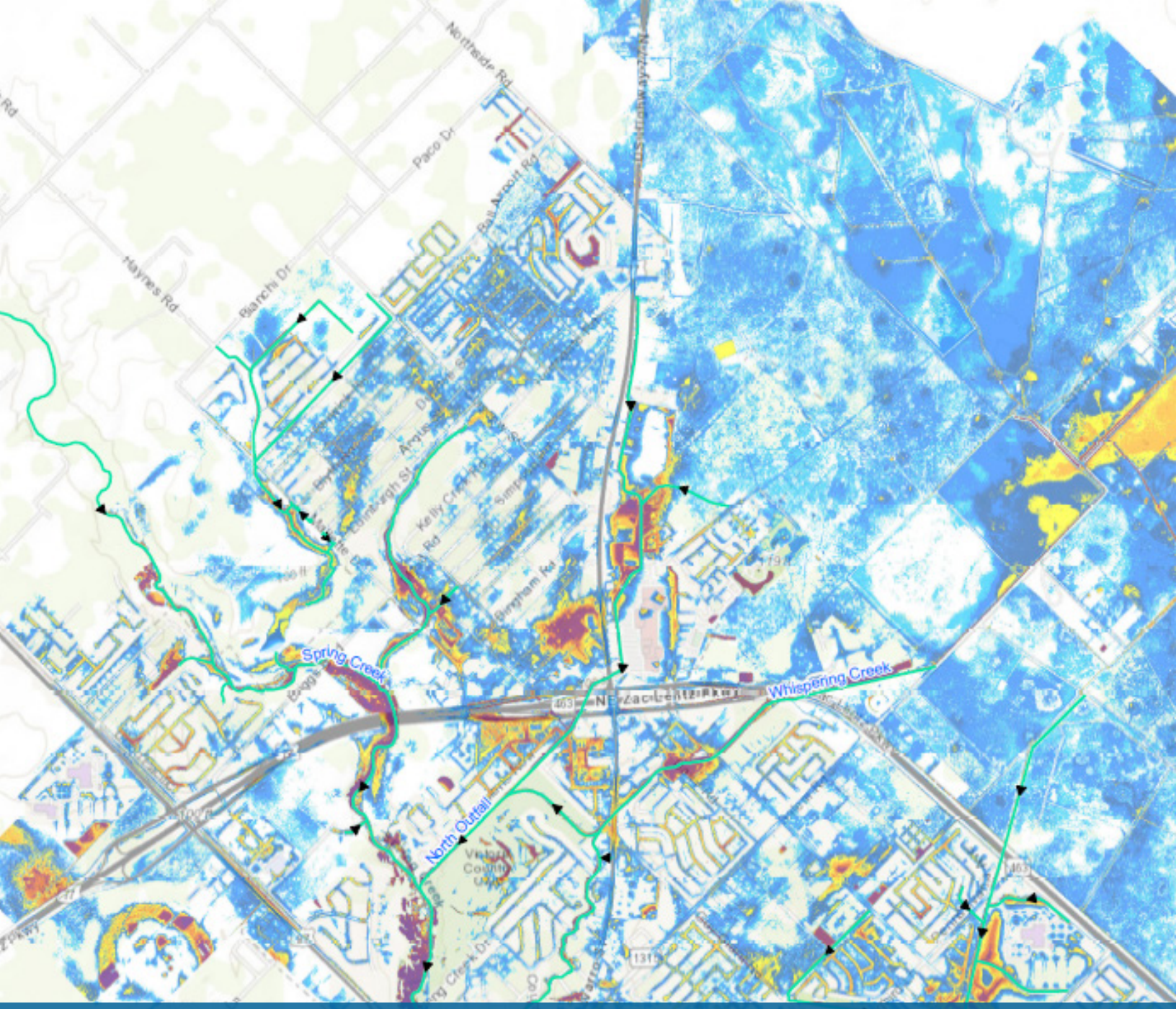

CITY OF VICTORIA
STORM DRAINAGE MASTER PLAN UPDATE

Victoria, Texas

Prepared for

THE CITY OF VICTORIA TEXAS

CivilTech Engineering, Inc.

URBAN engineering

City of Victoria Storm Drainage Master Plan Update

Victoria, Texas

This report has been prepared under the supervision of Texas Licensed Professional Engineers:

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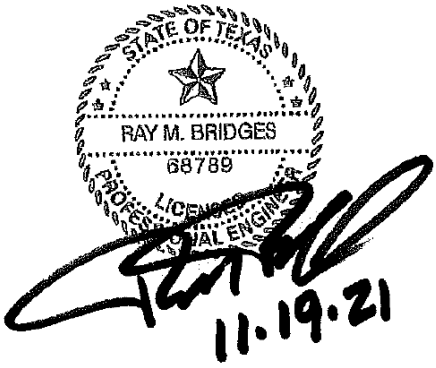

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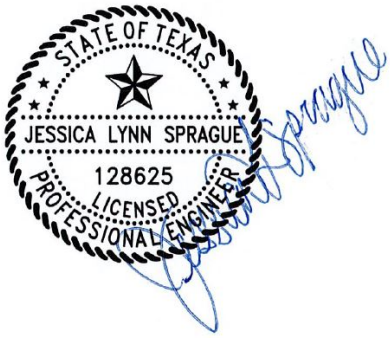

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Firm Registration No. F-382
Re: CEI Job No. 405011.00

TABLE OF CONTENTS

Contents

EXECUTIVE SUMMARY

CivilTech Engineering, Inc. (CivilTech), in association with Urban Engineering, Inc., was contracted by the City of Victoria to prepare an update to the 1999/2007 Storm Drainage Master Plan (SDMP) and 2007 Drainage Criteria Manual (DCM) prepared by Post, Buckley, Schuh and Jernigan Corporation (PBS&J). The Professional Services Agreement was authorized by City Council in September 2020.

The study update included the following seven (7) primary tasks:

1. Project Management (Task A)
2. Data Collection and Review (Task B)
3. Independent Study Areas (Task C)
4. Drainage Criteria Manual Update (Task D)
5. Storm Sewer System Evaluation (Task E)
6. Roadside Open Ditch Evaluation (Task F)
7. Major Outfall Channels (Task G)

The study deliverables included six (6) technical memorandums which are included in this document as **Attachment 1** through **Attachment 6**. The study deliverables also included digital Geographic Information System (GIS) datasets. CivilTech hosted an ERSI On-Line GIS Webpage which data transfer has been made to the City of Victoria GIS Department. The final presentation of the 2021 SDMP Update was made to City Council on September 24, 2021.The final presentation is included under a separate tab in this document.

This study update was not intended to replace the drainage recommendations in the 1999/2007 SDMP but rather to supplement the drainage recommendations with updated cost data and to include the prior drainage recommendations in the City's GIS.

A. City of Victoria 1999/2007 Storm Drainage Master Plan (SDMP) Overview

The City of Victoria Storm Drainage Master Plan was submitted in June 1999 and resubmitted in March 2007 by PBS&J. All hydrologic and hydraulic modeling was performed based on watershed land use and channel conditions in 1997.

The following highlights are provided about the 1999/2007 SDMP and are generally shown in **Figure ES-1**:

- The 1999/2007 SDMP provides drainage recommendations to accommodate an ultimate development scenario. This is referred to as the Future/Future condition. However, these recommendations do not necessarily eliminate flooding along major drainage channels,

but rather maintain the FEMA effective base flood elevations (BFEs) and 100-year floodplains based on 1997 conditions.

- There are two proposed regional detention basins, as outlined below:
  - Lone Tree Facility: 1,158,000 CY (this basin has been partially constructed, approximately 75%)
  - Spring Creek Facility: 3,113,000 CY (still to be constructed)
- The 1999/2007 SDMP recommends adding flow capacity to open channels, bridges, and culverts. Specifically, recommendations are made to widen the channel and replace bridges and/or culverts along Whispering Creek, North Outfall, US 77 Outfall, West Outfall (completed from Airline Road to Woodlawn Subdivision), Ben Jordan Outfall, South Outfall, Jim Branch Outfall, Lone Tree Creek (completed between Houston Highway to Greenway Park Subdivision) and Marcado Creek.
- The 1999/2007 SDMP recommends closed system improvements, including pipe and box storm sewers. Closed system improvements include upsizing most storm sewer systems along collector and major arterial streets to meet a 10-year or 25-year level of service.
- The 1999/2007 SDMP recommends a pump station and bypass system servicing the Second Street Outfall.
- The total construction cost to implement the drainage improvement recommendations in the 1999/2007 SDMP is $170 million (1999 dollars) and updated as $293 million (2021 dollars). The cost does not include ROW and/or easement acquisition or project design fees. The updated 2021 cost construction cost tables are provided in **Attachment 1** which replaces Appendix 8 in the 1999/2007 SDMP.

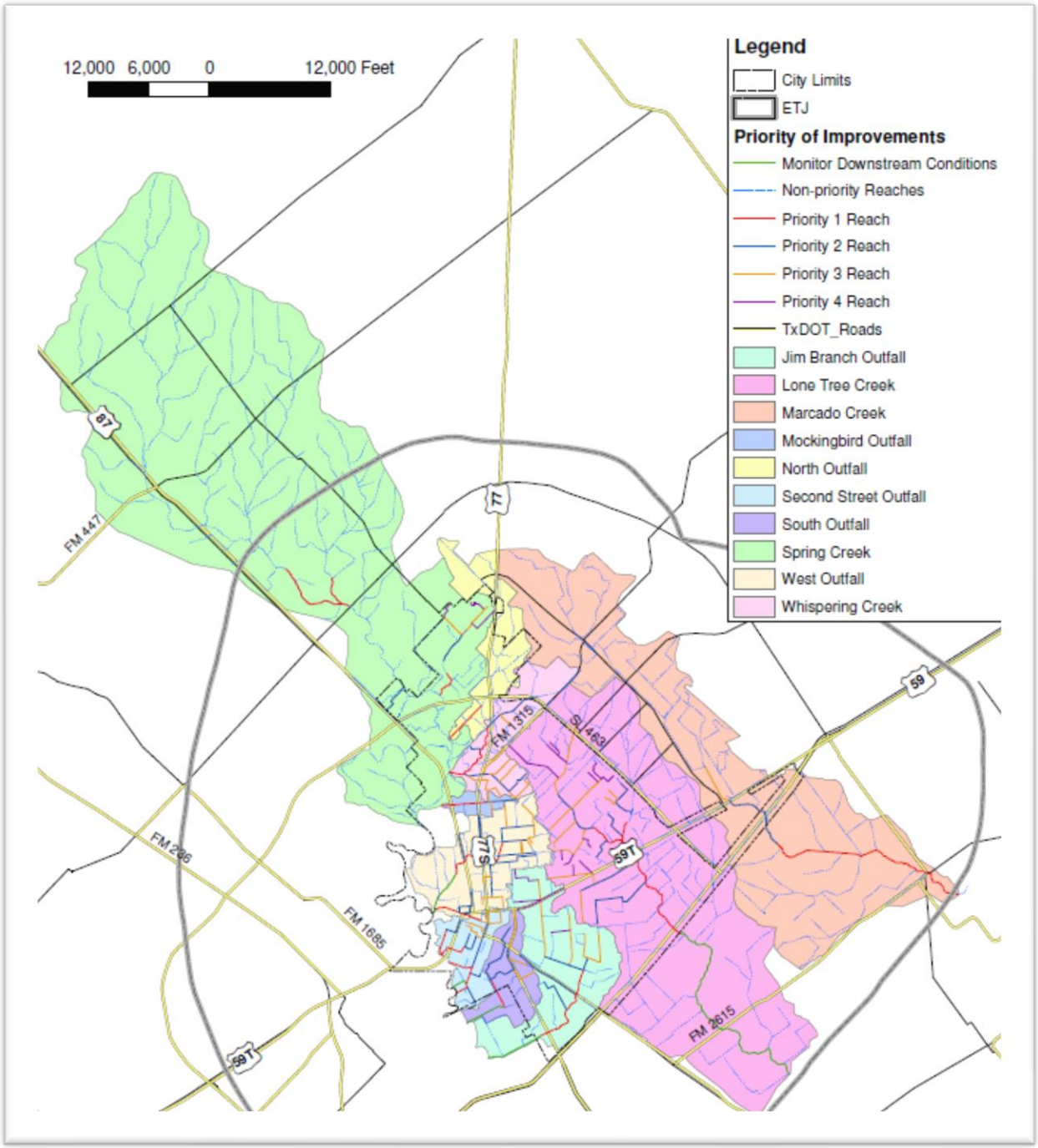


Figure ES-1. 1999/2007 SDMP Drainage Improvement Projects

B. FEMA Effective and FEMA Preliminary Floodplain Maps

The FEMA effective floodplains for the City of Victoria are dated 1987, 1998, and 1999. New preliminary floodplain maps have been released, dated April 30, 2020, and are currently pending approval. It is important to note that the preliminary maps were developed based on hydrologic (flows) and hydraulic (water surface elevations) models developed in the 1980's and 1990's. The results of these models, specifically the base flood elevations, were then remapped by FEMA using updated LiDAR topography. The one exception to this is the Guadalupe River, which has been studied more recently.

C. 2021 SDMP Update Summary

The 2021 SDMP Update was limited to seven (7) primary tasks and deliverables as follows:

1. Project Management and Meetings (Task A)
2. Data Collection and Review (Task B): Refer to Technical Memorandum No. 1 in **Attachment 1**
3. Independent Study Areas (Task C): Refer to Technical Memorandum No. 2 in **Attachment 2**
4. Drainage Criteria Manual Update (Task D): Refer to Technical Memorandum No. 3 in **Attachment 3**
5. Storm Sewer System Evaluation (Task E): Refer to Technical Memorandum No. 4 in **Attachment 4**
6. Roadside Open Ditch Evaluation (Task F): Refer to Technical Memorandum No. 5 in **Attachment 5**
7. Major Outfall Channels Evaluation (Task G): Refer to Technical Memorandum No. 6 in **Attachment 6**

Additionally, an ESRI On-Line GIS webpage was created as part of this study to supplement the technical memorandums by providing spatial features related to each of the task items. The link is as follows:

https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f

1. Project Management and Meetings (Task A)

The development of the 2021 SDMP Update included regular coordination meetings with the City staff (virtually and in-person), stakeholder meetings, and completion of a City drainage survey. Three virtual stakeholder meetings were held on December 22, 2020, January 12, 2021, and September 17, 2021.

The City conducted a drainage survey to gage the local residence's concerns related to flooding and drainage issues. The results of the survey are summarized below:

- 65% of survey respondents rate high importance to reducing street flooding.
- 59% of survey respondents rate high importance to improve drainage outfalls to reduce 100-year floodplains within the City.
- 90% of survey respondents have not flooded (homes and businesses) in the past 15 years.
- Less than 20% of survey respondents have flood insurance.

2. Technical Memorandum No. 1 – Data Collection and Review (Task B)

The Data Collection and Review (Task B) involved assimilating and reviewing information and data as documented in the technical memorandum in **Attachment 1**. The City of Victoria Public Works Department provided prior drainage studies including the *City of Victoria Storm Drainage Master Plan* dated June 1999 (Resubmitted March 2007) and the *City of Victoria Drainage Criteria Manual* dated May 2007. The data compilation included all prior hydrologic/hydraulic modeling, GIS datasets and technical worksheets. It should be noted that all prior hydrologic/hydraulic modeling was developed on computer modelling software in 1997 and not supported in today's computer environment. The City will need to determine if and when investments can be made to update the hydrologic and hydraulic modeling for floodplain management and/or understanding the hydraulic operation of storm sewer systems based on current land use and drainage system conditions.

Updates were made to the unit cost values in Appendix 8 – Detailed Construction Cost Estimates of the 1999/2007 SDMP. Unit cost values were updated from 1999 dollars to 2021 dollars. The updated construction cost tables are provided in the attachment.

An ESRI On-Line GIS platform was created as part of this project. In addition to the GIS data layers collected as part of the data collection effort,17 new GIS data layers were created to supplement this study. The ERSI ArcGIS webpage can be found at the following link:

https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f

GIS metadata tables are provided in the attachment.

3. Technical Memorandum No. 2 – Independent Study Areas (Task C)

The Independent Study Areas (Task C) involved performing a drainage evaluation for 45 undeveloped parcels as documented in the technical memorandum in **Attachment 2**. The drainage evaluation was performed to aid the City and Developer in addressing existing drainage issues and future drainage solutions to accommodate new growth. The 45 undeveloped parcels

(or 30 study areas) encompassed 1,358 acres of land were in the city. The 45 undeveloped parcels are shown on twenty-eight (28) Development Constraints Maps provided in the attachment. For information purposes, the city corporate limits has over 265 undeveloped tracts encompassing over 5,000 acres.

Five independent areas comprised of 39 of the 45 undeveloped parcels were further studied to determine regional drainage solutions that could be implemented by the City of Victoria to accommodate future growth. Drainage solutions included solely or a combination of channel improvements, storm sewer improvements and drainage easements. Recommended drainage improvement schematics (exhibits) and cost estimates for the regional drainage solutions are provided in the attachment. The five regional drainage projects and probable estimate of cost are summarized as follows:

- Project A. Gardens Apartment Diversion Improvements - $280,625
- Project B. Shenandoah Ditch Improvements - $3,780,500
- Project C. Anthony Rd Outfall Improvements - $1,566,875
- Project D. Lone Tree Road Outfall Improvements - $5,500,875
- Project E. Clegg Ditch Outfall Improvements - $2,150,750

The total cost for the five regional drainage projects is $13,279,625. The total cost does not include right-of-way acquisition costs or design fees. These regional drainage projects are separate from the recommended drainage projects in the 1999/2007 SDMP.

4. Technical Memorandum No. 3 – Drainage Criteria Manual Update (Task D)

The Drainage Criteria Manual Update (Task D) included discussions with City staff to determine changes to the City of Victoria 2007 Drainage Criteria Manual (DCM) as documented in the technical memorandum in **Attachment 3**. This task included new rainfall data to update Figure 3.1 – IDF Curves for the City of Victoria and Table 4.1 – Rainfall Totals for the City of Victoria. The new rainfall data is based on the *National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11 Version 2.0, Texas*, dated 2018. New rainfall data shows a 100-year event (1% Annual Exceedance Probability) 24-hour duration storm for the City of Victoria is 13.40 inches as compared to the previous rainfall total of 11.50 inches, an increase of 1.90 inches.

Other recommended drainage criteria changes are listed in "RED" in **Table ES-1**. It is recommended that the City of Victoria adopt permanent detention for all new developments and remove temporary detention from the drainage policy. The new detention policy would require:

- All detention calculations shall be based on SCS methods using a pre- and post-development routing analysis.

- Parcels that outfall directly into primary channels shall discharge at pre-developed rates. Parcels that discharge into pipes or roadside ditches less than 3 feet in depth shall discharge based on the pro-rata share of the outfall capacity.

Table ES-1. Recommended Drainage Criteria Manual Updates

Criteria Description	Victoria Current	Victoria Proposed
Design Year for Basis of Calculation		
Local Streets	5 Year	5 Year
Collectors / Arterials	10 Year/25 Year	10 Year/25 Year
Outfalls	100 Year	100 Year
Maximum Flooding Depth		
Local Streets	1' at lowest point	1' at lowest point
Collector	1' at lowest point	1' at lowest point
Arterial	1' at lowest point	1' at lowest point
Outfall	1' at Freeboard	1' at Freeboard
Detention Design Frequency	100 Year	100 Year
Storm Sewer Minimize Size	18"	18"
Detention for Residential Subdivisions	None[1]	Required/100 Year
Detention for Commercial	200' from street; increase in impervious cover	Development or Redevelopment greater than 1 acre
Detention Exemptions	Infill Development less than 5 acres	Lower Spring Creek and directly adjacent to Guadalupe River

[1]Temporary detention required if downstream improvements had not been made per 2007 SDMP.

It is recommended that the City of Victoria adopt a minimum detention storage rate based on the increased impervious cover associated with a project. The recommended minimum detention rate for all development types for a 100-year storm event is provided in **Figure ES-2**. There are recommended exemptions to the detention requirement noted as follows:

1. Redevelopment (remodels and additions) shall only be required to detain based on increase in impervious cover.

2. Development 1 acre or less with less than 65% impervious cover are exempt. Detention required above 65% impervious cover.

3. Low Density Development – Parcels of any size, that develop to less than 20% impervious cover are exempt.

4. Guadalupe River – Parcels that drain directly to the Guadalupe River are exempt.

5. Lower Reach of Spring Creek – Development within the portion of Spring Creek downstream of Briggs Blvd are exempt.

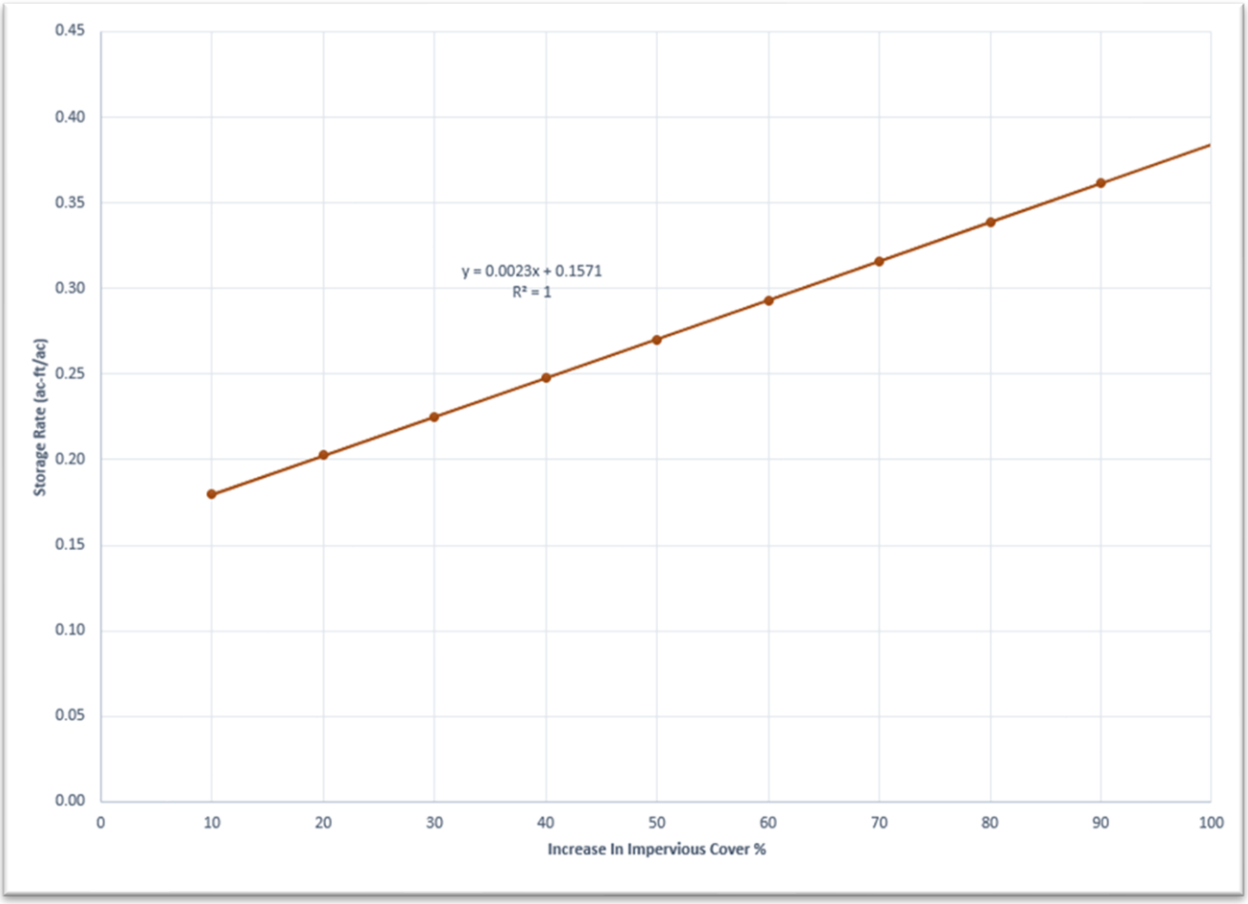


Figure ES-2. City of Victoria Proposed Minimum Detention Storage Rate

5. Technical Memorandum No. 4 – Storm Sewer System Evaluation (Task E)

The Storm Sewer System Evaluation (Task E) included a technical evaluation of the existing surface drainage patterns and storm drainage systems which is documented in the technical memorandum in **Attachment 4**. The technical evaluations included:

- Perform a 100-year sheet flow analysis using a Rain-On-Grid two-dimensional model.
- Examine the performance of the existing storm sewer systems and approximate the design and actual level of service.
- Prepare cost estimates to clean and televise existing storm sewer systems including replacing storm sewer pipes less than 18-inches in diameter.

The 100-year sheet flow analysis performed for the City of Victoria is depicted in the ponding depth map in **Figure ES-3**. The 100-year sheet flow analysis shows the ponding depths based on a theoretical rainfall of 13.4 inches (100-year storm event) assuming the storm sewer systems are operating at a 2-year level of capacity.

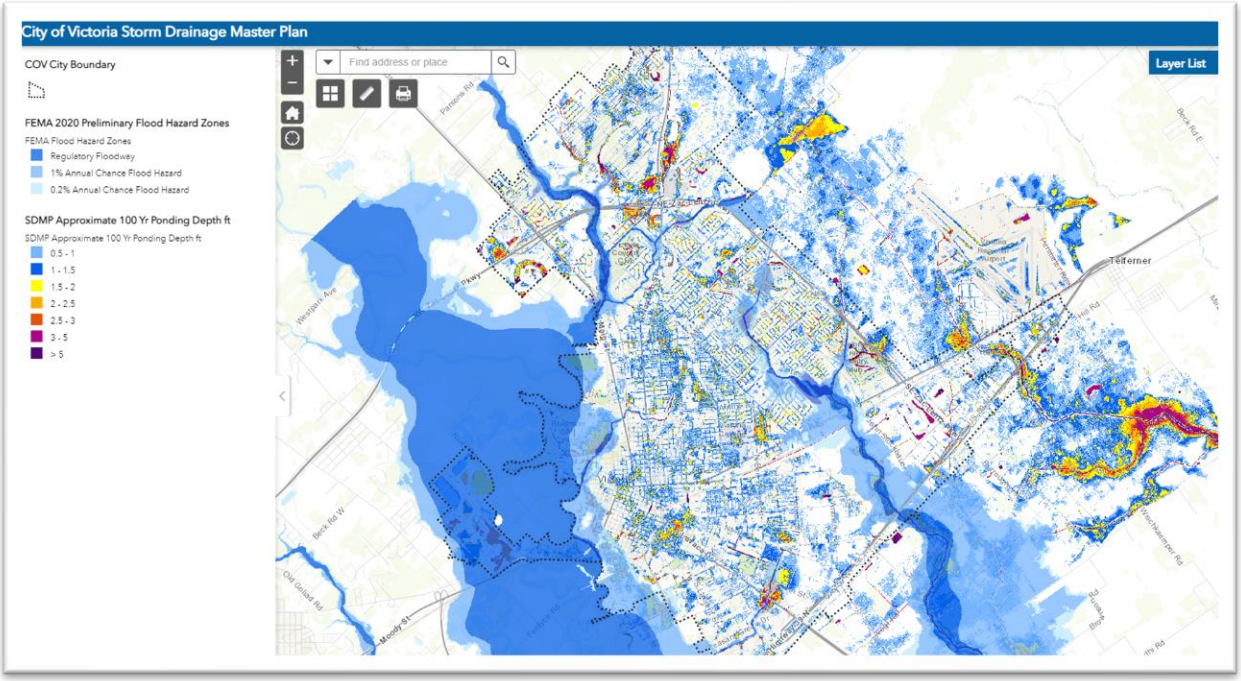


Figure ES-3. 100-Year Sheet Flow Analysis (Ponding Depth Map)

The City of Victoria has over 196 miles of storm sewer pipe. The storm sewer size distribution is summarized in **Table ES-2**. The City requested estimated costs for the following:

- Cost to Replace Storm Sewer Pipes Under 18-inch Diameter (29.9 miles) = $39,461,000
- Cost to Clean and Televise Storm Sewers (165.7 miles) = $16,621,061

Table ES-2. Storm Sewer Size Distribution

Pipe Size (inches)	Length (Miles)
Less than 18	29.9
18	47.7
24	44.6
30	23.7
36	19.8
42	13.2
48	9.8
54	5.8
60	1.1
Total	**195.6**

6. Technical Memorandum No. 5 – Roadside Open Ditch Evaluation (Task F)

The Roadside Open Ditch Evaluation (Task F) included an identification of all the existing roadside ditches in the city. The technical evaluation of the existing roadside open ditches is documented in the technical memorandum in **Attachment 5**. The technical evaluation revealed the following:

- The length of roadside open ditches in the city is 114 miles. The total number of driveway culverts is 3,093 pipes.
- The total cost to regrade all the roadside ditches is $15,030,664. The total cost to replace all the driveway culverts is $43,000,870.

The study team investigated all the roadside open ditches and determined which ditches have a maintenance **priority need** (reshaping ditches and replacing driveway culverts). The investigation found the following:

- Approximately 23 miles of existing roadside open ditches will need to be reshaped including replacing 669 driveway culverts.
- The total cost to regrade the priority roadside open ditches and driveway culverts is $11,658,531.

7. Technical Memorandum No. 6 – Major Outfall Channel Evaluation (Task G)

The Major Outfall Channel Evaluation (Task G) included a technical evaluation of ten (10) major outfall channels in the city that were previously identified with channel improvements and ultimate right-of-way needs in the 1999/2007 SDMP. The technical evaluation is documented in the technical memorandum in **Attachment 6**. The ten (10) major outfall channels are listed as follows:

Table ES-3: Major Outfall Channels

Jim Branch (JB)	Whispering Creek (WC)
Ben Jordan (BJ)	North Outfall (NO)
South Outfall (SO)	US 77 Outfall (US)
West Outfall (WO)	Lone Tree Creek (LT)
Spring Creek (SC)	Marcado Creek (MC)

Ultimate Right-of-Way (ROW) from the 1999/2007 SDMP were spatially mapped on the new ArcGIS webpage. No channel improvements are recommended along Spring Creek (SC), thus no ultimate ROW shown.

Field investigations were performed along major and non-major open channels to examine the existing channel conditions and maintenance needs. There is approximately 74 miles of open

channels (major and non-major) in the city. Drone videos were taken along the major outfall channels. Maintenance needs were categorized into the following categories:

- Concrete-Lined Channel Failure: Locations where the concrete pavement has significantly cracked or has failed requiring repair.
- Earthen Channel Failure: Locations where the grass open channel has eroded and failed along its side slopes requiring repair.
- Sediment Deposits: Locations where sediment build-up has occurred along the channel requiring removal.

The recommended channel repairs (as of September 2020) are summarized in **Table ES-4**. The repair locations are shown in exhibits in the attachment.

Table ES-4: Recommended Channel Repair Needs

Repair Type	Total Repair Area	Total Estimated Repair Cost
Concrete-Lined Channel Repair	33,657 sq ft	$1,262,145
Earthen Channel Repair	11,928 sq ft	$591,473
Sediment Removal	227,099 sq ft	$908,396
Total		**$2,762,014**

D. 2021 SDMP Update Cost Summary

The 2021 SDMP Update included several drainage recommendations separate and in addition to the 199/2007 SDMP cost of $293 million (2021 dollars). A summary of the 2021 SDMP recommended improvements and cost is provided in **Table ES-5**.

