5.00	$ 250.00
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	200	$ 9.00	$ 1,800.00
					SUB-TOTAL	**$ 14,116.67**
DRAINAGE						
6		ROW PREP	STA	0.6	$ 4,000.00	$ 2,400.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X2' RBC STORM DRAIN	LF	0	$ 406.00	
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	3	$ 6,500.00	$ 19,500.00
18		STORM MANHOLE	EA	2	$ 4,200.00	$ 8,400.00
					SUB-TOTAL	**$ 30,300.00**
					TOTAL	**$ 44,416.67**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 30,300
Road Improvements	$ 14,120
Traffic Control (1%)	$ 440
Erosion and Sediment Control (0.5%)	$ 220
Utility Adjustments (5%)	$ 1,520
Mobilization	$ 4,660
Preliminary Total	$ 51,260
Contingency (30%)	$ 15,380
Design/Soft Costs (15%)	$ 7,690
Overall Preliminary Project Total	**$ 74,330**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 02 North Drive

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of MC 02 North Drive

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	656	$ 13.50	$ 8,856.00
2		GEOGRID (TYPE 2)	SY	656	$ 3.50	$ 2,296.00
3		FLEX BASE (12 IN)	CY	875	$ 65.00	$ 56,853.33
4		PRIME COAT	GAL	164	$ 5.00	$ 820.00
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	656	$ 9.00	$ 5,904.00
					SUB-TOTAL	**$ 74,729.33**
DRAINAGE						
6		ROW PREP	STA	6.6	$ 4,000.00	$ 26,240.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X2' RBC STORM DRAIN	LF	656	$ 406.00	$ 266,336.00
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	3	$ 6,500.00	$ 19,500.00
18		STORM MANHOLE	EA	2	$ 4,200.00	$ 8,400.00
					SUB-TOTAL	**$ 320,476.00**
					TOTAL	**$ 395,205.33**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 320,480
Road Improvements	$ 74,730
Traffic Control (1%)	$ 3,950
Erosion and Sediment Control (0.5%)	$ 1,980
Utility Adjustments (5%)	$ 16,020
Mobilization	$ 41,720
Preliminary Total	$ 458,880
Contingency (30%)	$ 137,660
Design/Soft Costs (15%)	$ 68,830
Overall Preliminary Project Total	**$ 665,370**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 05 McLain Street

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of MC 05 McLain Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	1124	$ 13.50	$ 15,171.75
2		GEOGRID (TYPE 2)	SY	1124	$ 3.50	$ 3,933.42
3		FLEX BASE (12 IN)	CY	2121	$ 65.00	$ 137,887.27
4		PRIME COAT	GAL	281	$ 5.00	$ 1,404.79
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	1124	$ 9.00	$ 10,114.50
					SUB-TOTAL	**$ 168,511.73**
DRAINAGE						
6		ROW PREP	STA	13.3	$ 4,000.00	$ 53,000.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	461	$ 110.00	$ 50,710.00
11		42" RCP STORM DRAIN	LF	49	$ 130.00	$ 6,370.00
12		48" RCP STORM DRAIN	LF	815	$ 155.00	$ 126,325.00
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	9	$ 6,500.00	$ 58,500.00
18		STORM MANHOLE	EA	4	$ 4,200.00	$ 16,800.00
					SUB-TOTAL	**$ 311,705.00**
					TOTAL	**$ 480,216.73**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 311,710
Road Improvements	$ 168,510
Traffic Control (1%)	$ 4,800
Erosion and Sediment Control (0.5%)	$ 2,400
Utility Adjustments (5%)	$ 15,590
Mobilization	$ 50,300
Preliminary Total	$ 553,310
Contingency (30%)	$ 165,990
Design/Soft Costs (25%)	$ 138,330
Overall Preliminary Project Total	**$ 857,630**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

GPD 02 Mariposa Lane

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of GPD 02 Mariposa Lane

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	489	$ 13.50	$ 6,598.50
2		GEOGRID (TYPE 2)	SY	489	$ 3.50	$ 1,710.72
3		FLEX BASE (12 IN)	CY	652	$ 65.00	$ 42,360.74
4		PRIME COAT	GAL	122	$ 5.00	$ 610.97
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	489	$ 9.00	$ 4,399.00
					SUB-TOTAL	**$ 55,679.94**
DRAINAGE						
6		ROW PREP	STA	4.9	$ 4,000.00	$ 19,400.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		3'X2' RBC STORM DRAIN	LF	53	$ 300.00	$ 15,900.00
14		4'X2' RBC STORM DRAIN	LF	575	$ 288.00	$ 165,600.00
15		OUTLET STRUCTURE	EA	2	$ 15,000.00	$ 30,000.00
16		CHANNEL IMPROVEMENTS	SY	260	$ 35.00	$ 9,100.00
17		STORM INLET	EA	4	$ 6,500.00	$ 26,000.00
18		STORM MANHOLE	EA	2	$ 4,200.00	$ 8,400.00
					SUB-TOTAL	**$ 274,400.00**
					TOTAL	**$ 330,079.94**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 274,400
Road Improvements	$ 55,680
Traffic Control (1%)	$ 3,300
Erosion and Sediment Control (0.5%)	$ 1,650
Utility Adjustments (5%)	$ 13,720
Mobilization	$ 34,880
Preliminary Total	$ 383,630
Contingency (30%)	$ 115,090
Design/Soft Costs (25%)	$ 95,910
Overall Preliminary Project Total	**$ 594,630**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 12 Otis Street

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 12 Otis Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	772	$ 13.50	$ 10,428.00
2		GEOGRID (TYPE 2)	SY	772	$ 3.50	$ 2,703.56
3		FLEX BASE (12 IN)	CY	1545	$ 65.00	$ 100,417.78
4		PRIME COAT	GAL	193	$ 5.00	$ 965.56
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	772	$ 9.00	$ 6,952.00
					SUB-TOTAL	**$ 121,466.89**
DRAINAGE						
6		ROW PREP	STA	8.7	$ 4,000.00	$ 34,760.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	869	$ 155.00	$ 134,695.00
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	8	$ 6,500.00	$ 52,000.00
18		STORM MANHOLE	EA	2	$ 4,200.00	$ 8,400.00
					SUB-TOTAL	**$ 244,855.00**
					TOTAL	**$ 366,321.89**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 244,860
Road Improvements	$ 121,470
Traffic Control (1%)	$ 3,660
Erosion and Sediment Control (0.5%)	$ 1,830
Utility Adjustments (5%)	$ 12,240
Mobilization	$ 38,410
Preliminary Total	$ 422,470
Contingency (30%)	$ 126,740
Design/Soft Costs (25%)	$ 105,620
Overall Preliminary Project Total	**$ 654,830**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 04 Travis Street

DATE PREPARED: 6/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of MC 04 Travis Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	2504	$ 13.50	$ 33,804.00
2		GEOGRID (TYPE 2)	SY	2504	$ 3.50	$ 8,764.00
3		FLEX BASE (12 IN)	CY	1790	$ 65.00	$ 116,371.67
4		PRIME COAT	GAL	626	$ 5.00	$ 3,130.00
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	2504	$ 9.00	$ 22,536.00
					SUB-TOTAL	**$ 184,605.67**
DRAINAGE						
6		ROW PREP	STA	13.0	$ 4,000.00	$ 52,040.00
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	191	$ 70.00	$ 13,370.00
9		30" RCP STORM DRAIN	LF	60	$ 85.00	$ 5,100.00
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	1	$ 15,000.00	$ 15,000.00
16		CHANNEL IMPROVEMENTS	SY	2100	$ 35.00	$ 73,500.00
17		STORM INLET	EA	4	$ 6,500.00	$ 26,000.00
18		STORM MANHOLE	EA	2	$ 4,200.00	$ 8,400.00
					SUB-TOTAL	**$ 193,410.00**
					TOTAL	**$ 378,015.67**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ 193,410
Road Improvements	$ 184,610
Traffic Control (1%)	$ 3,780
Erosion and Sediment Control (0.5%)	$ 1,890
Utility Adjustments (5%)	$ 9,670
Mobilization	$ 39,340
Preliminary Total	$ 432,700
Contingency (30%)	$ 129,810
Design/Soft Costs (25%)	$ 108,180
Overall Preliminary Project Total	**$ 670,690**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

MC 03 Debus Drive

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.000

Summary of MC 03 Debus Drive

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	0	$ 13.50	$ -
2		GEOGRID (TYPE 2)	SY	0	$ 3.50	$ -
3		FLEX BASE (12 IN)	CY	0	$ 65.00	$ -
4		PRIME COAT	GAL	0	$ 5.00	$ -
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	0	$ 9.00	$ -
					SUB-TOTAL	**$ -**
DRAINAGE						
6		ROW PREP	STA	0.0	$ 4,000.00	$ -
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ -**
					TOTAL	**$ -**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ -
Road Improvements	$ -
Traffic Control (1%)	$ -
Erosion and Sediment Control (0.5%)	$ -
Utility Adjustments (5%)	$ -
Mobilization	$ -
Preliminary Total - Previous MDUS Estimate (2021 cost)	$ 1,229,874
Contingency (0%)	$ -
Design/Soft Costs (0%)	$ -
Overall Preliminary Project Total - Previous MDUS Estimate	**$ 1,229,870**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 06 Davis Street North

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 06 Davis Street North

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	0	$ 13.50	$ -
2		GEOGRID (TYPE 2)	SY	0	$ 3.50	$ -
3		FLEX BASE (12 IN)	CY	0	$ 65.00	$ -
4		PRIME COAT	GAL	0	$ 5.00	$ -
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	0	$ 9.00	$ -
					SUB-TOTAL	**$ -**
DRAINAGE						
6		ROW PREP	STA	0.0	$ 4,000.00	$ -
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ -**
					TOTAL	**$ -**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ -
Road Improvements	$ -
Traffic Control (1%)	$ -
Erosion and Sediment Control (0.5%)	$ -
Utility Adjustments (5%)	$ -
Mobilization	$ -
Preliminary Total - Previous MDUS Estimate (2021 cost)	$ 74,194
Contingency (0%)	$ -
Design/Soft Costs (0%)	$ -
Overall Preliminary Project Total - Previous MDUS Estimate	**$ 74,190**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

TC 01 Sandy Lane

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of TC 01 Sandy Lane

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	0	$ 13.50	$ -
2		GEOGRID (TYPE 2)	SY	0	$ 3.50	$ -
3		FLEX BASE (12 IN)	CY	0	$ 65.00	$ -
4		PRIME COAT	GAL	0	$ 5.00	$ -
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	0	$ 9.00	$ -
					SUB-TOTAL	**$ -**
DRAINAGE						
6		ROW PREP	STA	0.0	$ 4,000.00	$ -
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
11		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
12		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
13		6'X4' RBC STORM DRAIN	LF	0	$ 675.00	$ -
14		7'X4' RBC STORM DRAIN	LF	0	$ 820.00	$ -
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ -**
					TOTAL	**$ -**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ -
Road Improvements	$ -
Traffic Control (1%)	$ -
Erosion and Sediment Control (0.5%)	$ -
Utility Adjustments (5%)	$ -
Mobilization	$ -
Preliminary Total - Twelve (12) Voluntary Residential Property Buy-outs	$ 3,212,195
Contingency (0%)	$ -
Design/Soft Costs (0%)	$ -
Overall Preliminary Project Total - Twelve (12) Voluntary Residential Property Buyouts	**$ 3,212,200**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

MC 09 West Mustang Street

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of MC 09 West Mustang Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	0	$ 13.50	$ -
2		CURB AND GUTTER	LF	0	$ 3.50	$ -
3		FLEX BASE (12 IN)	CY	0	$ 65.00	$ -
4		PRIME COAT	GAL	0	$ 5.00	$ -
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	0	$ 9.00	$ -
					SUB-TOTAL	**$ -**
DRAINAGE						
6		ROW PREP	STA	0.0	$ 4,000.00	$ -
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
11		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
12		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
13		6'X4' RBC STORM DRAIN	LF	0	$ 675.00	$ -
14		7'X4' RBC STORM DRAIN	LF	0	$ 820.00	$ -
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ -**
					TOTAL	**$ -**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ -
Road Improvements	$ -
Traffic Control (1%)	$ -
Erosion and Sediment Control (0.5%)	$ -
Utility Adjustments (5%)	$ -
Mobilization	$ -
Preliminary Total - Six (6) Voluntary Residential Property Buy-outs & Previous MDUS Estimate (2021 cost)	$ 593,929
Contingency (0%)	$ -
Design/Soft Costs (0%)	$ -
Overall Preliminary Project Total - Six (6) Voluntary Residential Property Buyouts & Previous MDUS Estimate	**$ 593,930**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

BB 13 North Main Street

DATE PREPARED: 7/26/2022

PREPARED BY: HALFF ASSOCIATES

HA PROJ. NO.: 36276.001

Summary of BB 13 North Main Street

PAY ITEM NO.	SPEC NO.	DESCRIPTION	UNITS	TOTAL ITEM QTY	UNIT PRICE	ITEM COST
FULL DEPTH RECONSTRUCTION						
1		HOT MIX ASPHALT CONCRETE PACEMENT (2 IN) (TY-D)	SY	0	$ 13.50	$ -
2		GEOGRID (TYPE 2)	SY	0	$ 3.50	$ -
3		FLEX BASE (12 IN)	CY	0	$ 65.00	$ -
4		PRIME COAT	GAL	0	$ 5.00	$ -
5		REMOVE ASPHALT AND EXISTING BASE (12 IN)	SY	0	$ 9.00	$ -
					SUB-TOTAL	**$ -**
DRAINAGE						
6		ROW PREP	STA	0.0	$ 4,000.00	$ -
7		18" RCP STORM DRAIN	LF	0	$ 55.00	$ -
8		24" RCP STORM DRAIN	LF	0	$ 70.00	$ -
9		30" RCP STORM DRAIN	LF	0	$ 85.00	$ -
10		36" RCP STORM DRAIN	LF	0	$ 110.00	$ -
11		42" RCP STORM DRAIN	LF	0	$ 130.00	$ -
12		48" RCP STORM DRAIN	LF	0	$ 155.00	$ -
13		4'X4' RBC STORM DRAIN	LF	0	$ 325.00	$ -
14		5'X4' RBC STORM DRAIN	LF	0	$ 415.00	$ -
15		OUTLET STRUCTURE	EA	0	$ 15,000.00	$ -
16		CHANNEL IMPROVEMENTS	SY	0	$ 35.00	$ -
17		STORM INLET	EA	0	$ 6,500.00	$ -
18		STORM MANHOLE	EA	0	$ 4,200.00	$ -
					SUB-TOTAL	**$ -**
					TOTAL	**$ -**

Preliminary Opinion of Probable Cost

Item Description	Estimate
Storm Improvements	$ -
Road Improvements	$ -
Traffic Control (1%)	$ -
Erosion and Sediment Control (0.5%)	$ -
Utility Adjustments (5%)	$ -
Mobilization	$ -
Preliminary Total - Previous MDUS Estimate (2021 cost)	$ 58,659
Contingency (0%)	$ -
Design/Soft Costs (0%)	$ -
Overall Preliminary Project Total - Previous MDUS Estimate	**$ 58,660**

These estimates were prepared utilizing standard cost estimating practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be liable to Owner or to a third party for any failure to accurately estimate the cost of the project, or any part thereof. All values are in 2021 dollars. An inflation rate of 3% should be allocated to each year until formal project funding.

APPENDIX C

KBI POND REPORT (HDR, INC.)

Technical Memorandum

Date:	Thursday, February 03, 2022
Revised:	**Thursday, February 24, 2022**
Project:	KBI Detention Pond Study
To:	Brian LaBorde, City Manager
From:	Samantha Paul, HDR Engineering Inc. Jennifer Leonard, HDR Engineering Inc.
Subject:	**KBI Detention Pond Study – Technical Memorandum**

HDR was selected by the City of Taylor to perform an assessment of the KBI Detention Pond, located at the intersection of T.H. Johnson Drive and Bull Run in Taylor, Williamson County, Texas. The pond is purportedly not detaining runoff during storm events. The objective of this memo is to evaluate the functionality of the pond and make recommendations to improve the performance of the detention facility.

The findings of this memorandum were presented to the City of Taylor City Council on Thursday, February 10th, 2022.

Overview Summary

According to the existing conditions modeling, the pond is not utilizing the full pond volume during larger storm events because a low spot in the northwest corner of the pond berm overtops for events greater than the 2-year, 24-hour storm event. Record drawings for the pond indicate that the pond was designed to detain the 100-year storm event, and this low spot in the berm was not intended to be built. Therefore, the saddle may need to be filled to increase the pond's capacity. Model results showed the pond has capacity to detain the 100-year event within regulation when the pond berm was brought up to design elevation (per record drawings). Therefore, HDR recommends raising the entire pond berm to the design elevation of 600' MSL to close off unintended spills, limit adverse impacts to neighboring property, and to meet freeboard requirements.

Modernizing the pond may also allow for low-flow detention improvements, such as a splitter box, to be installed at the principal spillway. Modeling results showed that while introducing a splitter box was able to increase pond storage, it resulted in additional discharge, which could create adverse impacts downstream. Further study is required to see if this proposed solution is feasible.

Lastly, HDR recommends performing needed maintenance on the pond by removing thick vegetation that has accumulated in a depression and regrading the pond bottom to reduce nuisance water. This will assist in long-term performance of the pond.

Background

The 5-acre pond was constructed in 2003 to provide detention for the Summerfield neighborhood. The pond also receives runoff from the adjacent commercial space (Walmart, McCoy's Building Supply, and Trinity Lutheran Church) and its associated detention facilities. The KBI Detention Pond has five inflow locations; four RCP outfalls from the neighborhood storm drain network, and one 5-foot-wide concrete channel that drains west along T.H. Johnson Drive upstream of the pond (see **Figure 3**). The pond has two 36-inch RCPs principal spillways (see **Figure 1**) that run west down T.H. Johnson Drive for approximately 700 feet before they outfall into a neighborhood drainage channel (**Figure 2)**. The pond also has a 200-foot grass-lined overflow weir auxiliary spillway (elev. 599.00' MSL), which directs large event flows onto T.H. Johnson Drive, where water would flow west and eventually into the neighborhood drainage channel. The design top-of-berm is elevation 600' MSL. Record drawings for the pond that were reviewed as part of this scope are listed below. These plans are provided as **Appendix 3** of this memorandum.

- Street, Drainage, Water and Wastewater Construction Plans for Northpark, Section 1
- North Park Phase Three (3A and 3B); Street, Drainage, Water and Wastewater Improvements
- North Park Phase Five; Street, Drainage, Water and Wastewater Improvements

Historic Rainfall vs. Atlas 14 24-Hour Events

Photographs and videos of the pond during three storm events in 2020 and 2021 were provided by City of Taylor council members to help calibrate the model. For these storm events, photographs confirmed ponding at the pond depression (see **Figure 4**). Depth of water appeared to be less than 1 foot in depth. Although these were significant rainfall events, when comparing historic rainfall from NOAA for these dates, the received rain depth was less than the 2-year 24-hour NOAA Atlas 14 rainfall data (3.97 inches, City of Taylor Drainage Criteria Manual). Therefore, these events were relatively small events for the pond's design intent, and model verification could not be determined based solely off these provided rain event datasets. To compare the historic NOAA rain depth for these events to the 2-year 24-hour Atlas 14 rain depth, please reference **Table 1** and **Table 2** below.

However, during the historic 2015 Memorial Day Flood, a local representative's account noted that the pond was holding significant water and appeared full (no photographs of this event were provided). The Memorial Day Flood was estimated at 4 to 5 inches of rainfall (AHPS Precipitation Analysis) during a 6-hour period, where the soils were already saturated from rainfall the day before. This event is roughly equivalent to a 50-year storm event.

NOAA Atlas 14 Rainfall Depth-Duration-Frequency (DDF) values for the 24-hour storm are provided in **Table 1** (City of Taylor Engineering Manual, Table 8-1). Recent observed rain events are summarized in **Table 2** below.

Table 1: 24-hour Depth-Duration-Frequency (DDF) Table

Recurrence Interval (years)	24-hr Storm Depth of Precipitation (inches)
1	3.08*
2	3.97
5	5.20
10	6.38
25	8.17
50	9.70
100	11.5
200	13.5
500	16.7

*1-year data was not available in the COT EM and therefore derived from NOAA's Point Precipitation Frequency Estimates

Table 2: Observed NOAA Rainfall Data for Historical Events

Event Date	NOAA AHPS Rainfall Data (inches)
May 24, 2015 (Memorial Day Flood)	4.0-5.5
March 22, 2020	1.0 – 1.5
April 22, 2020	1.53*
May 1, 2021	1.0 – 1.5

*data point provided by Taylor Airport rain gauge. No recorded rainfall from NOAA on this date.

Field Investigation and Survey

HDR conducted a site visit on October 25, 2021 and obtained survey data of the pond dated October 27, 2021. Findings from the field visit included identifying a depression in the pond bottom that collects water during storm events. A City maintenance employee discussed with HDR's field team that the depression ponds water that results in thick vegetation, as shown in **Figure 4** and **Figure 5**.

During the site visit, HDR representatives noted a saddle (**Figure 6**) in the northwest corner of the pond berm. Survey data later confirmed this portion of the pond berm (at elevation 595.9') is approximately 4 feet lower than the design top-of-berm elevation (600.0'). Residential homes are located behind this spill point in between Stone Ridge Drive and Sagewood Drive. Record drawings of the KBI Detention Pond show that the original design (Section 1) intended for additional flow to enter the pond via a channel to this saddle, however the design was changed in later phases of the neighborhood. Phase 3 of the North Park subdivision plans show an additional storm pipe entering the pond in place of the channel which was constructed in the field. Additionally, Phase 3 indicates that the saddle point was to be built to match the pond berm design

height of 600.0’ MSL, however, field survey confirms this work was not completed. Therefore, it appears the original intent of this low point in the berm is not in use today, and therefore operates as a low spill location, reducing the pond’s detention capacity.

In addition to the saddle location, survey showed that there are additional portions of the eastern pond berm that are lower than the design top-of-berm elevation, as well as lower than the auxiliary spillway. These locations are identified in **Appendix 2**.

The top of crown of Bill Pickett Drive, which crosses the drainage channel coming into the pond at T.H. Johnson Drive, sits at elevation 600.2’. Therefore, tailwater conditions in the pond could result in the partial flooding or overtopping of this roadway.

Additional existing conditions and survey information are summarized in **Appendix 2.**

Figure 1: KBI Pond principal spillway: two 36-inch RCP

Figure 2: Outfall of pond principal spillway into neighborhood drainage channel (1310 T.H. Johnson Drive)

Figure 3: Concrete drainage channel entering pond, looking east

Figure 4: Apparent depression with poor drainage in pond

Figure 5: Pond inlet adjacent to depression with standing water

Figure 6: Saddle in northwest corner of the pond berm (elev. 595.89')

H&H Modeling

Drainage calculations were prepared for the pond with an overall contributing area of approximately 140 acres. Curve numbers were calculated using the NRCS method, Urban and Residential Values, using ARC-II condition (COT Engineering Manual, Table 8-5). The SCS curve number loss method was applied using HEC-HMS v4.8. Seven drainage areas were delineated using best available LiDAR data (TNRIS Central Texas LiDAR, 2017). Drainage areas DA5 and DA7 are controlled by detention ponds with unknown outfall flows. The overall Drainage Area Map is provided in **Appendix 1**.

NRCS-TR 55 method was used to calculate lag time for the drainage areas (COT Engineering Manual, Section 8-4). Base curve number values by land use are summarized in **Table 3** below. Time of concentration values and composite curve numbers for existing conditions are summarized in **Table 4**. Flowlines and pond elevations for the KBI Detention Pond were determined by survey (Inland Geodetics, 2021). Storage-elevation curves for all three detention ponds were determined using LiDAR (TNRIS Central Texas LiDAR 2017).

Table 3: TR-55 Hydrology Summary

Land Use	Base CN	Hydrologic Soil Group	Percent Impervious (%)
Open-Fair	84	D	0
Open-Good	80	D	0
Impervious	98	D	100
Residential-1/4 acre	87	D	38

Table 4: Existing Conditions Hydrology Summary

Subbasin ID	Area (acres)	Total Tc (min)	Total Lag (min)	Composite CN
DA1	8.9	10.7	6.4	86
DA2	16.4	15.8	9.5	88
DA3	39.2	10.0	6.0	89
DA4	3.4	11.3	6.8	76
DA5	11.2	12.5	7.5	98
DA6	4.2	17.2	10.3	84
DA7	9.8	8.7	5.2	94

A hydrologic model of the KBI Detention Pond was built based on available survey and LIDAR data. The 2-, 10-, 25-, and 100-year storm events were modeled based on Atlas 14 rainfall data (City of Taylor Engineering Manual Table 8-2). The SCS unit hydrograph was employed to determine stormwater runoff.

Key elevations for KBI Detention Pond are shown in **Table 5**. Results from the model for runoff, discharge, and peak stage elevations for the pond, including the adjacent saddle serving as an existing spillway, are summarized in **Table 6** below.

Table 5: KBI Key Elevations Summary

Location	Elevation (ft MSL)
Design Top-of-Berm	600.0’
Design Auxiliary Spillway	599.0’
Surveyed Auxiliary Spillway	598.6’
Surveyed NW Saddle Berm	595.89’
Surveyed SE Berm Low Point	598.01’
Surveyed Primary Spillway Flowlines	589.63’

Table 6: Existing KBI Detention Pond Summary

Storm Frequency Event	Peak Runoff to Pond, Q (cfs)	Peak Pond Discharge, Q (cfs)	Peak Pond Stage, elev. MSL (ft)
1-year	285	129	594.7
2-year	374	157	595.5
10-year	606	421	596.6
25-year	751	589	597.0
100-year	1004	896	597.5

Modeling Results

The existing model shows the pond is underutilized, with peak stages overtopping at the saddle and unable to be conveyed through the principal spillway. Peak pond discharge overtops at the saddle for events greater than the 2-year storm event. However, the 100-year water surface elevation (WSEL) does not overtop other portions of the berm lower than design elevation. Therefore, the release of water over the saddle spillway does not allow the full pond volume to be utilized. Additionally, with the lowest portion of the pond berm at elevation 595.8, the KBI Detention Pond does not currently meet the required minimum 1-foot of freeboard from top-of-berm for the 100-year storm event (City of Taylor Engineering Manual, Section 8.15.1.c).

Two proposed solutions were developed to maximize storage of the KBI Detention Pond. The two modeled solutions include raising the saddle area to adjacent top-of-berm elevation and introducing a splitter box to increase storage during low-flow events.

Proposed Solution 1: Raising the Berm

The first proposed solution is to determine the resulting water surface elevations in the pond if the saddle area and entire pond berm perimeter were to be raised to match the design top-of-berm (600.0 feet). Results of this model show an increase in peak water surface elevations for the 10-, 25- and 100-year events but a decrease in peak discharge, as summarized in **Table 7**. Peak pond stage for the 100-year falls just below the auxiliary spillway, as well as meets the City's minimum freeboard requirement of 1 foot.

Table 7: KBI Detention Pond Summary with Raised Berm

Storm Frequency Event	Prop. Peak Pond Discharge, Q (cfs)	Prop. Peak Pond Stage, elev. MSL (ft)	Ex. Peak Pond Discharge, Q (cfs)	Ex. Peak Pond Stage, elev. MSL (ft)
1-year	129	594.7	129	594.7
2-year	143	595.6	157	595.5
10-year	175	597.8	421	596.6
25-year	444	598.3	589	597.0
100-year	850	598.8	896	597.5

Proposed Solution 2: Raising the Berm and Splitter Box

The second solution, which builds upon the first, is to install a splitter box with smaller orifice opening(s) around the existing principal spillway pipes, which will restrict the pond outflows during low flow (more frequent) storm events. The splitter box cannot be implemented separately from Solution 1 without creating adverse impacts (i.e. releasing more water than existing conditions). The box is conceptualized as a 5'x10' concrete structure set just above the existing 2-year storm peak pond stage (595.8'). For this solution, the splitter box orifice was sized to two 24"-diameter opening (flowline elev. of 589.63'). Storms over the pond stage 595.8' will overtop the splitter box, reducing the flow restriction and allowing additional flow to exit via the existing principal spillways. To model this, a stage-storage-discharge curve was developed in excel and input into HEC-HMS. Results for this scenario are summarized in **Table 8** below. Results show an increase in peak water surface elevations for all events and a decrease in peak discharge for lower events, but an increase in peak discharge for the 100-year storm event. Peak pond stage for the 100-year falls just below the auxiliary spillway, as well as meets the City's minimum freeboard requirement of 1 foot.

Table 8: KBI Detention Pond Summary with proposed (2)-24" Orifice Splitter Box and Raised Berm

Storm Frequency Event	Prop. Peak Pond Discharge, Q (cfs)	Prop. Peak Pond Stage, elev. MSL (ft)	Ex. Peak Pond Discharge, Q (cfs)	Ex. Peak Pond Stage, elev. MSL (ft)
1-year	85	595.6	129	594.7
2-year	125	596.4	157	595.5
10-year	280	598.1	421	596.6
25-year	569	598.5	589	597.0
100-year	901	598.9	896	597.5

Recommendations and Conclusions

According to the existing conditions modeling, the pond appears to be underperforming due to the unintentional spillway at the saddle, which overtops during the 10-, 25-, and 100-year frequency events. Because the saddle is not a designated spillway per the record drawings, this area is considered an unintended spill point. Therefore, the existing pond does not meet the Engineering Manual's requirements for 1-foot of freeboard in the 100-year event.

Proposed modeling results show that bringing the entire pond perimeter up to design top of berm, accomplished by closing off the saddle in combination with raising other lower portions of the berm allows the pond to utilize more volume, raising the water surface elevation during the 10-, 25-, and 100-year events, while limiting adverse impacts by releasing additional water or diverting water. Therefore, HDR recommends making modifications to the pond berm to increase detention capacity (Proposed Solution 1) by filling the saddle and low portions of the pond embankment with select fill or parapets to reestablish a consistent top-of-berm of 600.0' MSL.

Additionally, HDR investigated a splitter box retrofit design that may utilize more of the pond's detention volume during more frequent storm events. The design modeled in Proposed Solution 2 did accomplish additional water storage, but released a higher peak discharge downstream for

the 100-year event, creating potential adverse impacts. Therefore, HDR recommends additional study of the downstream impacts and refinement of the splitter box design at this time.

For an Engineer's Opinion of Probable Construction Costs associated with the work described in this memorandum, please see **Appendix 4**.

It should be noted that these modeling results are provided for informational purposes only. The proposed solutions are conceptual at this time and require further study to ensure there are no adverse impacts to downstream structures. While the results for Proposed Solution 2 shows an increase in peak pond discharge, further refinement during an engineering design phase of this pond modification may be able to limit impact. Further analysis of timing of peak flows to the downstream neighborhood channel may also be completed to mitigate adverse impact to any downstream structures.

Additionally, for the long-term maintenance and performance of the pond, HDR recommends removing thick vegetation that has accumulated in the depression in the pond bottom and regrading this area at approximately 2% slope (EM 8.15.3.b) if possible for positive drainage. This will remove nuisance standing water and help the pond perform as intended.

It must be acknowledged that having real world data to calibrate the model with observed storm events is an important step to verify the accuracy of the existing model results. At the time of this report, the only record photographs and videos provided of the pond for known storm events were during rainfall events less than the 2-year event (see **Table 2**). There is no way to verify that visual evidence was obtained during the pond's peak stage for that event, and therefore difficult to determine if pond is under-detaining in these events. For better model results, HDR recommends that further data be collected or observed of the pond's performance at peak stage during larger storm events.

Areas of Future Study

A final design of the proposed splitter box should be performed to eliminate adverse impacts, develop details and prepare construction documents.

Other improvements to slow water through the concrete channel might include retrofitting the channel in segments with energy dissipation baffles or riprap, or removing the concrete channel and replacing with a grass-lined channel through the pond.

The KBI pond may also be able to capture additional drainage area by adding inlets to TH Johnson Drive and diverting this water into the concrete channel. It is recommended that this be studied in combination with the solutions presented in this memo, so that the berms can be raised to handle the additional capacity needed, and the outfall structure be sized appropriately.

Lastly, HDR recommends that this watershed be studied holistically. Additional improvements could be made to other upstream areas, such as the wet pond located next to Taylor Middle School, or additional detention be implemented north of Carlos G Parker Blvd. Addressing more frequent storm event release of water in the upstream areas, flooding conditions can be mitigated at the confluence point near the KBI Detention Pond outfall.

Regards,

Jennifer Leonard, PE (TX #130258)
4401 West Gate Blvd, Suite 400
Austin, Texas 78745
(512) 498-4738
jennifer.leonard@hdrinc.com

List of Attachments:

Appendix 1: Overall Drainage Area Map Exhibit

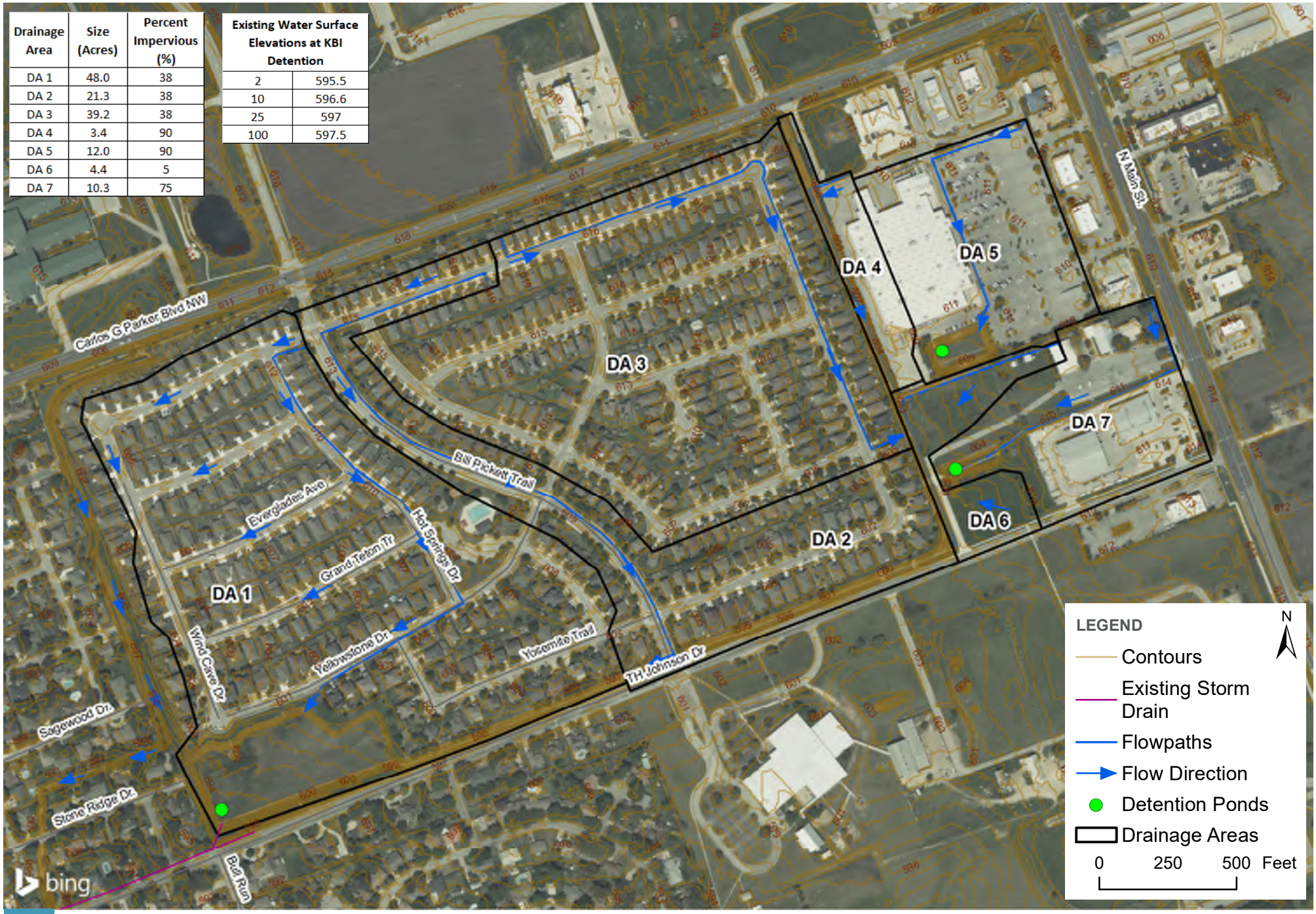
Appendix 2: Existing Conditions and Survey Information Exhibit

Appendix 3: Northpark Record Drawings for Sections 1, 3A, 3B, and 5

Appendix 4: Cost Estimate for Proposed Solutions

Drainage Area	Size (Acres)	Percent Impervious (%)
DA 1	48.0	38
DA 2	21.3	38
DA 3	39.2	38
DA 4	3.4	90
DA 5	12.0	90
DA 6	4.4	5
DA 7	10.3	75

Existing Water Surface Elevations at KBI Detention	
2	595.5
10	596.6
25	597
100	597.5



KBI DETENTION POND EXISTING CONDITIONS

DRAINAGE AREA MAP

APPENDIX 1

KBI DETENTION POND EXISTING CONDITIONS

APPENDIX 2

D-4

STREET, DRAINAGE, WATER AND WASTEWATER CONSTRUCTION PLANS

FOR

NORTHPARK, SECTION 1

IN THE

CITY OF TAYLOR, TEXAS

VICINITY MAP

DRAWING INDEX:

CITY OF TAYLOR – FOUNDED 1876

GENERAL CONSTRUCTION NOTES

1. CONTRACTOR SHALL CALL THE CITY (352-3487) FOR UTILITY LOCATIONS PRIOR TO ANY WORK IN CITY EASEMENTS OR STREET R.O.W.

2. CONTRACTOR SHALL NOTIFY THE PUBLIC WORKS (352-3633) AT LEAST 24 HOURS PRIOR TO THE BEGINNING OF WORKS. THE METHOD OF PLACEMENT AND COMPACTION OF BACKFILL IN THE CITY'S R.O.W. MUST BE APPROVED PRIOR TO THE START OF BACKFILL OPERATIONS.

3. FOR SLOPES OR TRENCHES GREATER THAN FIVE FEET IN DEPTH, "ALL CONSTRUCTION OPERATIONS SHALL BE ACCOMPLISHED IN ACCORDANCE WITH APPLICABLE REGULATIONS OF THE U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION." (OSHA STANDARDS MAY BE PURCHASED FROM THE GOVERNMENT PRINTING OFFICE; INFORMATION AND RELATED REFERENCE MATERIALS MAY BE PURCHASED FROM OSHA, 611 EAST 6TH STREET, AUSTIN, TEXAS.)

SUBMITTED FOR REVIEW BY:

I, TIMOTHY E. HAYNIE, DO HEREBY CERTIFY THAT THE PUBLIC WORKS AND DRAINAGE IMPROVEMENTS DESCRIBED HEREIN HAVE BEEN DESIGNED IN COMPLIANCE WITH THE SUBDIVISION AND BUILDING REGULATION ORDINANCES AND STORMWATER DRAINAGE POLICY ADOPTED BY THE CITY OF TAYLOR, TEXAS.

03-15-03

TIMOTHY E. HAYNIE, P.E. DATE:
REGISTERED PROFESSIONAL ENGINEER
TEXAS NO. 36982

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1010 Provident Lane
Round Rock, Texas 78664-3276
Ph. 512-837-2446 Fax 512-837-9463

ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAINS WITH THE ENGINEER WHO PREPARED THEM. IN ACCEPTING THESE PLANS, THE CITY OF TAYLOR MUST RELY UPON THE ADEQUACY OF THE WORK OF THE DESIGN ENGINEER.

ACCEPTED FOR CONSTRUCTION:

David J Simms 3-4-2003

DEPARTMENT OF PUBLIC WORKS DATE:
CITY OF TAYLOR, TEXAS

TxDOT DRIVEWAY PERMIT NO.