Table ES-5. 2021 SDMP Update Cost Summary

Item	Task	Project Description	Estimated Cost
1	C	Five (5) regional drainage projects	$13,279,625(*)
2	E	Replace storm sewer pipe under 18-inch diameter (29.9 miles)	$39,461,000
3	E	Clean and televise storm sewers (165.7 miles)	$16,621,061
4	F	Regrade Priority Ditches (23 miles) & Driveway Culverts (669)	$11,658,531
5	G	Repair Channel Failures & Sediment Removal	$2,762,014
Total			**$83,782,231**

(*) Cost does not include right-of-way acquisition cost or design fees.

E. 2021 SDMP Update Recommendations

The 2021 SDMP includes the following recommendations:

1. Perform a detailed watershed study of the Marcado Creek and Jim Branch watersheds to examine alternative channel sections and regional detention solution options. Develop new hydrologic and hydraulic models based on current land use and channel conditions. Planning Budget = $800,000 - $1,000,000

2. Establish an annual drainage maintenance program for cleaning storm sewer systems (pipe, manholes and inlets) and cleaning/regrading roadside ditches. Only includes the priority ditches.
   Program Budget = $28.3M

   Consider implementing a stormwater/drainage utility fee for annual funding.

3. Establish an annual channel repair and sediment removal program. Only includes channel repair needs as of September 2021.
   Program Budget = $2.8M

   Consider implementing a stormwater/drainage utility fee for annual funding.

4. Adopt the five (5) regional drainage projects: Total Cost = $13,279,625.

    - Project A. Gardens Apartment Diversion Improvements - $280,625
    - Project B. Shenandoah Ditch Improvements - $3,780,500
    - Project C. Anthony Rd Outfall Improvements - $1,566,875
    - Project D. Lone Tree Road Outfall Improvements - $5,500,875
    - Project E. Clegg Ditch Outfall Improvements - $2,150,750

    The total cost for the five regional drainage projects is $13,279,625. Cost excludes right-of-way acquisition costs and design fees.

5. Adopt the new NOAA Atlas 14 rainfall and the new detention criteria in the City of Victoria Drainage Criteria Manual.

6. Develop a flood monitoring program to track flooding incidents in the City after storm events. The flood monitoring program would initially gather data from surveyed high-water marks, flooded home and business inventory, and street ponding locations.
   Program Budget = $100,000 annually

Presentation
City of Victoria Storm Drainage Master Plan Update
Final Presentation
September 24, 2021

CITY OF VICTORIA STORM DRAINAGE MASTER PLAN UPDATE

FINAL PRESENTATION

September 24, 2021

CivilTech Engineering, Inc.

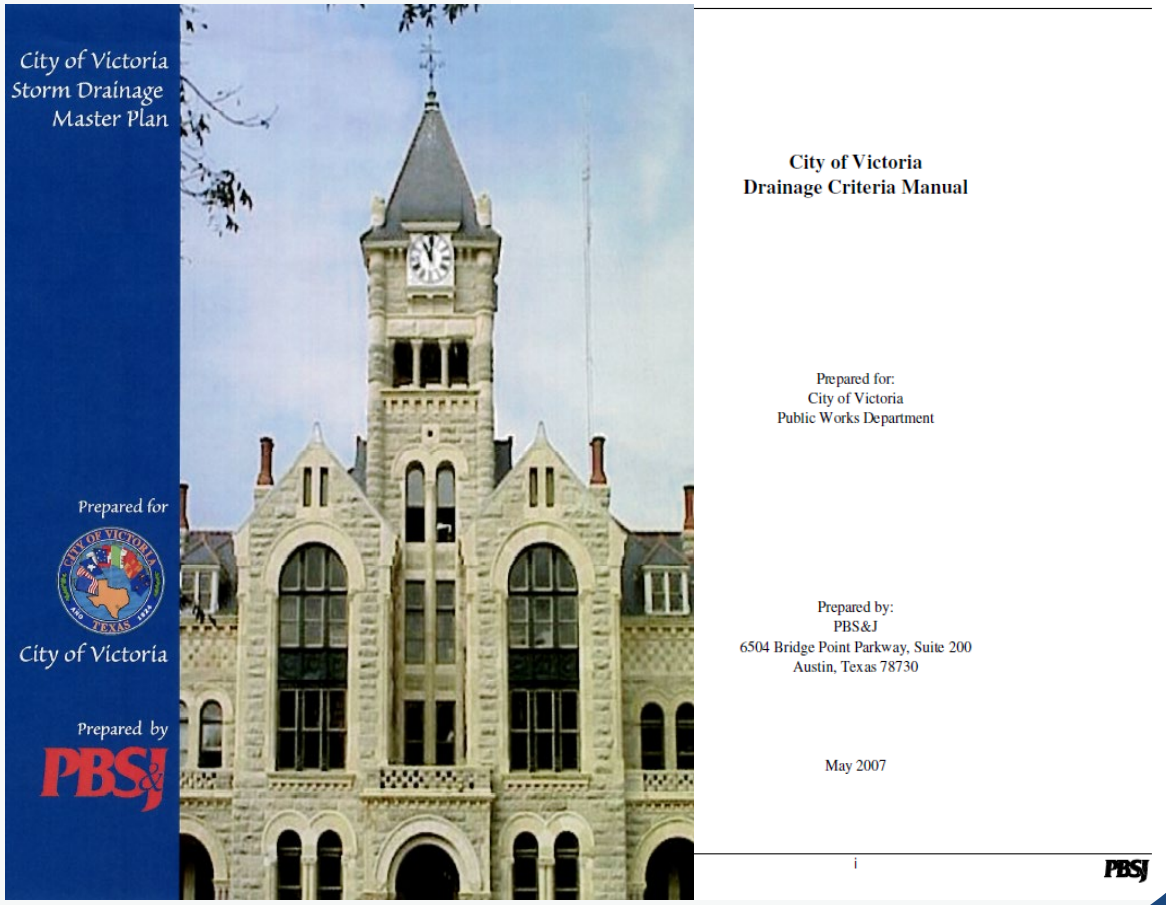
URBAN engineering

City of Victoria Storm Drainage Master Plan (SDMP) Update

- CivilTech Engineering, Inc. and Urban Engineering, Inc.
- Study Agreement: September 2020
- Scope of Work (7 Tasks)
  - Project Management and Meetings (Task A)
  - Data Collection and Review (Task B)
  - Priority One: Independent Study Areas (Task C)
  - Priority Two: Drainage Criteria Manual Update (Task D)
  - Priority Three: Storm Sewer System Evaluation (Task E)
  - Priority Four: Roadside Open Ditch Evaluation (Task F)
  - Priority Five: Major Outfalls (Task G)
- Deliverables
  - Six (6) Technical Memorandums (Task B – Task G)
  - ERSI On-Line GIS Webpage

City of Victoria Storm Drainage Master Plan (SDMP)

- City of Victoria Storm Drainage Master Plan dated June 1999 (Resubmitted March 2007)
- City of Victoria Drainage Criteria Manual dated May 2007



City of Victoria 1999/2007 Storm Drainage Master Plan (SDMP)

Drainage recommendations to accommodate Ultimate Development Scenario (Future/Future)

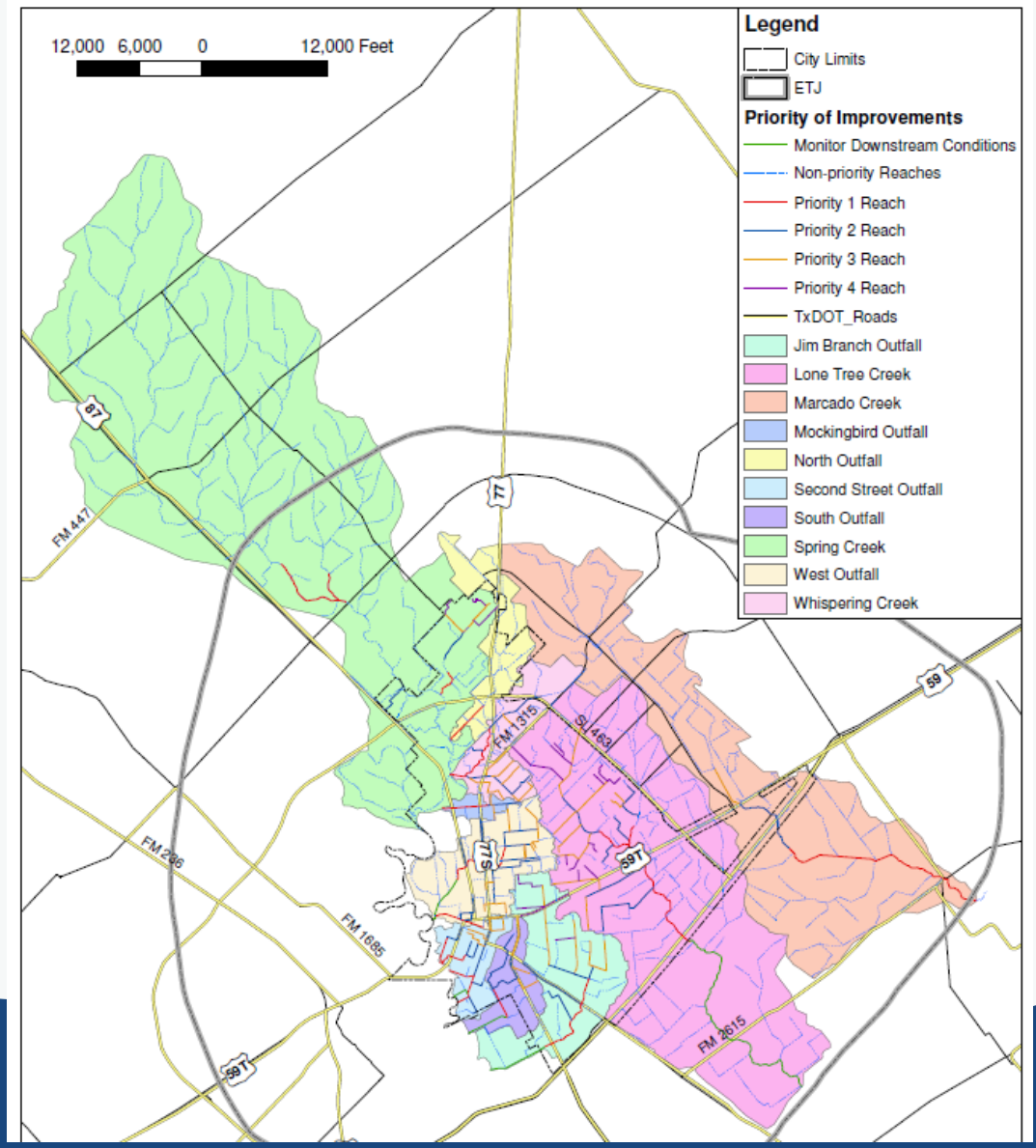
- **Drainage solutions do not necessarily eliminate flooding along major drainage channels but maintain FEMA effective base flood elevations and 100-year floodplains**

- Regional Detention Basins (2 Ponds)
  - Lone Tree Facility: 1,158,000 cy (**Partially constructed – 75% Complete**)
  - Spring Creek Facility: 3,113,000 cy
- Open Channel / Bridge / Culvert Improvements (Added Flow Capacity)
  - Channel widening and bridge/culvert replacements along Whispering Creek, North Outfall, US 77 Outfall, **West Outfall (Completed Airline Rd to Woodlawn Subdivision)** , Ben Jordan Outfall, South Outfall, Jim Branch Outfall, **Lone Tree Creek (Completed Houston Highway to Greenway Park Subdivision)** and Marcado Creek
- Closed System Improvements (Pipe and Box Storm Sewers)
  - Upsized most storm sewer systems along collector/major arterial streets to a 10- and 25-year storm levels
- Pump Station and Bypass System (Second Street Outfall)

City of Victoria 1999/2007 Storm Drainage Master Plan (SDMP)

- Total Cost of All Improvements = $170 million (1999 dollars) - Updated $293 million (2021 dollars)

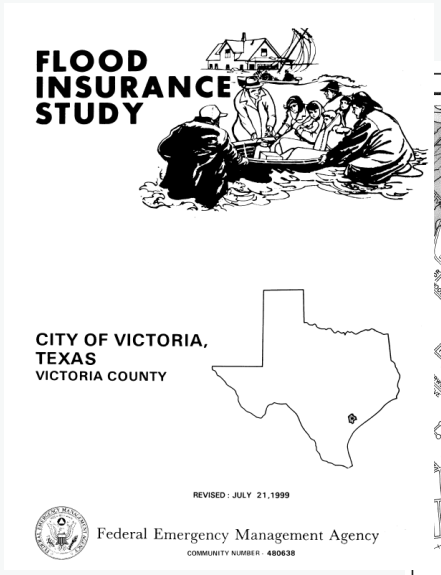
(Does not include ROW and/or Easement acquisition or project design fees costs)

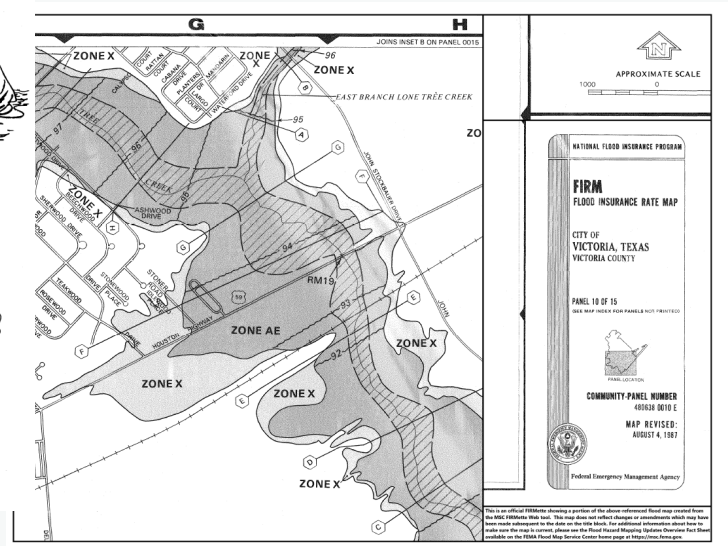


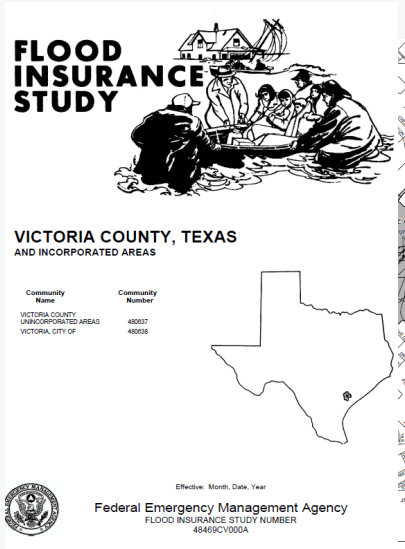
CivilTech Engineering, Inc.

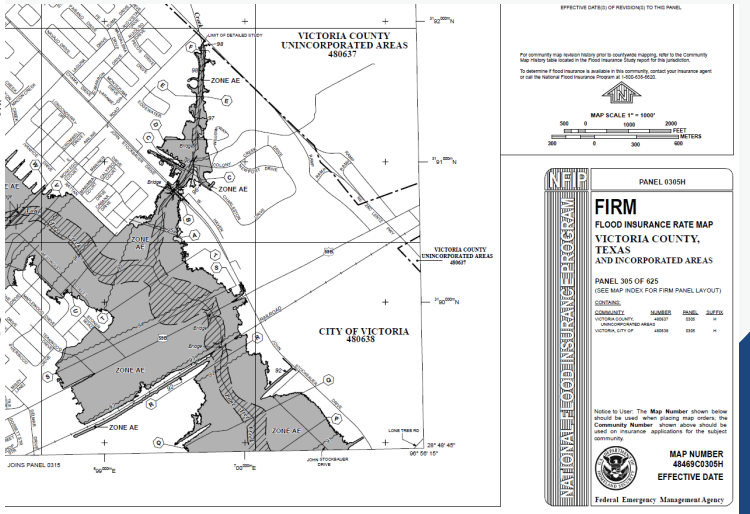
FEMA Floodplain Maps

- FEMA Effective Floodplain Maps dated 1987, 1998, 1999
- FEMA Preliminary Floodplain Maps dated April 30, 2020 (Pending Approval)
  - Relies on scientific data such as watershed hydrology (flows) and hydraulic models (water elevations) developed in the 80's and 90's except for Guadalupe River.
  - Base flood elevations remapped on new LiDAR topography
- No significant changes to 100-year or 1% floodplain limits along major channels in the City.





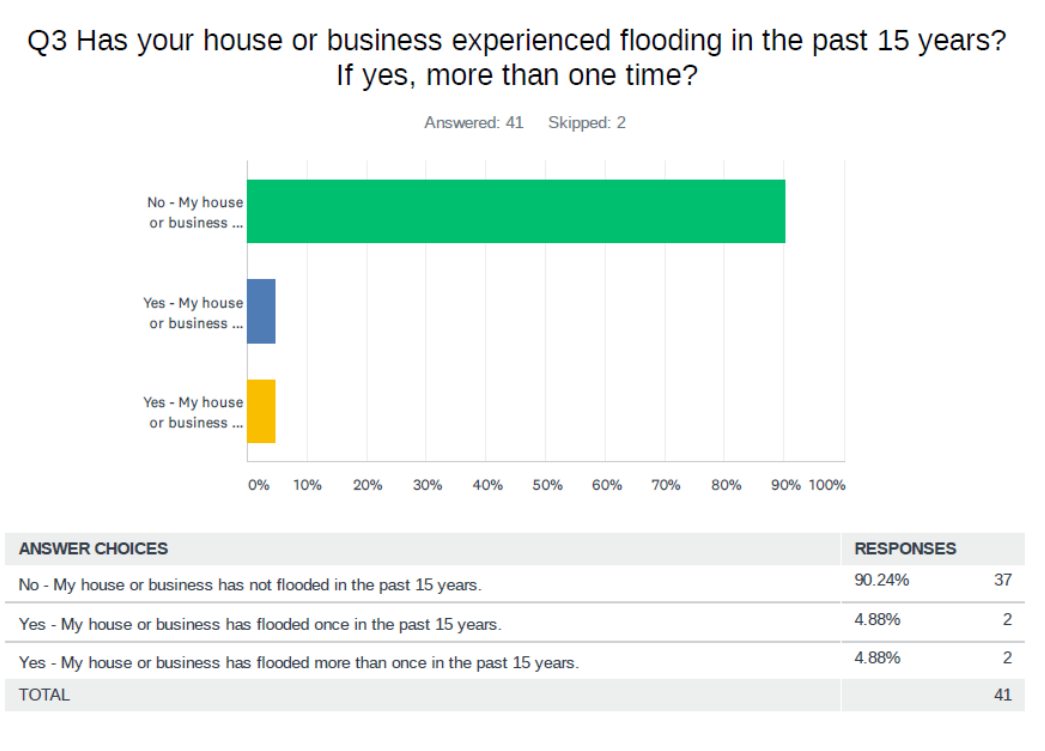




CivilTech Engineering, Inc.

Project Management and Meetings (Task A)

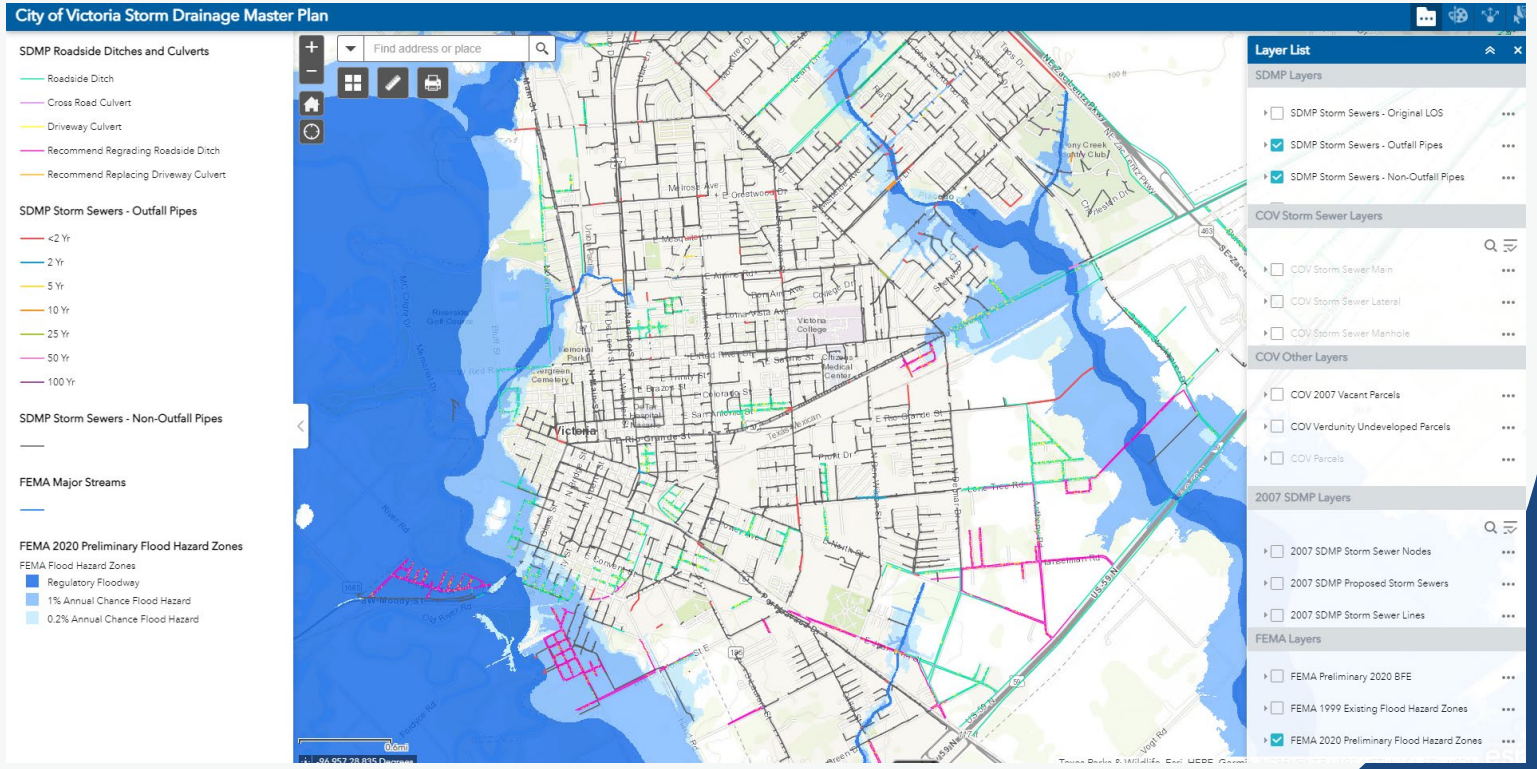
- Meetings
  - Virtual stakeholder meetings held on December 22, 2020, January 12, 2021, and September 17, 2021
  - Bi-monthly coordination meetings held with City staff (virtual and in-person)
- City of Victoria conducted a Drainage Master Plan Survey (Approximately 40 - 45 responses)
  - 65% survey respondents rate high importance to reducing street flooding
  - 59% survey respondents rate high importance to improve drainage outfalls to reduce 100-year floodplain.
  - 90% survey respondents have not flooded (homes and businesses) in the past 15 years
  - Less than 20% of survey respondents have flood insurance



ANSWER CHOICES	RESPONSES	
No - My house or business has not flooded in the past 15 years.	90.24%	37
Yes - My house or business has flooded once in the past 15 years.	4.88%	2
Yes - My house or business has flooded more than once in the past 15 years.	4.88%	2
TOTAL		41

Data Collection and Review (Task B)

- Data Compilation
  - 1999/2007 City of Victoria Storm Drainage Master Plan
  - Hydrology and Hydraulic Models – Open Channels and Closed Systems (Outdated)
  - Land Use Assumptions: 1997 Baseline Conditions
- ERSI On-Line GIS Platform
  - https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f
  - 2021 SDMP New GIS Data Layers (17)
  - 2007 SDMP GIS Data Layers (6)
- Deliverable: Technical Memorandum – Attachment 1

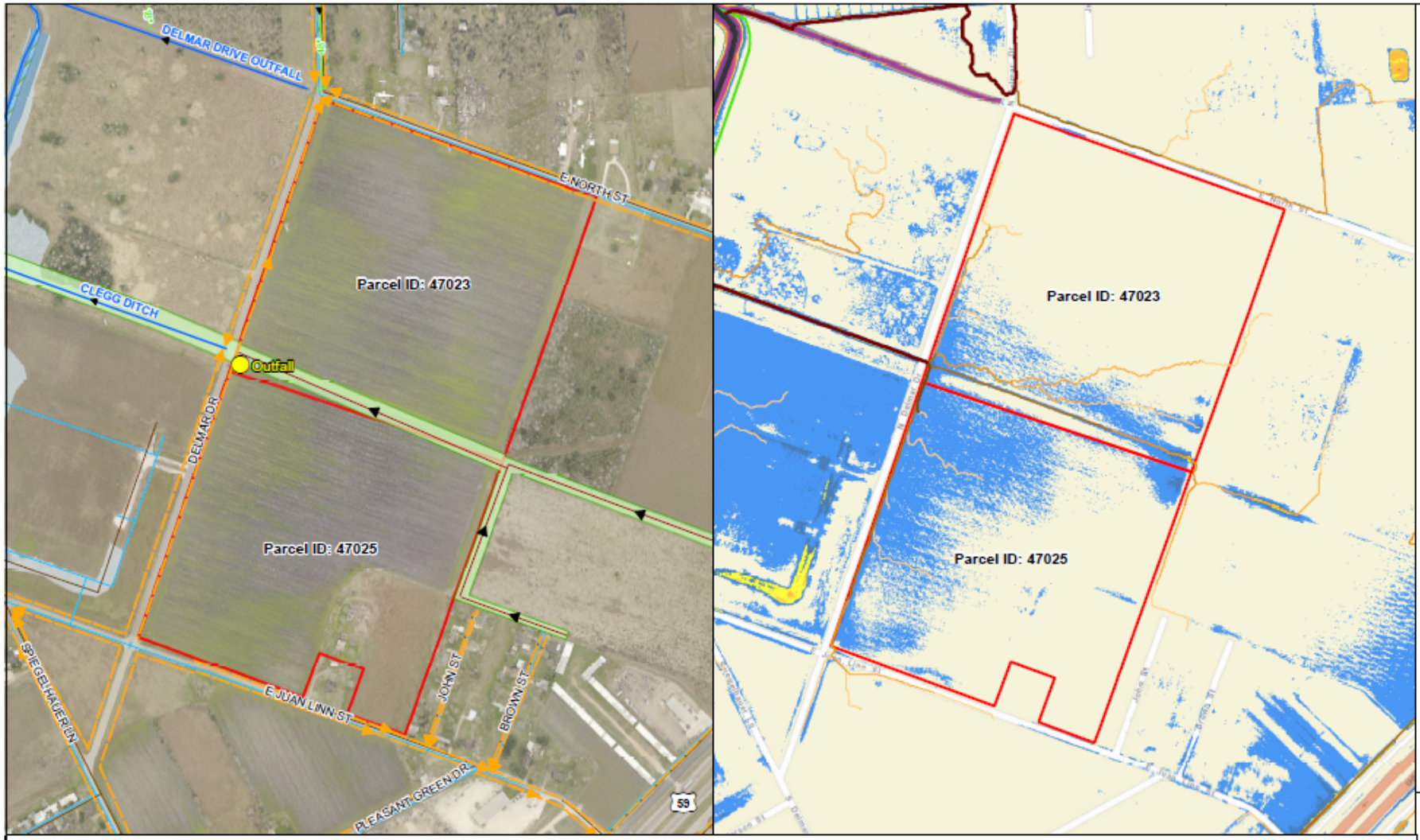


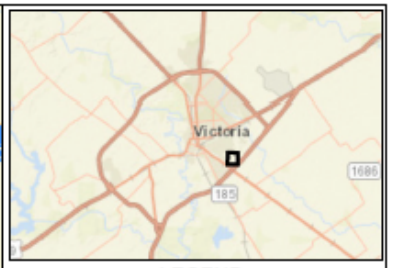
CivilTech Engineering, Inc.

Priority One: Independent Study Areas (Task C)

- Drainage Evaluation for 45 undeveloped parcels (1,358 acres) in the City
  - To aid the City and Developer in addressing existing drainage issues and future drainage solutions
  - Developed 28 Development Constraint Maps
- Developed Five (5) Regional Drainage Solutions
  - Channel Improvements
  - Storm Sewer Improvements
  - Drainage Easements
- Deliverable: Technical Memorandum – Attachment 2

CivilTech Engineering, Inc.





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 250 500

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	47023, 47025	Property Size (ac)	80
Watershed	Jim Branch Outfall		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain and Floodway	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 1.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Jim Branch Outfall	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow	X		128 Ac + Offsite Area from West	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation	Route detention pond outfall to Jim Branch Outfall and limit discharge to pre-development conditions.				

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2004 N. Commerce, Victoria, Texas 77901 | 361.578.5636

The City of Victoria Texas

City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.21

Priority One: Independent Study Areas (Task C)

- **Five Regional Drainage Solutions & Probable Construction Costs**

  Project A: Buhler Property Diversion
  Cost = $280,625*

  Project B: Shenandoah Ditch
  Cost = $3,780,500*

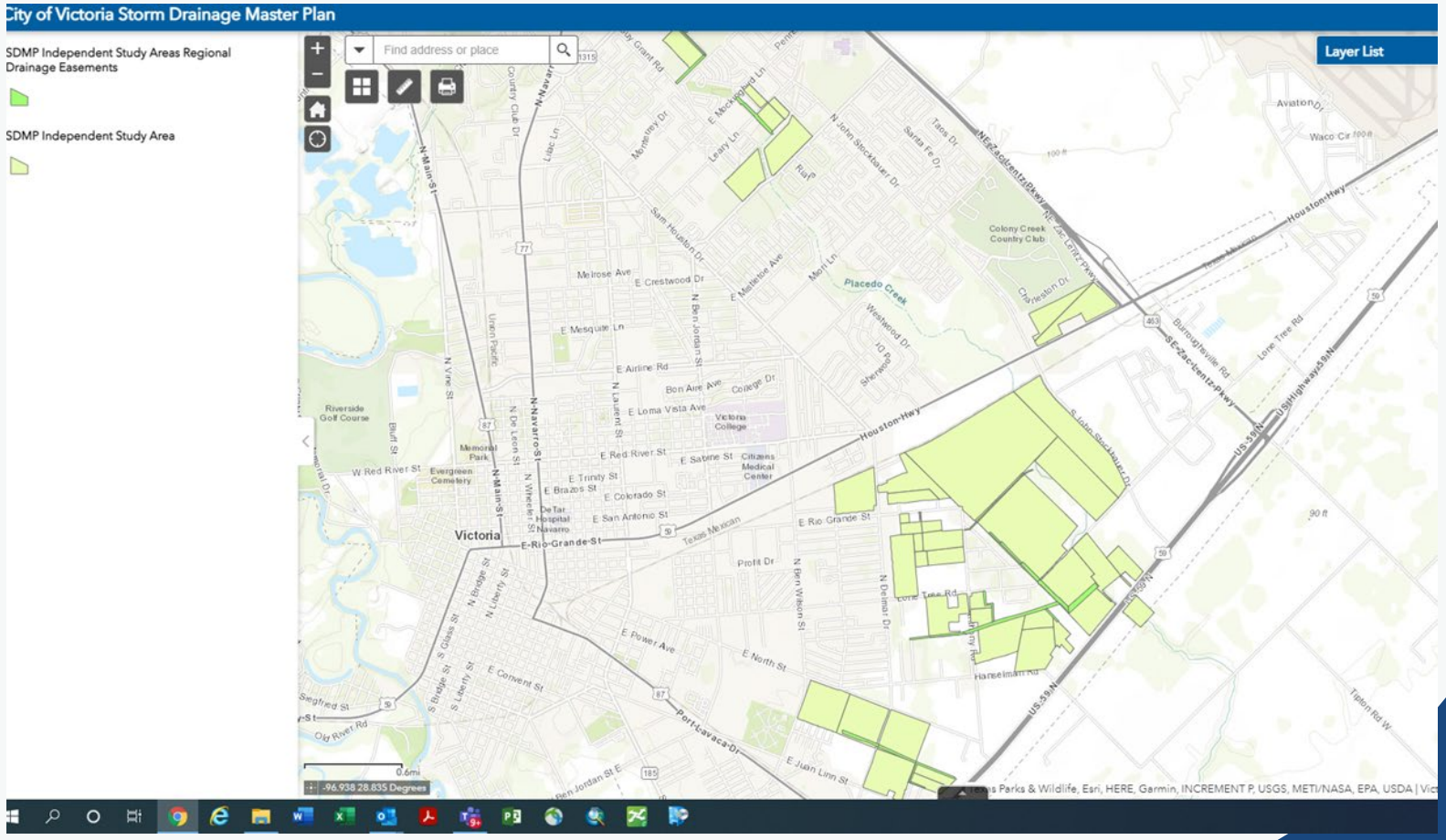
  Project C: Anthony Rd Outfall
  Cost = $1,566,875*

  Project D: Lone Tree Road Outfall
  Cost = $5,500,875*

  Project E: Clegg Ditch Outfall
  Cost = $2,150,750*

- **Total Cost - $13,279,625***

*Cost does not include ROW and/or Easement acquisition



CivilTech Engineering, Inc.

Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.

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URBAN engineering

THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Project B - Shenandoah Ditch

September 2021	Project No. 400022	Exhibit No. 2.1.2


JOHN STOCKBAUER DR
LONE TREE CREEK
50' DE
141430
133950
133951
46703
9800383
46704
33561
DELMAR DR
OAKLAWN ST
WILDWOOD ST
MEADOWLANE ST
AVONDALE ST
ALLENDALE ST
GLENDALE ST
MORNINGSIDE ST
WOODLAWN ST
TIBILETTI DR
MORRIS AVE
HYAK AVE
MASSOUH ST
LONE TREE RD
LALA ST
Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.
LEGEND
Proposed Structure
Proposed Storm Sewer
Stream
Proposed Drainage Easement
Study Parcel
0 300 600
N
Aerial Source:
2020 City of Victoria
CivilTech Engineering, Inc.
11821 Telge Rd
Cypress, Texas 77429
Tel: 281-304-0200
Fax: 281-304-0210
URBAN engineering
THE CITY OF VICTORIA TEXAS
City of Victoria
Storm Drainage Master Plan Update
Priority One - Independent Study Area
Project C - Anthony Road Outfall
September 2021
Project No. 400022
Exhibit No. 2.1.3


33561
20404804
76170
46655
46734
46750
46723
46724
46753
60' DE
80' DE
100' DE
120' DE
180' DE
TIBLETTI DR
MORRIS AVE
HYAK AVE
MASSOUH ST
LALA ST
LONE TREE RD
JOHN STOCKBAUER DR
LONE TREE CREEK
59
LEGEND
Proposed Structure
Proposed Storm Sewer
Stream
Proposed Drainage Easement
Study Parcel
N
Aerial Source:
2020 City of Victoria
ESRI World Street Map
CivilTech Engineering, Inc.
11821 Telge Rd
Cypress, Texas 77429
Tel: 281-304-0200
Fax: 281-304-0210
URBAN engineering
THE CITY OF VICTORIA TEXAS
City of Victoria
Storm Drainage Master Plan Update
Priority One - Independent Study Area
Project D - Lone Tree Road Outfall
September 2021
Project No. 400022
Exhibit No. 2.1.4
Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.


GAYLE DR
SWAN DR
HANSELMAN RD
OWENS ST
JULIUS ST
LEWIS RD
DELMAR DRIVE OUTFALL
BEN JORDAN OUTFALL
S BEN WILSON ST
E NORTH ST
46970
47023
100' DE
CLEGG DITCH
80' DE
60' DE
60' DE
40' DE
47001
47000
47025
DELMAR DR
JIM BRANCH OUTFALL
EKSTURM ST
WILLARD ST
E FORREST ST
BARBARA ST
MARVELLE ST
LILLIAN ST
ODEM ST
E JUAN LINN ST
SPIEGELHAUER LN
JOHN ST
BROWN ST
FRANCIS ST
ALGIE ST
MORGAN DR
HENDERSON ST
PLEASANT GREEN DR
87
59
Victoria
LEGEND
Proposed Structure
Stream
Proposed Storm Sewer
Proposed Drainage Easement
Study Parcel
0 250 500
N
Aerial Source:
2020 City of Victoria
ESRI World Street Map
CivilTech Engineering, Inc.
11821 Telge Rd
Cypress, Texas 77429
Tel: 281-304-0200
Fax: 281-304-0210
URBAN engineering
THE CITY OF VICTORIA TEXAS
City of Victoria
Storm Drainage Master Plan Update
Priority One - Independent Study Area
Project E - Jim Branch Outfall
September 2021
Project No. 400022
Exhibit No. 2.1.5
Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.

Priority Two: Drainage Criteria Manual (Task D)

- Section 3.0 Determination of Storm Runoff from Small Areas and Section and Section 4.0 Determination of Storm Runoff from Large Areas (New Rainfall Data for Texas)
  - Figure 3.1 – Updated Intensity-Duration-Frequency (IDF) Curves for City of Victoria (TxDOT 2019 e, b and d coefficients – NOAA Atlas 14) – No design changes for storm sewer pipes in the City.
  - Table 4.1 – Updated Rainfall Totals for City of Victoria (NOAA Atlas 14) – 100-year 24-hour design storm produces 1.9 inches more rainfall (11.5 inches vs 13.4 inches)

Storm Event (years)	Annual Exceedance	Current Rainfall (inches)	Atlas 14 Rainfall (inches)	Change (inches)
2	50%	4.50	4.74	0.24
5	20%	6.25	6.29	0.04
10	10%	7.50	7.69	0.19
25	4%	8.90	9.77	0.87
50	2%	10.10	11.50	1.40
100	1%	11.50	13.40	1.90
500	0.20%	14.55	18.70	4.15

- Deliverable: Technical Memorandum – Attachment 3

Priority Two: Drainage Criteria Manual (Task D)

Recommended Drainage Criteria Changes (in RED)

Criteria Description	Victoria Current	Victoria Proposed
Design Year for Basis of Calculations		
Local Streets	5 Year	5 year
Collectors / Arterials	10 Year / 25 Year	10 Year / 25 Year
Outfalls	100 Year	100 Year
Maximum Flooding Depth		
Local Streets	Maximum 1'	Maximum 1'
Collector	Maximum 1'	Maximum 1'
Arterial	Maximum 1'	Maximum 1'
Outfall	1' Freeboard	1' Freeboard
Detention Design Frequency	100 year	100 year
Storm Sewer Minimum Size	18"	18"
Detention for Residential Subdivisions	None*	Required/100 year
Detention for Commercial	200' from street; increase in impervious cover	Development or Redevelopment greater than 1 acre
Detention Exemptions	Infill Development less than 5 acres	Lower Spring Creek and directly adjacent to Guadalupe River

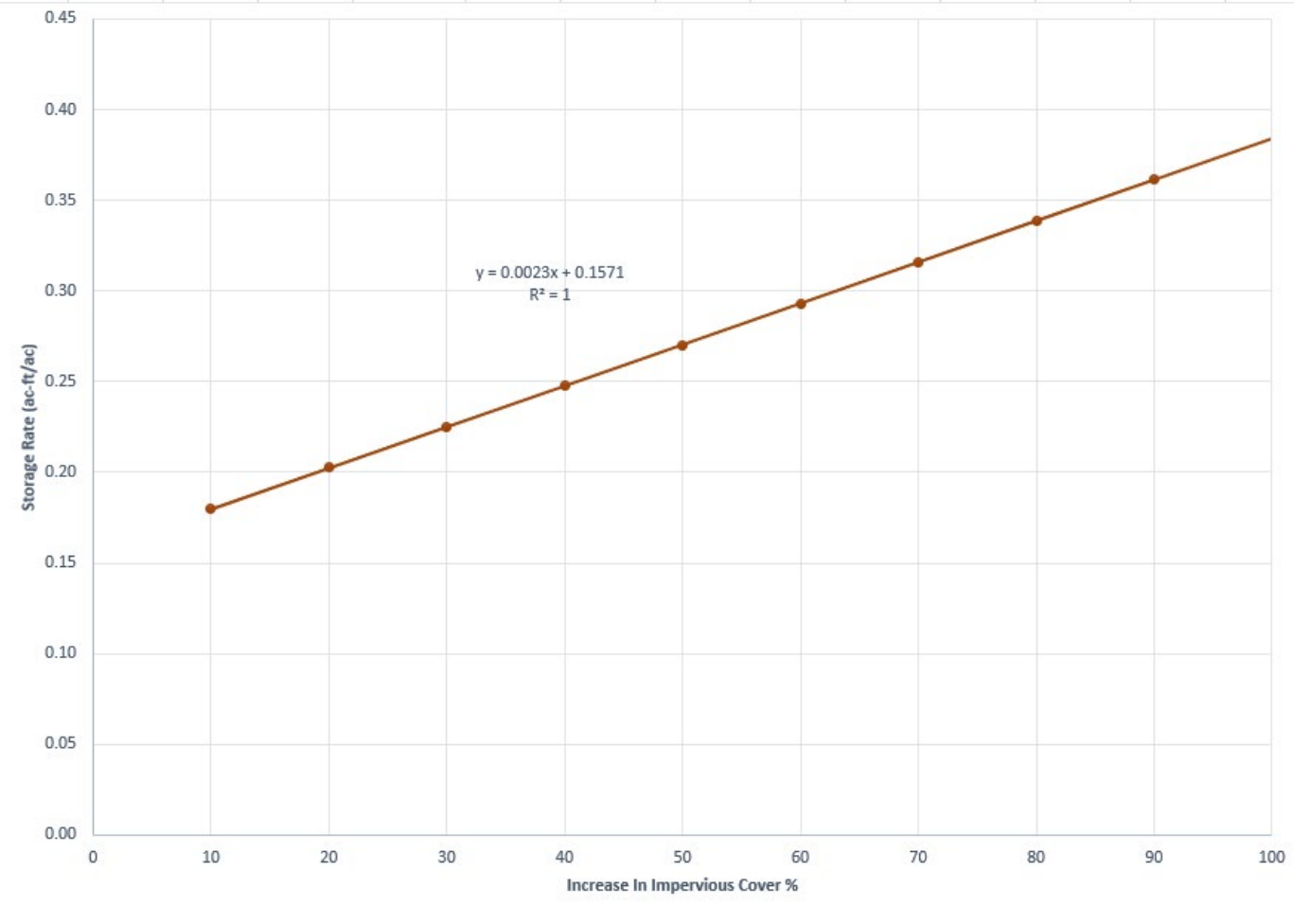
*Temporary detention required if downstream improvements had not been made per SDMP

Priority Two: Drainage Criteria Manual (Task D)

- Section 2.0 Drainage Policies (Detention Policy)
  - Page 2-5: "Temporary detention must be provided and maintained by the developer until downstream SDMP improvement are constructed."
- Required permanent detention for all new developments and remove temporary detention in Drainage Criteria Manual.
  - All detention will be based on SCS method using pre and post analysis.
  - Parcels that outfall directly into primary channels will discharge at pre development rates. Parcels that discharge into pipes or roadside ditches less than 3' deep will discharge based on the pro-rata shall the capacity.
- Suggested Detention Exemptions:
  1) Redevelopment (remodels and additions) shall only be required to detain based on increase in impervious cover.
  2) Development 1 acre or less with less than 65% impervious cover are exempt. Detention required above 65% impervious cover.
  3) Low Density Development – Parcels of any size, that develop to less than 20% impervious cover are exempt.
  4) Guadalupe River – Parcels that drain directly to the Guadalupe River are exempt.
  5) Lower Reaches of Spring Creek – development within the portion of Spring Creek downstream of Briggs Blvd are exempt.

Priority Two: Drainage Criteria Manual (Task D)

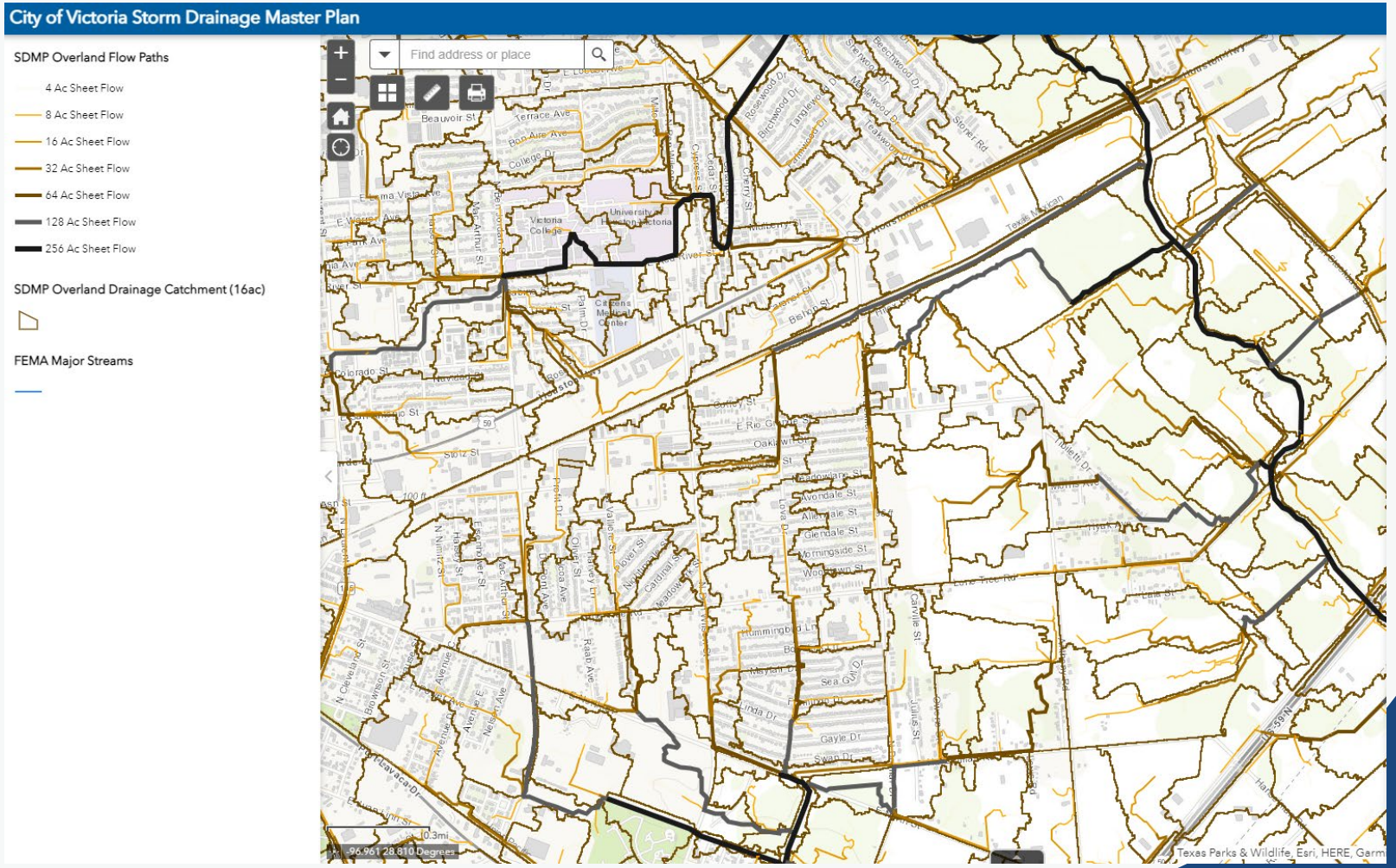
- Recommended Minimum Detention Storage Rate (Based on Increased Impervious Cover)



CivilTech Engineering, Inc.

Priority Three: Storm Sewer System Evaluation (Task E)

- Drainage Catchments and Overland Flow Paths
  - 2 Acres
  - 8 Acres
  - 16 Acres
  - 32 Acres
  - 64 Acres
  - 128 Acres
  - 256 Acres



CivilTech Engineering, Inc.

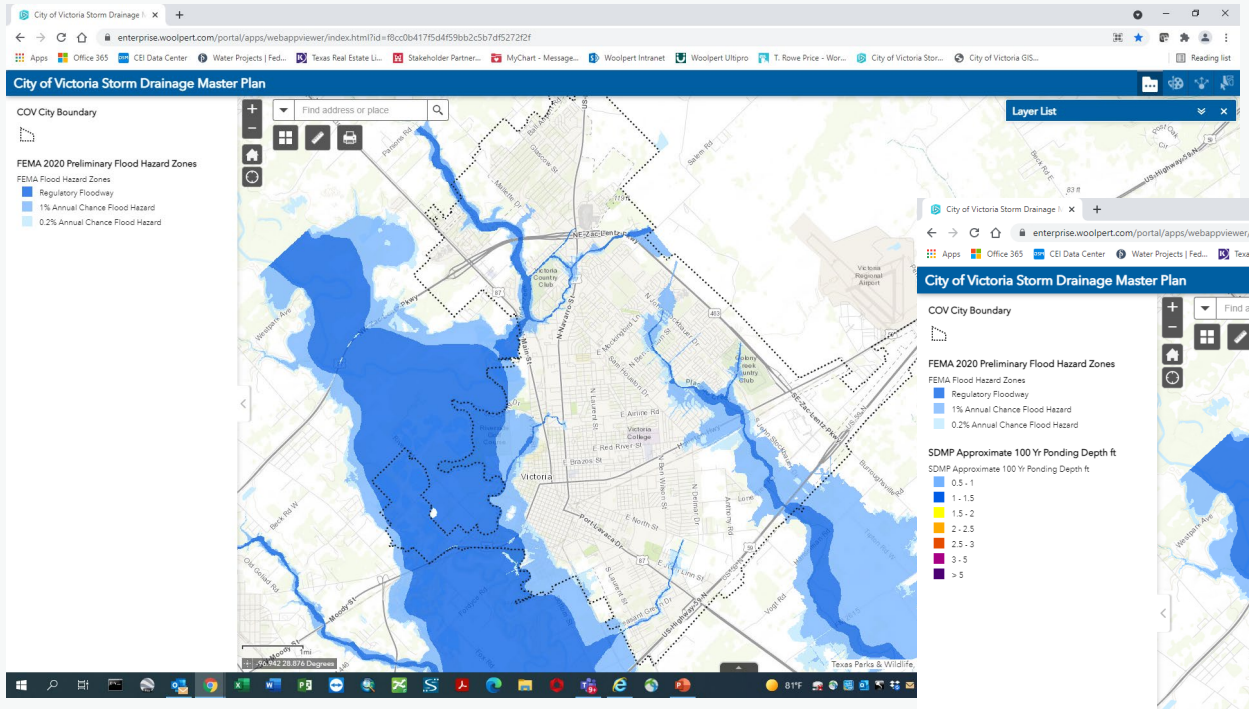
Priority Three: Storm Sewer System Evaluation (Task E)

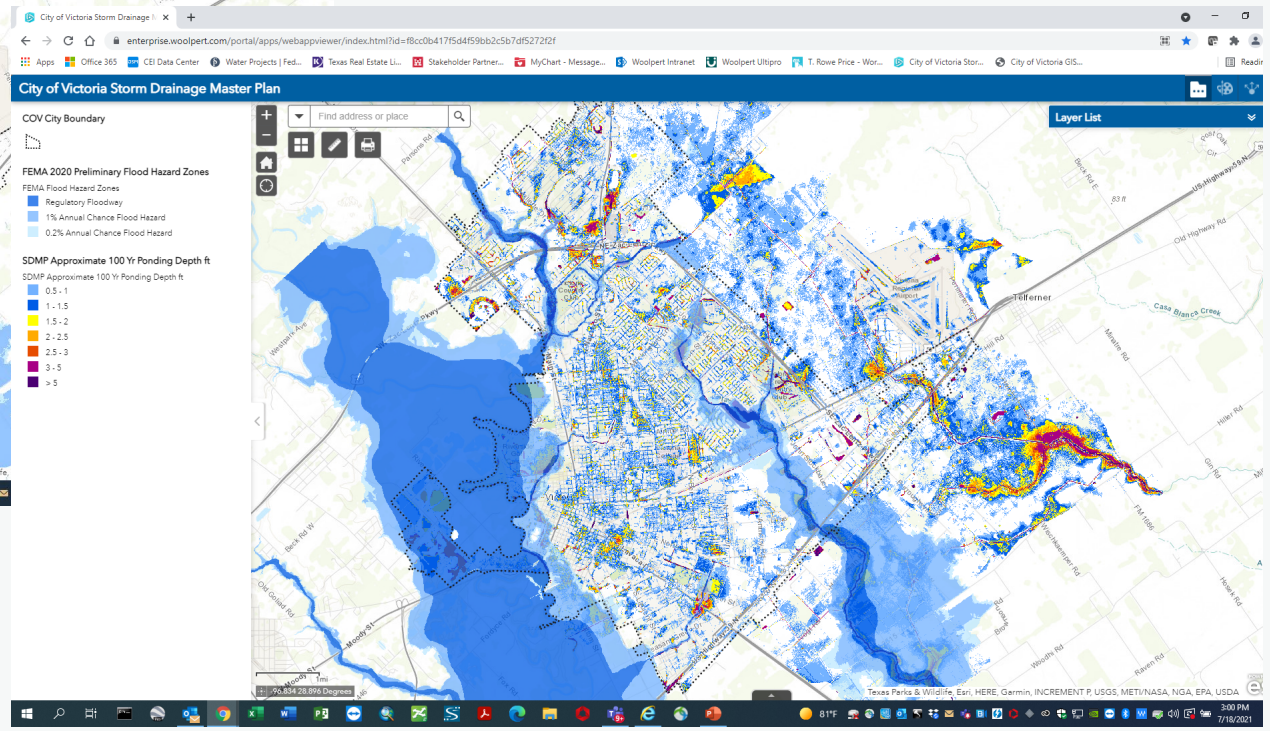
100-Year Overland Flow Analysis (HEC-RAS 2D Rain-On-Grid Model)

CivilTech Engineering, Inc.

Priority Three: Storm Sewer System Evaluation (Task E)

100-Year Floodplains vs 100-Year Overland Flow Analysis



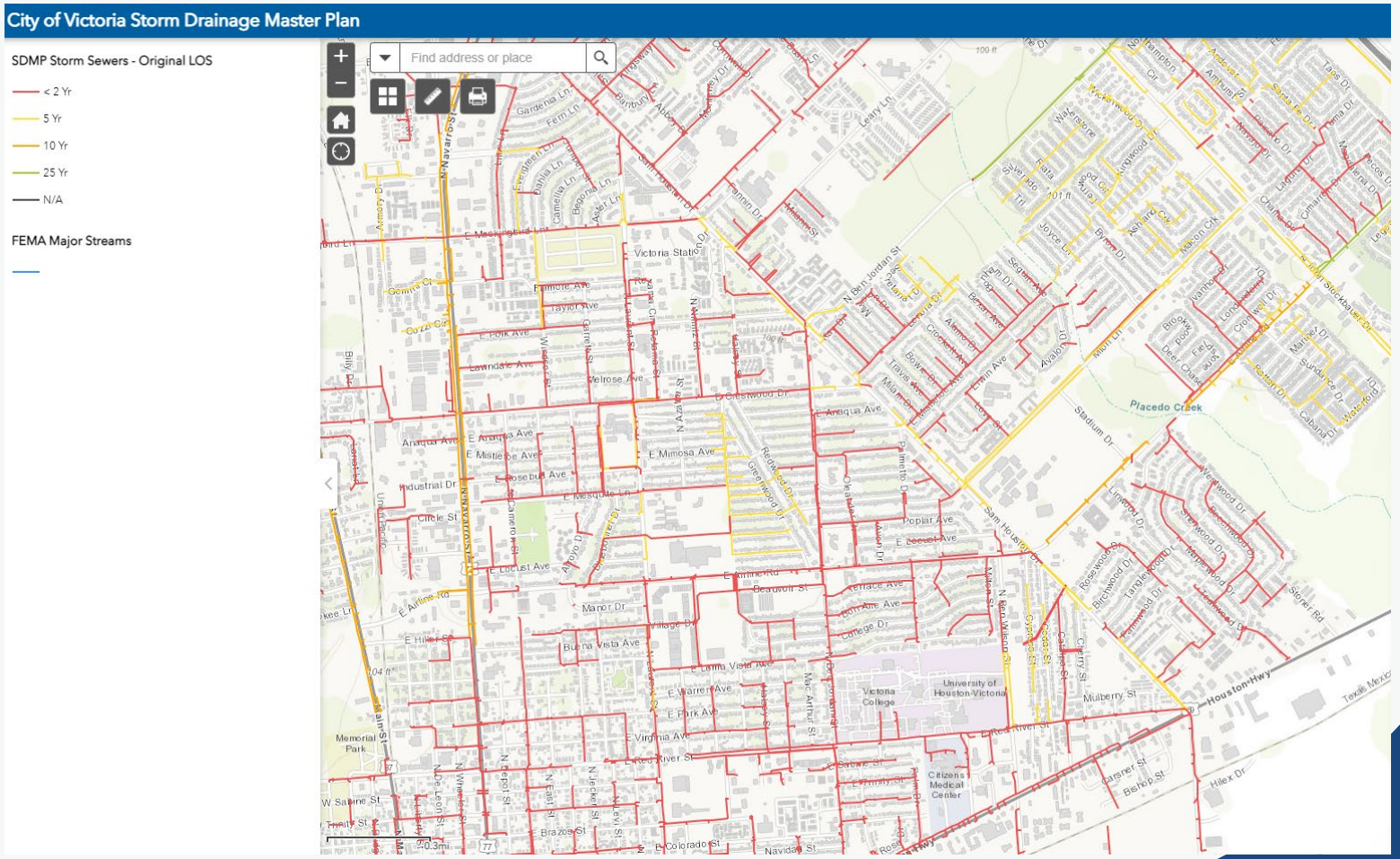


CivilTech Engineering, Inc.

Priority Three: Storm Sewer System Evaluation (Task E)

Storm Sewer System Level of Service Analysis

- Design Level of Service
  - Street Classification
  - Year Constructed
- Actual Level of Service
  - Approximate Capacity of Outfall Pipe



Priority Three: Storm Sewer System Evaluation (Task E)

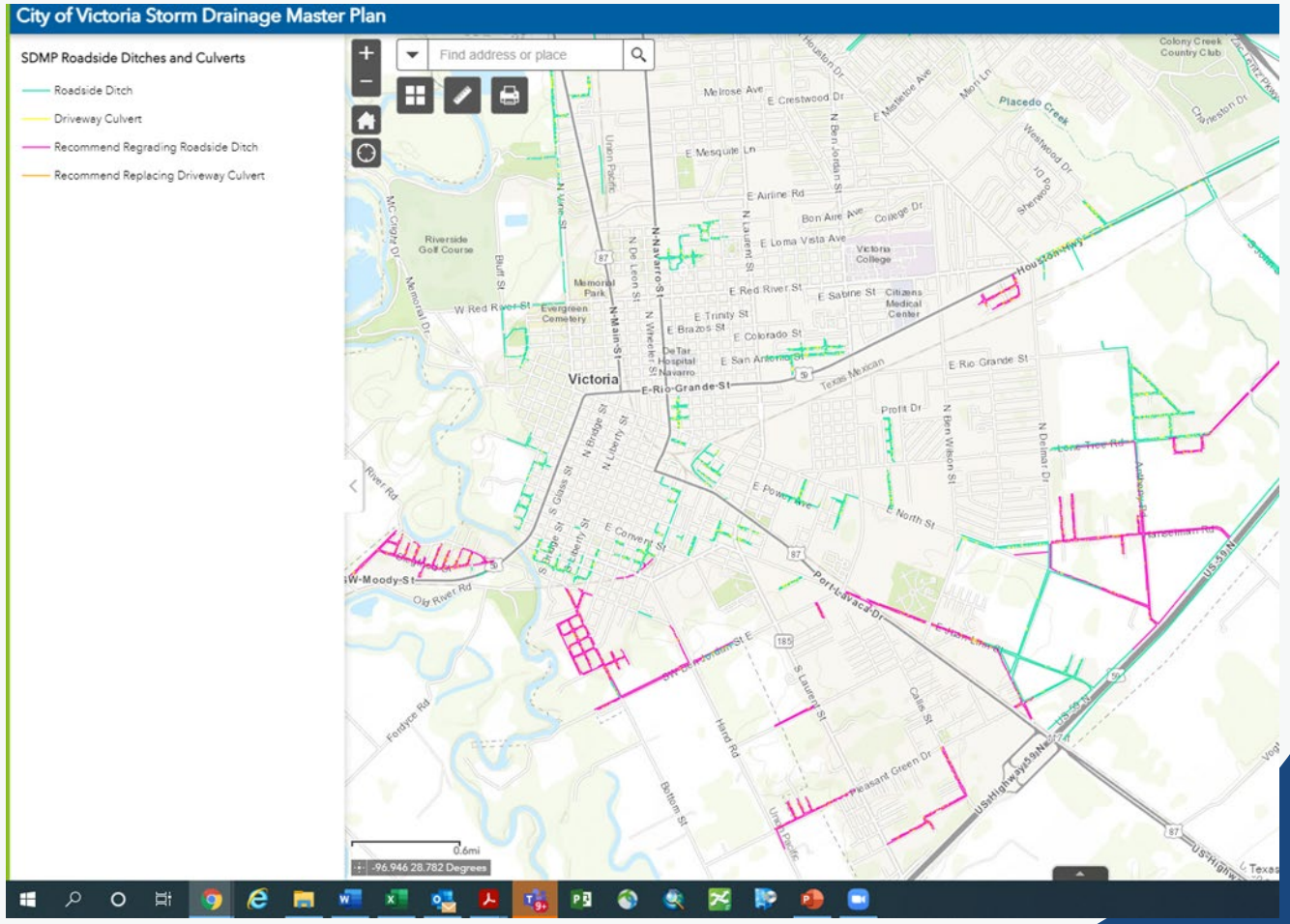
Storm Sewer Size Distribution

- Less Than 18-Inch - 29.9 Miles
- 18-Inch - 47.7 Miles
- 24-Inch - 44.6 Miles
- 30-Inch - 23.7 Miles
- 36-Inch - 19.8 Miles
- 42-Inch - 13.2 Miles
- 48-Inch - 9.8 Miles
- 54-Inch - 5.8 Miles
- 60-Inch - 1.1 Miles
- **All Sewers - 195.6 Miles**

1. Cost to Replace Storm Sewer Pipes Under 18-Inch Diameter
   - Replace Less Than 18-Inch - 29.9 Miles
   - Cost = $39,461,000 (2021 Values)
2. Storm Sewer Televising & Cleaning Cost
   - Televise & Clean Sewers - 165.7 Miles
   - Cost = $16,621,061 (2021 Values)
3. Deliverable: Technical Memorandum - Attachment 4

Priority Four: Roadside Open Ditch Evaluation (Task F)

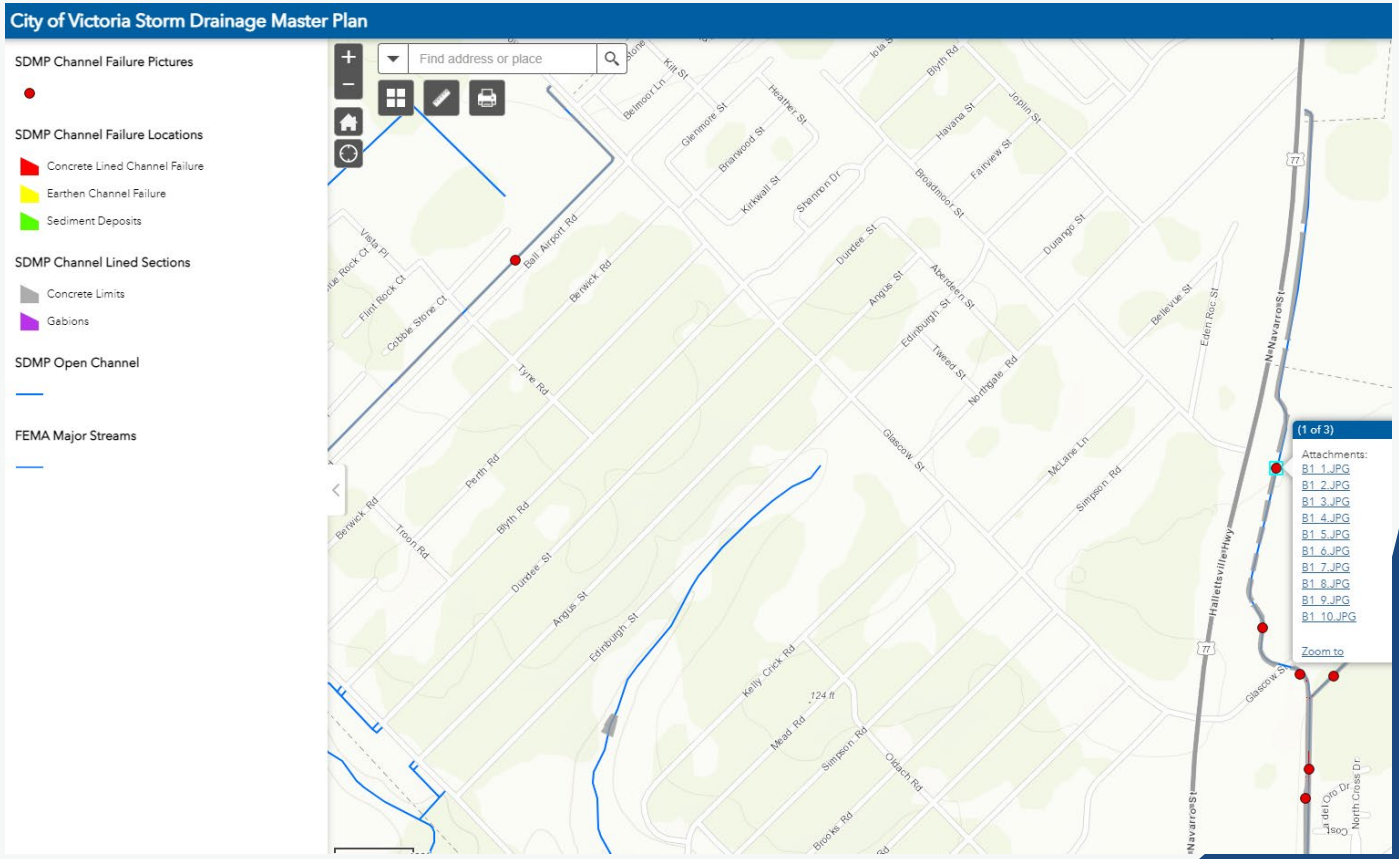
- Roadside Ditches Within City Limits
  - Total Length - 114 Miles
  - Cost To Regrade = $15,030,664
  - Total Length of All Driveway Culverts - 16.3 Miles (3,093 Culverts)
  - Cost To Replace All Driveway Culverts = $43,000,870
- Roadside Ditches & Driveway Culverts (**Priority**)
  - Roadside Ditches (23 miles)
  - Cost To Regrade = $2,961,444
  - Driveway Culverts (669 Culverts)
  - Cost To Replace = $8,697,087
  - Total Cost = $11,658,531
- Deliverable: Technical Memorandum – Attachment 5



CivilTech Engineering, Inc.