REVISIONS

NO.	DATE:	DESCRIPTION	ACCEPTED BY:	DATE:

AS-BUILT
DATE: 1-9-03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1010 Provident Lane
Round Rock, Texas 78664-3276
Ph. 512-837-2446 Fax 512-837-9463

PROJECT NO. 02-164 DESIGNED BY: K.B.H.
FILE NAME: NP1-1R DRAWN BY: K.B.H.
DATE: 12-21-02 CHECKED BY: T.E.H.
SCALE: PLOT 1:1 REVISED BY:

PLOT DATE: 3/12/2003

PROJECT: NORTHPARK SECTION 1 CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS

SHEET TITLE: COVER SHEET

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

STATE OF TEXAS – TIMOTHY E. HAYNIE – 36982 – LICENSED PROFESSIONAL ENGINEER

DATE: MAR 12 2003

SHEET NUMBER: 1 OF 91

LEGEND

- ■ CONCRETE MONUMENT FOUND
- ⊕ "X" CHISLED IN CONCRETE
- ● PIN FOUND
- ○ PIN SET
- ⊘ POWER POLE
- GUY WIRE
- CULVERT END (SIZE AS NOTED)
- SIGN
- CABLE ROUTE SIGN
- ( ) INDICATES RECORD INFO
- (B) SCHEDULE "B" EXCEPTION
- (12) SEE SURVEY NOTE AS NUMBERED
- WATER VALVE
- FIRE HYDRANT

200 0 200 400 600

Scale: 1" = 200'

FLOOD PLAIN NOTE

THE UNDERSIGNED DOES FURTHER CERTIFY THAT ALL AND/OR PORTIONS OF THE PROPERTY DESCRIBED HEREON IS LOCATED IN ZONE "C" AND IS NOT WITHIN A 100-YEAR FLOOD HAZARD AREA AS IDENTIFIED BY THE FEDERAL INSURANCE ADMINISTRATION FLOOD BOUNDARY MAP, PANEL No. 480626 0015 E & W, EFFECTIVE SEPT. 27, 1991

CURVE TABLE

NUMBER	DELTA ANGLE	CHORD DIRECTION	TANGENT	RADIUS	ARC LENGTH	CHORD LENGTH
C1	03°28'13"	N69°23'49"E	57.55	1899.95	115.07	115.05

POINT OF BEGINNING FIELD NOTE DESC.

JERRY STAMKOS 0.58 ACRES VOL. 823, PG. 893 W.C.D.R.

FARM TO MARKET 397

N22°21'16"W 140.87'

N21°51'49"W 136.03'

SHERRY CIRCLE

JOHN CUBA ADDITION SECTION TWO CAB. E, SLD. 311 W.C.P.R.

WILLOW BROOK TRAIL

JOHN CUBA ADDITION SECTION TWO CAB. E, SLD. 311 W.C.P.R.

RAGWOOD DRIVE

STONE RIDGE DRIVE

JOHN CUBA ADDITION SECTION ONE CAB. E, SLD. 302 W.C.P.R.

117.880 ACRES
(5,134,847 SQ. FT.)
CORN FIELD

176.52 ACRES REMAINING
JANE E. JONES
259.00 ACRES TRACT
VOL. 358, PG. 112
(W.C.D.R.)

CHURCH OF CHRIST
VOL. 518, PG. 481
4.00 ACRES
(W.C.D.R.)

F.M. 3349 JOHNSON DRIVE

W. F. BAKER SURVEY ABSTRACT NO. 65

STATE HIGHWAY 95 SOUTH

A8 - BUILT
DATE 1-9-03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1210 Royston Lane
Round Rock, Texas 78664-3175
Ph. 512-828-1246 Fax 512-828-7443

PROJECT NO.	02-164	DESIGNED BY:	K.W.M.
FILE NAME:	NPT-S	DRAWN BY:	K.W.M.
DATE:	10-21-02	CHECKED BY:	T.E.H.
SCALE:	PLOT 1:200	REVISED BY:	

NO.	BY:	DATE:	REVISION

PLOT DATE: 12/06/02

PROJECT:
NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

SHEET TITLE:
PRE-DEVELOPED SITE TOPOGRAPHY & IMPROVEMENTS

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

STATE OF TEXAS
TIMOTHY E. HAYNIE
56982
LICENSED PROFESSIONAL ENGINEER

DATE: DECEMBER 6, 2002

SHEET NUMBER:
6 OF 91

F.M. 397

INSTALL TX DOT STANDARD ROCK BERM

DRAINAGE & P.U.E.

50' LANDSCAPE BUFFER STRIP

100 L.F. STABILIZED CONSTRUCTION ENTRANCE - SEE DETAIL SHEET 8

INSTALL 40 LF ROCK BERM

INSTALL ROCK BERM @ EXISTING CHANNEL

INSTALL 40 LF ROCK BERM

INSTALL 1080 LF OF SILT FENCE

INSTALL 40' LF ROCK BERM

INSTALL 40 LF OF ROCK BERM @ EXIST. CHANNEL

INSTALL 680 LF OF INTERCEPTOR DIKE

INSTALL 2180 LF OF INTERCEPTOR DIKE

DB

LOT 48

LOT 49

48
5.72 ACRES
DETENTION POND SITE

INSTALL 40 LF OF ROCK BERM @ DETENTION POND OUTLET

INSTALL SILT FENCE

INSTALL ROCK 40 LF OF ROCK BERM

BLOCK 'E'

BLOCK 'G'

BLOCK 'H'

BLOCK 'O'

BLOCK 'P'

BLOCK 'Q'

BLOCK 'I'

BLOCK 'A'

WILLOWSTONE DRIVE

SUGARTHORN BLVD.

GREAT BROOM DRIVE

TOM AVENUE

BIG BEND TRAIL

YOSEMITE TRAIL

YOSEMITE TRAIL

40' LANDSCAPE EASEMENT

50' DRAINAGE EASEMENT

T.H. JOHNSON DRIVE

80' I.D. R.O.W. — 70' PROPOSED R.O.W.

INSTALL 40 LF OF ROCK BERM

INSTALL 40 LF OF ROCK BERM

100 0 100 200 300
Scale: 1" = 100'

LEGEND

SF — SILT FENCE

STABILIZED CONSTRUCTION ENTRANCE

RB — ROCK BERM

DB — DIVERSION BERM (INTERCEPTOR DIKE)

ENGINEERED FILL PLACEMENT AND SEEDING (PERMANENT SOIL)

NOTES:

1. ALL FILL SITES SHOWN SHALL COMPLY WITH COMPACTION REQUIREMENTS IN ENGINEERED FILL SPECIFICATIONS
2. AS OUTLINED ON THIS DRAWING, ALL FILL SHALL BE PLACED COMPLETELY OUTSIDE OF ANY TREE DRIPLINE.
3. ALL TEMPORARY AND PERMENANT EROSION CONTROL MEASURES SHOWN ON THIS SHEET SHALL COMPLY WITH THE CURRENT STATE AND FEDERAL REQUIREMENTS OUTLINED IN THE EPA GUIDELINES AND THE PROJECT STORM WATER POLLUTION PROTECTION PLAN, KEPT ON SITE AT ALL TIMES.
4. ALL FILL SITES SHOWN SHALL COMPLY WITH SEEDING REQUIREMENTS FOR SPECIFICATIONS OUTLINED ON SHEET 2 OF THIS PROJECT.
5. CONTRACTOR SHALL INSTALL THIS ROCK BERM TO TxDOT STANDARD DETAIL AND SPECIFICATIONS. TOP OF BERM MINIMUM 1' BELOW EDGE OF PAVEMENT.

ENGINEERING FILL CONSTRUCTION METHODS AND TESTING

Field density and moisture content tests should be performed at a rate of one test for every 5,000 square feet per lift.

All existing surface vegetation should be cleared, grubbed and removed from the site and a positive grade away from the center of the construction pad should be maintained. All exposed surfaces should then be scarified, watered as The City of Taylor requires that all fill within R.O.W. meet 95% standard proctor density, including dry utility trenches. Fill outside R.O.W. in public easements, including dry utility trenches, must meet95% standard proctor density. Density tests are required to verify compaction.
compaction procedures (ASTM D 698-78), at a moisture content near the optimum moisture value (+2 percent to +3 percent).

Trenches for electric, cable, and gas fall under this category.

The site may then be brought to the desired grade using suitable fill materials free from deleterious matter. Each lift should be placed in loose lifts of approximately 8 inches and compacted to a minimum of 95 percent of the maximum dry density as obtained from standard proctor procedures.

Field density and moisture content tests should be conducted in accordance with ASTM D 2922 and ASTM D 3017, respectively, for all fill and subgrade materials beneath the structure and compared to the laboratory compaction test(s) to insure compliance with the project specifications.

AS - BUILT
DATE 1-9-08

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1070 Brookleigh Lane, Suite 78664-3278
Round Rock, Texas
Ph. 512-831-2448 Fax 512-831-9463

PROJECT NO. 02-104 DESIGNED BY: K.M.M.
FILE NAME: NPT-7B DRAWN BY: K.M.M.
DATE: 12-21-02 CHECKED BY: T.E.H.
SCALE: PLOT 1:1 REVISED BY:

REVISION | BY | DATE

PLOT DATE: 3/11/03

PROJECT: NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

SHEET TITLE: EROSION / SEDIMENTATION CONTROL PLAN

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

STATE OF TEXAS
TIMOTHY E. HAYNIE
98983
LICENSED PROFESSIONAL ENGINEER

DATE: MARCH 11, 2003

SHEET NUMBER: 7 OF 91

F.M. 397

1050 L.F. 4' SIDEWALK

DRAINAGE & P.U.E.

A

A

10' LANDSCAPE BUFFER STRIP

1825 L.F. 4' SIDEWALK

CROSS-SECTION A-A
NOT TO SCALE

Hapco Style 21 Single Tapered Elliptical Arms, Plain Base

STANDARD STREET POLE DETAIL
NOT TO SCALE

100 0 100 200 300
Scale: 1" = 100'

LEGEND

10' THERMOPLASTIC STOP BAR (TYP.)

STOP SIGN

STOP LINE

FUTURE NORTHPARK

NORTHPARK BLVD.

YELLOWSTONE DRIVE

BIG BEND TRAIL

YOSEMITE TRAIL

GREAT BASIN DRIVE

KINGS CANYON DRIVE

BLOCK 'A'

BLOCK 'E'

BLOCK 'G'

BLOCK 'I'

BLOCK 'O'

BLOCK 'P'

BLOCK 'Q'

40' LANDSCAPE EASEMENT

30' DRAINAGE EASEMENT

3 REVISION NO. 3 - REVISED SCHOOL SIGNAGE AND MARKINGS
ADDED KEYED NOTES 1 - 6

KEYED NOTES

1. STOP SIGN, R1-1 (30x30)
2. SCHOOL ADVANCE SIGN (S1-1, 36x36) FLUORESCENT YELLOW-GREEN W/ DIAGONAL ARROW PLAQUE (W16-7, 24x6) FLUORESCENT YELLOW-GREEN
3. RELOCATE EXISTING SCHOOL FLASHING BEACON ASSEMBLY TO EAST SIDE OF PROPERTY LINE ON SW NEAR PHASE#1 TRANSITION AREA. FOUNDATION PER "LIGHT DETAIL TS-1"
4. CROSSWALK, NO CROSS-HATCH, THERMOPLASTIC
   6" WHITE STRIPE
5. CROSSWALK, WITH CROSS-HATCH, THERMOPLASTIC
   6" WHITE STRIPE
   6" WHITE STRIPE
6. SCHOOL ASSEMBLY SIGN WITH THE FOLLOWING
   S5-1, 24x30
   S4-3, 24x8
   S4-1, 24x10, "7 TO 9 A.M." "2:30 TO 4:30 P.M."

NOTE: STREET LIGHTS PER P.E.C. ELEC. PLAN

NO.	BY	DATE	REVISION
3	KWH	4/30/03	REVISED SCHOOL SIGNAGE AND MARKINGS ADDED KEYED NOTES 1 - 6

PLOT DATE: 4/30/03

PROJECT NO. 02-34 DESIGNED BY: K.W.H.
FILE NAME: 02-34 DRAWN BY: K.W.H.
SCALE: 1"=2' CHECKED BY: T.E.H.
PLAT 1/1 REVISED BY:

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1500 Round Rock Ave., Suite 125
Round Rock, Texas 78681
Ph 512-671-2444 Fax 512-671-1463

PROJECT:
NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

SHEET TITLE:
OVERALL STREET INDEX, SIGNAGE AND LIGHTING PLAN

DEVELOPER: KBHome, c/o Michael Stock, 11911 Burnet Road, Austin, Texas 78758

TIMOTHY E. HAYNIE
96882
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

DATE: APRIL 30, 2003

SHEET NUMBER
9 OF 91

AS - BUILT
DATE: 7-9-03

EXISTING ROUTING DIAGRAM

EXISTING 25-YEAR & 100-YEAR FLOWS									
AREA NO.	AREA (ac.)	TC (min.)	C25	I25	Q25	C100	I100	Q100	REMARKS
A	52.8	45	0.48	4.39	111.26	0.55	5.47	158.85	Study Point 'A'
B	43.2	37	0.4	4.88	84.39	0.47	6.07	123.26	Study Point 'B'
C	73.5	47	0.4	4.32	126.93	0.47	5.39	186.15	Study Point 'C'
D	11.7	30	0.4	5.49	25.72	0.47	6.80	37.40	Study Point 'D'
E	83.2	85	0.4	2.98	99.33	0.47	3.77	147.39	Study Point 'E'

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1120 Pecan Park Lane
Round Rock, Texas 78664-3275
Ph. 512-837-2446 Fax 512-837-9663

PROJECT NO. 00-134 DESIGNED BY: K.B.H.
FILE NAME: NP1-1-02 DRAWN BY: K.B.H.
DATE: 12/05/02 CHECKED BY: T.E.H.
SCALE: PLOT 1=400 REVISED BY:

NO.	BY	DATE	REVISION

PLOT DATE: 12/05/02

PROJECT: NORTHPARK SECTION 1 CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS

SHEET TITLE: PRE-DEVELOPED DRAINAGE AREA MAP WATERSHED PLAN

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

STATE OF TEXAS TIMOTHY E. HAYNIE 36982 LICENSED PROFESSIONAL ENGINEER

DATE: DECEMBER 5, 2002

SHEET NUMBER: 41 OF 91

AS-BUILT DATE 7-9-03

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

SHEET TITLE:	PROJECT:	PLAT DATE: 12/09/03
PRE-DEVELOPED DRAINAGE AREA MAP SUBDIVISION PLAN	NORTHPARK SECTION 1 CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS	NO. BY DATE REVISION

STATE OF TEXAS — JOEL T. HAVNIE — 39882 — REGISTERED PROFESSIONAL ENGINEER

DATE: DECEMBER 6, 2002 — SHEET NUMBER: 42 OF 91

AS - BUILT
DATE: 12-9-03

HAVNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1212 Rivervalley Lane
Round Rock, Texas 78664-3276
PH. 512-827-2446 Fax 512-827-9461

PROJECT NO.	02-104	DESIGNED BY	K.M.H.
FILE NAME:	NP1-40	DRAWN BY	K.M.H.
DATE:	10-21-02	CHECKED BY	T.E.H.
SCALE:	AS SHOWN	REVISED BY	

STATE HIGHWAY 95 SOUTH

FARM TO MARKET 1307

170.62 ACRES REMAINING
JANE E. JONES
150.00 ACRES TRACT
VOL. 456, PG. 172
(W.C.D.R.)

117.880 ACRES
(5,134,247 SQ. FT.)
CORN FIELD

SCALE: 1"=200'

NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

PROJECT

SHEET TITLE

POST-DEVELOPED DRAINAGE AREA MAP
SUBDIVISION PLAN

DATE: DECEMBER 8, 2002
SHEET NUMBER 43 OF 91

AS-BUILT
DATE 1-1-13

KBHome, c/o Michael Stack, 11911 Burnet Road, Austin, Texas 78758

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1616 Rowden Lane
Round Rock, Texas 78664-3775
PH. 512/827-2446 FAX 512/827-9843

PROJECT NO 02-104 DESIGNED BY K.M.M.
FILE NAME NP1-41 DRAWN BY K.M.M.
DATE 10-21-02 CHECKED BY T.E.H.
SCALE PLOT 1:100 HORIZ BY

PLOT DATE: 12/06/02

STRUCTURE NO. 1
SEE SHEET 59

STRUCTURE NO. 2
SEE SHEET 22

E.M. 397

H. JOHNSON DRIVE (FM 397)

Curb Capacity Calculations

[illegible] Johnson Drive

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
44	0.0087	9.38	0.50	13+85	15+75
44	0.0044	6.65	0.50	15+75	18+00
44	0.0001	5.42	0.50	18+00	34+50
44	0.0026	5.15	0.50	34+50	42+00
44	0.0106	10.11	0.50	42+00	51+00
44	0.0016	3.89	0.50	51+00	52+50
44	0.0026	14.63	0.50	50+50	54+20.24

NorthPark Blvd.

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
40	0.0215	14.89	0.50	0+00	2+50
40	0.0100	8.89	0.50	2+50	8+00
40	0.004	6.34	0.50	8+00	18+00
40	0.0067	8.41	0.50	18+00	21+13.80

Yosemite Trail

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0148	10.04	0.50	0+00	1+00
30	0.004	5.48	0.50	1+00	2+75
30	0.008	7.75	0.50	2+75	6+50
30	0.0044	5.75	0.50	6+50	9+25
30	0.004	5.48	0.50	9+25	11+25
30	0.004	5.48	0.50	11+25	12+75
30	0.0045	5.81	0.50	12+75	19+25
30	0.0064	6.63	0.50	19+25	20+85.58

Yellowstone

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.004	5.48	0.50	0+00	1+50
30	0.004	5.48	0.50	1+50	3+00
30	0.0077	7.61	0.50	3+00	6+00
30	0.004	5.48	0.50	6+00	8+50
30	0.0062	6.81	0.50	8+50	14+00
30	0.0075	7.51	0.50	14+00	18+50
30	0.0054	6.37	0.50	18+50	24+85.22

Great Basin

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0067	7.09	0.50	2+00	4+60.23

Hot Springs

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0083	7.90	0.50	0+00	3+00
30	0.004	5.48	0.50	3+00	11+76.57

[illegible] Park

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.004	5.48	0.50	0+00	3+00
30	0.0112	9.17	0.50	3+00	5+00
30	0.015	10.62	0.50	5+00	8+50
30	0.005	6.13	0.50	8+50	15+00
30	0.004	5.48	0.50	15+00	18+00
30	0.006	6.71	0.50	18+00	25+54.57

King's Canyon

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0045	5.81	0.50	0+00	5+50
30	0.007	7.25	0.50	5+00	8+00
30	0.011	9.09	0.50	8+00	11+00
30	0.0045	5.81	0.50	11+00	13+66.04

Everglades

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0043	5.68	0.50	0+00	2+50
30	0.0088	8.13	0.50	2+50	8+30.58

[illegible] Avenue

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0114	8.25	0.50	0+00	4+00
30	0.004	5.48	0.50	4+00	9+07.08

Big Sur

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0064	6.93	0.50	0+00	2+50
30	0.004	5.48	0.50	3+50	12+00
30	0.0102	8.75	0.50	12+00	14+32.84

Big Bend

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.004	5.48	0.50	0+00	8+00
30	0.0058	6.62	0.50	8+00	20+25
30	0.0052	6.25	0.50	20+25	21+84.89

Glacier Point Trail

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.004	5.48	0.50	0+00	5+00
30	0.0124	9.65	0.50	5+00	6+42.65

Glacier Point Cove

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0050	6.31	0.50	0+00	2+20.62

Mammoth

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.004	5.48	0.50	0+00	2+50
30	0.0112	9.17	0.50	2+50	6+88.40

Wind Cave

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0041	5.55	0.50	0+00	11+80.30

Grand Teton

Face of Curb Width	Sx(ft/ft)	Max. Q(cfs)	Yo	From Sta.	To Sta.
30	0.0042	5.62	0.50	0+00	3+00
30	0.0093	8.36	0.50	3+00	6+00
30	0.0091	8.19	0.50	6+00	9+31.38

DEVELOPED DRAINAGE AREA CALCULATIONS

AREA NO.	AREA (ac.)	Tc (min.)	C25	I25	Q25	C100	I100	Q100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GRADE INLET FLOW CALCULATION TABLE FOR 100 YEAR FLOWS

INLET NUMBER	DRAINAGE AREA NO.	Q (cfs)	Q Pass (cfs)	Q Total Qa (cfs)	SLOPE (%)	a (in.)	Yo (ft.)	PONDED WIDTH (ft)	R.F. (%)	Qa/La	La (ft)	LENGTH (ft)	L/La	a/Yo	Q/Qa	Q @ INLET (cfs)	Q Pass (cfs)	REMARKS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SUMP INLET FLOW CALCULATION TABLE FOR 100 YEAR FLOWS