Priority Five: Major Outfall Channels (Task G)

- Outfall Channels
  - Field Visits & Drones
  - Total Length Within City Limits - 74 Miles
  - Length of Concrete Lined Channel - 19 Miles
- Concrete Lined Channel Failure
  - Total Repair Area - 33,657 sq ft
  - Cost To Repair = $1,262,145
- Earthen Channel Failure
  - Total Repair Area - 11,829 sq ft
  - Cost To Repair = $591,473
- Channel Sedimentation
  - Total Surface Removal - 227,099 sq ft
  - Cost to Excavate = $908,396
- Deliverable: Technical Memorandum – Attachment 6



CivilTech Engineering, Inc.

2021 SDMP Update - Summary of Cost

In addition to the projected $293 million (2021 dollars) for the 1999/2007 SDMP recommended drainage improvements, the following summarizes the added projects and costs:

1. Priority One: Independent Study Areas
    - Cost for Five Regional Drainage Solutions = $13,279,625*
2. Priority Three: Storm Sewer System Evaluation (Total Cost = $56,082,061)
    - Cost of Replace Storm Sewer Pipes Under 18-Inch Diameter = $39,461,000
    - Cost for Televising/Cleaning Storm Sewers = $16,621,061
3. Priority Four: Roadside Open Ditch Evaluation (Total Cost = $11,658,531)
    - Cost to Regrade Roadside Ditches (Priority) = $2,961,444
    - Cost to Replace Driveway Culvert (Priority) = $8,697,087
4. Priority Five: Major Outfall Channels (Total Cost = $2,762,014)
    - Cost To Repair Concrete Lined Channel Failures = $1,262,145
    - Cost To Repair Earthen Channel Failures = $591,473
    - Cost to Remove Sediments = $908,396

Total Added Cost = $83,782,231 (*does not include ROW and/or Easement acquisition costs)

City of Victoria 2021 SDMP Update Recommendations

SDMP Update Recommendation #1 – Perform detailed watershed restudies for Jim Branch and Marcado Creek to examine alternative channel sections and regional detention options

- Need regional detention plan for Jim Branch and Marcado Creek
- Request grant funds from Texas Water Development Board (TWDB) Flood Infrastructure Funds
- Watershed Planning Budget = $0.4M per watershed

SDMP Update Recommendation #2 – Drainage Maintenance Program

- Establish a drainage maintenance program (annual) for cleaning storm sewer systems (pipe, manholes and inlets) and cleaning/regrading roadside ditches (priority)
- Estimated total cost = $28.3 million
- Consider a Stormwater/Drainage Utility Fee

SDMP Update Recommendation #3 – Channel Erosion Repair and Cleaning Program

- Developed a channel erosion repair project to correct existing failures in concrete-lined channels, channel erosion areas, and sediment deposits
- Estimated total cost = $2.8 million
- Fund through City Capital Improvement Program or Stormwater/Drainage Utility Fee

City of Victoria 2021 SDMP Update Recommendations

SDMP Update Recommendation #4 – Adopt the five regional drainage solutions (Buhler Property Diversion, Shenandoah Ditch, Anthony Road Outfall, Lone Tree Road Outfall, and Clegg Ditch Outfall) into the 1999/2007 SDMP. Cost of improvements = $13.3M (excludes ROW and/or Easement acquisition).

SDMP Update Recommendation #5 – Adopt the new NOAA Atlas 14 rainfall (drainage criteria) and new detention criteria in the City of Victoria Drainage Criteria Manual.

SDMP Update Recommendation #6 – Flood Monitoring Program

Develop a program to track flooding incidents within the City including but not limited to automated stream gages, survey high-water marks, flooded homes and businesses inventory, and street ponding locations. Estimated budget = $0.1M annually.

QUESTIONS?

City of Victoria Storm Drainage Master Plan Update

Attachment No. 1
Technical Memorandum No. 1 – Data Collection and Review

CivilTech
Engineering, Inc.
Civil Engineering
Water Resources
Transportation
Structures
Economic Analysis
GIS
Land Development
Construction Services

Attachment 1

TO: Ken Gill, P.E., – City of Victoria

FROM: Mike McGovern, P.E., CFM – CivilTech Engineering Inc.

DATE: May 20, 2021

RE: Task B - Data Collection and Review

CivilTech Engineering, Inc. (CivilTech) was contracted by the City of Victoria to prepare an update to the City of Victoria Storm Drainage Master Plan. The task, data collection and review (Task B), included creating an online GIS platform. This memorandum presents the data collection effort for each of the task items, and the data available on the web mapping application, description of the data, and the source of the data, and includes an update to the 1999/2007 SDMP construction cost estimate for the recommended drainage improvements based on 2021 dollars. All maps, apps, and layers will be transferred to the City of Victoria GIS department for future internal use. The online GIS platform can be accessed at the following link: https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f

The total construction cost to implement the drainage improvement recommendations in the 1999/2007 SDMP is $170 million (1999 dollars) and updated as $293 million (2021 dollars). The cost does not include ROW and/or easement acquisition or project design fees. The updated 2021 cost construction cost tables replace Appendix 8 in the 1999/2007 SDMP. The updated construction cost tables are enclosed with this memo.

The following outlines the data sources used for each of the subsequent tasks and associated attachments.

1. Data Sourcing

- *Land Use Fiscal Analysis, Victoria, Texas*, dated June 11, 2020, prepared by Verdunity
  - GIS data queried for parcel identification/selection (see Attachment 2)

- Preliminary FEMA floodplains for Victoria County, dated 2020
  - Floodplain layers overlaid parcel boundaries for parcel analysis (see Attachment 2)

- United States Fish and Wildlife National Wetlands Inventory, dated 2019
  - Addressed wetland concerns on studied parcels (see Attachment 2)

- *National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11 Version 2.0: Texas*, Perica, S., Pavlovic, S., St. Laurent, M., Trypaluk, C., Unruh, D., Wihite, O. (2018)

  - Data used for the calculation of Atlas 14 rainfall intensities and rainfall totals (see Attachment 3)

- *City of Victoria Drainage Criteria Manual,* dated May 2007, prepared by PBS&J, Inc.
  - Used for obtaining e, b and d values for the calculation of Pre-Atlas 14 Rainfall intensities (see Attachment 3)
- *Recommendations for: Rainfall Depths and Intensities in Harris County*, dated March 2019, prepared by Harris County Flood Control District (HCFCD).
  - Contained information regarding differences between Partial Duration Series and Annual Maximum Series Rainfall datasets (see Attachment 3)

- *E, b, and d values developed by the Texas Department of Transportation (TxDOT), as outlined on the following website: https://ftp.txdot.gov/pub/txdot/hou/resources/houston-district-ebdlkup-user-manual.pdf*
  - Provided Victoria County e, b and d values for the calculation of Pre-Atlas 14 Rainfall intensities (see Attachment 3)

- Light Detection and Ranging (LiDAR) data obtained from the Texas Natural Resources Information System (TNRIS) from the South Texas LiDAR dataset, dated 2018.
  - Utilized to determine longest flow paths, contributing drainage areas, and utilized in the Rain-On-Grid analysis (Attachment 4)
  - Proposed channel geometry modifications created with the use of 2018 LiDAR data (see Attachment 6)

- *City of Victoria Storm Drainage Master Plan*, dated June 1999 & resubmitted March 2007, prepared by PBS&J, Inc.
  - Used Ultimate Right-of-Way channel characteristics for creating proposed channel geometry (see Attachment 6)
  - Consumer Price Indexed costs are based on major outfall channel modification costs (see Attachment 6)

The following summarizes the data on the ArcGIS web application. It has been broken out by category.

2. SDMP Layers

All layers in this category have been derived by CivilTech Engineering and Urban Engineering and relate to the relevant project priorities. Further information on the methodology for these layers can be found in the relevant attachment. All layers are in NAD 1983 State Plane Texas South Central FIPS 4204 Feet coordinate system and NAVD 1988 vertical datum (when applicable).

SDMP Roadside Ditches and Culverts: This layer was digitized utilizing high-quality City of Victoria aerial imagery 2020 and USGS South Texas LiDAR 2018. Ditches and culverts were checked against available city storm sewer layers for connectivity and proper flow direction. (GIS Metadata found on **Table 1.1**)

SDMP Storm Sewers: These layers combine the underlying data from the City of Victoria storm sewer mains, laterals, and box culverts along with data derived from the project. The storm sewers are visualized in a few layers. (GIS Metadata found on **Table 1.2** and **Table 1.3**)

- Under 18 in pipes are broken down by pipe size to visualize pipes the are undersized.
- Original Level of Service (LOS) is the determined level of service at the time that the pipe was installed. This is based on plat information and city installation records.
- Outfall Pipes are visualized by their calculated LOS (for more information see Attachment 4).
- Non-Outfall Pipes are a derivative dataset from the City of Victoria storm sewers.
- Drainage Areas are storm sewer drainage areas, which were further refined from the 2007 PBS&J Master Drainage Study. This layer is also visualized by the calculated LOS (for more information see Attachment 4).

SDMP Channel Failures: Failures were identified through drone videos and field data collection. Three categories of channel failures were identified: concrete lined channel failure, earthen channel failure, and siltation. Associated pictures can be viewed on the ArcGIS Online Web App. (GIS Metadata found on **Table 1.4**)

SDMP Concrete Lined Channel Sections: Areas of streams with concrete lining were identified from drone videos, aerial imagery, and field data collection. (GIS Metadata found on **Table 1.5**)

SDMP 2020 Drone Flights: Drone Flights were flown starting in October 2020 and were completed in January 2021. All pop-ups include a link to the YouTube video. (GIS Metadata found on **Table 1.6**)

SDMP Ultimate Channel Right of Way: This layer was derived from the Future-Future Condition in the 2007 PBS&J Master Drainage Study and GIS files that were included in the data collected from the PBS&J study. For more information see Attachment 6. (GIS Metadata found on **Table 1.7**)

SDMP Open Channel: Open Channels come from a variety of sources including FEMA Streams, City of Victoria Streams, USGS Streams, aerial imagery, and LiDAR data. This layer includes ditches and creeks. (GIS Metadata found on **Table 1.8**)

SDMP Drainage Features: This layer includes detention ponds, other ponds, and reservoirs in the City of Victoria. These features were digitized based on FEMA layers, aerial imagery, and LiDAR data. (GIS Metadata found on **Table 1.9**)

SDMP Overland Flow Paths: Flow paths are created from LiDAR data input. The ArcHydro tool generates the drainage lines based on the elevation of the area. By specifying the drainage area acres, different sized flow paths are created. This layer shows primarily shows overland sheet flow as well as streams and ditches. (GIS Metadata found on **Table 1.10**)

SDMP Overland Drainage Catchment: This layer is associated with SDMP Flow Paths and also is created from an ArcHydro tool. This layer visualizes 16-acre overland flow catchment areas. (GIS Metadata found on **Table 1.11**)

SDMP Independent Study Areas: These are parcels identified by the city for development. Underlying data is from the Victoria County Appraisal District and parcel map exhibits are attached for relevant information for developing the land. (GIS Metadata found on **Table 1.12**)

SDMP Approximate 100 Yr. Ponding Depth: This layer was generated based on the existing storm sewer system, open channels, ditches, culverts, and LiDAR data. (GIS Metadata found on **Table 1.13**)

3. COV Storm Sewer Layers

These layers were collected from the City of Victoria GIS department. None of these layers have been edited. Layers such as the SDMP Storm Sewers have been derived from these layers. The COV Storm Sewers are for visualization and comparison.

4. COV Other Layers

These are other layers that were collected from the City of Victoria GIS department. They are primarily for visualization. Other layers have been derived from these layers, but the layers in this category remain unchanged from the City's files.

5. 2007 SDMP Layers

These layers were collected from the City of Victoria from the 2007 PBS&J Master Drainage Study. These layers remain largely unchanged from the data provided to use from the 2007 study; however, a few fields were added to provide clarity and reduce the amount of time needed to lookup associated information in the 2007 Storm Drainage Master Plan Report.

6. FEMA Layers

Taken directly from FEMA's database, this data has not been edited. This includes the current preliminary Flood Hazard Zones as of early 2020.

Table 1.1: SDMP Roadside Ditches and Culverts	
Category	Roadside Ditch, driveway culvert or cross road culvert
Length (ft)	Length, in feet, for the line segment
Cost Estimate	Cost estimate to either regrade the roadside ditch or clean the driveway culvert
Culvert Replacement	Cost to replace the culvert, if the category is driveway culvert
Notes	Notes for the cost estimate
Jurisdiction	The owner of the roadside ditch or culvert (City of Victoria or TxDOT)
Action Needed	Identified through field visit if ditches and culverts need regrading/replacing

Table 1.2: SDMP Storm Sewers- Drainage Areas	
Basin	The watershed the pipe can be found in
DA ID	ID of the Basin
Outfall Pipe Capacity LOS	Calculated level of service, determined from the flows of the outfall pipe
Area (ac)	Acreage of the drainage area
Flow 2 yr	Flows for the outfall pipe during a 2 yr storm event, in cfs
Flow 5 yr	Flows for the outfall pipe during a 5 yr storm event, in cfs
Flow 10 yr	Flows for the outfall pipe during a 10 yr storm event, in cfs
Flow 25 yr	Flows for the outfall pipe during a 25 yr storm event, in cfs
Flow 50 yr	Flows for the outfall pipe during a 50 yr storm event, in cfs
Flow 100 yr	Flows for the outfall pipe during a 100 yr storm event, in cfs
Notes	Notes for the drainage area

Table 1.3: SDMP Storm Sewers	
Basin	The watershed the pipe can be found in
Type	Type of pipe: RCB, RCP, CMP, CMP Pipe Arch, HDPE, Unknown
Rise (in)	The diameter of the pipe, in inches, or the rise of the box, in inches
Span (in)	The span of a box, in inches
Barrel Count	The number of barrels
Slope (%)	The slope of the pipe segment
Length (ft)	Length, in feet, of the segment
Cleaning Cost	The cost to clean the segment of pipe
Pipe Capacity	The capacity of that segment, in cfs
Pipe Calculated LOS	The level of service of the segment, determined by the outfall pipe flows
Original LOS	Level of service as determined by the installation date
Replacement Cost	Cost to replace any pipe under 18 in and replace it with an 18 in
Flow 2 yr	Flows for the outfall pipe during a 2 yr storm event, in cfs
Flow 5 yr	Flows for the outfall pipe during a 5 yr storm event, in cfs
Flow 10 yr	Flows for the outfall pipe during a 10 yr storm event, in cfs
Flow 25 yr	Flows for the outfall pipe during a 25 yr storm event, in cfs
Flow 50 yr	Flows for the outfall pipe during a 50 yr storm event, in cfs
Flow 100 yr	Flows for the outfall pipe during a 100 yr storm event, in cfs
Source	The source for the pipe data, City of Victoria
Cost Estimate Notes	Notes for the cost estimate
Outfall Pipe Notes	Notes for the outfall pipes
Original LOS Notes	Notes for the original level of service
Non-Outfall Pipe Notes	Notes for the non-outfall pipes

Table 1.4: SDMP Channel Failure Locations	
Failure ID	ID of the failure, ordered by when it was drawn in
Picture ID	ID of the picture that goes with the failure
Area	Area in square feet of the failure location
Failure Type	Type of failure: concrete lined channel failure, earthen channel failure, sediment deposits
Cost Estimate	Cost estimate to fix the failure type

Table 1.5: SDMP Concrete Lined Channel Sections	
Area	Area of the concrete, in sq feet

Table 1.6: SDMP 2020 Drone Flights	
Outfall	Drainage area location
Flight Number	Flight number in the series of flight in the drainage area
Name	Approximate location of the drone flight
Date Recorded	Date the drone footage was flown
URL	URL attachment to the Youtube video

Table 1.7: SDMP Ultimate Channel Right of Way	
ID	ID of the segment
Stream	Drainage area location
ROW Width	Width of the segment
Slide Slope	Recommended slope of the channel
Bench to High Bank	Recommended bench to high bank
Berm Width	Recommended berm width
Bench to Bottom Width	Recommended bench to bottom width
Cost Estimate 1999	Cost estimate of repairs in the PBS&J Study
Cost Estimate 2021	Costs Consumer Price Indexed to Feb 2021
Cost Estimate Notes	Notes for the cost estimate
Notes	Notes for how the layer was created

Table 1.8: SDMP Open Channel	
Label	Name of the channel, if applicable
Length	Length, in feet
Length	Length, in miles
Type	Type of open channel, ditch or creek

Table 1.9: SDMP Drainage Feature	
Type	Type of feature- detention pond, lake

Table 1.10: SDMP Overland Flow Paths	
Acreage	Acreage associated with each overland flow path

Table 1.11: SDMP Overland Drainage Catchment	
Acreage	Acreage associated with each drainage catchment

Table 1.12: SDMP Independent Study Areas	
Parcel ID	ID of the parcel from the appraisal district
Owner Name	Name of the owner
Area	Area of the parcel, in acres
Legal Description	Legal description from the plat information
Attachment	Associated constraints map for future development

Table 1.13: SDMP Approximate 100 Yr. Ponding Depth	
Depth	Depth of the water, in inches

CITY OF VICTORIA
Jim Branch
Engineer's Preliminary Estimate of Costs (Updated Construction Costs based on July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R0A		Reach R38A		Reach R66A		Reach R102A		Reach R122A		Reach R148A		JB 1:2		JB 1:3	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			2,631		3,165		3,631		1,963		2,684		1,326		4153			
			Estimated ROW width needed for excavated open channel (feet)			301		280		228		208		211		208					
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$47,444	1	$85,181	1	$117,247	1	$41,020	1	$92,708	1	$5,848	1	$83,023		$4,429
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$11,861	1	$21,295	1	$29,312	1	$10,255	1	$23,177	1	$1,462	1	$20,756		$1,107
3	500	501	Mobilization	LS	2.5%	1	$29,652	1	$53,238	1	$73,279	1	$25,638	1	$57,942	1	$3,655	1	$51,889		$2,768
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$17,791	1	$31,943	1	$43,968	1	$15,383	1	$34,765	1	$2,193	1	$31,134		$1,661
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	64,000	$430,080	133,250	$895,440	72,580	$487,738	31,030	$208,522	34,340	$230,765	8,180	$54,970				
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	89,310	$75,021	99,564	$83,633	93,387	$78,445	46,124	$38,744	64,140	$53,878	31,203	$26,211	9,229	$7,752		
10	162	6002	Block sod (St. Augustine)	SY	$3.36													2,307	$7,752		
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	89,310	$112,531	99,564	$125,450	93,387	$117,668	46,124	$58,116	64,140	$80,817	31,203	$39,316	6,922	$8,721		
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47							23,062	$33,901	32,070	$47,143	15,602	$22,934	4,614	$6,783		
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13	29,770	$122,950	33,188	$137,066	31,129	$128,563										
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88													6,922	$123,759		
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21													6,922	$84,514		
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61													33	$53		
17	402	6001	Trench Safety Protection	LF	$1.86													4,153	$7,725		
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00													817	$306,375		
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00													1,361	$596,118		
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00	4,410	$441,000	8,501	$850,100	9,300	$930,000	6,826	$682,600	9,562	$956,200						
29	422	501	Bridge 2 - straightforward	SF	$100.00					5,481	$548,100			4,949	$494,900						
30	422	501	Bridge 3 - straightforward	SF	$100.00					6,348	$634,800			4,494	$449,400						
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50																
34	464	6009	RCP - Class III - 42"	LF	$156.51													1,409	$220,523		
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95													566	$108,078		
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20															10	$53,462
44	465	6018	Inlet - Double	EA	$5,727.52													20	$114,550	10	$57,275
45	465	6020	Inlet - Triple	EA	$6,405.17																
46	465	6584	Drainage MH or JB	EA	$4,573.90													8	$37,991		
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68													1	$14,262		
49	529	6008	Concrete Curb and Gutter	LF	$31.70													2,077	$65,825		
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57													42	$289,114		
52	531	6002	Sidewalk	SY	$54.76													831	$45,484		
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27													42	$8,982		
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	868	$3,538	1,044	$4,256	1,198	$4,883	648	$2,640	886	$3,609	438	$1,783	1,384	$5,641		
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29													42	$14,589		
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978		
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00			1	$32,600												
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$193,927		$348,177		$479,247		$167,669		$378,942		$23,902		$339,356		$18,106
			TOTAL BASE BID (subject to revision)				$1,486,773		$2,669,358		$3,674,227		$1,285,466		$2,905,225		$183,252		$2,601,726		$138,809
			(cost per linear foot =)				$565		$843		$1,012		$655		$1,082		$138		$626		

CITY OF VICTORIA
Jim Branch
Engineer's Preliminary Estimate of Costs (Updated Construction Costs based on July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R148B Ben Jordan		Reach R163A Ben Jordan		JB 2:1 Ben Jordan		JB 2:4		JB 2:5		JB 2:6 Ben Jordan		JB 2 :7 Ben Jordan		JB 2:8 Ben Jordan	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			1,254		2,349		10,131		2,508		2,900		4,780		1,593		2,429	
			Estimated ROW width needed for excavated open channel (feet)			181		179													
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$11,320	1	$16,893	1	$377,253	1	$62,493	1	$56,304	1	$193,111	1	$30,632	1	$42,092
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$2,830	1	$4,223	1	$94,313	1	$15,623	1	$14,076	1	$48,278	1	$7,658	1	$10,523
3	500	501	Mobilization	LS	2.5%	1	$7,075	1	$10,558	1	$235,783	1	$39,058	1	$35,190	1	$120,694	1	$19,145	1	$26,307
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$4,245	1	$6,335	1	$141,470	1	$23,435	1	$21,114	1	$72,417	1	$11,487	1	$15,784
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	30,900	$207,648	32,780	$220,282												
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	25,638	$21,536	47,546	$39,939	22,513	$18,911	5,573	$4,682	6,444	$5,413	10,622	$8,923	3,540	$2,974	5,398	$4,534
10	162	6002	Block sod (St. Augustine)	SY	$3.36					5,628	$18,911	1,393	$4,682	1,611	$5,413	2,656	$8,923	885	$2,974	1,349	$4,534
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	25,638	$32,304	47,546	$59,909	16,885	$21,275	4,180	$5,267	4,833	$6,090	7,967	$10,038	2,655	$3,345	4,048	$5,101
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	12,819	$18,844			11,257	$16,547	2,787	$4,096	3,222	$4,737	5,311	$7,807	1,770	$2,602	2,699	$3,967
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13			15,849	$65,456												
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88					16,885	$301,904	4,180	$74,738	4,833	$86,420	7,967	$142,444	2,655	$47,471	4,048	$72,384
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21					16,885	$206,166	4,180	$51,038	4,833	$59,015	7,967	$97,273	2,655	$32,418	4,048	$49,430
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61					81	$130	20	$32	23	$37	38	$62	13	$21	19	$31
17	402	6001	Trench Safety Protection	LF	$1.86					10,131	$18,844	2,508	$4,665	2,900	$5,394	4,780	$8,891	1,593	$2,963	2,429	$4,518
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00											1,051	$394,125				
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00					861	$377,118	1,170	$512,460	816	$357,408						
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00					1,682	$913,326					1,029	$558,747				
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87					5,697	$5,428,500	160	$152,459			1,771	$1,687,533				
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50											707	$864,308				
28	422	501	Bridge 1 - straightforward	SF	$100.00																
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50									718	$80,775			258	$29,025	616	$69,300
34	464	6009	RCP - Class III - 42"	LF	$156.51																
35	464	6010	RCP - Class III - 48"	LF	$176.52							1,178	$207,941	1,366	$241,126	222	$39,187				
36	464	6011	RCP - Class III - 54"	LF	$190.95																
37	464	6012	RCP - Class III - 60"	LF	$262.86					1,891	$497,068							1,335	$350,918	1,813	$476,565
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20					20	$106,924	20	$106,924	20	$106,924	30	$160,386	10	$53,462	11	$58,808
44	465	6018	Inlet - Double	EA	$5,727.52					30	$171,826	15	$85,913	10	$57,275	30	$171,826	10	$57,275	5	$28,638
45	465	6020	Inlet - Triple	EA	$6,405.17					30	$192,155	10	$64,052	10	$64,052	20	$128,103				
46	465	6584	Drainage MH or JB	EA	$4,573.90					20	$92,676	5	$22,943	6	$26,529	10	$43,726	3	$14,572	5	$22,220
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70					5,066	$160,576	1,254	$39,752	1,450	$45,965	2,390	$75,763	797	$25,249	1,215	$38,500
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57					101	$705,277	25	$174,596	29	$201,886	48	$332,763	16	$110,898	24	$169,097
52	531	6002	Sidewalk	SY	$54.76					2,026	$110,955	502	$27,468	580	$31,761	956	$52,351	319	$17,447	486	$26,602
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27					101	$21,910	25	$5,424	29	$6,272	48	$10,338	16	$3,445	24	$5,253
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	414	$1,686	775	$3,159	3,377	$13,761	836	$3,407	967	$3,939	1,593	$6,493	531	$2,164	810	$3,299
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29					101	$35,589	25	$8,810	29	$10,187	48	$16,792	16	$5,596	24	$8,533
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00			1	$32,600												
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$46,270		$69,050		$1,542,022		$255,440		$230,142		$789,342		$125,208		$172,050
			TOTAL BASE BID (subject to revision)				$354,735		$529,380		$11,822,171		$1,958,375		$1,764,422		$6,051,620		$959,925		$1,319,049
			(cost per linear foot =)				$283		$225		$1,167		$781		$608		$1,266		$603		$543