INLET NUMBER	DRAINAGE AREA NO.	Q (cfs)	Q Pass (cfs)	Q Total Qa (cfs)	LENGTH (ft)	a (in.)	Yo (ft.)	PONDED WIDTH (ft)	R.F. (%)	HEAD a +Yo	CAPACITY Q	CAPACITY Q w/ R.F.	INLET TYPE
D-1	D-1	7.76	0	7.76	10	5	0.38	–	10	0.80	17.57	15.81	S-1
C-4	C-4	10.34	0	10.34	10	5	0.49	–	10	0.91	17.57	15.81	S-1
C-5	C-5	11.96	0	11.96	10	5	0.54	–	10	0.96	17.57	15.81	S-1
K-2	K-2	10.87	0	10.87	10	5	0.51	–	10	0.93	17.57	15.81	S-1
K-3	K-3	5.43	0	5.43	10	5	-0.09	–	10	0.33	17.57	15.81	S-1

GRADE INLET FLOW CALCULATION TABLE FOR 25 YEAR FLOWS

INLET NUMBER	DRAINAGE AREA NO.	Q (cfs)	Q Pass (cfs)	Q Total Qa (cfs)	SLOPE (%)	a (in.)	Yo (ft.)	PONDED WIDTH (ft)	R.F. (%)	Qa/La	La (ft)	LENGTH (ft)	L/La	a/Yo	Q/Qa	Q @ INLET (cfs)	Q Pass (cfs)	REMARKS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SUMP INLET FLOW CALCULATION TABLE FOR 25 YEAR FLOWS

INLET NUMBER	DRAINAGE AREA NO.	Q (cfs)	Q Pass (cfs)	Q Total Qa (cfs)	LENGTH (ft)	a (in.)	Yo (ft.)	PONDED WIDTH (ft)	R.F. (%)	HEAD a +Yo	CAPACITY Q	CAPACITY Q w/ R.F.	INLET TYPE
D-1	D-1	5.2	0	5.2	10	5	0.31	–	10	0.73	10.61	9.55	S-1
C-4	C-4	7.4	0	7.4	10	5	0.39	–	10	0.81	10.61	9.55	S-1
C-5	C-5	8.6	0	8.6	10	5	0.43	–	10	0.85	10.61	9.55	S-1
K-2	K-2	7.8	0	7.8	10	5	0.41	–	10	0.82	10.61	9.55	S-1
K-3	K-3	4.1	0	4.1	10	5	-0.15	–	10	0.27	10.61	9.55	S-1

AS - BUILT
DATE: 7-9-03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1010 President Lane
Round Rock, Texas 78664-3276
Ph. 512-837-2446 Fax 512-837-9463

DESIGNED BY: K.W.M.
DRAWN BY: K.W.M.
CHECKED BY: T.E.H.
REVIEWED BY:
PROJECT NO.: 00-104
FILE NAME: NP1-42
DATE: 10-21-02
SCALE: PLOT 1:1

REVISION | NO. | BY | DATE

PLOT DATE: 12/06/02

PROJECT: NORTHPARK
SECTION I
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

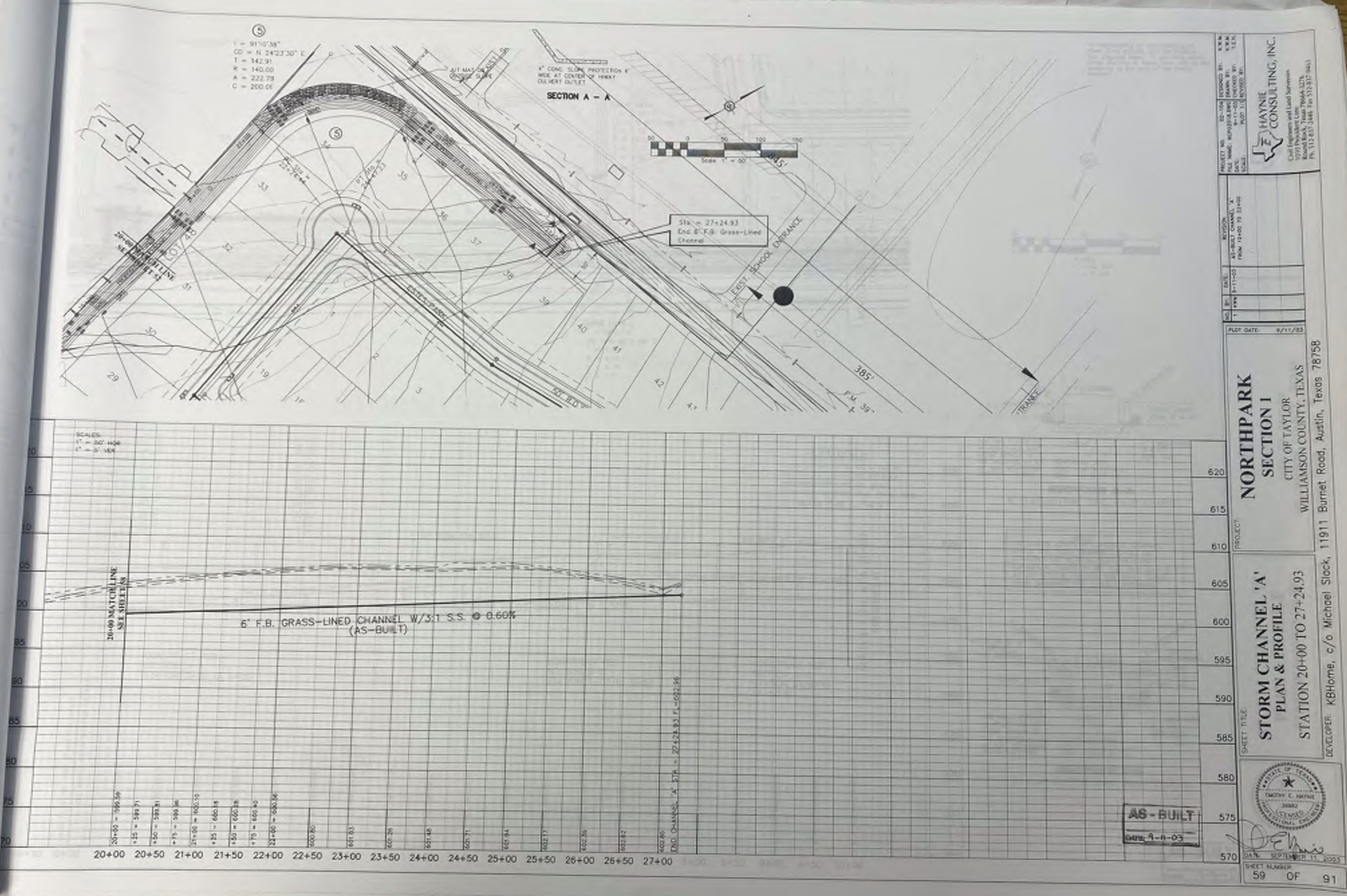
SHEET TITLE: DRAINAGE CALCULATIONS

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

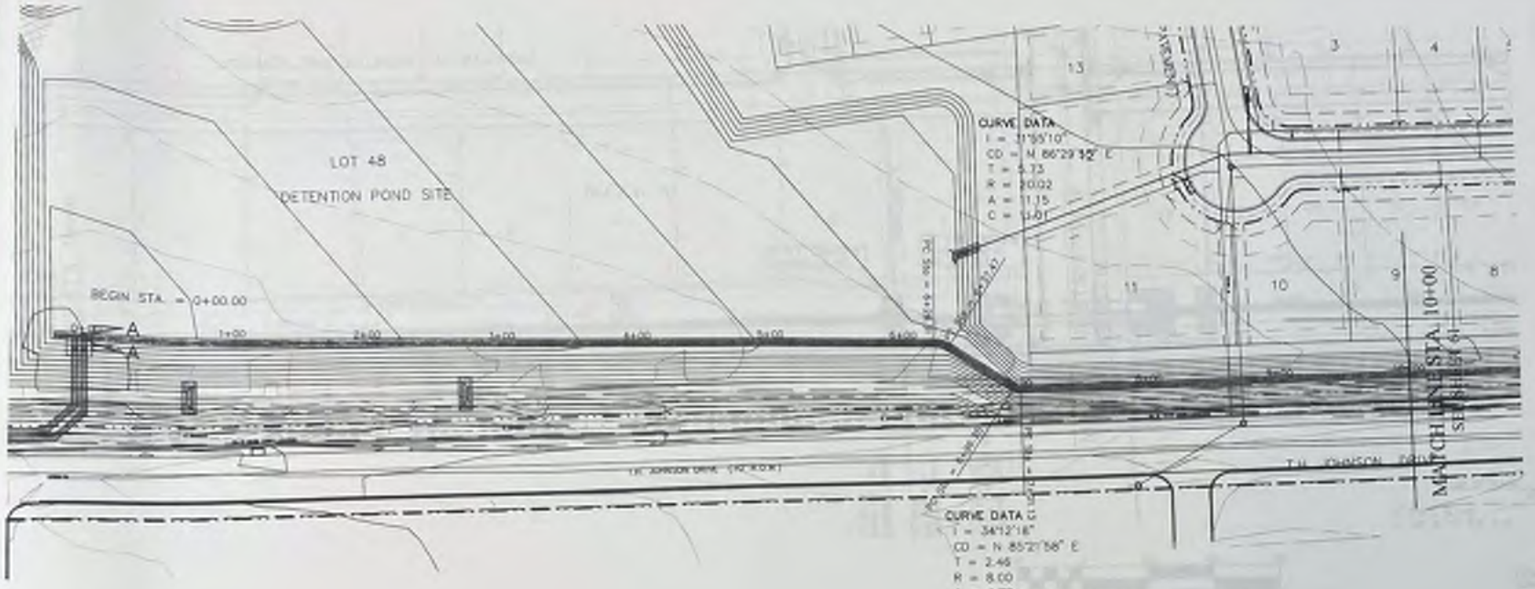
STATE OF TEXAS
TIMOTHY E. HAYNIE
36082
LICENSED
PROFESSIONAL ENGINEER

DATE: DECEMBER 6, 2002

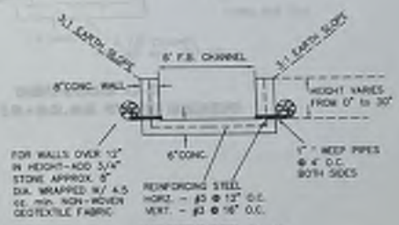
SHEET NUMBER: 44 OF 91


SECTION A – A
Sta. = 27+24.93
End 6' F.B. Grass-Lined Channel
EXIST. SCHOOL ENTRANCE
385'
SCALES:
1" = 50' HOR
1" = 5' VER
20+00 MATCHLINE SEE SHEET 58
6' F.B. GRASS-LINED CHANNEL W/3:1 S.S. @ 0.60%
(AS-BUILT)
AS-BUILT
20+00
20+50
21+00
21+50
22+00
22+50
23+00
23+50
24+00
24+50
25+00
25+50
26+00
26+50
27+00
620
615
610
605
600
595
590
585
580
575
570
HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
PLOT DATE: 9/11/03
PROJECT
NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS
SHEET TITLE
STORM CHANNEL 'A'
PLAN & PROFILE
STATION 20+00 TO 27+24.93
DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758
STATE OF TEXAS
TIMOTHY E. HAYNIE
LICENSED
PROFESSIONAL ENGINEER
DATE: SEPTEMBER 11, 2003
SHEET NUMBER
59 OF 91

STORM CHANNEL 'B'



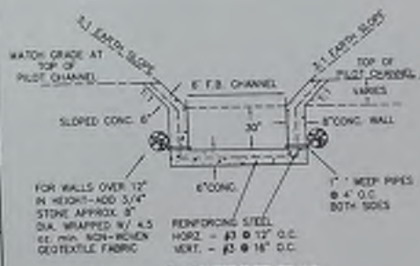
All responsibility for the adequacy of these plans remains with the Engineer who prepared them. In approving these plans, the City of Taylor must rely on the adequacy of the work of the Design Engineer.



SECTION A-A

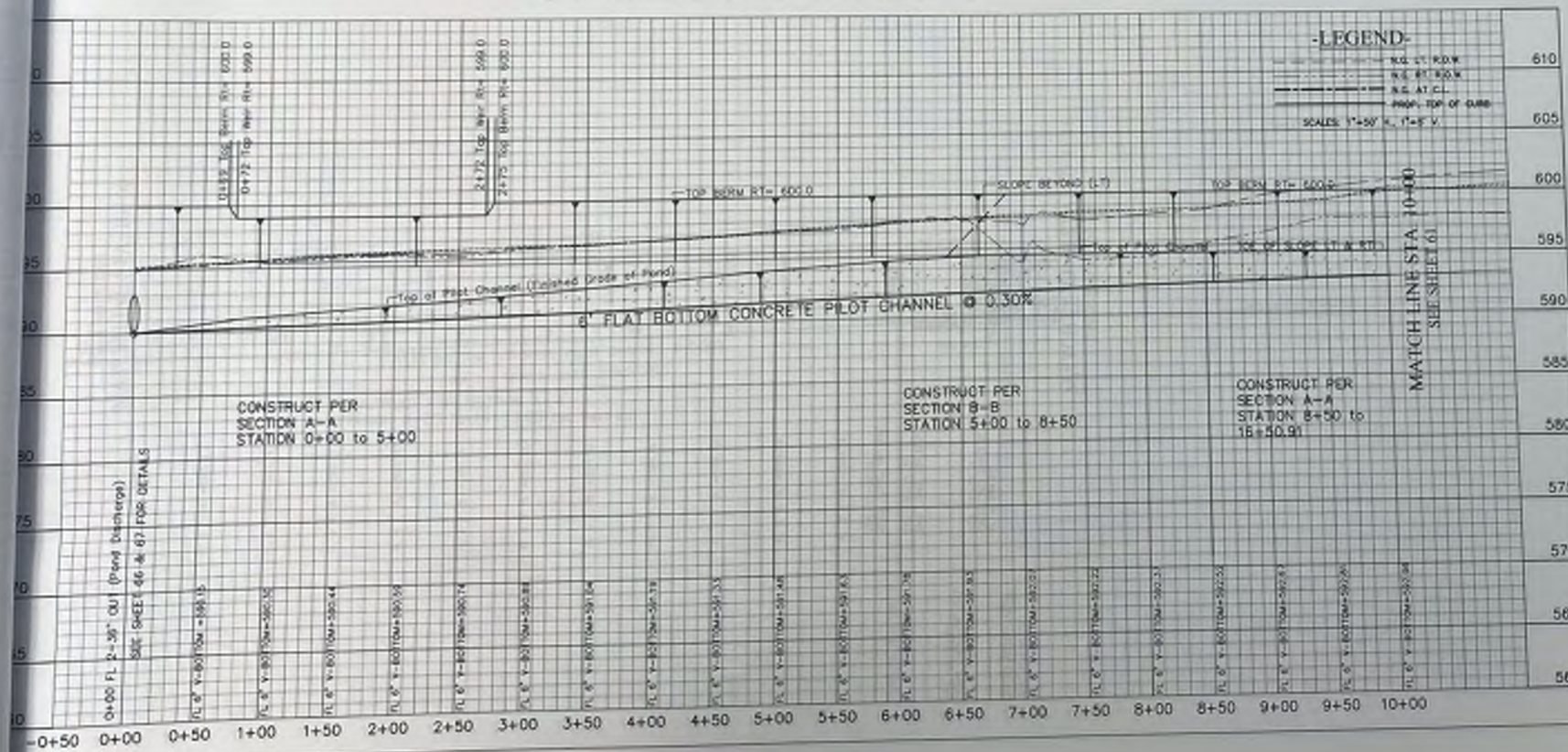
6' FLAT BOTTOM CONC. PILOT CHANNEL

NOTE:
EXPANSION JOINTS IN CONCRETE CHANNEL LINING AND PILOT CHANNELS SHALL BE CONSTRUCTED WITH REDWOOD KEYLOAD EXPANSION JOINTS AT 60' O.C. WITH SAW CUT AT 20' O.C.E.W. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR LAYOUT APPROVAL.



SECTION B-B

6' FLAT BOTTOM CONC. PILOT CHANNEL



AS - BUILT
DATE 7-9-03

NO.	BY	DATE	REVISION

PILOT DATE: 2/21/03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1370 Pecanland Lane
Round Rock, Texas 78664-2376
Ph. 512-837-9446 Fax 512-837-9483

PROJECT NO.	02-106
FILE NAME:	NPT-SHE
DATE:	02/21/03
SCALE:	PLOT 1:1
DESIGNED BY:	K.W.H.
DRAWN BY:	K.W.H.
CHECKED BY:	T.E.H.
REVISED BY:	

PROJECT: NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

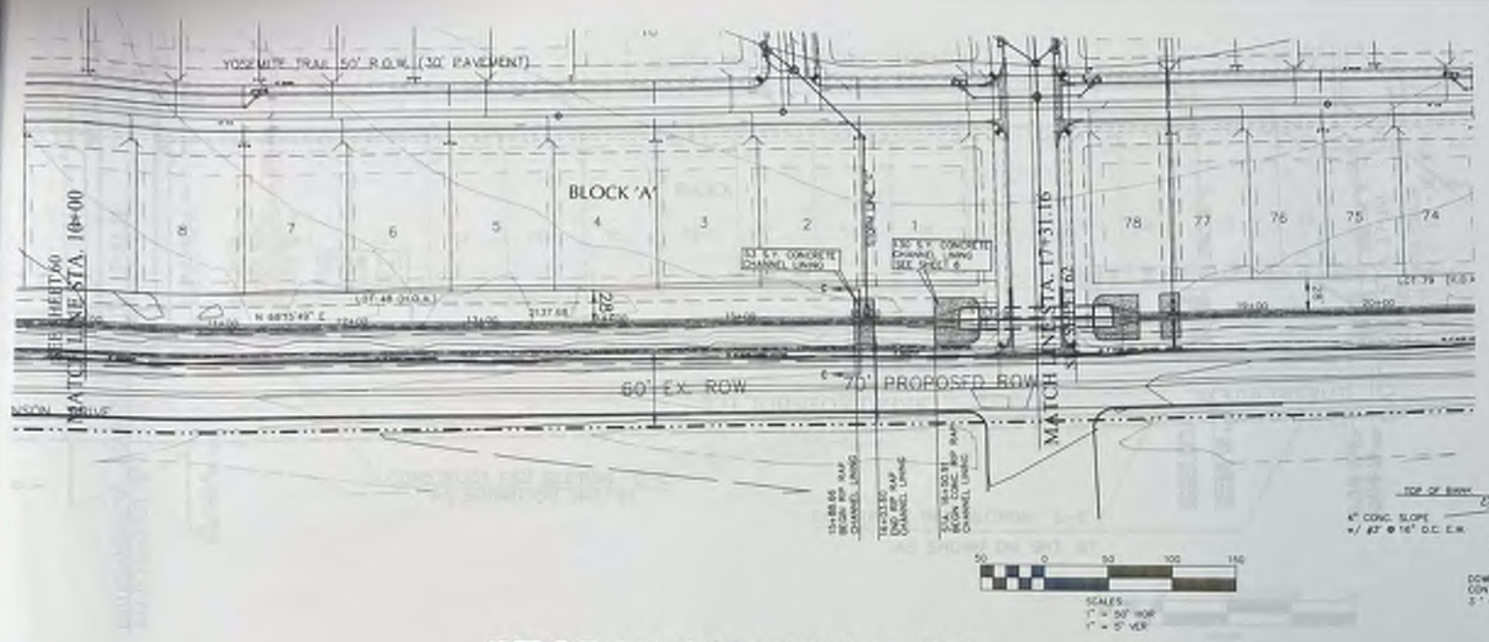
SHEET TITLE: STORM CHANNEL 'B'
PLAN & PROFILE
STATION 0+00 TO 10+00

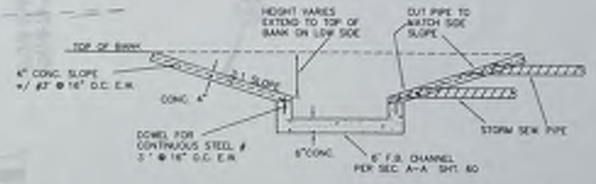
DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

STATE OF TEXAS
TIMOTHY E. HAYNIE
99992
LICENSED
PROFESSIONAL ENGINEER

DATE: FEBRUARY 21, 2003

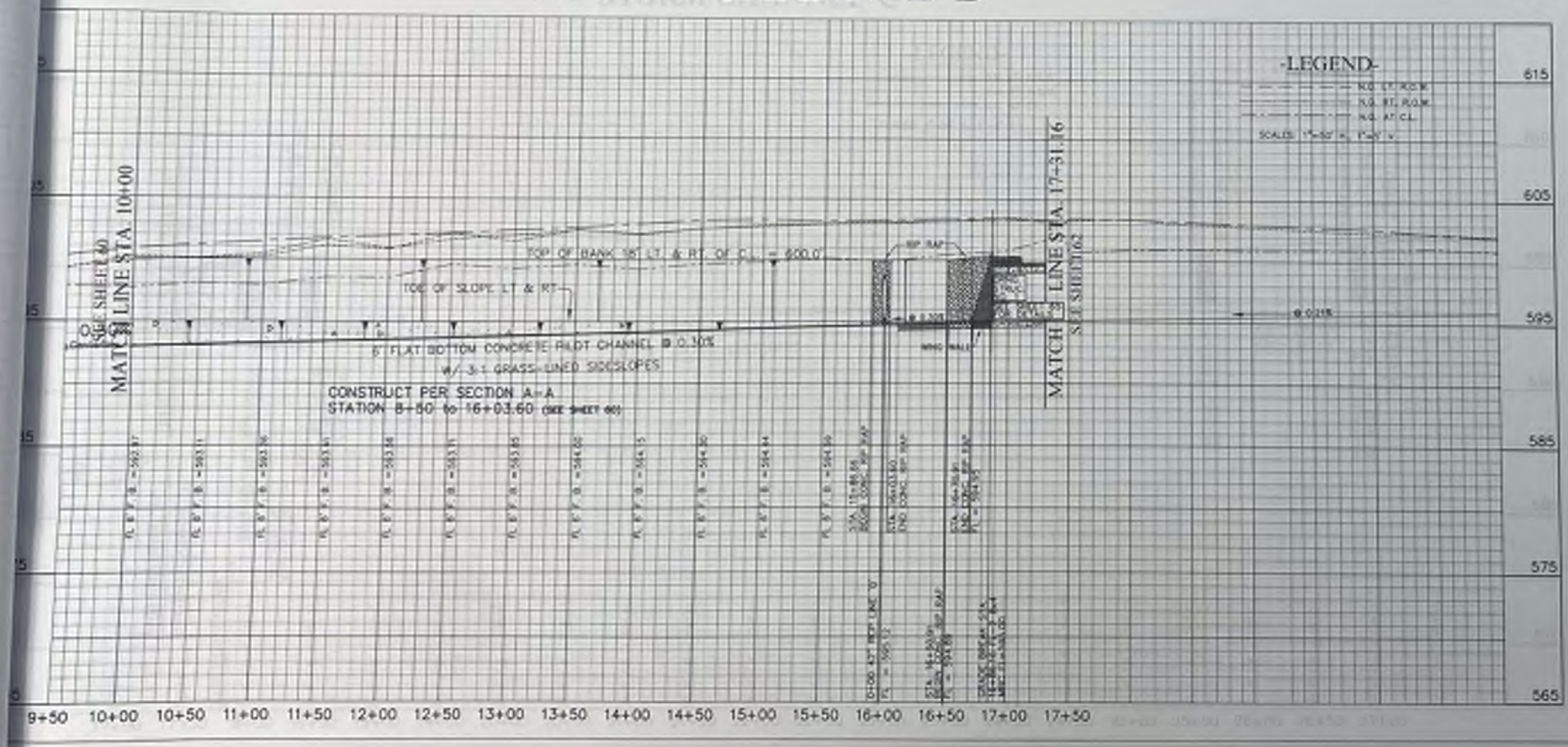
SHEET NUMBER: 60 OF 91





SECTION C-C
STA. 15+93.66 THIS SHEET

STORM CHANNEL 'B'



All responsibility for the adequacy of these plans remains with the Engineer who prepared them. In approving these plans, the City of Taylor must rely on the adequacy of the work of the Design Engineer.

AS-BUILT
DATE 7-9-03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1370 Primrose Lane
Round Rock, Texas 78664-1275
Ph. 512-857-3440 Fax 512-857-9461

PROJECT NO. 02-164 DESIGNED BY K.W.H.
FILE NAME: NPT-STR DRAWN BY K.W.H.
DATE: 10-1-02 CHECKED BY T.L.H.
SCALE: AS SHT. TITLE REVISED BY

NO.	BY	DATE	REVISION

PLOT DATE: 3/14/03

PROJECT
NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

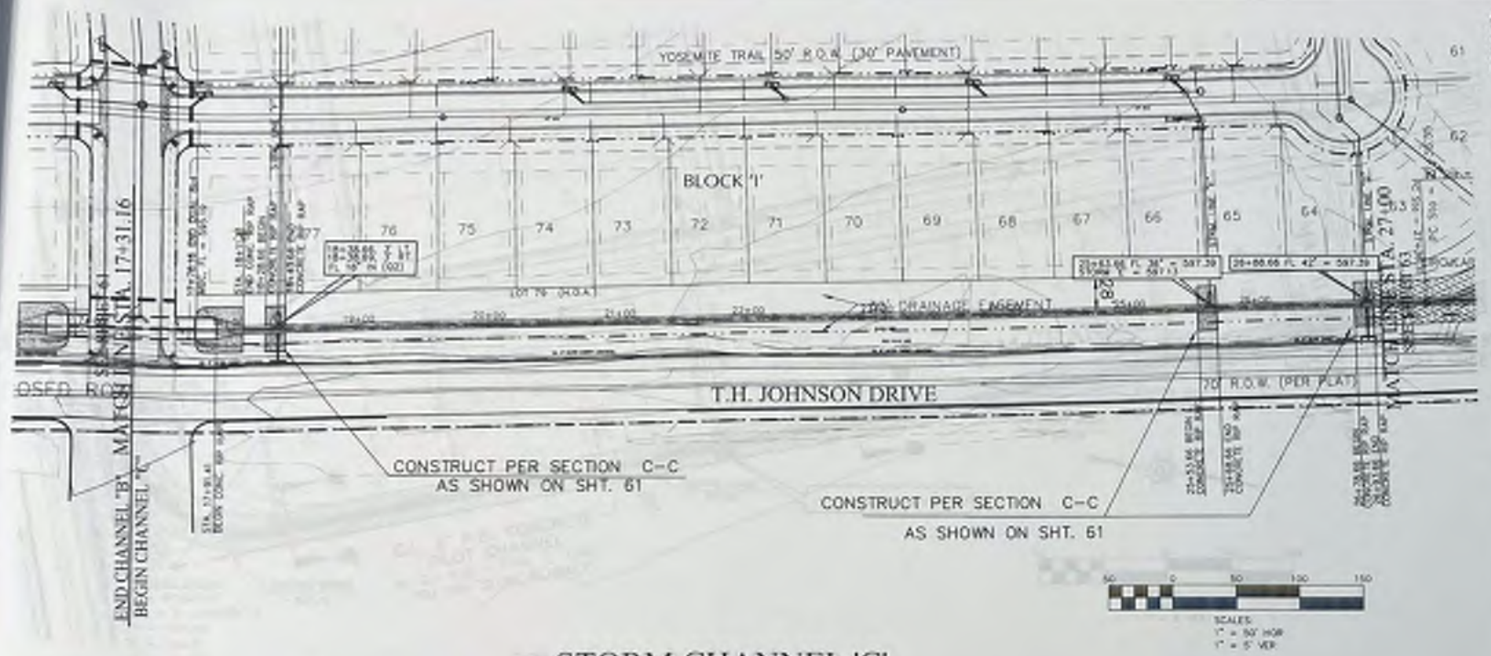
DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

SHEET TITLE
STORM CHANNEL 'B'
PLAN & PROFILE
STATION 10+00 TO 17+31.16

STATE OF TEXAS
TIMOTHY L. HAYNIE
90882
LICENSED PROFESSIONAL ENGINEER

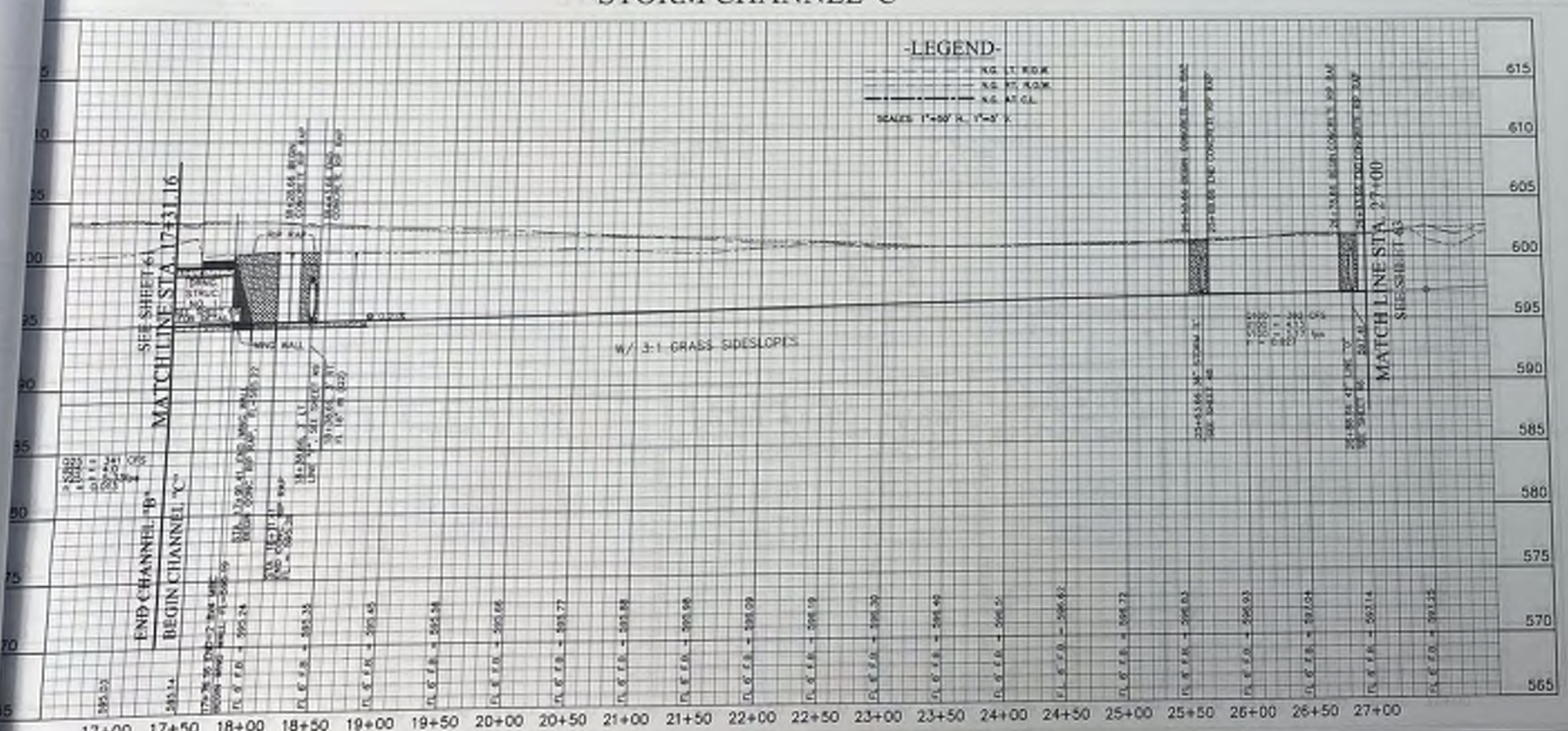
DATE MARCH 14, 2003

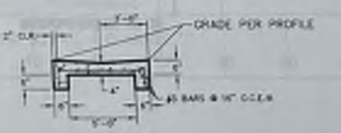
SHEET NUMBER
61 OF 91



All responsibility for the adequacy of these plans remains with the Engineer who prepared them. In approving these plans, the City of Taylor must rely on the adequacy of the work of the Design Engineer.

STORM CHANNEL 'C'





DETAIL
CONCRETE PILOT
OR TRICKLE CHANNEL
NOT TO SCALE

AS-BUILT
DATE 7-1-03

HAYNE CONSULTING, INC.
Civil Engineers and Land Surveyors
1250 Capitol Lake
Round Rock, Texas 78664-1375
Ph. 512.671.3440 Fax 512.671.3443

NO	BY	DATE	REVISION

PLOT DATE: 2/19/03

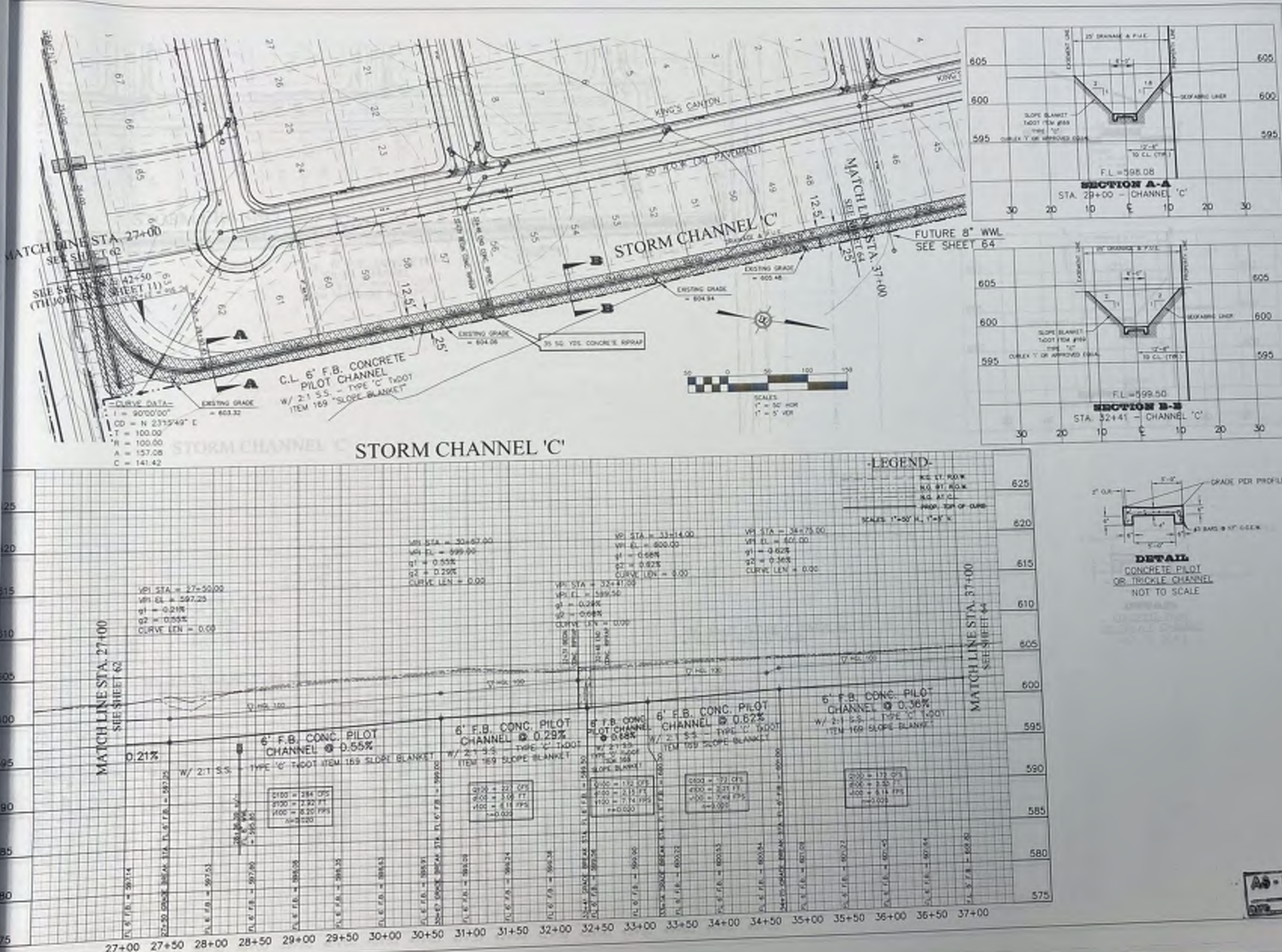
PROJECT: NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

SHEET TITLE: STORM CHANNEL 'C'
PLAN & PROFILE
STATION 17+31.16 TO 27+00

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

STATE OF TEXAS
TIMOTHY E. HAYNE
36842
LICENSED
PROFESSIONAL ENGINEER
DATE: FEBRUARY 19, 2003

SHEET NUMBER
62 OF 91



HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors

PROJECT: NORTHPARK
SECTION I
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

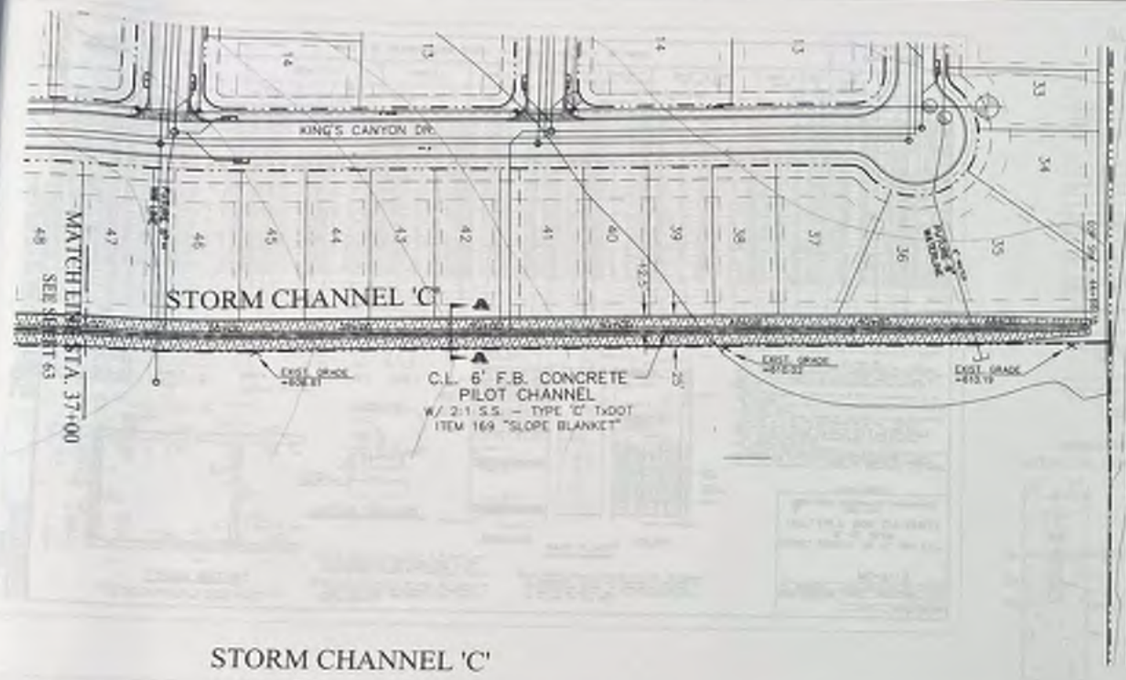
PLOT DATE: 3/14/03

SHEET TITLE: STORM CHANNEL 'C'
PLAN & PROFILE
STATION 27+00 TO 37+00

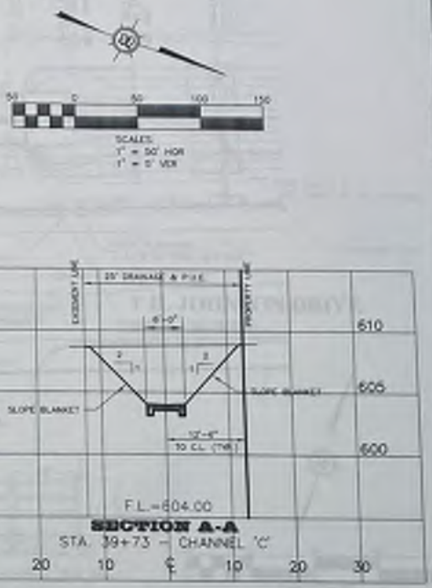
DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