CITY OF VICTORIA
Jim Branch
Engineer's Preliminary Estimate of Costs (Updated Construction Costs based on July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	JB 2:9 Ben Jordan Quantity	JB 2:9 Ben Jordan Sheet $	JB 2:10 Ben Jordan Quantity	JB 2:10 Ben Jordan Sheet $	**JIM BRANCH Overall Project Quantity**	**JIM BRANCH Overall Project Total $**
			Length of individual Reach (feet)			2,625		1,377		51,499	
			Estimated ROW width needed for excavated open channel (feet)								
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$51,012	1	$36,953	17	$1,354,962
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$12,753	1	$9,238	17	$338,740
3	500	501	Mobilization	LS	2.5%	1	$31,883	1	$23,095	17	$846,851
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$19,130	1	$13,857	17	$508,111
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37						
6	110	6002	Excavation - channel	CY	$6.72					407,060	$2,735,443
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08						
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08						
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	5,833	$4,900	3,060	$2,570	569,127	$478,066
10	162	6002	Block sod (St. Augustine)	SY	$3.36	1,458	$4,900	765	$2,570	18,053	$60,659
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	4,375	$5,513	2,295	$2,892	551,073	$694,352
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	2,917	$4,288	1,530	$2,249	119,660	$175,900
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13					109,936	$454,035
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	4,375	$78,225	2,295	$41,035	54,160	$968,381
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	4,375	$53,419	2,295	$28,022	54,160	$661,294
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	21	$34	11	$18	260	$419
17	402	6001	Trench Safety Protection	LF	$1.86	2,625	$4,883	1,377	$2,561	32,496	$60,443
18	423	6008	Retaining walls (cast in place)	SF	$63.80						
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29						
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00						
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00	733	$274,875	1,377	$516,375	3,978	$1,491,750
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00	521	$228,198			4,729	$2,071,302
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00					2,711	$1,472,073
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46						
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87					7,628	$7,268,492
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48						
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50					707	$864,308
28	422	501	Bridge 1 - straightforward	SF	$100.00					38,599	$3,859,900
29	422	501	Bridge 2 - straightforward	SF	$100.00					10,430	$1,043,000
30	422	501	Bridge 3 - straightforward	SF	$100.00					10,842	$1,084,200
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00						
32	464	6005	RCP - Class III - 24"	LF	$67.49						
33	464	6008	RCP - Class III - 36"	LF	$112.50	519	$58,388			2,111	$237,488
34	464	6009	RCP - Class III - 42"	LF	$156.51					1,409	$220,523
35	464	6010	RCP - Class III - 48"	LF	$176.52	852	$150,395			3,618	$638,649
36	464	6011	RCP - Class III - 54"	LF	$190.95					566	$108,078
37	464	6012	RCP - Class III - 60"	LF	$262.86					5,039	$1,324,552
38	464	6013	RCP - Class III - 66"	LF	$294.00						
39	464	6014	RCP - Class III - 72"	LF	$336.00						
40	464	516	RCP - Class III - 78"	LF	$378.00						
41	464	517	RCP - Class III - 84"	LF	$462.00						
42	464	518	RCP - Class III - 96"	LF	$546.00						
43	465	6017	Inlet - Single	EA	$5,346.20	10	$53,462	15	$80,193	146	$780,545
44	465	6018	Inlet - Double	EA	$5,727.52	10	$57,275	10	$57,275	150	$859,128
45	465	6020	Inlet - Triple	EA	$6,405.17			5	$32,026	75	$480,388
46	465	6584	Drainage MH or JB	EA	$4,573.90	5	$24,013	3	$12,597	65	$297,267
47	466	501	Headwall - small	EA	$3,446.93						
48	466	501	Headwall - large	EA	$14,261.68					1	$14,262
49	529	6008	Concrete Curb and Gutter	LF	$31.70	1,313	$41,606	689	$21,825	16,248	$515,062
50	529	6030	Concrete Valley Gutter	LF	$25.45						
51	530	604	Remove & Replace Driveway	EA	$6,961.57	26	$182,741	14	$95,861	325	$2,262,232
52	531	6002	Sidewalk	SY	$54.76	525	$28,749	275	$15,081	6,499	$355,896
53	550	501	Chain Link Fence - 6ft.	LF	$21.10						
54	560	6001	Mailbox Assembly	EA	$216.27	26	$5,677	14	$2,978	325	$70,279
55	580	none	Project Maintenance (subsidiary)								
56	459	6001	Gabions	CY	$212.30						
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50						
58	639	none	Rock Berm	LF	$1,467.00						
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	875	$3,566	459	$1,870	17,103	$69,695
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	26	$9,221	14	$4,837	325	$114,155
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	17	$16,626
62	528	6002	Conlock II pavers	SY	$52.88						
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00					2	$65,200
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00						
65	506	6001	Pump		$285,250.00						
66	xx	xx									
End of Current BASE BID specification items and unit prices											
			Contingency =	15%			$208,512		$151,044		$5,538,405
			TOTAL BASE BID (subject to revision)				$1,598,594		$1,158,000		$42,461,108
			(cost per linear foot =)				$609		$841		$825

CITY OF VICTORIA
South Outfall
Engineer's Preliminary Estimate of Costs (Updated Construction Costs based on July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R0A		Reach R45A		Reach R76A		SO 1:1		SO 1:2		SO 1:3		SO 1:4		SOUTH OUTFALL Overall Project	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	**Quantity**	**Total $**
			Length of individual Reach (feet)			3,342		3,263		1,130		7,944		6,069		2,341		1,953		26,042	
			Estimated ROW width needed for excavated open channel (feet)			155		168		143											
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$30,403	1	$56,878	1	$6,686	1	$195,903	1	$148,028	1	$47,824	1	$28,243	7	$513,965
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$7,601	1	$14,219	1	$1,672	1	$48,976	1	$37,007	1	$11,956	1	$7,061	7	$128,491
3	500	501	Mobilization	LS	2.5%	1	$19,002	1	$35,549	1	$4,179	1	$122,440	1	$92,518	1	$29,890	1	$17,652	7	$321,228
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$11,401	1	$21,329	1	$2,507	1	$73,464	1	$55,511	1	$17,934	1	$10,591	7	$192,737
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	48,900	$328,608	28,770	$193,334	10,080	$67,738									87,750	$589,680
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	58,903	$49,478	62,486	$52,488	18,501	$15,540	17,653	$14,829	13,487	$11,329	5,202	$4,370	4,340	$3,646	180,572	$151,680
10	162	6002	Block sod (St. Augustine)	SY	$3.36							4,413	$14,829	3,372	$11,329	1,301	$4,370	1,085	$3,646	10,171	$34,173
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	58,903	$74,217	62,486	$78,733	18,501	$23,311	13,240	$16,682	10,115	$12,745	3,902	$4,916	3,255	$4,101	170,401	$214,705
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	29,451	$43,294					8,827	$12,975	6,743	$9,913	2,601	$3,824	2,170	$3,190	49,792	$73,195
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13			20,829	$86,023	6,167	$25,469									26,996	$111,492
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88							13,240	$236,731	10,115	$180,856	3,902	$69,762	3,255	$58,199	30,512	$545,549
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21							13,240	$161,660	10,115	$123,504	3,902	$47,639	3,255	$39,744	30,512	$372,547
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61							64	$102	49	$78	19	$30	16	$25	146	$236
17	402	6001	Trench Safety Protection	LF	$1.86							7,944	$14,776	6,069	$11,288	2,341	$4,354	1,953	$3,633	18,307	$34,051
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00							3,357	$1,258,875	644	$241,500					4,001	$1,500,375
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00									1,492	$653,496	1,174	$514,212			2,666	$1,167,708
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00							3,248	$1,763,664	2,476	$1,344,468					5,724	$3,108,132
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00	2,590	$259,000	2,730	$273,000											5,320	$532,000
29	422	501	Bridge 2 - straightforward	SF	$100.00			2,870	$287,000											2,870	$287,000
30	422	501	Bridge 3 - straightforward	SF	$100.00			3,808	$380,800											3,808	$380,800
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49							564	$38,064	746	$50,348					1,310	$88,412
33	464	6008	RCP - Class III - 36"	LF	$112.50									711	$79,988			751	$84,488	1,462	$164,475
34	464	6009	RCP - Class III - 42"	LF	$156.51											1,167	$182,647			1,167	$182,647
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95							775	$147,986					1,202	$229,522	1,977	$377,508
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20							20	$106,924	20	$106,924	10	$53,462	6	$32,077	56	$299,387
44	465	6018	Inlet - Double	EA	$5,727.52							15	$85,913	20	$114,550	5	$28,638	4	$22,910	44	$252,011
45	465	6020	Inlet - Triple	EA	$6,405.17							20	$128,103	10	$64,052	2	$12,810			32	$204,965
46	465	6584	Drainage MH or JB	EA	$4,573.90							16	$72,670	12	$55,518	5	$21,415	4	$17,866	37	$167,469
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70							3,972	$125,912	3,035	$96,194	1,171	$37,105	977	$30,955	9,154	$290,166
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57							79	$553,027	61	$422,498	23	$162,970	20	$135,959	183	$1,274,455
52	531	6002	Sidewalk	SY	$54.76							1,589	$87,003	1,214	$66,468	468	$25,639	391	$21,389	3,661	$200,498
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27							79	$17,180	61	$13,125	23	$5,063	20	$4,224	183	$39,593
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	1,103	$4,494	1,077	$4,388	373	$1,520	2,648	$10,791	2,023	$8,244	780	$3,180	651	$2,653	8,655	$35,269
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29							79	$27,906	61	$21,320	23	$8,224	20	$6,861	183	$64,311
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	7	$6,846
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00			2	$65,200	1	$32,600									3	$97,800
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$124,271		$232,488		$27,330		$800,755		$605,066		$195,482		$115,442		$2,100,833
			TOTAL BASE BID (subject to revision)				$952,747		$1,782,407		$209,529		$6,139,120		$4,638,841		$1,498,694		$885,052		$16,106,390
			(cost per linear foot =)				$285		$546		$185		$773		$764		$640		$453		$618

CITY OF VICTORIA
Second Street Outfall
Engineer's Preliminary Estimate of Costs (Updated Construction Costs based on July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	SS 1:1		SS 1:2		SS 1:3		SS 2:1		SS 2:1 Diversion		SS 2:1 Pump		SS 2:2		SS 2:3	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			3,779		3,605		1,442		6,250		655						2,028	
			Estimated ROW width needed for excavated open channel (feet)																		
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$112,888	1	$82,906	1	$29,312	1	$137,384	1	$14,373	1	$23,380		$1,100	1	$27,274
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$28,222	1	$20,726	1	$7,328	1	$34,346	1	$3,593	1	$5,845		$275	1	$6,819
3	500	501	Mobilization	LS	2.5%	1	$70,555	1	$51,816	1	$18,320	1	$85,865	1	$8,983	1	$14,612		$687	1	$17,046
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$42,333	1	$31,090	1	$10,992	1	$51,519	1	$5,390	1	$8,767		$412	1	$10,228
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72											11,000	$73,920				
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	8,398	$7,054	8,011	$6,729	3,204	$2,692	13,889	$11,667	1,456	$1,223					4,507	$3,786
10	162	6002	Block sod (St. Augustine)	SY	$3.36	2,099	$7,054	2,003	$6,729	801	$2,692	3,472	$11,667	364	$1,223					1,127	$3,786
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	6,298	$7,936	6,008	$7,571	2,403	$3,028	10,417	$13,125	1,092	$1,376	7,000	$8,820			3,380	$4,259
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	4,199	$6,172	4,006	$5,888	1,602	$2,355	6,944	$10,208	728	$1,070					2,253	$3,312
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	6,298	$112,614	6,008	$107,429	2,403	$42,972	10,417	$186,250	1,092	$19,519					3,380	$60,434
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	6,298	$76,903	6,008	$73,362	2,403	$29,345	10,417	$127,188	1,092	$13,329					3,380	$41,270
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	30	$49	29	$46	12	$19	50	$81	5	$8					16	$26
17	402	6001	Trench Safety Protection	LF	$1.86	3,779	$7,029	3,605	$6,705	1,442	$2,682	6,250	$11,625	655	$1,218					2,028	$3,772
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00							3,690	$1,383,750	655	$245,625	360	$135,000				
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00	1,168	$511,584					983	$430,554								
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00	347	$188,421	1,626	$882,918												
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87	1,259	$1,199,663														
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00																
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49															335	$22,609
33	464	6008	RCP - Class III - 36"	LF	$112.50	347	$39,038	939	$105,638			1,315	$147,938							335	$37,688
34	464	6009	RCP - Class III - 42"	LF	$156.51															1,028	$160,892
35	464	6010	RCP - Class III - 48"	LF	$176.52	658	$116,150					262	$46,248							330	$58,252
36	464	6011	RCP - Class III - 54"	LF	$190.95			1,040	$198,588												
37	464	6012	RCP - Class III - 60"	LF	$262.86					1,442	$379,044										
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20	5	$26,731	16	$85,539	11	$58,808	20	$106,924					3	$16,039	3	$16,039
44	465	6018	Inlet - Double	EA	$5,727.52	10	$57,275	20	$114,550	8	$45,820	20	$114,550					2	$11,455	3	$17,183
45	465	6020	Inlet - Triple	EA	$6,405.17	5	$32,026	10	$64,052			20	$128,103							3	$19,216
46	465	6584	Drainage MH or JB	EA	$4,573.90	8	$34,570	7	$32,978	3	$13,191	13	$57,174	1	$5,992					4	$18,552
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70	1,890	$59,897	1,803	$57,139	721	$22,856	3,125	$99,063	328	$10,382					1,014	$32,144
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57	38	$263,078	36	$250,965	14	$100,386	63	$435,098	7	$45,598					20	$141,181
52	531	6002	Sidewalk	SY	$54.76	756	$41,388	721	$39,482	288	$15,793	1,250	$68,450	131	$7,174					406	$22,211
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27	38	$8,173	36	$7,797	14	$3,119	63	$13,517	7	$1,417					20	$4,386
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	1,260	$5,133	1,202	$4,897	481	$1,959	2,083	$8,490	218	$890					676	$2,755
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	38	$13,275	36	$12,664	14	$5,066	63	$21,956	7	$2,301					20	$7,124
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978					1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00											1	$81,500				
65	420	none	Pump		$285,250.00											1	$285,250				
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$461,428		$338,877		$119,813		$561,557		$58,749		$95,564		$4,495		$111,483
			TOTAL BASE BID (subject to revision)				$3,537,616		$2,598,059		$918,568		$4,305,273		$450,409		$732,658		$34,463		$854,701
			(cost per linear foot =)				$936		$721		$637		$689		$688						$421

CITY OF VICTORIA
Second Street Outfall
Engineer's Preliminary Estimate of Costs (Updated Construction Costs based on July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	SS 2:4		SS 2:5		SS 2:6		SS 2:7		SS 2:8		**Second Street Overall Project**	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	**Quantity**	**Total $**
			Length of individual Reach (feet)			369		2,322		1,395		1,385		2,652		25,227	
			Estimated ROW width needed for excavated open channel (feet)														
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$6,987	1	$38,715	1	$39,241	1	$19,296	1	$42,502		$537,605
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$1,747	1	$9,679	1	$9,810	1	$4,824	1	$10,626		$134,401
3	500	501	Mobilization	LS	2.5%	1	$4,367	1	$24,197	1	$24,526	1	$12,060	1	$26,564		$336,003
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$2,620	1	$14,518	1	$14,715	1	$7,236	1	$15,938		$201,602
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37												
6	110	6002	Excavation - channel	CY	$6.72												
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08												
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08												
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	820	$689	5,160	$4,334	3,100	$2,604	3,078	$2,585	5,893	$4,950		$47,090
10	162	6002	Block sod (St. Augustine)	SY	$3.36	205	$689	1,290	$4,334	775	$2,604	769	$2,585	1,473	$4,950		$47,090
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	615	$775	3,870	$4,876	2,325	$2,930	2,308	$2,909	4,420	$5,569		$52,977
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	410	$603	2,580	$3,793	1,550	$2,279	1,539	$2,262	2,947	$4,332		$41,204
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13												
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	615	$10,996	3,870	$69,196	2,325	$41,571	2,308	$41,273	4,420	$79,030		$751,765
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	615	$7,509	3,870	$47,253	2,325	$28,388	2,308	$28,185	4,420	$53,968		$513,369
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	3	$5	19	$30	11	$18	11	$18	21	$34		$325
17	402	6001	Trench Safety Protection	LF	$1.86	369	$686	2,322	$4,319	1,395	$2,595	1,385	$2,576	2,652	$4,933		$46,922
18	423	6008	Retaining walls (cast in place)	SF	$63.80												
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29												
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00												
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00												$1,383,750
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00					717	$314,046						$1,256,184
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00												$1,071,339
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46												
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87												$1,199,663
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48												
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50												
28	422	501	Bridge 1 - straightforward	SF	$100.00												
29	422	501	Bridge 2 - straightforward	SF	$100.00												
30	422	501	Bridge 3 - straightforward	SF	$100.00												
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00												
32	464	6005	RCP - Class III - 24"	LF	$67.49												$22,609
33	464	6008	RCP - Class III - 36"	LF	$112.50							660	$74,250	329	$37,013		$441,563
34	464	6009	RCP - Class III - 42"	LF	$156.51	369	$57,752	1,002	$156,823			725	$113,470	661	$103,453		$592,390
35	464	6010	RCP - Class III - 48"	LF	$176.52									666	$117,562		$338,212
36	464	6011	RCP - Class III - 54"	LF	$190.95												$198,588
37	464	6012	RCP - Class III - 60"	LF	$262.86			1,320	$346,975					996	$261,809		$987,828
38	464	6013	RCP - Class III - 66"	LF	$294.00												
39	464	6014	RCP - Class III - 72"	LF	$336.00					678	$227,808						$227,808
40	464	516	RCP - Class III - 78"	LF	$378.00												
41	464	517	RCP - Class III - 84"	LF	$462.00												
42	464	518	RCP - Class III - 96"	LF	$546.00												
43	465	6017	Inlet - Single	EA	$5,346.20	3	$16,039	4	$21,385	15	$80,193	5	$26,731	5	$26,731		$481,158
44	465	6018	Inlet - Double	EA	$5,727.52	3	$17,183	4	$22,910	15	$85,913	5	$28,638	8	$45,820		$561,297
45	465	6020	Inlet - Triple	EA	$6,405.17	3	$19,216	3	$19,216	5	$32,026			2	$12,810		$326,664
46	465	6584	Drainage MH or JB	EA	$4,573.90	1	$3,376	5	$21,241	3	$12,761	3	$12,670	5	$24,260		$230,772
47	466	501	Headwall - small	EA	$3,446.93												
48	466	501	Headwall - large	EA	$14,261.68												
49	529	6008	Concrete Curb and Gutter	LF	$31.70	185	$5,849	1,161	$36,804	698	$22,111	693	$21,952	1,326	$42,034		$399,848
50	529	6030	Concrete Valley Gutter	LF	$25.45												
51	530	604	Remove & Replace Driveway	EA	$6,961.57	4	$25,688	23	$161,648	14	$97,114	14	$96,418	27	$184,621		$1,756,195
52	531	6002	Sidewalk	SY	$54.76	74	$4,041	464	$25,431	279	$15,278	277	$15,169	530	$29,045		$276,286
53	550	501	Chain Link Fence - 6ft.	LF	$21.10												
54	560	6001	Mailbox Assembly	EA	$216.27	4	$798	23	$5,022	14	$3,017	14	$2,995	27	$5,735		$54,558
55	580	none	Project Maintenance (subsidiary)														
56	459	6001	Gabions	CY	$212.30												
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50												
58	639	none	Rock Berm	LF	$1,467.00												
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	123	$501	774	$3,154	465	$1,895	462	$1,881	884	$3,602		$34,267
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	4	$1,296	23	$8,157	14	$4,900	14	$4,865	27	$9,316		$88,620
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978		$9,780
62	528	6002	Conlock II pavers	SY	$52.88												
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00												
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00												
65	420	none	Pump		$285,250.00												
66	xx	xx															
End of Current BASE BID specification items and unit prices																	
			Contingency =	15%			$28,558		$158,248		$160,398		$78,874		$173,728		$2,197,460
			TOTAL BASE BID (subject to revision)				$218,946		$1,213,234		$1,229,718		$604,700		$1,331,914		$16,847,193
			(cost per linear foot =)				$593		$522		$882		$437		$502		$668

CITY OF VICTORIA
West Outfall
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R0A		Reach R0B		Reach R20A		Reach R32		Reach R48		Reach R67		Reach R85A		Reach R100A	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			441		1,869		676		1,659		1,964		1,753		1,462		948	
			Estimated ROW width needed for excavated open channel (feet)			455		413		378		378		366		261		128		129	
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$14,273	1	$43,764	1	$28,306	1	$34,535	1	$40,061	1	$83,681	1	$156,227	1	$2,109
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$3,568	1	$10,941	1	$7,076	1	$8,634	1	$10,015	1	$20,920	1	$39,057	1	$527
3	500	501	Mobilization	LS	2.5%	1	$8,921	1	$27,352	1	$17,691	1	$21,584	1	$25,038	1	$52,301	1	$97,642	1	$1,318
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$5,353	1	$16,411	1	$10,615	1	$12,951	1	$15,023	1	$31,380	1	$58,585	1	$791
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	43,310	$291,043	125,640	$844,301	92,950	$624,624	98,370	$661,046	109,690	$737,117	33,260	$223,507	14,420	$96,902	1,280	$8,602
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	22,653	$19,028	86,877	$72,976	28,620	$24,041	70,237	$58,999	80,486	$67,608	51,351	$43,135	22,526	$18,922	14,772	$12,408
10	162	6002	Block sod (St. Augustine)	SY	$3.36																
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	22,653	$28,543	86,877	$109,465	28,620	$36,061	70,237	$88,498	80,486	$101,412	51,351	$64,702	22,526	$28,383	14,772	$18,612
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	11,326	$16,650	43,438	$63,854	14,310	$21,036	35,118	$51,624	40,243	$59,157	25,676	$37,743			7,386	$10,857
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13													7,509	$31,011		
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88																
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21																
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61																
17	402	6001	Trench Safety Protection	LF	$1.86																
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00																
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00											11,036	$1,103,600	11,349	$1,134,900		
29	422	501	Bridge 2 - straightforward	SF	$100.00											6,160	$616,000	25,600	$2,560,000		
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50																
34	464	6009	RCP - Class III - 42"	LF	$156.51																
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95																
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20																
44	465	6018	Inlet - Double	EA	$5,727.52																
45	465	6020	Inlet - Triple	EA	$6,405.17																
46	465	6584	Drainage MH or JB	EA	$4,573.90																
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70																
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57																
52	531	6002	Sidewalk	SY	$54.76																
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27																
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	146	$593	617	$2,513	223	$909	547	$2,231	648	$2,641	578	$2,357	482	$1,966	313	$1,275
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29																
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00									1	$32,600			1	$32,600		
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$58,343		$178,883		$115,700		$141,162		$163,747		$342,046		$638,576		$8,622
			TOTAL BASE BID (subject to revision)				$447,293		$1,371,439		$887,037		$1,082,243		$1,255,397		$2,622,351		$4,895,749		$66,099
			(cost per linear foot =)				$1,014		$734		$1,312		$652		$639		$1,496		$3,349		$70

CITY OF VICTORIA
West Outfall
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Bridge Reach R101A		Bridge Reach R113A		WO 1:1		WO 1:2		WO 1:3		WO 2:2		WO 2:3		WO 2:4	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			433		1,274		4,361				2,771				4,349		3,802	
			Estimated ROW width needed for excavated open channel (feet)																		
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$23,870	1	$27,884	1	$107,548		$1,543	1	$41,087		$2,215	1	$91,255	1	$63,709
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$5,968	1	$6,971	1	$26,887		$386	1	$10,272		$554	1	$22,814	1	$15,927
3	500	501	Mobilization	LS	2.5%		$14,919		$17,427	1	$67,218		$964	1	$25,679		$1,384	1	$57,034	1	$39,818
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%		$8,951		$10,456	1	$40,331		$579	1	$15,408		$831	1	$34,221	1	$23,891
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72																
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84					9,691	$8,141			6,158	$5,173			9,664	$8,118	8,449	$7,097
10	162	6002	Block sod (St. Augustine)	SY	$3.36					2,423	$8,141			1,539	$5,173			2,416	$8,118	2,112	$7,097
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26					7,268	$9,158			4,618	$5,819			7,248	$9,133	6,337	$7,984
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47					4,846	$7,123			3,079	$4,526			4,832	$7,103	4,224	$6,210
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88					7,268	$129,958			4,618	$82,576			7,248	$129,600	6,337	$113,300
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21					7,268	$88,746			4,618	$56,390			7,248	$88,502	6,337	$77,371
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61					35	$56			22	$36			35	$56	30	$49
17	402	6001	Trench Safety Protection	LF	$1.86					4,361	$8,111			2,771	$5,154			4,349	$8,089	3,802	$7,072
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00					1,679	$629,625							3,162	$1,185,750		
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00					1,845	$1,001,835										
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00	5,952	$595,200	6,944	$694,400												
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50									743	$83,588						
34	464	6009	RCP - Class III - 42"	LF	$156.51					837	$130,999									1,404	$219,740
35	464	6010	RCP - Class III - 48"	LF	$176.52									616	$108,736			496	$87,554		
36	464	6011	RCP - Class III - 54"	LF	$190.95									1,412	$269,621			691	$131,946		
37	464	6012	RCP - Class III - 60"	LF	$262.86															2,398	$630,338
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20					10	$53,462	4	$21,385	5	$26,731	5	$26,731	7	$37,423	5	$26,731
44	465	6018	Inlet - Double	EA	$5,727.52					10	$57,275	3	$17,183	5	$28,638	5	$28,638	10	$57,275	5	$28,638
45	465	6020	Inlet - Triple	EA	$6,405.17					10	$64,052			5	$32,026			5	$32,026	5	$32,026
46	465	6584	Drainage MH or JB	EA	$4,573.90					9	$39,894			6	$25,349			9	$39,784	8	$34,780
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70					2,181	$69,122			1,386	$43,920			2,175	$68,932	1,901	$60,262
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57					44	$303,594			28	$192,905			43	$302,759	38	$264,679
52	531	6002	Sidewalk	SY	$54.76					872	$47,762			554	$30,348			870	$47,630	760	$41,640
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27					44	$9,432			28	$5,993			43	$9,406	38	$8,223
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	143	$582	420	$1,713	1,454	$5,924			924	$3,764			1,450	$5,907	1,267	$5,164
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29					44	$15,320			28	$9,734			43	$15,278	38	$13,356
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978			1	$978			1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$97,570		$113,974		$439,603		$6,306		$167,943		$9,053		$373,004		$260,412
			TOTAL BASE BID (subject to revision)				$748,039		$873,804		$3,370,293		$48,344		$1,287,565		$69,405		$2,859,695		$1,996,491
			(cost per linear foot =)				$1,728		$686		$773				$465				$658		$525

CITY OF VICTORIA
West Outfall
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	WO 2:5		WO 2:6		WO 2:7		WO 3:1		WO 3:8		WO 3:9		WO 3:10		WO 3:11	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			6,268		1,431		1,978		7,148		3,267		3,772				3,367	
			Estimated ROW width needed for excavated open channel (feet)																		
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$221,924	1	$34,486	1	$40,430	1	$325,634	1	$84,547	1	$110,504		$1,543	1	$61,479
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$55,481	1	$8,622	1	$10,108	1	$81,408	1	$21,137	1	$27,626		$386	1	$15,370
3	500	501	Mobilization	LS	2.5%	1	$138,703	1	$21,554	1	$25,269	1	$203,521	1	$52,842	1	$69,065		$964	1	$38,424
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$83,222	1	$12,932	1	$15,161	1	$122,113	1	$31,705	1	$41,439		$579	1	$23,055
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72																
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	13,929	$11,700	3,180	$2,671	4,396	$3,692	15,884	$13,343	7,260	$6,098	8,382	$7,041			7,482	$6,285
10	162	6002	Block sod (St. Augustine)	SY	$3.36	3,482	$11,700	795	$2,671	1,099	$3,692	3,971	$13,343	1,815	$6,098	2,096	$7,041			1,871	$6,285
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	10,447	$13,163	2,385	$3,005	3,297	$4,154	11,913	$15,011	5,445	$6,861	6,287	$7,921			5,612	$7,071
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	6,964	$10,238	1,590	$2,337	2,198	$3,231	7,942	$11,675	3,630	$5,336	4,191	$6,161			3,741	$5,499
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	10,447	$186,786	2,385	$42,644	3,297	$58,944	11,913	$213,010	5,445	$97,357	6,287	$112,406			5,612	$100,337
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	10,447	$127,554	2,385	$29,121	3,297	$40,252	11,913	$145,462	5,445	$66,483	6,287	$76,760			5,612	$68,518
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	50	$81	11	$18	16	$25	57	$92	26	$42	30	$49			27	$43
17	402	6001	Trench Safety Protection	LF	$1.86	6,268	$11,658	1,431	$2,662	1,978	$3,679	7,148	$13,295	3,267	$6,077	3,772	$7,016			3,367	$6,263
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00			310	$116,250	1,015	$380,625			1,786	$669,750					608	$228,000
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00	997	$436,686	755	$330,690					1,481	$648,678	1,314	$575,532				
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00							948	$514,764			2,458	$1,334,694				
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87	3,624	$3,453,201					1,339	$1,275,893								
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50							3,276	$4,004,910								
28	422	501	Bridge 1 - straightforward	SF	$100.00																
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50															552	$62,100
34	464	6009	RCP - Class III - 42"	LF	$156.51																
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95	1,647	$314,495	366	$69,888	963	$183,885										
37	464	6012	RCP - Class III - 60"	LF	$262.86															2,207	$580,132
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00							1,585	$532,560								
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20	10	$53,462	7	$37,423	6	$32,077	30	$160,386	10	$53,462	13	$69,501	4	$21,385	6	$32,077
44	465	6018	Inlet - Double	EA	$5,727.52	20	$114,550	5	$28,638	6	$34,365	40	$229,101	20	$114,550	12	$68,730	3	$17,183	5	$28,638
45	465	6020	Inlet - Triple	EA	$6,405.17	15	$96,078	5	$32,026	6	$38,431	30	$192,155	10	$64,052	10	$64,052			4	$25,621
46	465	6584	Drainage MH or JB	EA	$4,573.90	13	$57,338	3	$13,091	4	$18,094	14	$65,388	7	$29,886	8	$34,506			7	$30,801
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70	3,134	$99,348	716	$22,681	989	$31,351	3,574	$113,296	1,634	$51,782	1,886	$59,786			1,684	$53,367
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57	63	$436,351	14	$99,620	20	$137,700	71	$497,613	33	$227,434	38	$262,590			34	$234,396
52	531	6002	Sidewalk	SY	$54.76	1,254	$68,647	286	$15,672	396	$21,663	1,430	$78,285	653	$35,780	754	$41,311			673	$36,875
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27	63	$13,556	14	$3,095	20	$4,278	71	$15,459	33	$7,066	38	$8,158			34	$7,282
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	2,089	$8,514	477	$1,944	659	$2,687	2,383	$9,709	1,089	$4,438	1,257	$5,124			1,122	$4,574
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	63	$22,019	14	$5,027	20	$6,949	71	$25,110	33	$11,477	38	$13,251			34	$11,828
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978			1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$907,115		$140,962		$165,258		$1,331,027		$345,587		$451,686		$6,306		$251,294
			TOTAL BASE BID (subject to revision)				$6,954,547		$1,080,707		$1,266,979		$10,204,542		$2,649,504		$3,462,927		$48,344		$1,926,591
			(cost per linear foot =)				$1,110		$755		$641		$1,428		$811		$918				$572

CITY OF VICTORIA
West Outfall
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	WO 3:12		WO 3:13		WO 3:14		WO 3:15		WO 3:16		WO 3:17		WO 3:18 plugged		WO 3:19 plugged	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			1,072		558		1,217		1,502		2,195		952					
			Estimated ROW width needed for excavated open channel (feet)																		
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$14,389	1	$7,277	1	$14,779	1	$35,391	1	$43,195	1	$24,982				
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$3,597	1	$1,819	1	$3,695	1	$8,848	1	$10,799	1	$6,246				
3	500	501	Mobilization	LS	2.5%	1	$8,993	1	$4,548	1	$9,237	1	$22,119	1	$26,997	1	$15,614				
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$5,396	1	$2,729	1	$5,542	1	$13,272	1	$16,198	1	$9,368				
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72																
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	2,382	$2,001	1,240	$1,042	2,704	$2,272	3,338	$2,804	4,878	$4,097	2,116	$1,777				
10	162	6002	Block sod (St. Augustine)	SY	$3.36	596	$2,001	310	$1,042	676	$2,272	834	$2,804	1,219	$4,097	529	$1,777				
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	1,787	$2,251	930	$1,172	2,028	$2,556	2,503	$3,154	3,658	$4,610	1,587	$1,999				
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	1,191	$1,751	620	$911	1,352	$1,988	1,669	$2,453	2,439	$3,585	1,058	$1,555				
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	1,787	$31,946	930	$16,628	2,028	$36,267	2,503	$44,760	3,658	$65,411	1,587	$28,370				
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	1,787	$21,815	930	$11,355	2,028	$24,766	2,503	$30,566	3,658	$44,668	1,587	$19,373				
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	9	$14	4	$7	10	$16	12	$19	18	$28	8	$12				
17	402	6001	Trench Safety Protection	LF	$1.86	1,072	$1,994	558	$1,038	1,217	$2,264	1,502	$2,794	2,195	$4,083	952	$1,771				
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00							1,502	$563,250	1,164	$436,500	952	$357,000				
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00																
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49	296	$19,977														
33	464	6008	RCP - Class III - 36"	LF	$112.50			558	$62,775	1,217	$136,913										
34	464	6009	RCP - Class III - 42"	LF	$156.51	776	$121,452														
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95									1,031	$196,869						
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20	4	$21,385	2	$10,692	2	$10,692	6	$32,077	6	$32,077	8	$42,770				
44	465	6018	Inlet - Double	EA	$5,727.52	2	$11,455	2	$11,455	2	$11,455	3	$17,183	4	$22,910	6	$34,365				
45	465	6020	Inlet - Triple	EA	$6,405.17							2	$12,810	2	$12,810	4	$25,621				
46	465	6584	Drainage MH or JB	EA	$4,573.90	2	$9,806	1	$5,104	2	$11,133	3	$13,740	4	$20,079	2	$8,709				
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70	536	$16,991	279	$8,844	609	$19,289	751	$23,807	1,098	$34,791	476	$15,089				
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57	11	$74,628	6	$38,846	12	$84,722	15	$104,563	22	$152,806	10	$66,274				
52	531	6002	Sidewalk	SY	$54.76	214	$11,741	112	$6,111	243	$13,329	300	$16,450	439	$24,040	190	$10,426				
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27	11	$2,318	6	$1,207	12	$2,632	15	$3,248	22	$4,747	10	$2,059				
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	357	$1,456	186	$758	406	$1,653	501	$2,040	732	$2,982	317	$1,293				
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	11	$3,766	6	$1,960	12	$4,275	15	$5,276	22	$7,711	10	$3,344				
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978				
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$58,815		$29,745		$60,408		$144,661		$176,560		$102,116				
			TOTAL BASE BID (subject to revision)				$450,917		$228,044		$463,131		$1,109,066		$1,353,630		$782,889				
			(cost per linear foot =)				$421		$409		$381		$738		$617		$822				

CITY OF VICTORIA
West Outfall
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	WO 3:20 plugged Quantity	WO 3:20 plugged Sheet $	WO 3:21 plugged Quantity	WO 3:21 plugged Sheet $	**WEST OUTFALL Quantity**	**WEST OUTFALL Total $**
			Length of individual Reach (feet)							62,489	
			Estimated ROW width needed for excavated open channel (feet)								
1	100	none	Preparing Right of Way - General	LS	4.0%					27	$1,782,627
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%					27	$445,657
3	500	501	Mobilization	LS	2.5%					25	$1,114,142
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%					25	$668,485
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37						
6	110	6002	Excavation - channel	CY	$6.72					518,920	$3,487,142
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08						
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08						
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84					488,654	$410,470
10	162	6002	Block sod (St. Augustine)	SY	$3.36					27,783	$93,352
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26					460,871	$580,698
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47					233,064	$342,604
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13					7,509	$31,011
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88					83,350	$1,490,298
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21					83,350	$1,017,704
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61					400	$644
17	402	6001	Trench Safety Protection	LF	$1.86					50,010	$93,019
18	423	6008	Retaining walls (cast in place)	SF	$63.80						
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29						
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00						
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00					12,178	$4,566,750
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00					4,547	$1,991,586
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00					5,251	$2,851,293
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46						
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87					4,963	$4,729,094
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48						
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50					3,276	$4,004,910
28	422	501	Bridge 1 - straightforward	SF	$100.00					35,281	$3,528,100
29	422	501	Bridge 2 - straightforward	SF	$100.00					31,760	$3,176,000
30	422	501	Bridge 3 - straightforward	SF	$100.00						
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00						
32	464	6005	RCP - Class III - 24"	LF	$67.49					296	$19,977
33	464	6008	RCP - Class III - 36"	LF	$112.50					3,070	$345,375
34	464	6009	RCP - Class III - 42"	LF	$156.51					3,017	$472,191
35	464	6010	RCP - Class III - 48"	LF	$176.52					1,112	$196,290
36	464	6011	RCP - Class III - 54"	LF	$190.95					6,110	$1,166,705
37	464	6012	RCP - Class III - 60"	LF	$262.86					4,605	$1,210,470
38	464	6013	RCP - Class III - 66"	LF	$294.00						
39	464	6014	RCP - Class III - 72"	LF	$336.00					1,585	$532,560
40	464	516	RCP - Class III - 78"	LF	$378.00						
41	464	517	RCP - Class III - 84"	LF	$462.00						
42	464	518	RCP - Class III - 96"	LF	$546.00						
43	465	6017	Inlet - Single	EA	$5,346.20					150	$801,930
44	465	6018	Inlet - Double	EA	$5,727.52					168	$962,223
45	465	6020	Inlet - Triple	EA	$6,405.17					113	$723,784
46	465	6584	Drainage MH or JB	EA	$4,573.90					100	$457,481
47	466	501	Headwall - small	EA	$3,446.93						
48	466	501	Headwall - large	EA	$14,261.68						
49	529	6008	Concrete Curb and Gutter	LF	$31.70					25,005	$792,659
50	529	6030	Concrete Valley Gutter	LF	$25.45						
51	530	604	Remove & Replace Driveway	EA	$6,961.57					500	$3,481,481
52	531	6002	Sidewalk	SY	$54.76					10,002	$547,710
53	550	501	Chain Link Fence - 6ft.	LF	$21.10						
54	560	6001	Mailbox Assembly	EA	$216.27					500	$108,157
55	580	none	Project Maintenance (subsidiary)								
56	459	6001	Gabions	CY	$212.30						
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50						
58	639	none	Rock Berm	LF	$1,467.00						
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08					20,788	$84,711
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29					500	$175,680
61	802-A	none	Capital Improvement Project Sign	LS	$978.00					27	$26,406
62	528	6002	Conlock II pavers	SY	$52.88						
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00					2	$65,200
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00						
65	506	6001	Pump		$285,250.00						
66	xx	xx									
End of Current BASE BID specification items and unit prices											
			Contingency =	15%							$7,286,486
			TOTAL BASE BID (subject to revision)								$55,863,060
			(cost per linear foot =)								$894

CITY OF VICTORIA
Spring Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Bridge Reach R87A		Bridge Reach R335A		Detention Pond Reach R360A		Bridge Reach R421A		Channel Reach R183B		Mallette Dr. Bridge Reach R183B		Mead Rd. Bridge Reach R183C	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			2,564		2,405		5,992		4,180		438		80		60	
			Estimated ROW width needed for excavated open channel (feet)			20		20		20		20		91		20		20	
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$18,265	1	$18,256	1	$906,395	1	$18,504	1	$1,258	1	$11,206	1	$9,026
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$4,566	1	$4,564	1	$226,599	1	$4,626	1	$315	1	$2,802	1	$2,256
3	500	501	Mobilization	LS	2.5%		$11,416		$11,410	1	$566,497		$11,565	1	$787		$7,004		$5,641
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%		$6,849		$6,846		$339,898		$6,939	1	$472		$4,202		$3,385
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37														
6	110	6002	Excavation - channel	CY	$6.72					3,113,000	$20,919,360			2,540	$17,069				
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08					50,751	$511,570								
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08														
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84					13,316	$11,185			4,524	$3,800				
10	162	6002	Block sod (St. Augustine)	SY	$3.36														
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26					13,316	$16,778			4,524	$5,700				
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47					6,658	$9,787			2,262	$3,325				
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13					7,608	$31,421								
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88														
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21														
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61														
17	402	6001	Trench Safety Protection	LF	$1.86					820	$1,525					400	$744	300	$558
18	423	6008	Retaining walls (cast in place)	SF	$63.80														
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29														
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00														
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00														
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00														
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00											400	$217,200	300	$162,900
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46														
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87														
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48					820	$1,149,214								
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50														
28	422	501	Bridge 1 - straightforward	SF	$100.00	4,522	$452,200	4,522	$452,200			4,560	$456,000						
29	422	501	Bridge 2 - straightforward	SF	$100.00														
30	422	501	Bridge 3 - straightforward	SF	$100.00														
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00														
32	464	6005	RCP - Class III - 24"	LF	$67.49														
33	464	6008	RCP - Class III - 36"	LF	$112.50														
34	464	6009	RCP - Class III - 42"	LF	$156.51														
35	464	6010	RCP - Class III - 48"	LF	$176.52														
36	464	6011	RCP - Class III - 54"	LF	$190.95														
37	464	6012	RCP - Class III - 60"	LF	$262.86														
38	464	6013	RCP - Class III - 66"	LF	$294.00														
39	464	6014	RCP - Class III - 72"	LF	$336.00														
40	464	516	RCP - Class III - 78"	LF	$378.00														
41	464	517	RCP - Class III - 84"	LF	$462.00														
42	464	518	RCP - Class III - 96"	LF	$546.00														
43	465	6017	Inlet - Single	EA	$5,346.20														
44	465	6018	Inlet - Double	EA	$5,727.52														
45	465	6020	Inlet - Triple	EA	$6,405.17														
46	465	6584	Drainage MH or JB	EA	$4,573.90														
47	466	501	Headwall - small	EA	$3,446.93														
48	466	501	Headwall - large	EA	$14,261.68											2	$28,523	2	$28,523
49	529	6008	Concrete Curb and Gutter	LF	$31.70														
50	529	6030	Concrete Valley Gutter	LF	$25.45														
51	530	604	Remove & Replace Driveway	EA	$6,961.57														
52	531	6002	Sidewalk	SY	$54.76														
53	550	501	Chain Link Fence - 6ft.	LF	$21.10														
54	560	6001	Mailbox Assembly	EA	$216.27														
55	580	none	Project Maintenance (subsidiary)																
56	459	6001	Gabions	CY	$212.30														
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50														
58	639	none	Rock Berm	LF	$1,467.00														
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	846	$3,448	794	$3,234	1,977	$8,058	1,379	$5,621	145	$589	26	$108	20	$81
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29														
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88														
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00											1	$32,600	1	$32,600
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00														
65	506	6001	Pump		$285,250.00														
66	xx	xx																	
End of Current BASE BID specification items and unit prices																			
			Contingency =	15%			$74,658		$74,623		$3,704,890		$75,635		$5,144		$45,805		$36,892
			TOTAL BASE BID (subject to revision)				$572,381		$572,113		$28,404,154		$579,868		$39,435		$351,172		$282,840
			(cost per linear foot =)				$223		$238		$4,740		$139		$90		$4,390		$4,714

CITY OF VICTORIA
Spring Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 20

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	SC 2:1		SC 2:2 No Improvements		SC 2:3		SC 2:4		SC 2:5		SC 4 :1		**SPRING CREEK Overall Project**	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	**Quantity**	**Total $**
			Length of individual Reach (feet)			4,857		523		2,539		3,328		747		281		27,994	
			Estimated ROW width needed for excavated open channel (feet)																
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$148,014	1	$12,802	1	$122,427	1	$57,158	1	$10,314	1	$6,323	13	$1,339,950
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$37,004	1	$3,201	1	$30,607	1	$14,290	1	$2,579	1	$1,581	13	$334,988
3	500	501	Mobilization	LS	2.5%	1	$92,509	1	$8,001	1	$76,517	1	$35,724	1	$6,447	1	$3,952	8	$837,469
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$55,505	1	$4,801	1	$45,910	1	$21,434	1	$3,868	1	$2,371	7	$502,481
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37														
6	110	6002	Excavation - channel	CY	$6.72													3,115,540	$20,936,429
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08													50,751	$511,570
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08														
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	10,793	$9,066	1,162	$976	5,642	$4,739	7,396	$6,212	1,660	$1,394	624	$525	45,117	$37,898
10	162	6002	Block sod (St. Augustine)	SY	$3.36	2,698	$9,066	291	$976	1,411	$4,739	1,849	$6,212	415	$1,394	156	$525	6,819	$22,913
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	8,095	$10,200	872	$1,098	4,232	$5,332	5,547	$6,989	1,245	$1,569	468	$590	38,298	$48,255
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	5,397	$7,933	581	$854	2,821	$4,147	3,698	$5,436	830	$1,220	312	$459	22,558	$33,161
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13													7,608	$31,421
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	8,095	$144,739	872	$15,585	4,232	$75,662	5,547	$99,174	1,245	$22,261	468	$8,374	20,458	$365,795
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	8,095	$98,840	872	$10,643	4,232	$51,669	5,547	$67,725	1,245	$15,201	468	$5,718	20,458	$249,796
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	39	$63	4	$7	20	$33	27	$43	6	$10	2	$4	98	$158
17	402	6001	Trench Safety Protection	LF	$1.86	4,857	$9,034	523	$973	2,539	$4,723	3,328	$6,190	747	$1,389	281	$523	13,795	$25,659
18	423	6008	Retaining walls (cast in place)	SF	$63.80														
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29														
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00														
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00							920	$345,000					920	$345,000
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00			523	$229,074									523	$229,074
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00	4,554	$2,472,822											5,254	$2,852,922
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46														
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87					2,539	$2,419,337							2,539	$2,419,337
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48													820	$1,149,214
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50														
28	422	501	Bridge 1 - straightforward	SF	$100.00													13,604	$1,360,400
29	422	501	Bridge 2 - straightforward	SF	$100.00														
30	422	501	Bridge 3 - straightforward	SF	$100.00														
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00														
32	464	6005	RCP - Class III - 24"	LF	$67.49														
33	464	6008	RCP - Class III - 36"	LF	$112.50									747	$84,038	281	$31,613	1,028	$115,650
34	464	6009	RCP - Class III - 42"	LF	$156.51							1,649	$258,085					1,649	$258,085
35	464	6010	RCP - Class III - 48"	LF	$176.52							759	$133,979					759	$133,979
36	464	6011	RCP - Class III - 54"	LF	$190.95														
37	464	6012	RCP - Class III - 60"	LF	$262.86														
38	464	6013	RCP - Class III - 66"	LF	$294.00														
39	464	6014	RCP - Class III - 72"	LF	$336.00	303	$101,808											303	$101,808
40	464	516	RCP - Class III - 78"	LF	$378.00														
41	464	517	RCP - Class III - 84"	LF	$462.00														
42	464	518	RCP - Class III - 96"	LF	$546.00														
43	465	6017	Inlet - Single	EA	$5,346.20	20	$106,924			10	$53,462	9	$48,116	4	$21,385	8	$42,770	51	$272,656
44	465	6018	Inlet - Double	EA	$5,727.52	15	$85,913			15	$85,913	10	$57,275	4	$22,910	6	$34,365	50	$286,376
45	465	6020	Inlet - Triple	EA	$6,405.17	15	$96,078			10	$64,052	2	$12,810					27	$172,940
46	465	6584	Drainage MH or JB	EA	$4,573.90	10	$44,431	1	$4,784	5	$23,226	7	$30,444	1	$6,833	1	$2,571	25	$112,289
47	466	501	Headwall - small	EA	$3,446.93														
48	466	501	Headwall - large	EA	$14,261.68													4	$57,047
49	529	6008	Concrete Curb and Gutter	LF	$31.70	2,429	$76,983	262	$8,290	1,270	$40,243	1,664	$52,749	374	$11,840	141	$4,454	6,138	$194,559
50	529	6030	Concrete Valley Gutter	LF	$25.45														
51	530	604	Remove & Replace Driveway	EA	$6,961.57	49	$338,123	5	$36,409	25	$176,754	33	$231,681	7	$52,003	3	$19,562	123	$854,533
52	531	6002	Sidewalk	SY	$54.76	971	$53,194	105	$5,728	508	$27,807	666	$36,448	149	$8,181	56	$3,078	2,455	$134,436
53	550	501	Chain Link Fence - 6ft.	LF	$21.10														
54	560	6001	Mailbox Assembly	EA	$216.27	49	$10,504	5	$1,131	25	$5,491	33	$7,197	7	$1,616	3	$608	123	$26,547
55	580	none	Project Maintenance (subsidiary)																
56	459	6001	Gabions	CY	$212.30														
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50														
58	639	none	Rock Berm	LF	$1,467.00														
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	1,619	$6,597	174	$710	846	$3,449	1,109	$4,521	249	$1,015	94	$382	9,279	$37,812
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	49	$17,062	5	$1,837	25	$8,919	33	$11,691	7	$2,624	3	$987	123	$43,121
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	13	$12,714
62	528	6002	Conlock II pavers	SY	$52.88														
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00													2	$65,200
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00														
65	506	6001	Pump		$285,250.00														
66	xx	xx																	
End of Current BASE BID specification items and unit prices																			
			Contingency =	15%			$605,009		$52,329		$500,420		$233,634		$42,160		$25,846		$5,477,046
			TOTAL BASE BID (subject to revision)				$4,638,399		$401,188		$3,836,557		$1,791,195		$323,229		$198,156		$41,990,686
			(cost per linear foot =)				$955		$767		$1,511		$538		$433		$705		$1,500

CITY OF VICTORIA
Mockingbird Outfall
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	MO 1:1		MO 1:2		MO 1:3		**Mockingbird**	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	**Quantity**	**Total $**
			Length of individual Reach (feet)			7,214						7,214	
			Estimated ROW width needed for excavated open channel (feet)										
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$172,072		$871		$871	1	$173,813
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$43,018		$218		$218	1	$43,453
3	500	501	Mobilization	LS	2.5%	1	$107,545		$544		$544	1	$108,633
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$64,527		$326		$326	1	$65,180
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37								
6	110	6002	Excavation - channel	CY	$6.72								
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08								
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08								
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	16,030	$13,466					16,030	$13,466
10	162	6002	Block sod (St. Augustine)	SY	$3.36	4,008	$13,466					4,008	$13,466
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	12,023	$15,149					12,023	$15,149
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	8,015	$11,782					8,015	$11,782
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13								
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	12,023	$214,968					12,023	$214,968
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	12,023	$146,799					12,023	$146,799
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	58	$93					58	$93
17	402	6001	Trench Safety Protection	LF	$1.86	7,214	$13,417					7,214	$13,417
18	423	6008	Retaining walls (cast in place)	SF	$63.80								
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29								
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00								
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00	1,914	$717,750					1,914	$717,750
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00	4,184	$1,832,592					4,184	$1,832,592
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00								
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46								
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87								
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48								
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50								
28	422	501	Bridge 1 - straightforward	SF	$100.00								
29	422	501	Bridge 2 - straightforward	SF	$100.00								
30	422	501	Bridge 3 - straightforward	SF	$100.00								
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00								
32	464	6005	RCP - Class III - 24"	LF	$67.49								
33	464	6008	RCP - Class III - 36"	LF	$112.50	1,116	$125,516					1,116	$125,516
34	464	6009	RCP - Class III - 42"	LF	$156.51								
35	464	6010	RCP - Class III - 48"	LF	$176.52								
36	464	6011	RCP - Class III - 54"	LF	$190.95								
37	464	6012	RCP - Class III - 60"	LF	$262.86								
38	464	6013	RCP - Class III - 66"	LF	$294.00								
39	464	6014	RCP - Class III - 72"	LF	$336.00								
40	464	516	RCP - Class III - 78"	LF	$378.00								
41	464	517	RCP - Class III - 84"	LF	$462.00								
42	464	518	RCP - Class III - 96"	LF	$546.00								
43	465	6017	Inlet - Single	EA	$5,346.20	21	$112,270	3	$16,039	3	$16,039	27	$144,347
44	465	6018	Inlet - Double	EA	$5,727.52	25	$143,188	1	$5,728	1	$5,728	27	$154,643
45	465	6020	Inlet - Triple	EA	$6,405.17	20	$128,103					20	$128,103
46	465	6584	Drainage MH or JB	EA	$4,573.90	14	$65,989					14	$65,989
47	466	501	Headwall - small	EA	$3,446.93								
48	466	501	Headwall - large	EA	$14,261.68								
49	529	6008	Concrete Curb and Gutter	LF	$31.70	3,607	$114,337					3,607	$114,337
50	529	6030	Concrete Valley Gutter	LF	$25.45								
51	530	604	Remove & Replace Driveway	EA	$6,961.57	72	$502,187					72	$502,187
52	531	6002	Sidewalk	SY	$54.76	1,443	$79,004					1,443	$79,004
53	550	501	Chain Link Fence - 6ft.	LF	$21.10								
54	560	6001	Mailbox Assembly	EA	$216.27	72	$15,601					72	$15,601
55	580	none	Project Maintenance (subsidiary)										
56	459	6001	Gabions	CY	$212.30								
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50								
58	639	none	Rock Berm	LF	$1,467.00								
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	2,405	$9,799					2,405	$9,799
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	72	$25,341					72	$25,341
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978					1	$978
62	528	6002	Conlock II pavers	SY	$52.88								
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00								
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00								
65	506	6001	Pump		$285,250.00								
66	xx	xx											
End of Current BASE BID specification items and unit prices													
			Contingency =	15%			$703,344		$3,559		$3,559		$710,461
			TOTAL BASE BID (subject to revision)				$5,392,301		$27,284		$27,284		$5,446,869
			(cost per linear foot =)				$748						$755

CITY OF VICTORIA
Whispering Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach WR0A		Reach WR15A		Reach WR33A		Reach WR57A		Reach WR77A		Reach WR86A		Reach WR95A		Reach WR108A	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			1,523		1,701		2,526		1,845		149		496		1,285		2,344	
			Estimated ROW width needed for excavated open channel (feet)			164		167		165		165		148		129		141		103	
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$39,377	1	$11,417	1	$15,751	1	$10,011	1	$3,870	1	$883	1	$2,964	1	$3,271
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$9,844	1	$2,854	1	$3,938	1	$2,503	1	$968	1	$221	1	$741	1	$818
3	500	501	Mobilization	LS	2.5%	1	$24,611	1	$7,136	1	$9,844	1	$6,257	1	$2,419	1	$552	1	$1,853	1	$2,044
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$14,766	1	$4,281	1	$5,907	1	$3,754	1	$1,451	1	$331	1	$1,112	1	$1,227
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	10,350	$69,552	25,260	$169,747	33,480	$224,986	18,800	$126,336	12,930	$86,890	6	$43	14	$96	35	$234
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	28,448	$23,897	32,335	$27,161	47,290	$39,724	34,657	$29,112	2,497	$2,098	7,187	$6,037	20,508	$17,227	27,307	$22,938
10	162	6002	Block sod (St. Augustine)	SY	$3.36																
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	28,448	$35,845	32,335	$40,742	47,290	$59,585	34,657	$43,668	2,497	$3,147	7,187	$9,056	20,508	$25,840	27,307	$34,407
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	14,224	$20,909									3,594	$5,283			13,654	$20,071
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13			10,778	$44,514	15,763	$65,102	11,552	$47,712	832	$3,438			6,836	$28,233		
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88																
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21																
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61																
17	402	6001	Trench Safety Protection	LF	$1.86																
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00																
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00	8,312	$831,200														
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50																
34	464	6009	RCP - Class III - 42"	LF	$156.51																
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95																
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20																
44	465	6018	Inlet - Double	EA	$5,727.52																
45	465	6020	Inlet - Triple	EA	$6,405.17																
46	465	6584	Drainage MH or JB	EA	$4,573.90																
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70																
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57																
52	531	6002	Sidewalk	SY	$54.76																
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27																
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	503	$2,048	561	$2,287	834	$3,397	609	$2,481	49	$200	164	$667	424	$1,728	774	$3,152
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29																
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$160,954		$46,668		$64,382		$40,922		$15,819		$3,608		$12,116		$13,371
			TOTAL BASE BID (subject to revision)				$1,233,982		$357,787		$493,593		$313,735		$121,277		$27,658		$92,886		$102,511
			(cost per linear foot =)				$810		$210		$195		$170		$814		$56		$72		$44

CITY OF VICTORIA
Whispering Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach WR132A		WC 1:8		WC 1:9		WC 2:2		WC 2:3		WC 2:4		WC 2:5		WC 2:6	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			1,165		983				8,209		5,021		1,513		4,163		2,134	
			Estimated ROW width needed for excavated open channel (feet)			103															
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$1,641	1	$14,635		$2,712	1	$192,873	1	$88,848	1	$30,014	1	$47,327	1	$38,777
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$410	1	$3,659		$678	1	$48,218	1	$22,212	1	$7,503	1	$11,832	1	$9,694
3	500	501	Mobilization	LS	2.5%	1	$1,026	1	$9,147		$1,695	1	$120,546	1	$55,530	1	$18,759	1	$29,579	1	$24,235
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$615	1	$5,488		$1,017	1	$72,327	1	$33,318	1	$11,255	1	$17,748	1	$14,541
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	15	$103														
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	13,539	$11,373	2,184	$1,835			18,242	$15,323	11,158	$9,373	3,362	$2,824	9,251	$7,771	4,742	$3,983
10	162	6002	Block sod (St. Augustine)	SY	$3.36			546	$1,835			4,561	$15,323	2,789	$9,373	841	$2,824	2,313	$7,771	1,186	$3,983
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	13,539	$17,059	1,638	$2,064			13,682	$17,239	8,368	$10,544	2,522	$3,177	6,938	$8,742	3,557	$4,481
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	6,770	$9,951	1,092	$1,606			9,121	$13,408	5,579	$8,201	1,681	$2,471	4,626	$6,800	2,371	$3,486
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88			1,638	$29,293			13,682	$244,628	8,368	$149,626	2,522	$45,087	6,938	$124,057	3,557	$63,593
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21			1,638	$20,004			13,682	$167,053	8,368	$102,177	2,522	$30,790	6,938	$84,717	3,557	$43,427
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61			8	$13			66	$106	40	$65	12	$19	33	$54	17	$27
17	402	6001	Trench Safety Protection	LF	$1.86			983	$1,828			8,209	$15,269	5,021	$9,339	1,513	$2,814	4,163	$7,743	2,134	$3,969
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00							1,575	$590,625								
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00							2,749	$1,204,062	535	$234,330						
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00							2,017	$1,095,231								
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00																
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49													905	$61,078		
33	464	6008	RCP - Class III - 36"	LF	$112.50			298	$33,525			643	$72,338	882	$99,225			3,258	$366,525		
34	464	6009	RCP - Class III - 42"	LF	$156.51			685	$107,209					1,071	$167,622						
35	464	6010	RCP - Class III - 48"	LF	$176.52											179	$31,597			600	$105,912
36	464	6011	RCP - Class III - 54"	LF	$190.95							1,225	$233,914	983	$187,704						
37	464	6012	RCP - Class III - 60"	LF	$262.86									807	$212,128	1,334	$350,655			1,534	$403,227
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00									743	$249,648						
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20			6	$32,077	6	$32,077	14	$74,847	16	$85,539	9	$48,116	5	$26,731	6	$32,077
44	465	6018	Inlet - Double	EA	$5,727.52			4	$22,910	4	$22,910	15	$85,913	12	$68,730	8	$45,820	2	$11,455	6	$34,365
45	465	6020	Inlet - Triple	EA	$6,405.17					2	$12,810	8	$51,241	8	$51,241	2	$12,810			4	$25,621
46	465	6584	Drainage MH or JB	EA	$4,573.90			2	$8,992			16	$75,094	10	$45,931	3	$13,841	8	$38,082	4	$19,521
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70			492	$15,581			4,105	$130,113	2,511	$79,583	757	$23,981	2,082	$65,984	1,067	$33,824
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57			10	$68,432			82	$571,475	50	$349,540	15	$105,329	42	$289,810	21	$148,560
52	531	6002	Sidewalk	SY	$54.76			197	$10,766			1,642	$89,905	1,004	$54,990	303	$16,570	833	$45,593	427	$23,372
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27			10	$2,126			82	$17,754	50	$10,859	15	$3,272	42	$9,003	21	$4,615
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	384	$1,567	328	$1,335			2,736	$11,151	1,674	$6,820	504	$2,055	1,388	$5,655	711	$2,899
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29			10	$3,453			82	$28,837	50	$17,638	15	$5,315	42	$14,624	21	$7,497
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978			1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$6,709		$59,819		$11,085		$788,369		$363,167		$122,682		$193,449		$158,500
			TOTAL BASE BID (subject to revision)				$51,433		$458,609		$84,984		$6,044,160		$2,784,280		$940,560		$1,483,109		$1,215,166
			(cost per linear foot =)				$44		$467				$736		$555		$622		$356		$569

CITY OF VICTORIA
Whispering Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	WC 2:7 Quantity	WC 2:7 Sheet $	**Whispering Creek Overall Project Quantity**	**Whispering Creek Overall Project Total $**
			Length of individual Reach (feet)			2,099		37,156	
			Estimated ROW width needed for excavated open channel (feet)						
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$30,639	16	$535,010
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$7,660	16	$133,752
3	500	501	Mobilization	LS	2.5%	1	$19,149	16	$334,381
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$11,490	16	$200,629
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37				
6	110	6002	Excavation - channel	CY	$6.72			100,891	$677,986
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08				
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08				
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	4,664	$3,918	267,374	$224,594
10	162	6002	Block sod (St. Augustine)	SY	$3.36	1,166	$3,918	13,401	$45,028
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	3,498	$4,408	253,973	$320,006
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	2,332	$3,428	65,043	$95,614
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13			45,763	$188,999
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	3,498	$62,550	40,203	$718,836
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	3,498	$42,715	40,203	$490,883
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	17	$27	193	$311
17	402	6001	Trench Safety Protection	LF	$1.86	2,099	$3,904	24,122	$44,867
18	423	6008	Retaining walls (cast in place)	SF	$63.80				
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29				
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00				
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00			1,575	$590,625
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00			3,284	$1,438,392
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00			2,017	$1,095,231
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46				
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87				
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48				
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50				
28	422	501	Bridge 1 - straightforward	SF	$100.00			8,312	$831,200
29	422	501	Bridge 2 - straightforward	SF	$100.00				
30	422	501	Bridge 3 - straightforward	SF	$100.00				
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00				
32	464	6005	RCP - Class III - 24"	LF	$67.49			905	$61,078
33	464	6008	RCP - Class III - 36"	LF	$112.50	690	$77,625	5,771	$649,238
34	464	6009	RCP - Class III - 42"	LF	$156.51			1,756	$274,832
35	464	6010	RCP - Class III - 48"	LF	$176.52			779	$137,509
36	464	6011	RCP - Class III - 54"	LF	$190.95	1,409	$269,049	3,617	$690,666
37	464	6012	RCP - Class III - 60"	LF	$262.86			3,675	$966,011
38	464	6013	RCP - Class III - 66"	LF	$294.00				
39	464	6014	RCP - Class III - 72"	LF	$336.00			743	$249,648
40	464	516	RCP - Class III - 78"	LF	$378.00				
41	464	517	RCP - Class III - 84"	LF	$462.00				
42	464	518	RCP - Class III - 96"	LF	$546.00				
43	465	6017	Inlet - Single	EA	$5,346.20	4	$21,385	66	$352,849
44	465	6018	Inlet - Double	EA	$5,727.52	4	$22,910	55	$315,014
45	465	6020	Inlet - Triple	EA	$6,405.17	2	$12,810	26	$166,534
46	465	6584	Drainage MH or JB	EA	$4,573.90	4	$19,201	48	$220,663
47	466	501	Headwall - small	EA	$3,446.93				
48	466	501	Headwall - large	EA	$14,261.68				
49	529	6008	Concrete Curb and Gutter	LF	$31.70	1,050	$33,269	12,061	$382,334
50	529	6030	Concrete Valley Gutter	LF	$25.45				
51	530	604	Remove & Replace Driveway	EA	$6,961.57	21	$146,123	241	$1,679,270
52	531	6002	Sidewalk	SY	$54.76	420	$22,988	4,824	$264,184
53	550	501	Chain Link Fence - 6ft.	LF	$21.10				
54	560	6001	Mailbox Assembly	EA	$216.27	21	$4,540	241	$52,169
55	580	none	Project Maintenance (subsidiary)						
56	459	6001	Gabions	CY	$212.30				
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50				
58	639	none	Rock Berm	LF	$1,467.00				
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	700	$2,851	12,342	$50,293
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	21	$7,374	241	$84,738
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	16	$15,648
62	528	6002	Conlock II pavers	SY	$52.88				
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00				
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00				
65	506	6001	Pump		$285,250.00				
66	xx	xx							
End of Current BASE BID specification items and unit prices									
			Contingency =	15%			$125,236		$2,186,853
			TOTAL BASE BID (subject to revision)				$960,145		$16,765,874
			(cost per linear foot =)				$457		$451