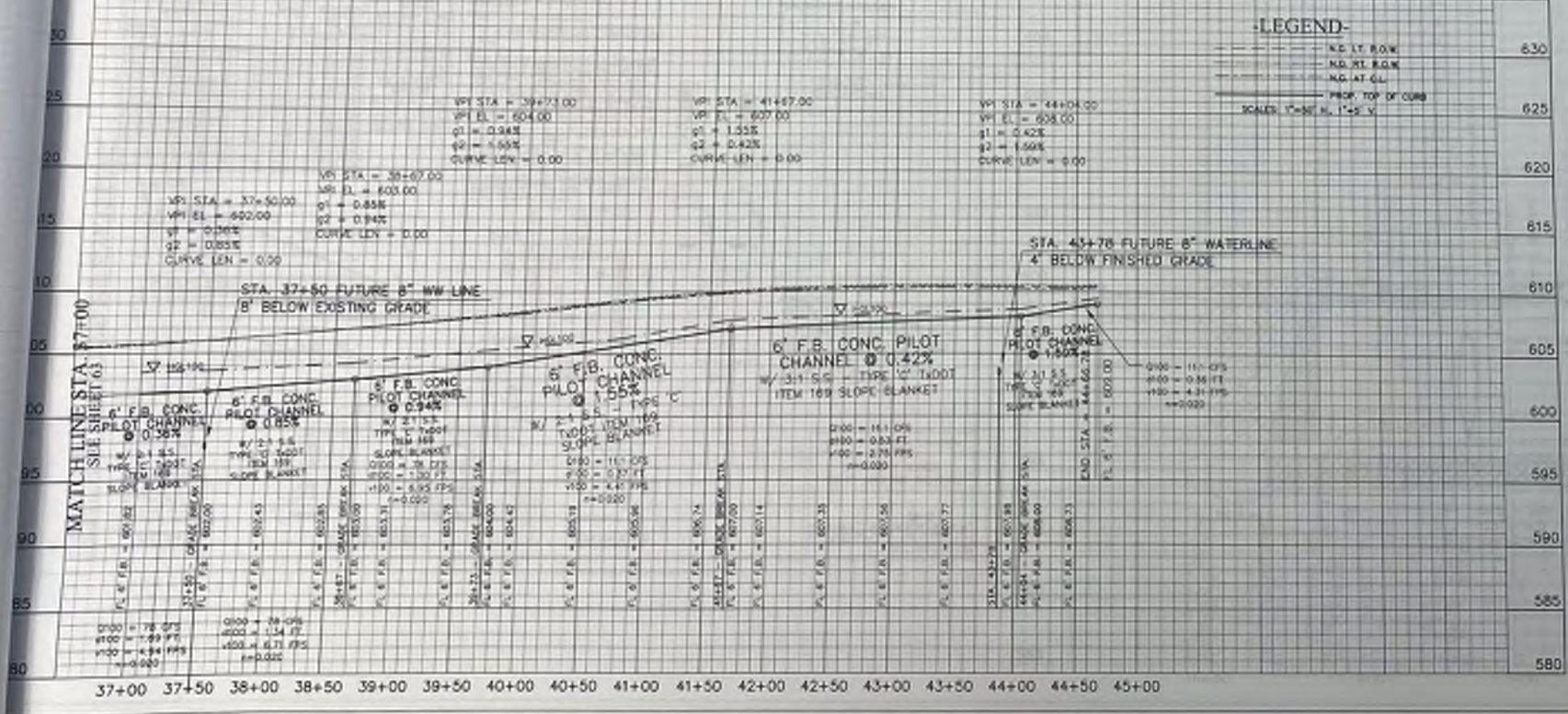
DATE: MARCH 14, 2003

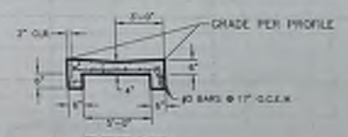
SHEET NUMBER: 63 OF 91



STORM CHANNEL 'C'







DETAIL
CONCRETE PILOT
OR TRICKLE CHANNEL
NOT TO SCALE

AS - BUILT
Date 7-9-03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1990 Pinnacle Law
Round Rock, Texas 78664-1376
Ph. 512.835.2460 Fax 512.835.9863

PROJECT NO. 01-104 DESIGNED BY: K.B.H.
FILE NAME: SP1-648 DRAWN BY: K.B.H.
DATE: 2/21/03 CHECKED BY: T.E.H.
SHEET: PLOT 1 REVISED BY:

REVISIONS
NO. BY DATE

PLOT DATE: 2/21/03

PROJECT
NORTHPARK
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

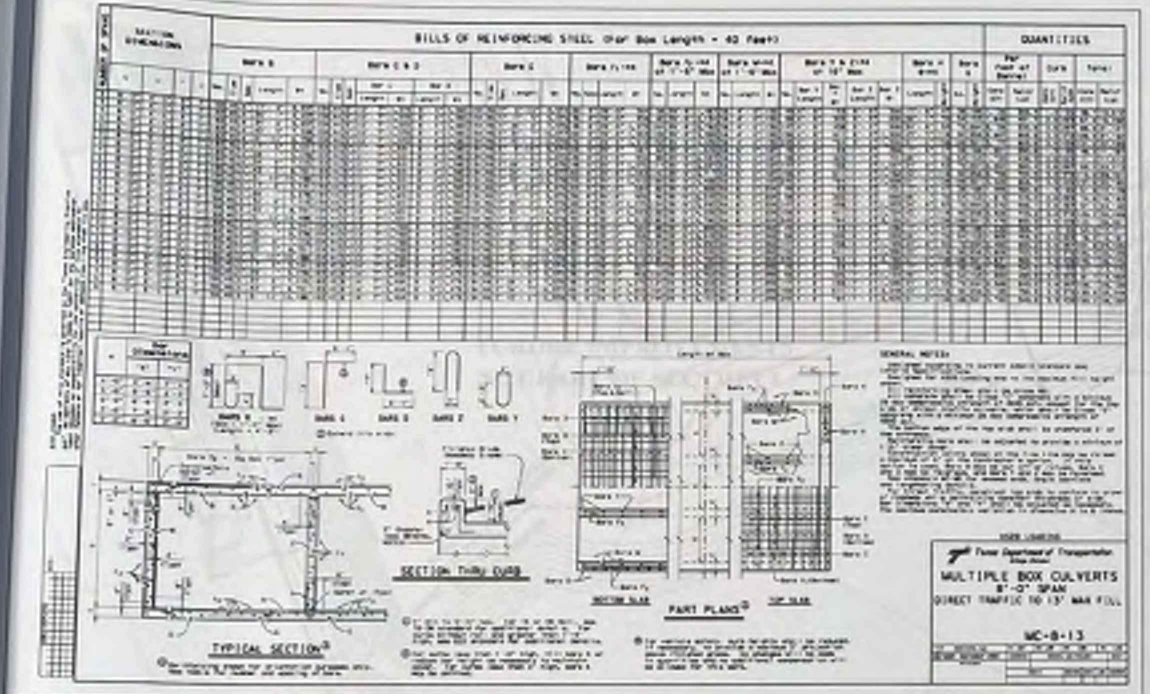
DEVELOPER KBHome, c/o Michael Stock, 11911 Burnet Road, Austin, Texas 78758

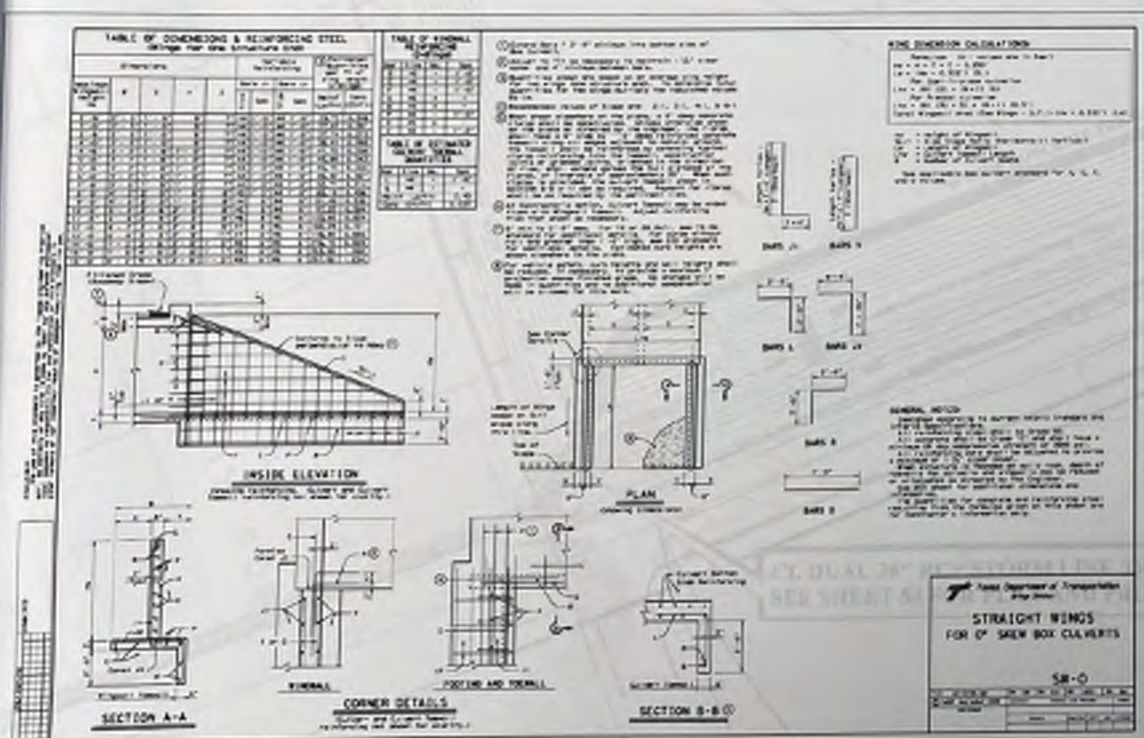
SHEET TITLE
STORM CHANNEL 'C'
PLAN & PROFILE
STATION 37+00 TO 44+66.78

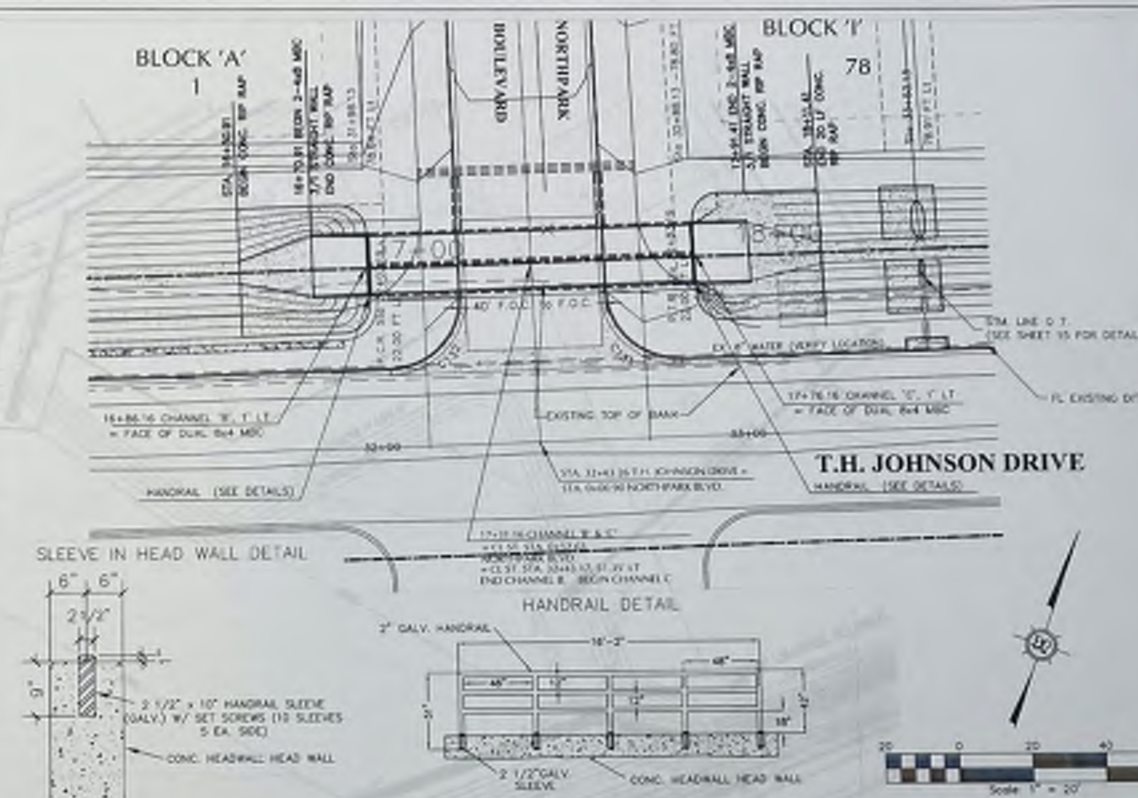
STATE OF TEXAS
TIMOTHY E. HAYNIE
99982
LICENSED
PROFESSIONAL ENGINEER

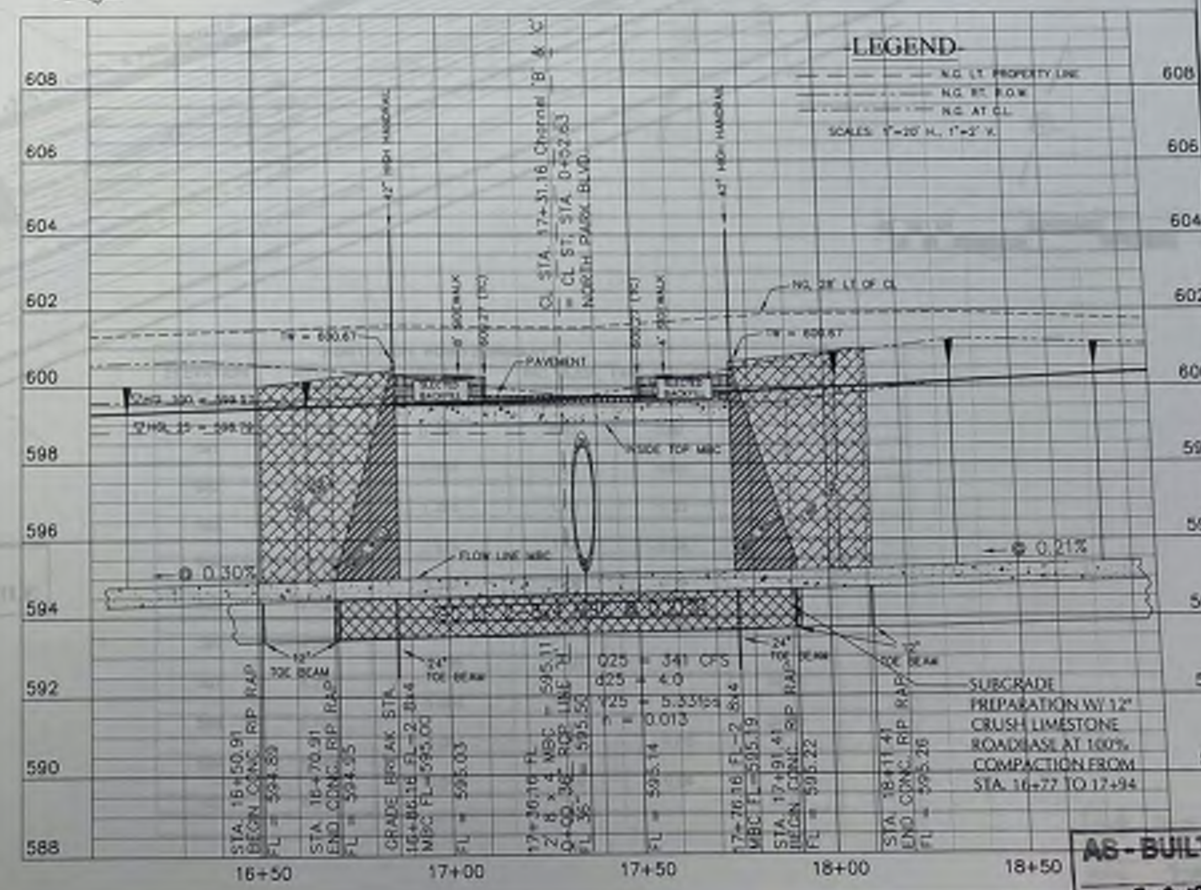
DATE FEBRUARY 21, 2003

SHEET NUMBER
64 OF 91









HAYNIE CONSULTING, INC.

Civil Engineers and Land Surveyors

1010 Provident Lane

Round Rock, Texas 78664-3276

Ph. 512-837-2446 Fax 512-837-9463

PLOT DATE: 5/17/03

PROJECT: **NORTHPARK**

SECTION 1

CITY OF TAYLOR

WILLIAMSON COUNTY, TEXAS

SHEET TITLE: **DRAINAGE STRUCTURE NO. 1**

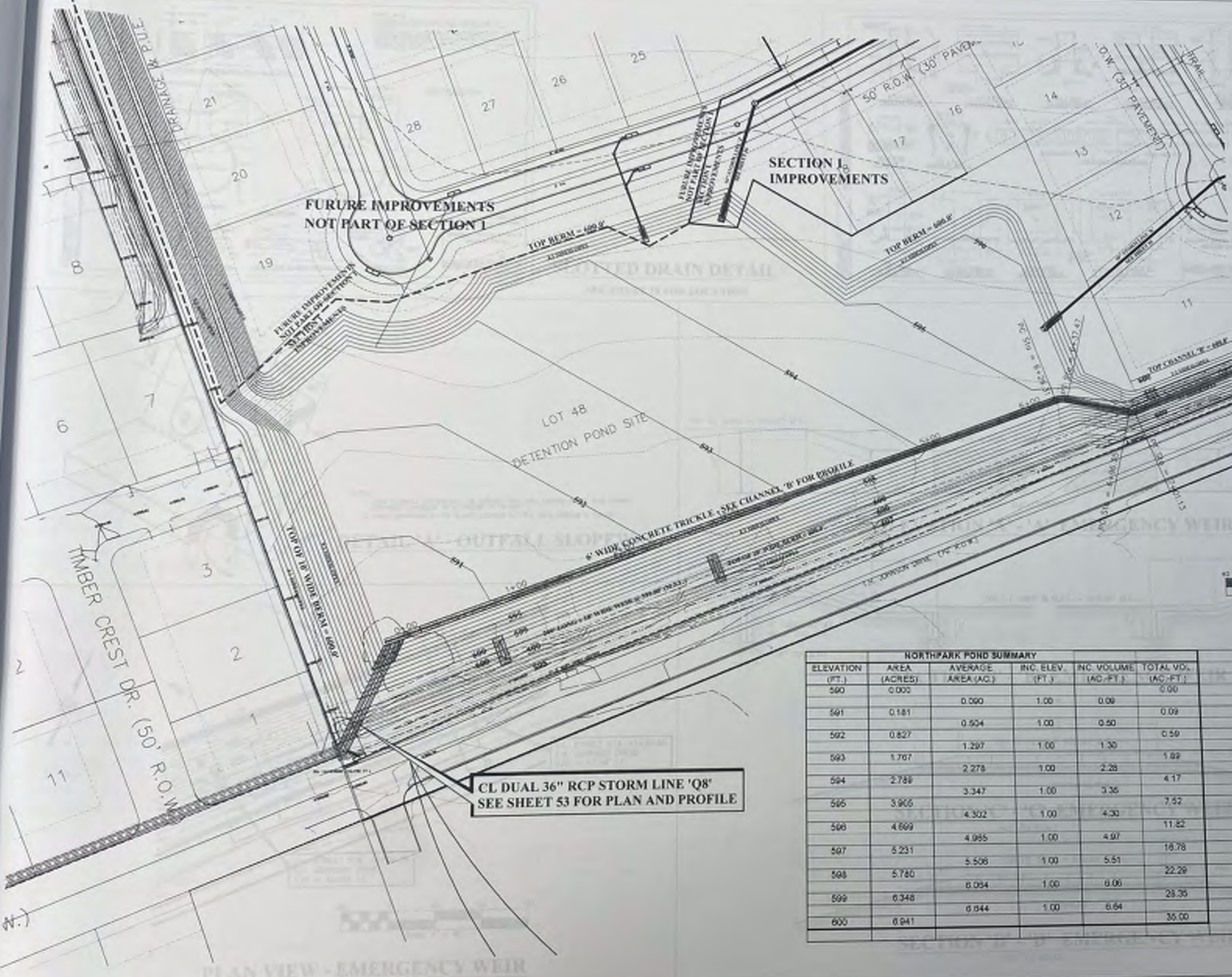
PLAN, PROFILE & DETAILS

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

STATE OF TEXAS — TIMOTHY E. HAYNIE — 38982 — LICENSED PROFESSIONAL ENGINEER

DATE: MARCH 17, 2003

SHEET NUMBER 65 OF 91



NORTHPARK POND SUMMARY					
ELEVATION (FT.)	AREA (ACRES)	AVERAGE AREA (AC.)	INC. ELEV. (FT.)	INC. VOLUME (AC.-FT.)	TOTAL VOL. (AC.-FT.)
590	0.000				0.00
		0.090	1.00	0.09	
591	0.181				0.09
		0.504	1.00	0.50	
592	0.827				0.59
		1.297	1.00	1.30	
593	1.767				1.89
		2.278	1.00	2.28	
594	2.789				4.17
		3.347	1.00	3.35	
595	3.905				7.52
		4.302	1.00	4.30	
596	4.699				11.82
		4.985	1.00	4.97	
597	5.231				16.78
		5.508	1.00	5.51	
598	5.780				22.29
		6.064	1.00	6.06	
599	6.348				28.35
		6.644	1.00	6.64	
600	6.941				35.00