CITY OF VICTORIA
North Outfall
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach NR0A		Reach NR28B		**NORTH OUTFALL Overall Project**	
						Quantity	Sheet $	Quantity	Sheet $	**Quantity**	**Total $**
			Length of individual Reach (feet)			2,719		2,214		4,933	
			Estimated ROW width needed for excavated open channel (feet)			150		143			
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$20,393	1	$19,010	2	$39,403
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$5,098	1	$4,753	2	$9,851
3	500	501	Mobilization	LS	2.5%	1	$12,746	1	$11,881	2	$24,627
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$7,647	1	$7,129	2	$14,776
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37						
6	110	6002	Excavation - channel	CY	$6.72	36,760	$247,027	2,650	$17,808	39,410	$264,835
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08						
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08						
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	46,126	$38,746	35,801	$30,073	81,927	$68,819
10	162	6002	Block sod (St. Augustine)	SY	$3.36						
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	46,126	$58,119	35,801	$45,109	81,927	$103,229
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47			17,901	$26,314	17,901	$26,314
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13	15,375	$63,501			15,375	$63,501
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88						
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21						
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61						
17	402	6001	Trench Safety Protection	LF	$1.86						
18	423	6008	Retaining walls (cast in place)	SF	$63.80						
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29						
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00						
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00						
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00						
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00						
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46						
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87						
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48						
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50						
28	422	501	Bridge 1 - straightforward	SF	$100.00			3,520	$352,000	3,520	$352,000
29	422	501	Bridge 2 - straightforward	SF	$100.00						
30	422	501	Bridge 3 - straightforward	SF	$100.00						
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00						
32	464	6005	RCP - Class III - 24"	LF	$67.49						
33	464	6008	RCP - Class III - 36"	LF	$112.50						
34	464	6009	RCP - Class III - 42"	LF	$156.51						
35	464	6010	RCP - Class III - 48"	LF	$176.52						
36	464	6011	RCP - Class III - 54"	LF	$190.95						
37	464	6012	RCP - Class III - 60"	LF	$262.86						
38	464	6013	RCP - Class III - 66"	LF	$294.00						
39	464	6014	RCP - Class III - 72"	LF	$336.00						
40	464	516	RCP - Class III - 78"	LF	$378.00						
41	464	517	RCP - Class III - 84"	LF	$462.00						
42	464	518	RCP - Class III - 96"	LF	$546.00						
43	465	6017	Inlet - Single	EA	$5,346.20						
44	465	6018	Inlet - Double	EA	$5,727.52						
45	465	6020	Inlet - Triple	EA	$6,405.17						
46	465	6584	Drainage MH or JB	EA	$4,573.90						
47	466	501	Headwall - small	EA	$3,446.93						
48	466	501	Headwall - large	EA	$14,261.68						
49	529	6008	Concrete Curb and Gutter	LF	$31.70						
50	529	6030	Concrete Valley Gutter	LF	$25.45						
51	530	604	Remove & Replace Driveway	EA	$6,961.57						
52	531	6002	Sidewalk	SY	$54.76						
53	550	501	Chain Link Fence - 6ft.	LF	$21.10						
54	560	6001	Mailbox Assembly	EA	$216.27						
55	580	none	Project Maintenance (subsidiary)								
56	459	6001	Gabions	CY	$212.30						
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50						
58	639	none	Rock Berm	LF	$1,467.00						
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	897	$3,656	731	$2,977	1,628	$6,634
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29						
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	2	$1,956
62	528	6002	Conlock II pavers	SY	$52.88						
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00	3	$97,800			3	$97,800
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00						
65	506	6001	Pump		$285,250.00						
66	xx	xx									
End of Current BASE BID specification items and unit prices											
			Contingency =	15%			$83,357		$77,705		$161,062
			TOTAL BASE BID (subject to revision)				$639,069		$595,738		$1,234,806
			(cost per linear foot =)				$235		$269		$250

CITY OF VICTORIA
U.S. 77
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach NR28A		Reach NR47A		Reach NR61A		Reach NR86A		Reach NR103A		**U.S. 77 Overall Project**	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	**Quantity**	**Total $**
			Length of individual Reach (feet)			1,133		1,813		2,758		1,388		130		7,222	
			Estimated ROW width needed for excavated open channel (feet)			127		127		170		97		91			
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$4,204	1	$76,056	1	$68,440	1	$3,774	1	$518	5	$152,991
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$1,051	1	$19,014	1	$17,110	1	$943	1	$130	5	$38,248
3	500	501	Mobilization	LS	2.5%	1	$2,627	1	$47,535	1	$42,775	1	$2,359	1	$324	5	$95,619
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$1,576	1	$28,521	1	$25,665	1	$1,415	1	$194	5	$57,372
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37												
6	110	6002	Excavation - channel	CY	$6.72	8,020	$53,894	11,080	$74,458	9,350	$62,832	7,170	$48,182	1,190	$7,997	36,810	$247,363
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08												
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08												
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	17,176	$14,428	27,484	$23,087	52,918	$44,451	15,278	$12,834	1,344	$1,129	114,200	$95,928
10	162	6002	Block sod (St. Augustine)	SY	$3.36												
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	17,176	$21,641	27,484	$34,630	52,918	$66,677	15,278	$19,251	1,344	$1,694	114,200	$143,892
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	8,588	$12,624	13,742	$20,201			7,639	$11,230	672	$988	30,641	$45,042
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13					17,639	$72,850					17,639	$72,850
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88												
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21												
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61												
17	402	6001	Trench Safety Protection	LF	$1.86												
18	423	6008	Retaining walls (cast in place)	SF	$63.80												
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29												
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00												
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00												
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00												
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00												
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46												
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87												
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48												
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50												
28	422	501	Bridge 1 - straightforward	SF	$100.00			5,192	$519,200	14,269	$1,426,900					19,461	$1,946,100
29	422	501	Bridge 2 - straightforward	SF	$100.00			12,264	$1,226,400							12,264	$1,226,400
30	422	501	Bridge 3 - straightforward	SF	$100.00												
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00												
32	464	6005	RCP - Class III - 24"	LF	$67.49												
33	464	6008	RCP - Class III - 36"	LF	$112.50												
34	464	6009	RCP - Class III - 42"	LF	$156.51												
35	464	6010	RCP - Class III - 48"	LF	$176.52												
36	464	6011	RCP - Class III - 54"	LF	$190.95												
37	464	6012	RCP - Class III - 60"	LF	$262.86												
38	464	6013	RCP - Class III - 66"	LF	$294.00												
39	464	6014	RCP - Class III - 72"	LF	$336.00												
40	464	516	RCP - Class III - 78"	LF	$378.00												
41	464	517	RCP - Class III - 84"	LF	$462.00												
42	464	518	RCP - Class III - 96"	LF	$546.00												
43	465	6017	Inlet - Single	EA	$5,346.20												
44	465	6018	Inlet - Double	EA	$5,727.52												
45	465	6020	Inlet - Triple	EA	$6,405.17												
46	465	6584	Drainage MH or JB	EA	$4,573.90												
47	466	501	Headwall - small	EA	$3,446.93												
48	466	501	Headwall - large	EA	$14,261.68												
49	529	6008	Concrete Curb and Gutter	LF	$31.70												
50	529	6030	Concrete Valley Gutter	LF	$25.45												
51	530	604	Remove & Replace Driveway	EA	$6,961.57												
52	531	6002	Sidewalk	SY	$54.76												
53	550	501	Chain Link Fence - 6ft.	LF	$21.10												
54	560	6001	Mailbox Assembly	EA	$216.27												
55	580	none	Project Maintenance (subsidiary)														
56	459	6001	Gabions	CY	$212.30												
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50												
58	639	none	Rock Berm	LF	$1,467.00												
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	374	$1,524	598	$2,438	910	$3,709	458	$1,867	43	$175	2,383	$9,712
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29												
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	5	$4,890
62	528	6002	Conlock II pavers	SY	$52.88												
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00					1	$32,600					1	$32,600
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00												
65	506	6001	Pump		$285,250.00												
66	xx	xx															
End of Current BASE BID specification items and unit prices																	
			Contingency =	15%			$17,182		$310,877		$279,748		$15,425		$2,119		$625,351
			TOTAL BASE BID (subject to revision)				$131,729		$2,383,394		$2,144,734		$118,256		$16,246		$4,794,359
			(cost per linear foot =)				$116		$1,315		$778		$85		$125		$664

CITY OF VICTORIA
Lone Tree Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R1211A		Reach R1249A		Reach R1316A		Reach R1362A		Reach R1434A		Reach R1453A		Reach R1470A		Reach R1486A		Reach R1508A	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			4,701		6,481		4,678		7,230		1,950		1,640		1,544		2,145		1,865	
			Estimated ROW width needed for excavated open channel (feet)			217		218		192		212		210		205		204		208		208	
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$81,697	1	$82,466	1	$77,535	1	$121,428	1	$24,006	1	$83,315	1	$35,108	1	$26,292	1	$24,819
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$20,424	1	$20,617	1	$19,384	1	$30,357	1	$6,001	1	$20,829	1	$8,777	1	$6,573	1	$6,205
3	500	501	Mobilization	LS	2.5%	1	$51,061	1	$51,541	1	$48,459	1	$75,892	1	$15,004	1	$52,072	1	$21,942	1	$16,433	1	$15,512
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$30,636	1	$30,925	1	$29,076	1	$45,535	1	$9,002	1	$31,243	1	$13,165	1	$9,860	1	$9,307
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																		
6	110	6002	Excavation - channel	CY	$6.72	89,650	$602,448	119,240	$801,293	89,090	$598,685	111,500	$749,280	35,020	$235,334	27,960	$187,891	22,070	$148,310	38,310	$257,443	40,610	$272,899
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																		
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																		
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	115,966	$97,411	161,014	$135,252	101,657	$85,392	174,643	$146,700	46,582	$39,129	38,232	$32,115	35,799	$30,071	50,773	$42,649	44,067	$37,016
10	162	6002	Block sod (St. Augustine)	SY	$3.36																		
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	115,966	$146,117	161,014	$202,878	101,657	$128,088	174,643	$220,050	46,582	$58,694	38,232	$48,172	35,799	$45,106	50,773	$63,974	44,067	$55,524
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	57,983	$85,235	80,507	$118,345	50,829	$74,718	87,322	$128,363	23,291	$34,238	19,116	$28,100	17,899	$26,312	25,387	$37,318	22,033	$32,389
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																		
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88																		
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21																		
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61																		
17	402	6001	Trench Safety Protection	LF	$1.86																		
18	423	6008	Retaining walls (cast in place)	SF	$63.80																		
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																		
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																		
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00																		
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																		
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																		
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																		
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																		
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																		
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																		
28	422	501	Bridge 1 - straightforward	SF	$100.00	5,515	$551,500			4,945	$494,500	4,900	$490,000			15,907	$1,590,700	4,434	$443,400				
29	422	501	Bridge 2 - straightforward	SF	$100.00							4,410	$441,000										
30	422	501	Bridge 3 - straightforward	SF	$100.00																		
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																		
32	464	6005	RCP - Class III - 24"	LF	$67.49																		
33	464	6008	RCP - Class III - 36"	LF	$112.50																		
34	464	6009	RCP - Class III - 42"	LF	$156.51																		
35	464	6010	RCP - Class III - 48"	LF	$176.52																		
36	464	6011	RCP - Class III - 54"	LF	$190.95																		
37	464	6012	RCP - Class III - 60"	LF	$262.86																		
38	464	6013	RCP - Class III - 66"	LF	$294.00																		
39	464	6014	RCP - Class III - 72"	LF	$336.00																		
40	464	516	RCP - Class III - 78"	LF	$378.00																		
41	464	517	RCP - Class III - 84"	LF	$462.00																		
42	464	518	RCP - Class III - 96"	LF	$546.00																		
43	465	6017	Inlet - Single	EA	$5,346.20																		
44	465	6018	Inlet - Double	EA	$5,727.52																		
45	465	6020	Inlet - Triple	EA	$6,405.17																		
46	465	6584	Drainage MH or JB	EA	$4,573.90																		
47	466	501	Headwall - small	EA	$3,446.93																		
48	466	501	Headwall - large	EA	$14,261.68																		
49	529	6008	Concrete Curb and Gutter	LF	$31.70																		
50	529	6030	Concrete Valley Gutter	LF	$25.45																		
51	530	604	Remove & Replace Driveway	EA	$6,961.57																		
52	531	6002	Sidewalk	SY	$54.76																		
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																		
54	560	6001	Mailbox Assembly	EA	$216.27																		
55	580	none	Project Maintenance (subsidiary)																				
56	459	6001	Gabions	CY	$212.30																		
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																		
58	639	none	Rock Berm	LF	$1,467.00																		
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	1,551	$6,322	2,139	$8,715	1,544	$6,291	2,386	$9,723	644	$2,622	541	$2,205	510	$2,076	708	$2,884	615	$2,508
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29																		
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88	10,447	$552,420	14,402	$761,590	10,396	$549,717	16,067	$849,605	4,333	$229,147	3,644	$192,718	3,431	$181,437	4,767	$252,061	4,144	$219,158
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00			1	$32,600														
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																		
65	506	6001	Pump		$285,250.00																		
66																							
End of Current BASE BID specification items and unit prices																							
			Contingency =	15%			$333,937		$337,080		$316,923		$496,337		$98,123		$340,551		$143,502		$107,470		$101,447
			TOTAL BASE BID (subject to revision)				$2,560,187		$2,584,279		$2,429,746		$3,805,249		$752,278		$2,610,890		$1,100,185		$823,937		$777,763
			(cost per linear foot =)				$545		$399		$519		$526		$386		$1,592		$713		$384		$417

CITY OF VICTORIA
Lone Tree Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 20

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R1527A		Reach R1535A		Reach R1550A		Reach R1560A		Upper Detention Basin Reach R1580A		Reach R1596A		Reach R1615A		Reach R1623A	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			861		1,477		1,002		1,876		2,000		1,701		663		2,595	
			Estimated ROW width needed for excavated open channel (feet)			181		171		173		176		20		20		171		170	
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$8,994	1	$15,276	1	$29,686	1	$68,902	1	$202,720	1	$169,297	1	$69,208	1	$34,624
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$2,249	1	$3,819	1	$7,421	1	$17,226	1	$50,680	1	$42,324	1	$17,302	1	$8,656
3	500	501	Mobilization	LS	2.5%	1	$5,621	1	$9,547	1	$18,554	1	$43,064	1	$126,700	1	$105,811	1	$43,255	1	$21,640
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$3,373	1	$5,728	1	$11,132	1	$25,838		$76,020		$63,486	1	$25,953	1	$12,984
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	10,610	$71,299	18,430	$123,850	12,880	$86,554	25,510	$171,427	560,000	$3,763,200	598,000	$4,018,560	6,450	$43,344	56,720	$381,158
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08									14,590	$147,067						
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	17,722	$14,887	28,752	$24,151	19,723	$16,568	37,665	$31,639	4,444	$3,733	3,780	$3,175	12,906	$10,841	50,241	$42,203
10	162	6002	Block sod (St. Augustine)	SY	$3.36																
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	17,722	$22,330	28,752	$36,227	19,723	$24,851	37,665	$47,458	4,444	$5,600	3,780	$4,763	12,906	$16,262	50,241	$63,304
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	8,861	$13,026	14,376	$21,132	9,862	$14,497	18,833	$27,684	2,222	$3,267	1,890	$2,778	6,453	$9,486	25,121	$36,927
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13									15,605	$64,449						
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88																
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21																
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61																
17	402	6001	Trench Safety Protection	LF	$1.86									600	$1,116						
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00																
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48									600	$840,888						
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00					4,796	$479,600	12,204	$1,220,400					15,705	$1,570,500		
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50																
34	464	6009	RCP - Class III - 42"	LF	$156.51																
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95																
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20																
44	465	6018	Inlet - Double	EA	$5,727.52																
45	465	6020	Inlet - Triple	EA	$6,405.17																
46	465	6584	Drainage MH or JB	EA	$4,573.90																
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70																
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57																
52	531	6002	Sidewalk	SY	$54.76																
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27																
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	284	$1,158	487	$1,986	331	$1,347	619	$2,523	660	$2,690	561	$2,287	219	$892	856	$3,490
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29																
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88	1,913	$101,177	3,282	$173,564	2,227	$117,746	4,169	$220,451	4,444	$235,022	3,780	$199,886	1,473	$77,910	5,767	$304,941
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00															1	$32,600
64	420	none	Pump Housing (metal duilding, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66																					
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$36,764		$62,439		$121,340		$281,639		$828,620		$692,002		$282,890		$141,526
			TOTAL BASE BID (subject to revision)				$281,856		$478,697		$930,274		$2,159,229		$6,352,750		$5,305,349		$2,168,821		$1,085,031
			(cost per linear foot =)				$327		$324		$928		$1,151		$3,176		$3,119		$3,271		$418

CITY OF VICTORIA
Lone Tree Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 20

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R1649A		Reach R1659A		Reach R1670A		Reach R1686A		Reach R1705A		Reach R1721A		LT 1:1		LT 2:1 Southern Pacific	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			1,175		950		1,671		1,896		1,471		2,746		5,548			
			Estimated ROW width needed for excavated open channel (feet)			160		160		166		140		139		139					
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$15,884	1	$13,319	1	$47,021	1	$15,299	1	$46,638	1	$102,250	1	$213,700		
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$3,971	1	$3,330	1	$11,755	1	$3,825	1	$11,660	1	$25,563	1	$53,425		
3	500	501	Mobilization	LS	2.5%	1	$9,928	1	$8,324	1	$29,388	1	$9,562	1	$29,149	1	$63,907	1	$133,563		
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$5,957	1	$4,995	1	$17,633	1	$5,737	1	$17,489	1	$38,344	1	$80,138		
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	29,140	$195,821	23,660	$158,995	27,980	$188,026	10,550	$70,896	8,370	$56,246	17,460	$117,331				
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	21,395	$17,972	17,285	$14,519	31,589	$26,534	30,073	$25,261	23,104	$19,408	43,130	$36,229	12,329	$10,357		
10	162	6002	Block sod (St. Augustine)	SY	$3.36													3,082	$10,357		
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	21,395	$26,957	17,285	$21,778	31,589	$39,802	30,073	$37,892	23,104	$29,111	43,130	$54,344	9,247	$11,651		
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	10,697	$15,725					15,036	$22,103	11,552	$16,982	21,565	$31,701	6,165	$9,062		
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13			5,762	$23,795	10,530	$43,487										
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88													9,247	$165,336		
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21													9,247	$112,906		
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61													44	$71		
17	402	6001	Trench Safety Protection	LF	$1.86													5,548	$10,320		
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00																
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00													2,838	$1,541,034		
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87													2,710	$2,582,468		
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00					6,455	$645,500			8,684	$868,400	13,117	$1,311,700				
29	422	501	Bridge 2 - straightforward	SF	$100.00											6,776	$677,600				
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50																
34	464	6009	RCP - Class III - 42"	LF	$156.51																
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95																
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20													14	$74,847		
44	465	6018	Inlet - Double	EA	$5,727.52													15	$85,913		
45	465	6020	Inlet - Triple	EA	$6,405.17													16	$102,483		
46	465	6584	Drainage MH or JB	EA	$4,573.90													11	$50,754		
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70													2,774	$87,939		
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57													55	$386,242		
52	531	6002	Sidewalk	SY	$54.76													1,110	$60,764		
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27													55	$11,999		
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	388	$1,580	314	$1,278	551	$2,247	626	$2,550	485	$1,978	906	$3,693	1,849	$7,536		
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29													55	$19,490		
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978		
62	528	6002	Conlock II pavers	SY	$52.88	2,611	$138,076	2,111	$111,636	3,713	$196,361	4,213	$222,801	3,269	$172,859	6,102	$322,686				
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00					1	$32,600										
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66																					
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$64,927		$54,442		$192,200		$62,536		$190,635		$417,949		$873,500		
			TOTAL BASE BID (subject to revision)				$497,775		$417,389		$1,473,533		$479,440		$1,461,534		$3,204,274		$6,696,832		
			(cost per linear foot =)				$424		$439		$882		$253		$994		$1,167		$1,207		

CITY OF VICTORIA
Lone Tree Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 20

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Channel Improvements LT 2:1 Southern Pacific		LT 2:2 Southern Pacific		LT 2:3 Southern Pacific		LT 2:4 Southern Pacific		LT 2:5 Southern Pacific		LT 3:1		LT 4:1		LT 4:2	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			6,500		3,376		1,294				3,147		1,831		1,421		1,260	
			Estimated ROW width needed for excavated open channel (feet)																		
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$13,403	1	$78,543	1	$26,331		$855	1	$79,155	1	$35,277	1	$37,444	1	$18,383
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$3,351	1	$19,636	1	$6,583		$214	1	$19,789	1	$8,819	1	$9,361	1	$4,596
3	500	501	Mobilization	LS	2.5%	1	$8,377	1	$49,089	1	$16,457		$535	1	$49,472	1	$22,048	1	$23,402	1	$11,489
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$5,026	1	$29,454	1	$9,874		$321	1	$29,683	1	$13,229	1	$14,041	1	$6,894
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	19,500	$131,040														
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	68,542	$57,575	7,502	$6,302	2,875	$2,415			6,993	$5,874	4,069	$3,418	3,158	$2,653	2,800	$2,352
10	162	6002	Block sod (St. Augustine)	SY	$3.36			1,876	$6,302	719	$2,415			1,748	$5,874	1,017	$3,418	789	$2,653	700	$2,352
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	68,542	$86,363	5,627	$7,090	2,156	$2,717			5,245	$6,609	3,052	$3,845	2,368	$2,984	2,100	$2,646
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	34,271	$50,378	3,751	$5,514	1,437	$2,113			3,497	$5,140	2,034	$2,991	1,579	$2,321	1,400	$2,058
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88			5,627	$100,605	2,156	$38,552			5,245	$93,781	3,052	$54,564	2,368	$42,346	2,100	$37,548
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21			5,627	$68,702	2,156	$26,327			5,245	$64,041	3,052	$37,261	2,368	$28,917	2,100	$25,641
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61			27	$43	10	$17			25	$41	15	$24	11	$18	10	$16
17	402	6001	Trench Safety Protection	LF	$1.86			3,376	$6,279	1,294	$2,406			3,147	$5,853	1,831	$3,406	1,421	$2,643	1,260	$2,344
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00			3,051	$1,144,125	647	$242,625			879	$329,625	921	$345,375				
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00									591	$258,858			1,421	$622,398		
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00									1,101	$597,843						
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00																
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50											303	$34,088			691	$77,738
34	464	6009	RCP - Class III - 42"	LF	$156.51									576	$90,150						
35	464	6010	RCP - Class III - 48"	LF	$176.52			325	$57,369							607	$107,148				
36	464	6011	RCP - Class III - 54"	LF	$190.95					647	$123,487									569	$108,651
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20			11	$58,808	4	$21,385	4	$21,385	12	$64,154	6	$32,077	5	$26,731	5	$26,731
44	465	6018	Inlet - Double	EA	$5,727.52			10	$57,275	6	$34,365			10	$57,275	6	$34,365	5	$28,638	5	$28,638
45	465	6020	Inlet - Triple	EA	$6,405.17			10	$64,052	2	$12,810			6	$38,431	2	$12,810	2	$12,810		
46	465	6584	Drainage MH or JB	EA	$4,573.90			7	$30,883	3	$11,835			6	$28,788	4	$16,750	3	$12,999	3	$11,526
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70			1,688	$53,510	647	$20,505			1,574	$49,880	916	$29,021	711	$22,523	630	$19,971
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57			34	$235,023	13	$90,062			31	$219,081	18	$127,466	14	$98,924	13	$87,716
52	531	6002	Sidewalk	SY	$54.76			675	$36,974	259	$14,169			629	$34,466	366	$20,053	284	$15,563	252	$13,800
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27			34	$7,301	13	$2,798			31	$6,806	18	$3,960	14	$3,073	13	$2,725
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	2,145	$8,741	1,125	$4,586	431	$1,757			1,049	$4,275	610	$2,487	474	$1,930	420	$1,712
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29			34	$11,860	13	$4,545			31	$11,055	18	$6,432	14	$4,992	13	$4,426
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978			1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal duilding, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66																					
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$54,785		$321,045		$107,629		$3,496		$323,547		$144,196		$153,051		$75,139
			TOTAL BASE BID (subject to revision)				$420,017		$2,461,347		$825,157		$26,806		$2,480,524		$1,105,506		$1,173,393		$576,067
			(cost per linear foot =)				$65		$729		$638				$788		$604		$826		$457

CITY OF VICTORIA
Lone Tree Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 20

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	LT 4:3		LT 4:4		LT 5:1		LT 6:1		LT 6:2		LT 6:3		LT 7:1		LT 8:1	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			1,961						1,598				546		2,862		194	
			Estimated ROW width needed for excavated open channel (feet)																		
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$30,944		$1,741		$5,753	1	$29,856		$1,986	1	$8,240	1	$60,147	1	$18,769
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$7,736		$435		$1,438	1	$7,464		$496	1	$2,060	1	$15,037	1	$4,692
3	500	501	Mobilization	LS	2.5%	1	$19,340		$1,088		$3,596	1	$18,660		$1,241	1	$5,150	1	$37,592	1	$11,731
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$11,604		$653		$2,157	1	$11,196		$745	1	$3,090	1	$22,555	1	$7,038
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72																
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	4,358	$3,661					3,551	$2,983			1,213	$1,019	6,360	$5,343	431	$362
10	162	6002	Block sod (St. Augustine)	SY	$3.36	1,089	$3,661					888	$2,983			303	$1,019	1,590	$5,343	108	$362
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	3,268	$4,118					2,663	$3,356			910	$1,147	4,770	$6,011	323	$407
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	2,179	$3,203					1,776	$2,610			607	$892	3,180	$4,675	216	$317
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13																
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	3,268	$58,438					2,663	$47,620			910	$16,271	4,770	$85,294	323	$5,781
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	3,268	$39,906					2,663	$32,519			910	$11,111	4,770	$58,246	323	$3,948
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	16	$25					13	$21			4	$7	23	$37	2	$2
17	402	6001	Trench Safety Protection	LF	$1.86	1,961	$3,647					1,598	$2,972			546	$1,016	2,862	$5,324	194	$361
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00							755	$283,125								
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00													1,303	$570,714		
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50															194	$237,165
28	422	501	Bridge 1 - straightforward	SF	$100.00																
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50											546	$61,425	496	$55,823		
34	464	6009	RCP - Class III - 42"	LF	$156.51							843	$131,938								
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95	1,961	$374,453														
37	464	6012	RCP - Class III - 60"	LF	$262.86													1,063	$279,420		
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20	6	$32,077	6	$32,077	9	$48,116	5	$26,731	5	$26,731	5	$26,731	6	$32,077	10	$53,462
44	465	6018	Inlet - Double	EA	$5,727.52	5	$28,638	2	$11,455	10	$57,275	5	$28,638	4	$22,910	4	$22,910	7	$40,093	14	$80,185
45	465	6020	Inlet - Triple	EA	$6,405.17					6	$38,431							5	$32,026	10	$64,052
46	465	6584	Drainage MH or JB	EA	$4,573.90	4	$17,939					3	$14,618			1	$4,995	6	$26,183	0	$1,775
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70	981	$31,082					799	$25,328			273	$8,654	1,431	$45,366	97	$3,075
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57	20	$136,516					16	$111,246			5	$38,010	29	$199,254	2	$13,505
52	531	6002	Sidewalk	SY	$54.76	392	$21,477					320	$17,501			109	$5,980	572	$31,347	39	$2,125
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27	20	$4,241					16	$3,456			5	$1,181	29	$6,190	2	$420
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	654	$2,664					533	$2,171			182	$742	954	$3,888	65	$264
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	20	$6,889					16	$5,614			5	$1,918	29	$10,055	2	$682
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978					1	$978			1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00																
64	420	none	Pump Housing (metal duilding, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66																					
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$126,486		$7,118		$23,515		$122,038		$8,116		$33,682		$245,852		$76,719
			TOTAL BASE BID (subject to revision)				$969,723		$54,568		$180,281		$935,622		$62,225		$258,227		$1,884,867		$588,176
			(cost per linear foot =)				$495						$585				$473		$659		$3,032

CITY OF VICTORIA
Lone Tree Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 20