AS - BUILT
DATE: 1-9-03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors

PLOT DATE: 5/12/03

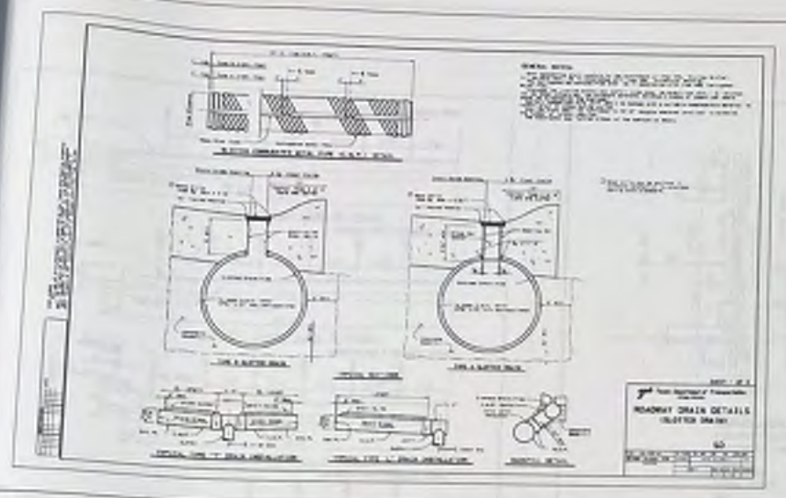
PROJECT: **NORTHPARK**
SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

SHEET TITLE: **DETENTION POND SITE GRADING PLAN**

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

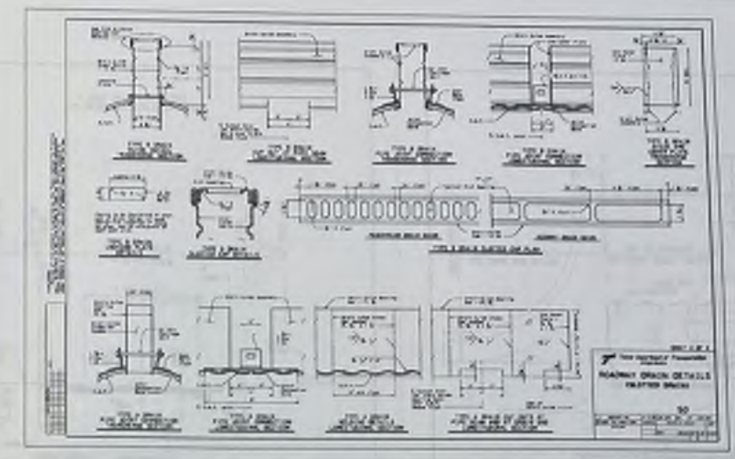
STATE OF TEXAS
TIMOTHY E. HAYNIE
LICENSED PROFESSIONAL ENGINEER

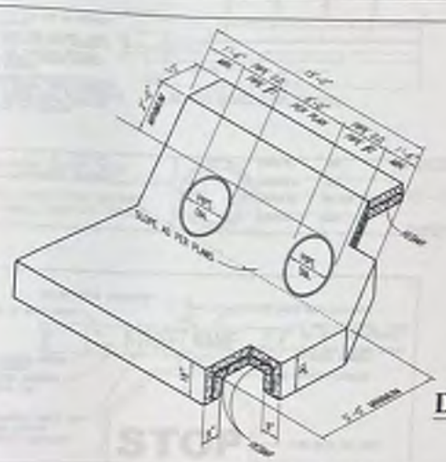
DATE: MARCH 12, 2003
SHEET NUMBER: 66 OF 91



SLOTTED DRAIN DETAIL

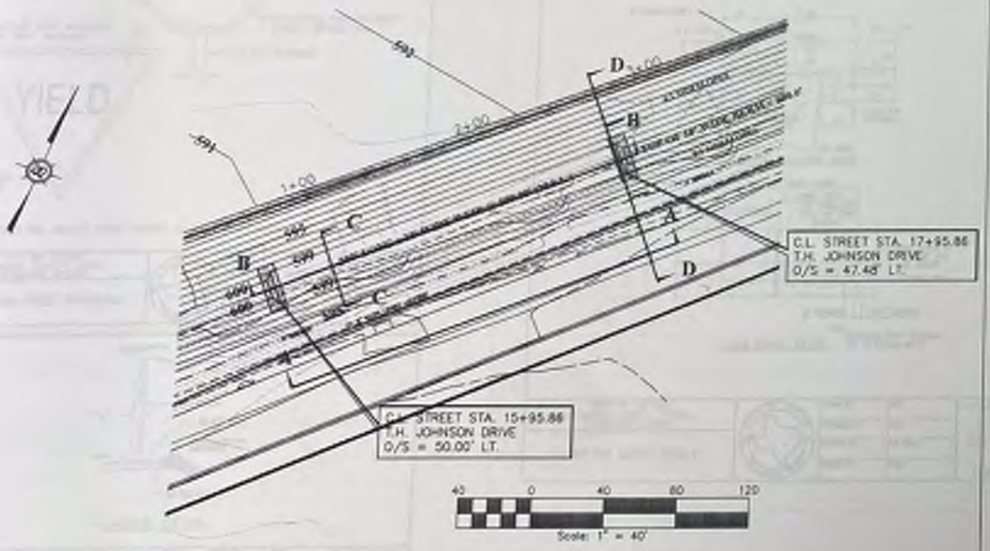
SEE SHEET 19 FOR LOCATION



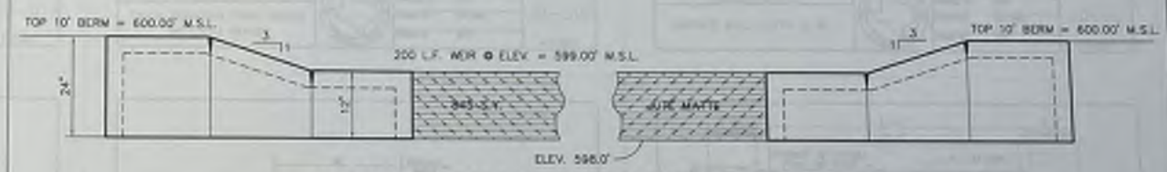


NOTES:
1. WHEN HEADWALLS AND WINGWALLS ARE REQUIRED, THEY SHALL CONFORM TO THE TEXAS HIGHWAY DEPARTMENT STANDARDS, OR AS DIRECTED BY THE CITY.
2. ENERGY DISSIPATORS IF PIPE VELOCITY EXCEEDED 5.0 F.P.S. OR AS DIRECTED BY THE CITY.

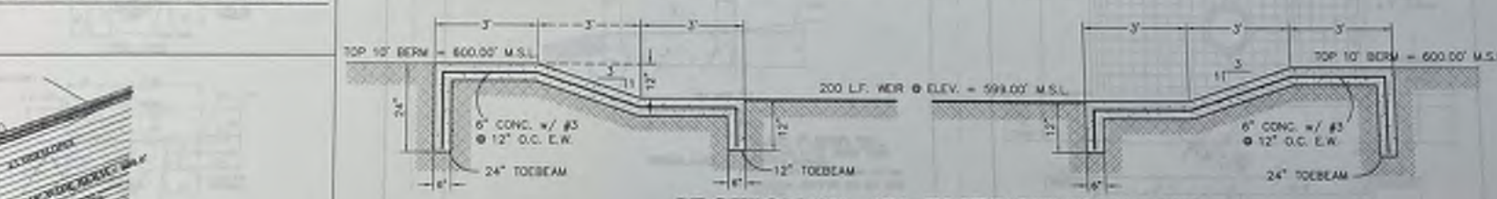
DETAIL 'A' - OUTFALL SLOPEWALL



PLAN VIEW - EMERGENCY WEIR



ELEVATION 'A' - 'A' EMERGENCY WEIR



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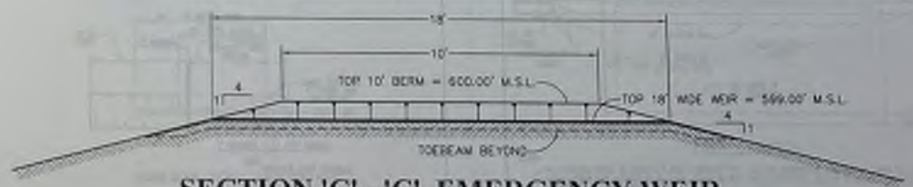
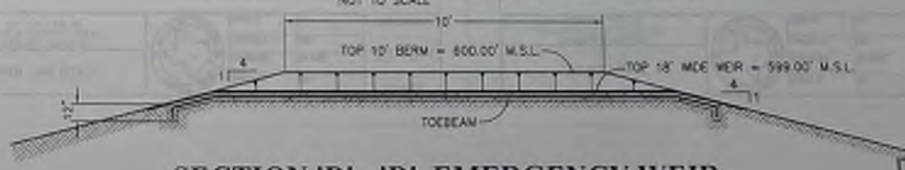


SECTION 'C' - 'C' EMERGENCY WEIR

NOT TO SCALE



SECTION 'D' - 'D' EMERGENCY WEIR

NOT TO SCALE

AS - BUILT
DATE 7-9-03

HAYNIE CONSULTING, INC.
Civil Engineers and Land Surveyors
1220 Rancho Lane
Round Rock, Texas 78664-2375
Ph. 512-837-2446 Fax 512-837-1463

NO.	BY	DATE	REVISION

PROJECT NO. 02-114 DESIGNED BY K.N.H.
FILE NAME 02-114 DRAWN BY K.N.H.
DATE 2-21-03 CHECKED BY T.E.H.
SCALE AS NOTED REVISED BY

PLOT DATE: 2/21/03

PROJECT: NORTHPARK SECTION 1
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS

DEVELOPER: KBHome, c/o Michael Slack, 11911 Burnet Road, Austin, Texas 78758

SHEET TITLE: DETENTION POND SECTIONS AND DETAILS

STATE OF TEXAS
TIMOTHY E. HAYNIE
36982
LICENSED PROFESSIONAL ENGINEER

DATE: FEBRUARY 21, 2003

SHEET NUMBER: 67 OF 91

NORTH PARK
PHASE THREE
STREET, DRAINAGE, WATER AND WASTEWATER IMPROVEMENTS

INDEX TO SHEETS

LEGAL DESCRIPTION:
NORTHPARK, PHASE 3
DOC. NO.____

LOCATION MAP

SUBMITTED FOR APPROVAL:

9-13-04
DATE

LONGARO AND CLARKE, INC.
S. DANNY MILLER, P.E. 82725

STATE OF TEXAS
S. DANNY MILLER
82725
REGISTERED
PROFESSIONAL ENGINEER

ACCEPTED FOR CONSTRUCTION

sledge ENGINEERING LLC 7/11/05
DATE

DEPARTMENT OF PUBLIC WORKS
CITY OF TAYLOR

N. Park Phase III

Owner:

KB HOME
11911 BURNET ROAD
AUSTIN, TEXAS 78758
(512) 833-8880

REVISIONS / CORRECTIONS

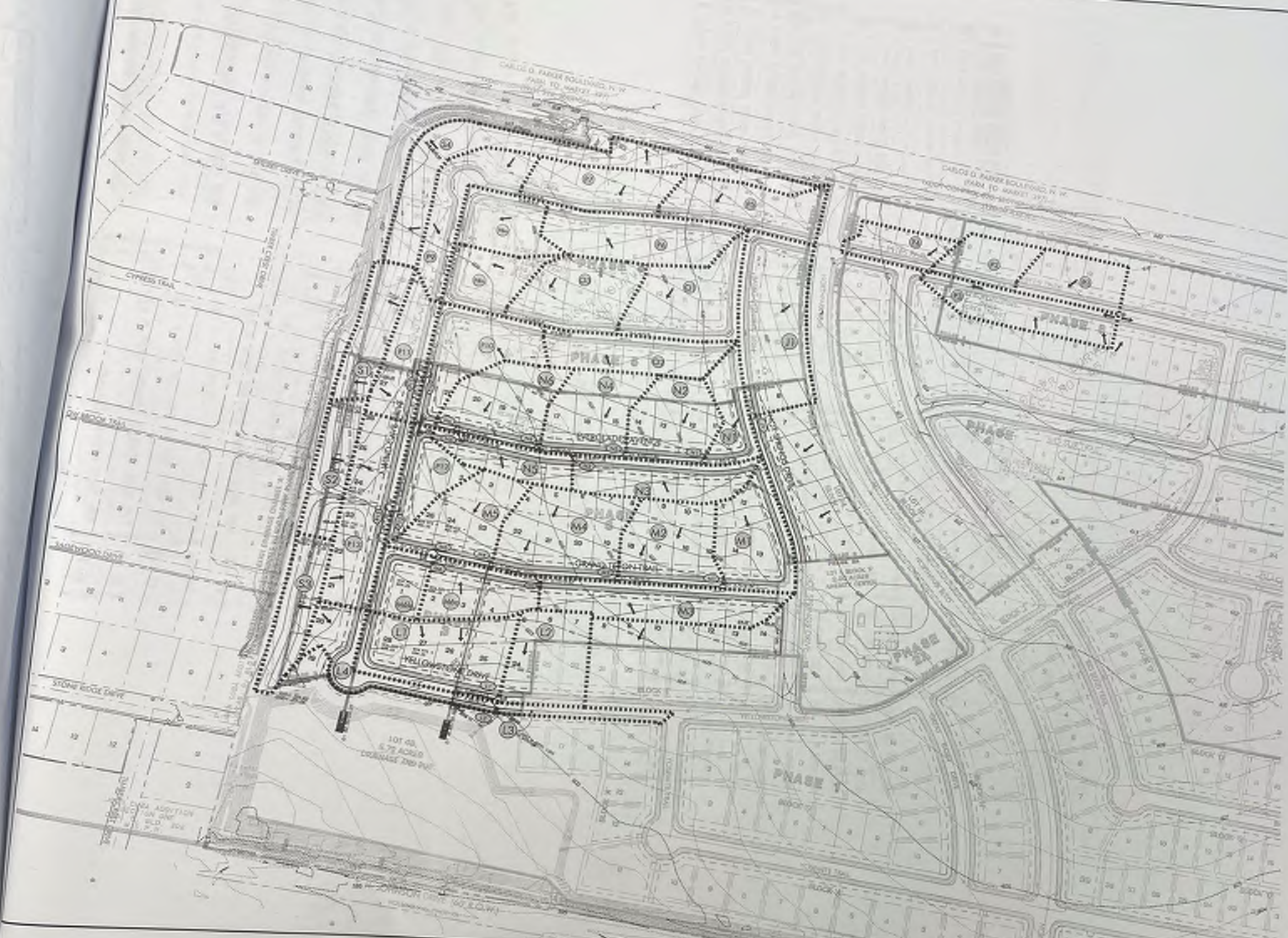
No.	Description	Revise (R) Add (A) Void (V) Sheet No's.	City of Taylor Approval / Date

RECEIVED
JUN - 6 2005
CITY OF TAYLOR

Longaro & Clarke, Inc.
Consulting Engineers
Land Development • Stormwater Quality Management • Water Resources
1101 Capital of Texas Highway South, Building C, Suite 100 Austin, Texas 78746
(512) 306-0228 ~ Fax (512) 306-0338

SURVEY DATA PROVIDED BY: T.E. HAYNIE CONSULTING, INC.
& LAND DESIGN SERVICES, INC.

RELEASE OF THIS APPLICATION DOES NOT CONSTITUTE A VERIFICATION OF ALL DATA, INFORMATION, AND CALCULATIONS SUPPLIED BY THE APPLICANT. THE ENGINEER OF RECORD IS SOLELY RESPONSIBLE FOR THE COMPLETENESS, ACCURACY AND ADEQUACY OF HIS/HER SUBMITTAL, WHETHER OR NOT THE APPLICATION IS REVIEWED FOR CODE COMPLIANCE BY CITY ENGINEERS.



LEGEND:

- (A) DRAINAGE AREA NUMBER
- INLET NUMBER
- FLOW DIRECTION ARROW
- HIGH POINT
- LOW POINT
- DRAINAGE DIVIDE
- PROPOSED INLET AND STORM SEWER SYSTEM
- Q25/Q100
- STREET FLOW ARROW

STATE OF TEXAS
S. DANNY MILLER
82725
PROFESSIONAL ENGINEER
9-18-04

S. DANNY MILLER, PE 82725
LONGARO AND CLARKE, INC.

SURVEY DATA PROVIDED BY: T.E. HAYNIE CONSULTING, INC.
& LAND DESIGN SERVICES, INC.

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NORTH PARK

PHASE 3
DRAINAGE AREA MAP

KB HOME
11911 BURNET ROAD
AUSTIN, TEXAS 78758
(512) 833-8880

Longaro & Clarke, Inc.
Consulting Engineers

DM 1

6 / 31

192-15

City of Taylor
KBI Detention Pond Analysis
Opinion of Probable Construction Cost
Released by PE for Review Only

Item	Description	Unit	Unit Cost	Quantity	Total Cost
Proposed Solution 1: Raising the Pond Berm					
1	Clearing and Grubbing	AC	$3,250	1.38	$4,487
2	Embankment	CY	$40.00	1,173	$46,904
3	Revegetation	SY	$2.07	6,682	$13,805
				SUBTOTAL:	**$65,196**
4	Mobilization	%	15%	1	$9,779
5	Contingency	%	30%	1	$22,493
				SOLUTION 1 TOTAL:	**$97,468**
Proposed Solution 2: Splitter Box					
1	Splitter Box, Complete In Place	LS	$5,833	1	$5,833
2	Water Diversion	LS	$10,000	1	$10,000
3	Revegetation	SY	$2.07	1,210	$2,500
				SUBTOTAL:	**$18,333**
4	Implementation of Solution 1	LS	$65,196	1	$65,196
5	Mobilization	%	15%	1	$12,529
6	Contingency	%	30%	1	$28,818
				SOLUTION 2 TOTAL:	**$124,876**
Pond Bottom Regrading					
1	Clearing and Grubbing	AC	$4,500	0.79	$3,563
2	Fine Grading	CY	$20.00	979	$19,588
3	Water Diversion	LS	$10,000	1	$10,000
4	Revegetation	SY	$2.07	2,555	$5,279
				SUBTOTAL:	**$38,431**
5	Mobilization	%	15%	1	$5,765
6	Contingency	%	30%	1	$13,259
				POND BOTTOM REGRADING TOTAL:	**$57,454**

ALL IMPROVEMENTS TOTAL:	**$182,330**

DRAFT Addendum to Techincal Memorandum

Date:	Tuesday, July 19, 2022
Project:	KBI Detention Pond Study
To:	Brian LaBorde, City Manager
From:	Paul Shattuck, HDR Engineering Inc. Bryan Martin, HDR Engineering Inc.
Subject:	**KBI Detention Pond Study – Addendum to Technical Memorandum** Revised Understanding of Findings and Amended Recommended Alternatives

Work Performed to Date

For incorporation of recommendations provided in this memorandum into the City of Taylor Drainage Master plan being prepared by Halff and Associates, HDR has performed additional analysis to further substantiate potential benefit to the community. HDR has incorporated findings from hydrologic modeling already performed in this study into an Infoworks ICM hydraulic model to better assess reduction to flood risk (benefit) to the community downstream of the existing pond.

Following the more in-depth review of analyses and recommendations provided to the City of Taylor in the Technical Memorandum dated February 24, 2022, it is necessary to provide this addendum to correct certain stated findings and update recommended mitigation alternatives to reflect those corrections.

Update to Understanding of Existing Pond Geometry

The memorandum refers to a ‘saddle’ type depressed area of the top of the pond berm in the northwest corner of the pond. It is stated that this area of the pond is about 4’ lower than other portions of the pond’s top bounding elevation, however, this statement is not accurate. The top of the pond at the northwest corner of the pond may not have a pronounced berm style embankment, however the controlling top elevation is consistent with the remainder of the pond.

Update to Understanding of Existing Pond Performance

Because the top of the pond is understood to be more consistent in elevation and capable of containing significantly more runoff before overflowing, the expected performance of the existing pond is significantly higher than stated in the memorandum and likely performs close to as intended upon its construction. The existing pond structure does not however meet current design criteria for several reasons; this may be largely attributable to design rainfall quantities being increased with Atlas 14.

The performance has not been remeasured in a hydrologic model in kind with previous analyses, however hydraulic modeling has instead been performed. Hydraulic analyses of the existing pond indicate that during large events (100-year) the pond has insufficient freeboard; considering adjacent properties and the tendency for the pond to overflow at multiple locations

along the western and southern boundaries of the pond and the intended high-flow spillway along T H Johnson Road.

Update to Recommended Alternatives

There are possibilities for improvements to the pond however they will not be as simple or straight forward as outlined in the technical memorandum. Flooding in the locale, from about as north as the pond toward Bull Branch is a known flood prone area; this nuisance type flooding is widespread and unregimented. The KBI pond is another similarly chaotic element during a flood. The previously recommended alternatives are:

- Raise the top of pond or pond berm to an elevation of 600':
    - Small changes such as this cause the expected overflow of the pond to change. The flood discharge distribution along the western and southern edges is sensitive and will cause marginal changes to flooding downstream, some beneficial and some adverse.
    - This will reduce what freeboard is provided, from substandard to more substandard.
- Improve the pond outlet structure:
    - This improvement has merits in smaller events where the pond is not at peak flood stages and will have beneficial impacts during smaller storm events where flooding may be occurring downstream but not at the pond itself.
    - Because the pond has existing flooding issues during large events, it is particularly sensitive to alterations; storing additional runoff at lower discharges causes the pond to both produce higher peak runoff rates (net higher flood risk) and diminish already substandard freeboard during flood events.

There is possibility for flood risk reduction at the KBI pond site, however this will necessitate raising the pond top, berm, and spillway in a relatively consistent fashion to maintain the current flood spill distribution at higher stages. A higher pond stage is key and would require the pond to operate without standard freeboard. It is recommended to maximize storage by raising expected pond water surface during design events to the elevation threshold of the adjacent upstream properties as not to flood them; approximately 600.3' msl. Adjacent property owners will maintain a 100-year level of protection and any overflow caused by storms beyond that design standard will be in the directions away from the adjacent properties, to the south and west.

The revised alternatives are to:

- Raise the pond overflow profile approximately 1' while maintaining the flood overflow distribution on the southern and western edges of the pond. This improvement is of very similar magnitude to what is outlined in the technical memorandum.
- Construct a pond outlet structure as defined in the technical memorandum to provide flood risk reduction during smaller, more frequent storm events.

City of Taylor
KBI Detention Pond Analysis
Opinion of Probable Construction Cost
Released by PE for Review Only

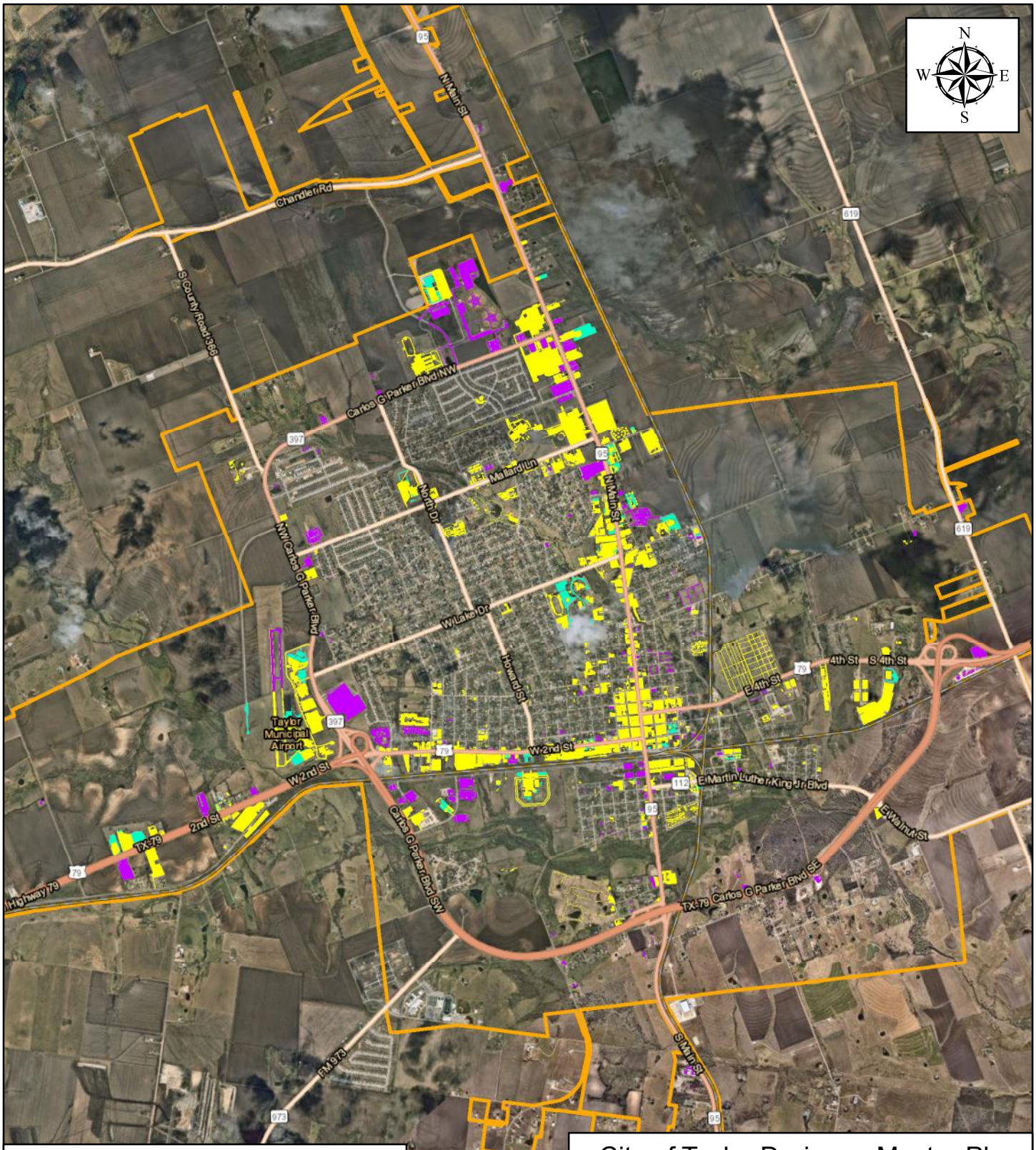
Item	Description	Unit	Unit Cost	Quantity	Total Cost
Proposed Solution 1: Raising the Pond Berm					
1	Clearing and Grubbing	AC	$3,250	1.38	$4,487
2	Embankment	CY	$40.00	1,173	$46,904
3	Revegetation	SY	$2.07	6,682	$13,805
4	Mortared Rock Wall	SF	$30.00	1,000	$30,000
				SUBTOTAL:	**$95,196**
4	Mobilization	%	15%	1	$14,279
5	Contingency	%	30%	1	$32,843
				SOLUTION 1 TOTAL:	**$142,318**
Proposed Solution 2: Splitter Box					
1	Splitter Box, Complete In Place	LS	$5,833	1	$5,833
2	Water Diversion	LS	$10,000	1	$10,000
3	Revegetation	SY	$2.07	1,210	$2,500
				SUBTOTAL:	**$18,333**
4	Implementation of Solution 1	LS	$95,196	1	$95,196
5	Mobilization	%	15%	1	$17,029
6	Contingency	%	30%	1	$39,168
				SOLUTION 2 TOTAL:	**$169,726**
Pond Bottom Regrading					
1	Clearing and Grubbing	AC	$4,500	0.79	$3,563
2	Fine Grading	CY	$20.00	979	$19,588
3	Water Diversion	LS	$10,000	1	$10,000
4	Revegetation	SY	$2.07	2,555	$5,279
				SUBTOTAL:	**$38,431**
5	Mobilization	%	15%	1	$5,765
6	Contingency	%	30%	1	$13,259
				POND BOTTOM REGRADING TOTAL:	**$57,454**

ALL IMPROVEMENTS TOTAL:	**$227,180**

APPENDIX D

DRAINAGE UTILITY FEE RATE STUDY
FIGURES

- EXHIBIT 6.1 – NON-RESIDENTIAL IMPERVIOUS AREA MODIFICATIONS FROM 2010 TO 2022
- REVENUE PROJECTIONS 2022-2027 FOR VARYING DRAINAGE UTILITY RATES
- SAMPLE 5-YEAR CAPITAL PLANS FOR VARIOUS DRAINAGE UTILITY FEES



Legend

- Existing Impervious Area (2010)
- Additional Impervious Area
- New Impervious Area
- City Limits

City of Taylor Drainage Master Plan

Exhibit 6.1
Non-Residential Impervious Area Modifications from 2010 to 2022

Miles
0 0.5 1 2

1 in = 1 miles

Revenue Projections 2022-2027 for Varying Drainage Utility Rates

Year	Description	Drainage Utility Fee (2022 USD)	Residential ERUs*	Residential Revenue (2022 USD)	Non-Residential ERUs*	Non-Residential Revenue (2022 USD)	Monthly Revenue (2022 USD)	Yearly Revenue (2022 USD)	Potential Yearly Revenue Increase** (2022 USD)
2022	Current revenue practices, per the March 2022 billing report provided by the City	$ 3.00	5,889	$ 17,700.00	8,506	$ 25,500.00	$ 43,200.00	$ 518,400.00	$ -
2022	Updated non-residential ERUs based off of 2022 impervious cover update	$ 3.00	5,889	$ 17,700.00	11,518	$ 34,600.00	$ 52,300.00	$ 627,600.00	$ 98,280.00
2023	Updated non-residential impervious layer; no change to drainage utility fee	$ 3.00	5,964	$ 17,900.00	11,518	$ 34,600.00	$ 52,500.00	$ 630,000.00	$ 100,440.00
	Updated non-residential impervious layer; increase drainage utility fee to $4.00	$ 4.00		$ 23,900.00		$ 46,100.00	$ 70,000.00	$ 840,000.00	$ 289,440.00
	Updated non-residential impervious layer; increase drainage utility fee to $5.00	$ 5.00		$ 29,800.00		$ 57,600.00	$ 87,400.00	$ 1,048,800.00	$ 477,360.00
2024	Updated non-residential impervious layer; assume continued average population growth; no change to drainage utility fee	$ 3.00	6,039	$ 18,100.00	11,769	$ 35,300.00	$ 53,400.00	$ 640,800.00	$ 110,160.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $4.00	$ 4.00		$ 24,200.00		$ 47,100.00	$ 71,300.00	$ 855,600.00	$ 303,480.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $5.00	$ 5.00		$ 30,200.00		$ 58,800.00	$ 89,000.00	$ 1,068,000.00	$ 494,640.00
2025	Updated non-residential impervious layer; assume continued average population growth; no change to drainage utility fee	$ 3.00	6,113	$ 18,300.00	12,020	$ 36,100.00	$ 54,400.00	$ 652,800.00	$ 120,960.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $4.00	$ 4.00		$ 24,500.00		$ 48,100.00	$ 72,600.00	$ 871,200.00	$ 317,520.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $5.00	$ 5.00		$ 30,600.00		$ 60,100.00	$ 90,700.00	$ 1,088,400.00	$ 513,000.00
2026	Updated non-residential impervious layer; assume continued average population growth; no change to drainage utility fee	$ 3.00	6,188	$ 18,600.00	12,271	$ 36,800.00	$ 55,400.00	$ 664,800.00	$ 131,760.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $4.00	$ 4.00		$ 24,800.00		$ 49,100.00	$ 73,900.00	$ 886,800.00	$ 331,560.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $5.00	$ 5.00		$ 30,900.00		$ 61,400.00	$ 92,300.00	$ 1,107,600.00	$ 530,280.00
2027	Updated non-residential impervious layer; assume continued average population growth; no change to drainage utility fee	$ 3.00	6,263	$ 18,800.00	12,522	$ 37,600.00	$ 56,400.00	$ 676,800.00	$ 142,560.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $4.00	$ 4.00		$ 25,100.00		$ 50,100.00	$ 75,200.00	$ 902,400.00	$ 345,600.00
	Updated non-residential impervious layer; assume continued average population growth; increase drainage utility fee to $5.00	$ 5.00		$ 31,300.00		$ 62,600.00	$ 93,900.00	$ 1,126,800.00	$ 547,560.00

*ERUs are based on an average growth rate of previous impervious updates from 2010 to 2022.
**Yearly revenue increase includes a 10% reduction to cover any unforeseen contingencies.

Sample 5-Year Capital Plans for Various Drainage Utility Fees

Year	Additional Yearly Expense (2022 Dollars)	Select SWU Rate	Additional Yearly Income (2022 Dollars)	Additional Income Remaining (2022 Dollars)	Breakeven by Year?	Balance Across Projected Years	Breakeven Overall?
2023	$ 35,000.00	$ 3.00	$ 100,440.00	$ 65,440.00	Yes	$ 65,440.00	Yes
2024	$ 155,000.00	$ 3.00	$ 110,160.00	$ (44,840.00)	No	$ 20,600.00	Yes
2025	$ 140,000.00	$ 3.00	$ 120,960.00	$ (19,040.00)	No	$ 1,560.00	Yes
2026	$ 38,000.00	$ 3.00	$ 131,760.00	$ 93,760.00	Yes	$ 95,320.00	Yes
2027	$ 230,000.00	$ 3.00	$ 142,560.00	$ (87,440.00)	No	$ 7,880.00	Yes

Implementation of Increased Costs at $3 SWU Rate							
#	Expense Type	Expense	Description	Unit Cost	Payout Type	Implementation Year	Cost/Year
1	Personnel*	Drainage Crewlead		$ 22.00	Hourly		$ 68,640.00
2	Personnel*	Drainage Operator I		$ 18.00	Hourly		$ 56,160.00
3	Personnel*	Drainage Operator I		$ 18.00	Hourly		$ 56,160.00
4	Equipment	Crew Truck		$ 38,000.00	Lump Sum	2026	$ 38,000.00
5	Equipment	Gradeall		$ 200,000.00	Lump Sum	2027	$ 200,000.00
6	Equipment	Dump Truck		$ 110,000.00	Lump Sum	2024	$ 110,000.00
7	Equipment	Sweeper		$ 140,000.00	Lump Sum	2025	$ 140,000.00
8	Equipment	Jet Machine		$ 35,000.00	Lump Sum	2023	$ 35,000.00
9	Projects	Small CIP		$ 492,000.00	Lump Sum		$ 492,000.00
10	Projects	Medium CIP		$ 1,288,000.00	Lump Sum		$ 1,288,000.00
11	Projects	Large CIP		$ 3,652,000.00	Lump Sum		$ 3,652,000.00
12	Projects	SWU Update Study		$ 30,000.00	Lump Sum	2027	$ 30,000.00
13	Projects	Maintenance Projects			Lump Sum	2024	$ 45,000.00
14	Prev. Expenses		Existing Debt		Lump Sum		
15							

*Personnel yearly expense includes a 1.5 multiplier to account for employee benefits or other expenses to the City associated with additional personnel.

Year	Additional Yearly Expense (2022 Dollars)	Select SWU Rate	Additional Yearly Income (2022 Dollars)	Additional Income Remaining (2022 Dollars)	Breakeven by Year?	Remaining Funds Balance (2022 Dollars)	Breakeven Overall?
2023	$ 253,960.00	$ 4.00	$ 289,440.00	$ 35,480.00	Yes	$ 35,480.00	Yes
2024	$ 270,960.00	$ 4.00	$ 303,480.00	$ 32,520.00	Yes	$ 68,000.00	Yes
2025	$ 380,960.00	$ 4.00	$ 317,520.00	$ (63,440.00)	No	$ 4,560.00	Yes
2026	$ 320,960.00	$ 4.00	$ 331,560.00	$ 10,600.00	Yes	$ 15,160.00	Yes
2027	$ 320,960.00	$ 4.00	$ 345,600.00	$ 24,640.00	Yes	$ 39,800.00	Yes

Implementation of Increased Costs at $4 SWU Rate							
#	Expense Type	Expense	Description	Unit Cost	Payout Type	Implementation Year	Cost/Year
1	Personnel*	Drainage Crewlead		$ 22.00	Hourly	2023	$ 68,640.00
2	Personnel*	Drainage Operator I		$ 18.00	Hourly	2023	$ 56,160.00
3	Personnel*	Drainage Operator I		$ 18.00	Hourly	2023	$ 56,160.00
4	Equipment	Crew Truck		$ 38,000.00	Lump Sum	2023	$ 38,000.00
5	Equipment	Gradeall		$ 200,000.00	Lump Sum	2025	$ 200,000.00
6	Equipment	Dump Truck		$ 110,000.00	Lump Sum	2027	$ 110,000.00
7	Equipment	Sweeper		$ 140,000.00	Lump Sum	2026	$ 140,000.00
8	Equipment	Jet Machine		$ 35,000.00	Lump Sum	2023	$ 35,000.00
9	Projects	Small CIP		$ 492,000.00	Lump Sum		$ 492,000.00
10	Projects	Medium CIP		$ 1,288,000.00	Lump Sum		$ 1,288,000.00
11	Projects	Large CIP		$ 3,652,000.00	Lump Sum		$ 3,652,000.00
12	Projects	SWU Update Study		$ 30,000.00	Lump Sum	2027	$ 30,000.00
13	Projects	Maintenance Projects			Lump Sum	2024	$ 90,000.00
14	Prev. Expenses		Existing Debt		Lump Sum		
15							

*Personnel yearly expense includes a 1.5 multiplier to account for employee benefits or other expenses to the City associated with additional personnel.

Year	Additional Yearly Expense (2022 Dollars)	Select SWU Rate	Additional Yearly Income (2022 Dollars)	Additional Income Remaining (2022 Dollars)	Breakeven by Year?	Balance Across Projected Years	Breakeven Overall?
2023	$ 218,960.00	$ 4.00	$ 289,440.00	$ 70,480.00	Yes	$ 70,480.00	Yes
2024	$ 280,960.00	$ 5.00	$ 494,640.00	$ 213,680.00	Yes	$ 284,160.00	Yes
2025	$ 180,960.00	$ 5.00	$ 513,000.00	$ 332,040.00	Yes	$ 616,200.00	Yes
2026	$ 180,960.00	$ 5.00	$ 530,280.00	$ 349,320.00	Yes	$ 965,520.00	Yes
2027	$ 1,498,960.00	$ 5.00	$ 547,560.00	$ (951,400.00)	No	$ 14,120.00	Yes

Implementation of Increased Costs at $5 SWU Rate							
#	Expense Type	Expense	Description	Unit Cost	Payout Type	Implementation Year	Cost/Year
1	Personnel*	Drainage Crewlead		$ 22.00	Hourly	2023	$ 68,640.00
2	Personnel*	Drainage Operator I		$ 18.00	Hourly	2023	$ 56,160.00
3	Personnel*	Drainage Operator I		$ 18.00	Hourly	2023	$ 56,160.00
4	Equipment	Crew Truck		$ 38,000.00	Lump Sum	2023	$ 38,000.00
5	Equipment	Gradeall		$ 200,000.00	Lump Sum		$ 200,000.00
6	Equipment	Dump Truck		$ 110,000.00	Lump Sum		$ 110,000.00
7	Equipment	Sweeper		$ 140,000.00	Lump Sum		$ 140,000.00
8	Equipment	Jet Machine		$ 35,000.00	Lump Sum		$ 35,000.00
9	Projects	Small CIP		$ 492,000.00	Lump Sum		$ 492,000.00
10	Projects	Medium CIP		$ 1,288,000.00	Lump Sum	2027	$ 1,288,000.00
11	Projects	Large CIP		$ 3,652,000.00	Lump Sum		$ 3,652,000.00
12	Projects	SWU Update Study		$ 30,000.00	Lump Sum	2027	$ 30,000.00
13	Projects	Maintenance Projects			Lump Sum	2024	$ 100,000.00
14	Prev. Expenses						
15							

*Personnel yearly expense includes a 1.5 multiplier to account for employee benefits or other expenses to the City associated with additional personnel.

APPENDIX E

DIGITAL DATA

- **BUDGET MODEL FOR 2022-2027 DRAINAGE UTILITY RATE CALCULATIONS**