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	LT 9:1		LT 9:2		LT Upper Det. Basin Reach R1580B East Branch		LT 10:1 East Branch		LT 11:1 East Branch		LT 11:2 East Branch		LT 11:3 East Branch		**LONE TREE Overall Project**	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	**Quantity**	**Total $**
			Length of individual Reach (feet)			2,832		3,233		2,791		2,399		1,472		1,263		840		100,686	
			Estimated ROW width needed for excavated open channel (feet)							145											
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$161,258	1	$49,041	1	$143,478	1	$39,846	1	$22,571	1	$17,445	1	$13,963	42	$2,503,917
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$40,314	1	$12,260	1	$35,869	1	$9,962	1	$5,643	1	$4,361	1	$3,491	42	$625,979
3	500	501	Mobilization	LS	2.5%	1	$100,786	1	$30,650	1	$89,674	1	$24,904	1	$14,107	1	$10,903	1	$8,727	42	$1,564,948
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$60,472	1	$18,390	1	$53,804	1	$14,942	1	$8,464	1	$6,542	1	$5,236	40	$938,969
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72					513,500	$3,450,720									2,492,710	$16,882,051
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08															14,590	$147,067
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	6,293	$5,286	7,184	$6,035	46,381	$38,960	5,331	$4,478	3,271	$2,748	2,807	$2,358	1,866	$1,567	1,239,316	$1,098,601
10	162	6002	Block sod (St. Augustine)	SY	$3.36	1,573	$5,286	1,796	$6,035			1,333	$4,478	818	$2,748	702	$2,358	467	$1,567	20,598	$69,210
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	4,720	$5,947	5,388	$6,789	46,381	$58,440	3,998	$5,038	2,453	$3,091	2,105	$2,652	1,400	$1,763	1,218,718	$1,621,948
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	3,147	$4,626	3,592	$5,281	23,191	$34,090	2,666	$3,918	1,636	$2,404	1,403	$2,063	933	$1,372	595,222	$925,354
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13															31,896	$131,731
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88	4,720	$84,394	5,388	$96,343			3,998	$71,490	2,453	$43,866	2,105	$37,637	1,400	$25,023	61,795	$1,104,889
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21	4,720	$57,631	5,388	$65,792			3,998	$48,820	2,453	$29,955	2,105	$25,702	1,400	$17,088	61,795	$754,513
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61	23	$36	26	$42			19	$31	12	$19	10	$16	7	$11	297	$478
17	402	6001	Trench Safety Protection	LF	$1.86	2,832	$5,268	3,233	$6,013			2,399	$4,462	1,472	$2,738	1,263	$2,349	840	$1,562	37,677	$70,079
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00															6,253	$2,344,875
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00															3,315	$1,451,970
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00															3,939	$2,138,877
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87															2,710	$2,582,468
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48															600	$840,888
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50	2,832	$3,462,120													3,026	$3,699,285
28	422	501	Bridge 1 - straightforward	SF	$100.00															96,662	$9,666,200
29	422	501	Bridge 2 - straightforward	SF	$100.00															11,186	$1,118,600
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49			76	$5,129											76	$5,129
33	464	6008	RCP - Class III - 36"	LF	$112.50									795	$89,438	580	$65,250			3,411	$383,760
34	464	6009	RCP - Class III - 42"	LF	$156.51							846	$132,407			683	$106,896			2,948	$461,391
35	464	6010	RCP - Class III - 48"	LF	$176.52							707	$124,800	230	$40,600			840	$148,224	2,709	$478,140
36	464	6011	RCP - Class III - 54"	LF	$190.95			3,157	$602,829											6,334	$1,209,420
37	464	6012	RCP - Class III - 60"	LF	$262.86							846	$222,380	447	$117,498					2,356	$619,298
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20	5	$26,731	6	$32,077			8	$42,770	5	$26,731	4	$21,385	5	$26,731	146	$780,545
44	465	6018	Inlet - Double	EA	$5,727.52	5	$28,638	5	$28,638			6	$34,365	4	$22,910	2	$11,455	5	$28,638	135	$773,215
45	465	6020	Inlet - Triple	EA	$6,405.17	4	$25,621					4	$25,621	2	$12,810	2	$12,810			71	$454,767
46	465	6584	Drainage MH or JB	EA	$4,573.90	6	$25,907	6	$29,575			5	$21,946	3	$13,466	3	$11,554	2	$7,681	74	$339,171
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70	1,416	$44,887	1,617	$51,243			1,200	$38,024	736	$23,331	632	$20,019	420	$13,309	18,538	$587,667
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57	28	$197,152	32	$225,068			24	$167,008	15	$102,474	13	$87,925	8	$58,456	371	$2,581,127
52	531	6002	Sidewalk	SY	$54.76	566	$31,016	647	$35,408			480	$26,274	294	$16,121	253	$13,832	168	$9,196	7,415	$406,065
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27	28	$6,125	32	$6,992			24	$5,188	15	$3,183	13	$2,731	8	$1,816	371	$80,186
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	944	$3,847	1,078	$4,391	921	$3,753	800	$3,259	491	$1,999	421	$1,716	280	$1,141	31,205	$135,901
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29	28	$9,949	32	$11,357			24	$8,427	15	$5,171	13	$4,437	8	$2,950	371	$130,247
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	42	$42,054
62	528	6002	Conlock II pavers	SY	$52.88															120,707	$6,382,969
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00															3	$97,800
64	420	none	Pump Housing (metal duilding, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66																					
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$659,141		$200,453		$586,465		$162,872		$92,260		$71,306		$57,074		$10,234,763
			TOTAL BASE BID (subject to revision)				$5,053,414		$1,536,810		$4,496,231		$1,248,688		$707,325		$546,680		$437,564		$78,466,514
			(cost per linear foot =)				$1,784		$475		$1,611		$521		$481		$433		$521		$779

CITY OF VICTORIA
Marcado Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 2021)

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R418A		Reach R474A		Reach R538A		Reach R576A		Reach R611A		Reach R631A		Reach R662A		Reach R677A	
						Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $	Quantity	Sheet $
			Length of individual Reach (feet)			6,277		5,560		3,916		3,943		2,207		2,832		1,360		2,717	
			Estimated ROW width needed for excavated open channel (feet)			247		247		232		218		183		185		155		155	
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$89,937	1	$79,725	1	$36,032	1	$41,005	1	$20,121	1	$23,009	1	$66,780	1	$15,722
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$22,484	1	$19,931	1	$9,008	1	$10,251	1	$5,030	1	$5,752	1	$16,695	1	$3,931
3	500	501	Mobilization	LS	2.5%	1	$56,211	1	$49,828	1	$22,520	1	$25,628	1	$12,576	1	$14,381	1	$41,738	1	$9,827
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$33,726	1	$29,897	1	$13,512	1	$15,377	1	$7,545	1	$8,628	1	$25,043	1	$5,896
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37																
6	110	6002	Excavation - channel	CY	$6.72	175,040	$1,176,269	170,460	$1,145,491	81,120	$545,126	110,910	$745,315	55,010	$369,667	59,830	$402,058	37,680	$253,210	37,680	$253,210
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08																
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08																
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	174,806	$146,837	155,268	$130,425	102,451	$86,059	96,480	$81,043	45,649	$38,345	59,393	$49,890	23,874	$20,055	47,696	$40,065
10	162	6002	Block sod (St. Augustine)	SY	$3.36																
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	174,806	$220,256	155,268	$195,638	102,451	$129,088	96,480	$121,564	45,649	$57,518	59,393	$74,835	23,874	$30,082	47,696	$60,097
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47			77,634	$114,122	51,225	$75,301	48,240	$70,912	22,825	$33,552	29,696	$43,654	11,937	$17,548	23,848	$35,057
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13	58,269	$240,650														
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88																
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21																
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61																
17	402	6001	Trench Safety Protection	LF	$1.86					70	$130										
18	423	6008	Retaining walls (cast in place)	SF	$63.80																
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29																
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00																
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00					70	$26,250										
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00																
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00																
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46																
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87																
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48																
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50																
28	422	501	Bridge 1 - straightforward	SF	$100.00	4,550	$455,000	3,990	$399,000									13,132	$1,313,200		
29	422	501	Bridge 2 - straightforward	SF	$100.00																
30	422	501	Bridge 3 - straightforward	SF	$100.00																
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00																
32	464	6005	RCP - Class III - 24"	LF	$67.49																
33	464	6008	RCP - Class III - 36"	LF	$112.50																
34	464	6009	RCP - Class III - 42"	LF	$156.51																
35	464	6010	RCP - Class III - 48"	LF	$176.52																
36	464	6011	RCP - Class III - 54"	LF	$190.95																
37	464	6012	RCP - Class III - 60"	LF	$262.86																
38	464	6013	RCP - Class III - 66"	LF	$294.00																
39	464	6014	RCP - Class III - 72"	LF	$336.00																
40	464	516	RCP - Class III - 78"	LF	$378.00																
41	464	517	RCP - Class III - 84"	LF	$462.00																
42	464	518	RCP - Class III - 96"	LF	$546.00																
43	465	6017	Inlet - Single	EA	$5,346.20																
44	465	6018	Inlet - Double	EA	$5,727.52																
45	465	6020	Inlet - Triple	EA	$6,405.17																
46	465	6584	Drainage MH or JB	EA	$4,573.90																
47	466	501	Headwall - small	EA	$3,446.93																
48	466	501	Headwall - large	EA	$14,261.68																
49	529	6008	Concrete Curb and Gutter	LF	$31.70																
50	529	6030	Concrete Valley Gutter	LF	$25.45																
51	530	604	Remove & Replace Driveway	EA	$6,961.57																
52	531	6002	Sidewalk	SY	$54.76																
53	550	501	Chain Link Fence - 6ft.	LF	$21.10																
54	560	6001	Mailbox Assembly	EA	$216.27																
55	580	none	Project Maintenance (subsidiary)																		
56	459	6001	Gabions	CY	$212.30																
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50																
58	639	none	Rock Berm	LF	$1,467.00																
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	2,071	$8,441	1,835	$7,477	1,292	$5,266	1,301	$5,302	728	$2,968	935	$3,808	449	$1,829	897	$3,654
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29																
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978	1	$978
62	528	6002	Conlock II pavers	SY	$52.88																
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00					1	$32,600							1	$32,600		
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00																
65	506	6001	Pump		$285,250.00																
66	xx	xx																			
End of Current BASE BID specification items and unit prices																					
			Contingency =	15%			$367,618		$325,877		$147,281		$167,606		$82,245		$94,049		$272,963		$64,265
			TOTAL BASE BID (subject to revision)				$2,818,408		$2,498,391		$1,129,151		$1,284,982		$630,547		$721,041		$2,092,719		$492,701
			(cost per linear foot =)				$449		$449		$288		$326		$286		$255		$1,539		$181

CITY OF VICTORIA
Marcado Creek
Engineer's Preliminary Estimate of Costs (Based on Updated Construction Costs in July 202

	TxDOT Spec	TxDOT Descrip. Code	Item	Units	Unit $	Reach R707A Quantity	Reach R707A Sheet $	MARCADO Overall Project Quantity	MARCADO Overall Project Total $
			Length of individual Reach (feet)			4,557		33,369	
			Estimated ROW width needed for excavated open channel (feet)			151			
1	100	none	Preparing Right of Way - General	LS	4.0%	1	$56,157	9	$428,488
2	100	none	Relocation of utilities - gas, telephone, power, others	LS	1.0%	1	$14,039	9	$107,122
3	500	501	Mobilization	LS	2.5%	1	$35,098	9	$267,805
4	502	none	Barricades, Signs and Traffic Handling	LS	1.5%	1	$21,059	9	$160,683
5	104	6028	Removing concrete (unusual items not a part of general ROW prep)	SY	$9.37				
6	110	6002	Excavation - channel	CY	$6.72	56,560	$380,083	784,290	$5,270,429
7	132	6007	Embankment - berms, dikes, detention basin dams	CY	$10.08				
8	158	6005	Specialized Excavation Work (hard to reach areas, more difficult)	CY	$10.08				
9	160	6005	Furnishing and Placing Topsoil	SY	$0.84	78,140	$65,637	783,757	$658,356
10	162	6002	Block sod (St. Augustine)	SY	$3.36				
11	164	6009	Seeding for Erosion Control (to include fertilizer & watering, subsidary)	SY	$1.26	78,140	$98,456	783,757	$987,534
12	169	6006	Soil Retention Blanket - Temporary (ECRM) - (if shear under 3 psf) L/2	SY	$1.47	39,070	$57,433	304,475	$447,579
13	169	6007	Soil Retention Blanket - Permanent (TRM) - (if shear over 3 psf) L/3	SY	$4.13			58,269	$240,650
14	247	6313	Flexible Base - assume 12" Thickness	SY	$17.88				
15	340	6119	HMAC - Type D - assume 2" Thickness	SY	$12.21				
16	400	6002	Excavation and Backfill for Structures (headwalls, junction boxes)	CY	$1.61				
17	402	6001	Trench Safety Protection	LF	$1.86			70	$130
18	423	6008	Retaining walls (cast in place)	SF	$63.80				
19	432	6051	Riprap - Stone (Channel) (assume 18" thick)	SY	$142.29				
20	441	none	Steel Structures (pedestrian hand rails, others)	EA	$3,360.00				
21	462	6009	Concrete Box Culverts - 5 x 5	LF	$375.00			70	$26,250
22	462	6013	Concrete Box Culverts - 6 x 6	LF	$438.00				
23	462	6021	Concrete Box Culverts - 8 x 6	LF	$543.00				
24	462	6026	Concrete Box Culverts - 9 x 7	LF	$639.46				
25	462	6041	Concrete Box Culverts - 12 x 6	LF	$952.87				
26	462	6043	Concrete Box Culverts - 12 x 8	LF	$1,401.48				
27	Special 4306	none	Precast CROWNSPAN culvert structures (assume 24 x 6)	LF	$1,222.50				
28	422	501	Bridge 1 - straightforward	SF	$100.00	7,952	$795,200	29,624	$2,962,400
29	422	501	Bridge 2 - straightforward	SF	$100.00				
30	422	501	Bridge 3 - straightforward	SF	$100.00				
31	422	501	Bridge 4 - more difficult and involved	SF	$100.00				
32	464	6005	RCP - Class III - 24"	LF	$67.49				
33	464	6008	RCP - Class III - 36"	LF	$112.50				
34	464	6009	RCP - Class III - 42"	LF	$156.51				
35	464	6010	RCP - Class III - 48"	LF	$176.52				
36	464	6011	RCP - Class III - 54"	LF	$190.95				
37	464	6012	RCP - Class III - 60"	LF	$262.86				
38	464	6013	RCP - Class III - 66"	LF	$294.00				
39	464	6014	RCP - Class III - 72"	LF	$336.00				
40	464	516	RCP - Class III - 78"	LF	$378.00				
41	464	517	RCP - Class III - 84"	LF	$462.00				
42	464	518	RCP - Class III - 96"	LF	$546.00				
43	465	6017	Inlet - Single	EA	$5,346.20				
44	465	6018	Inlet - Double	EA	$5,727.52				
45	465	6020	Inlet - Triple	EA	$6,405.17				
46	465	6584	Drainage MH or JB	EA	$4,573.90				
47	466	501	Headwall - small	EA	$3,446.93				
48	466	501	Headwall - large	EA	$14,261.68				
49	529	6008	Concrete Curb and Gutter	LF	$31.70				
50	529	6030	Concrete Valley Gutter	LF	$25.45				
51	530	604	Remove & Replace Driveway	EA	$6,961.57				
52	531	6002	Sidewalk	SY	$54.76				
53	550	501	Chain Link Fence - 6ft.	LF	$21.10				
54	560	6001	Mailbox Assembly	EA	$216.27				
55	580	none	Project Maintenance (subsidiary)						
56	459	6001	Gabions	CY	$212.30				
57	COA-594-B	none	Reno Revetment Mattress	CY	$244.50				
58	639	none	Rock Berm	LF	$1,467.00				
59	2361	2	Silt Fence (curlex logs) (assume 33% of total project L)	LF	$4.08	1,504	$6,128	11,012	$44,873
60	1004	6001	Preservation of Trees (Type C)	EA	$351.29				
61	802-A	none	Capital Improvement Project Sign	LS	$978.00	1	$978	9	$8,802
62	528	6002	Conlock II pavers	SY	$52.88				
63	2632	5	Concrete Structures (drop, energy dissipation, special)	EA	$32,600.00			2	$65,200
64	420	none	Pump Housing (metal building, concrete pad, sumps, outlet works)		$81,500.00				
65	506	6001	Pump		$285,250.00				
66	xx	xx							
End of Current BASE BID specification items and unit prices									
			Contingency =	15%			$229,540		$1,751,445
			TOTAL BASE BID (subject to revision)				$1,759,807		$13,427,746
			(cost per linear foot =)				$386		$402

Attachment No. 2
Technical Memorandum No. 2 – Independent Study Areas

CivilTech
Engineering, Inc.
Civil Engineering
Water Resources
Transportation
Structures
Economic Analysis
GIS
Land Development
Construction Services

Attachment 2

TO: Ken Gill, P.E., – City of Victoria

FROM: Mike McGovern, P.E., CFM – CivilTech Engineering Inc.

DATE: May 20, 2021

RE: Task C – Independent Study Areas

CivilTech Engineering, Inc. (CivilTech) was contracted by the City of Victoria to prepare an update to the City of Victoria Storm Drainage Master Plan. The scope of work included Task C Independent Study Areas, which entails performing a drainage evaluation for a set of identified parcels with the City. The following summarizes the drainage evaluation approach and findings.

1. Independent Study Area (Parcel) Identification

The City of Victoria Land Development Study (2007) and the Land Use Fiscal Analysis Study (2020) were used as the basis for the initial selection of the parcels to be evaluated. The parcels were selected based on the potential of the areas to be developed in the near future. The final set of parcels were determined in coordination with the City and are identified in **Table 1**. A total of 45 parcels were selected to be evaluated. The 45 parcels are shown on the City of Victoria Master Drainage Study ArcGIS webpage developed by CivilTech as part of this study: https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f

2. Development Constraints

Each parcel was evaluated to identify the constraints of the site regarding future development. The following factors were considered.

- Watershed
- FEMA flood risk
- Other flood risk such as local drainage flood risk
- Outfall channel
- Limited outfall depth
- Offsite overland flow
- Detention needs
- Drainage easement dedication
- Other constraints

3. Evaluation Results

The evaluation results were documented on development constraint maps that are included in **Exhibit 2.1 – Exhibit 2.28**. The development constraints maps are also provided on the City of Victoria Master Drainage Study ArcGIS webpage developed by CivilTech as part of this study.

Table 2.1 – Selected Independent Study Areas (Parcels)

Parcel ID	Area (acres)	Exhibit No.	Parcel ID	Area (acres)	Exhibit No.
33561	133	2.1	46750	12	2.18
34054	225	2.2	46753	8	2.18
34166	11	2.3	46970	41	2.19
34192	28	2.4	46971	40	2.19
34209	14	2.5	47000	9	2.20
34300	7	2.6	47001	10	2.20
34301	20	2.7	47023	40	2.21
34654	9	2.8	47025	39	2.21
34661	8	2.8	81267	81	2.22
34890	21	2.9	20317256	32	2.23
35531	34	2.9	20406997	20	2.23
36137	10	2.10	20384788	56	2.24
36139	5	2.10	20397494	35	2.25
36144	5	2.11	20401664	67	2.26
36172	20	2.12	133951	6	2.27
46655	30	2.13	141430	2	2.27
46700	33	2.14	9800383	4	2.27
46709	12	2.15	9800384	4	2.27
46710	28	2.15	46703	17	2.27
46723	37	2.16	46704	13	2.27
46734	9	2.17	133950	6	2.27
76170	7	2.17	20404804	74	2.28
46724	34	2.18	**Total Acreage**		**1,358**

Five regional drainage solutions within the City were identified and further studied to identify needed outfall improvements servicing each area. These five areas are identified as, the Gardens Apartment diversion, Shenandoah ditch improvements, Anthony Road outfall improvements, Lone Tree Road outfall improvements, and Clegg Ditch outfall. Within the five areas, 39 parcels of the 45 total are included. A schematic level design and opinion of probable cost estimate was developed for each of the recommended improvements. A summary of the opinion of probable cost estimate for each area follows.

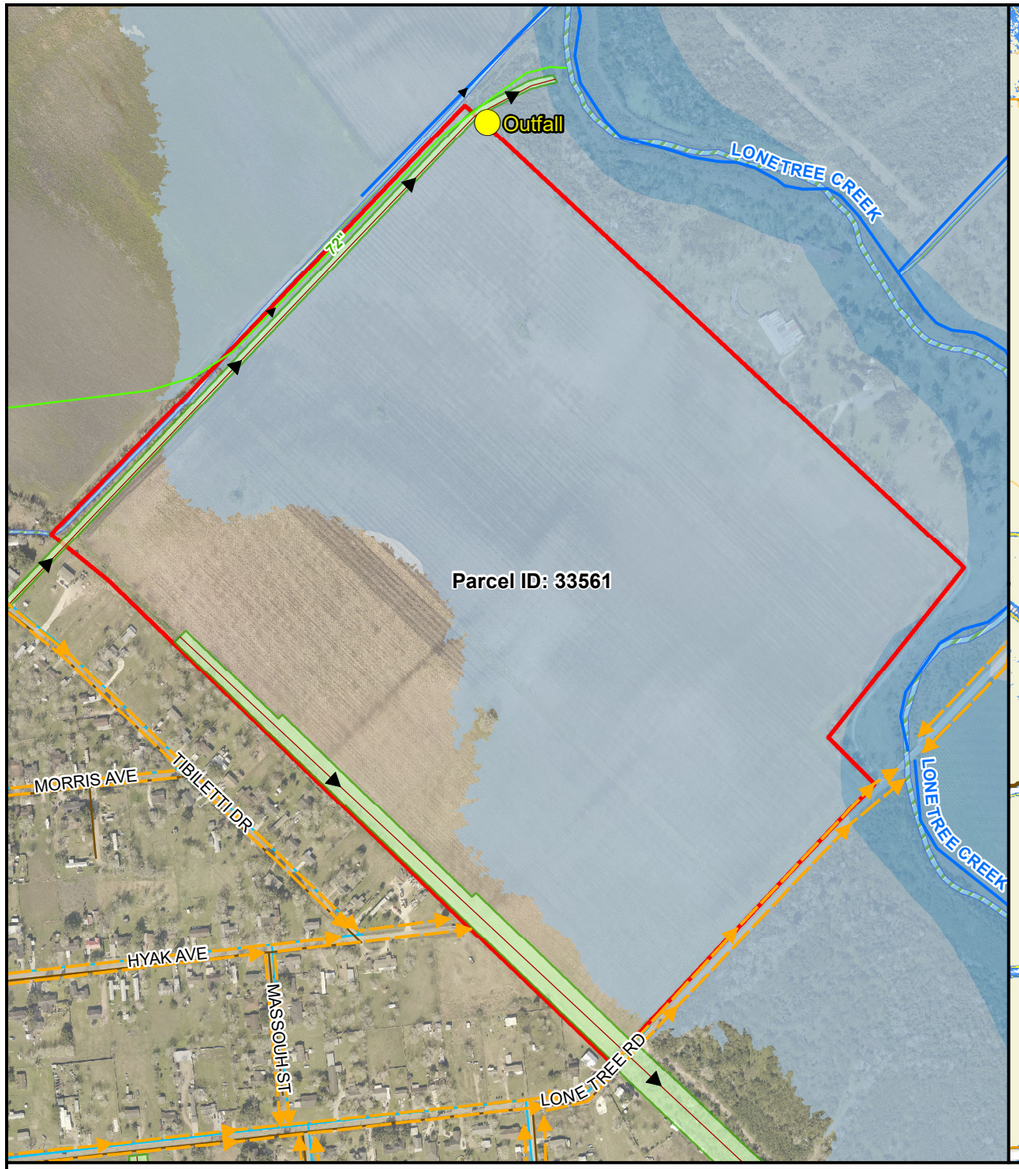
- Project A, The Gardens Apartment Diversion - $280,625
- Project B, Shenandoah Ditch - $3,780,500

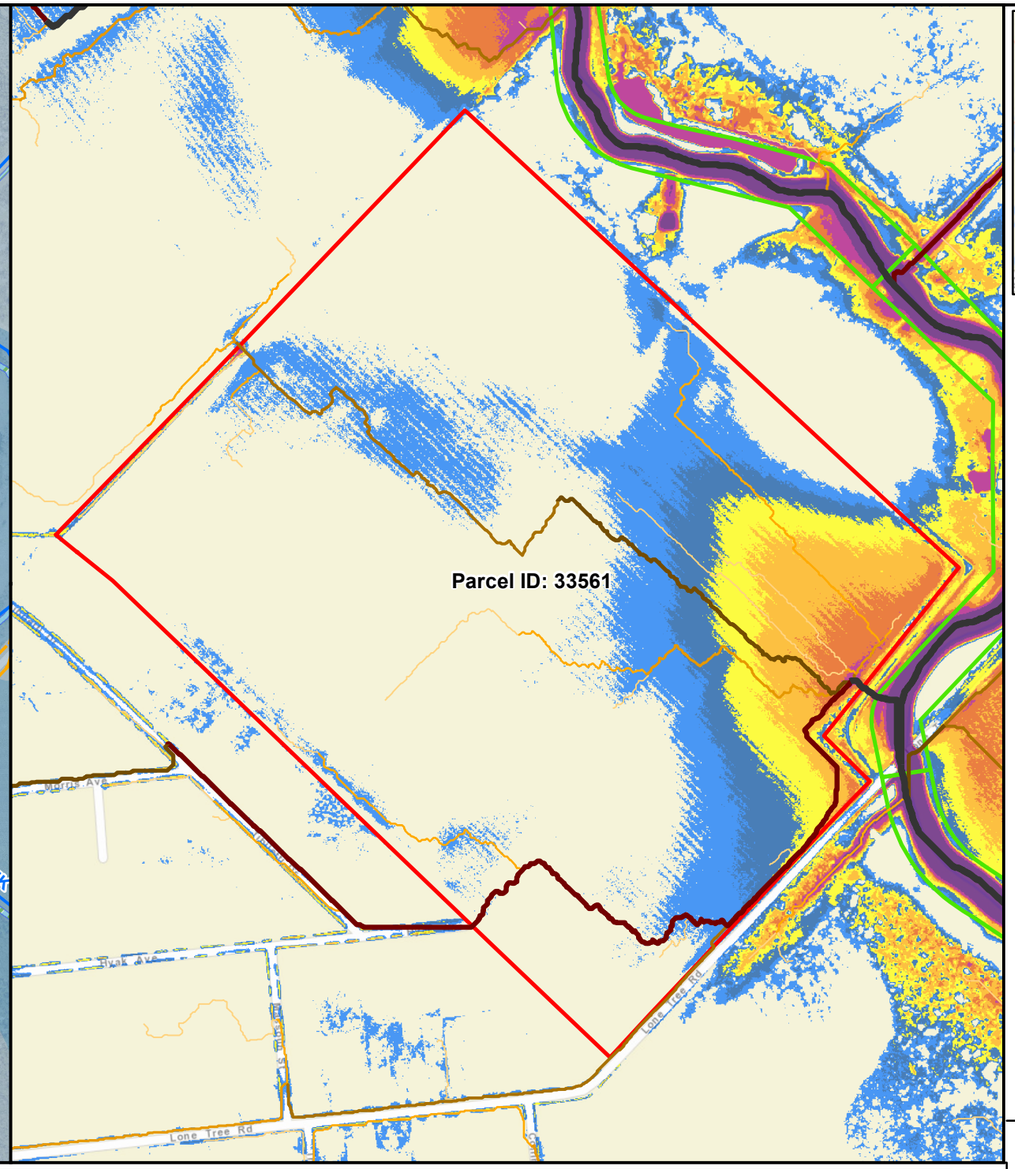
- Project C, Anthony Rd Outfall - $1,566,875
- Project D, Lone Tree Road Outfall - $5,500,875
- Project E, Clegg Ditch Outfall - $2,150,750

The total cost for the five regional drainage solutions is $13,279,625 which excludes the ROW and/or easement acquisition cost. The general layout of each of the five areas with the proposed improved outfall can be found in **Appendix 2.1** on **Exhibit 2.1.1 – Exhibit 2.1.5** and the associated typical section for each type of proposed outfall can be seen on **Exhibit 2.1.6**. Cost estimates for each area can be found in **Appendix 2.1**.

Exhibit 2.1 – 2.28

Independent Study Area Development Constraint Maps





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

0 250 500

N

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	33561	Property Size (ac)	133
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential Error on Current FEMA Maps, Potential for Ponding Water	2020 Preliminary FEMA maps indicate that the extent of the 100 yr Flood Plain on this parcel will expand significantly when the new maps are adopted. Overland flow analysis indicates that ponding to 3' may occur on portions of this parcel during heavy rains.
3	Outfall Channel		X		Parcel does not have direct drainage access is Lone Tree Creek.
4	Limited Outfall Depth	X		Roadside Ditch, Less than 3 ft of Depth	
5	Offsite Overland Flow	X		128 Ac + from Hyak Ave	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation		Drainage options include: 1) utilize surface drainage along existing flow paths; 2) Utilize the existing drainage easement across the north corner of parcel #33563 to direct drainage to Lone Tree Creek; 3) Obtain new drainage easements across parcel #33563 at appropriate locations and construct offsite drainage improvements to Lone Tree Creek;			

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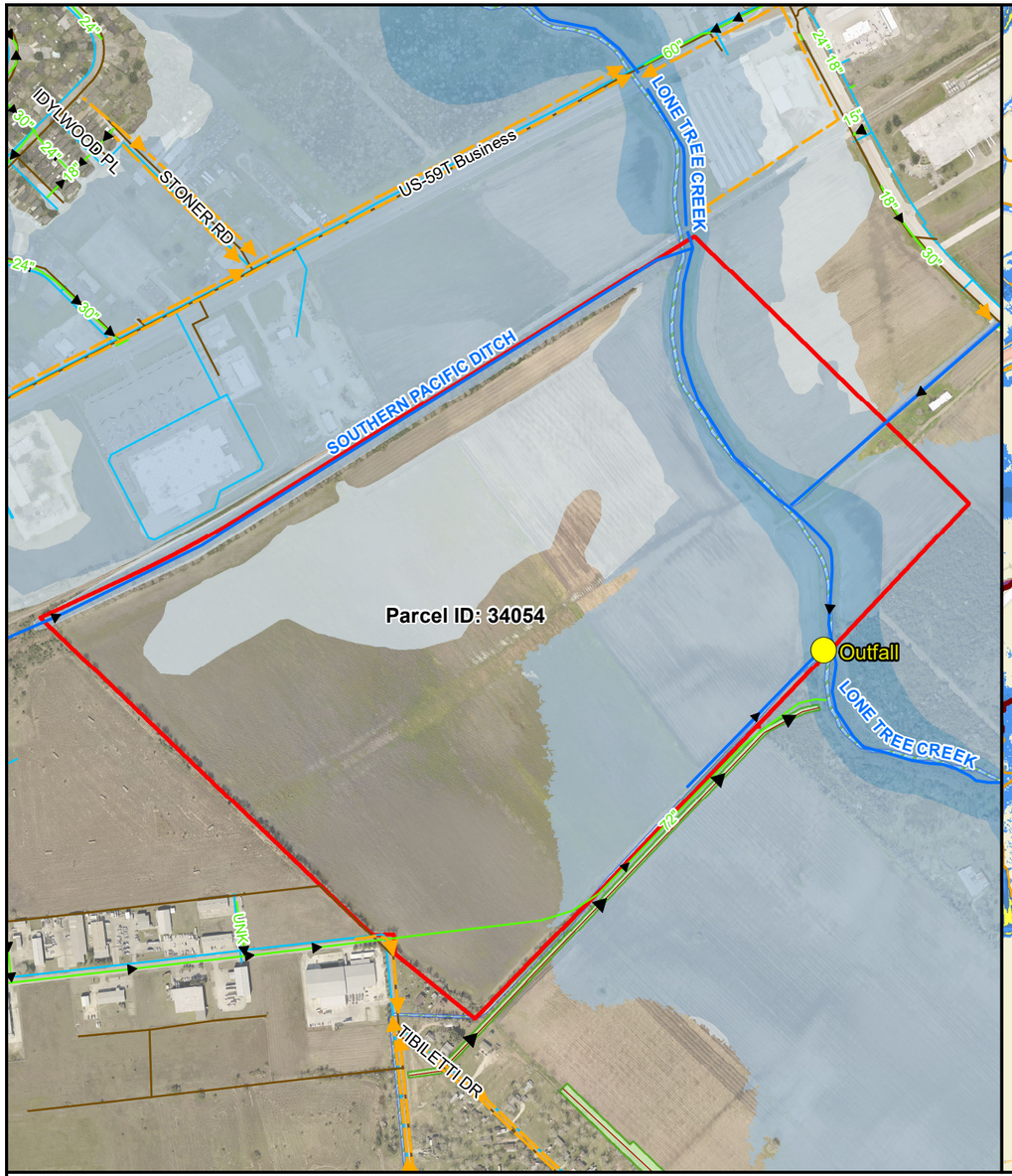
THE CITY OF VICTORIA TEXAS

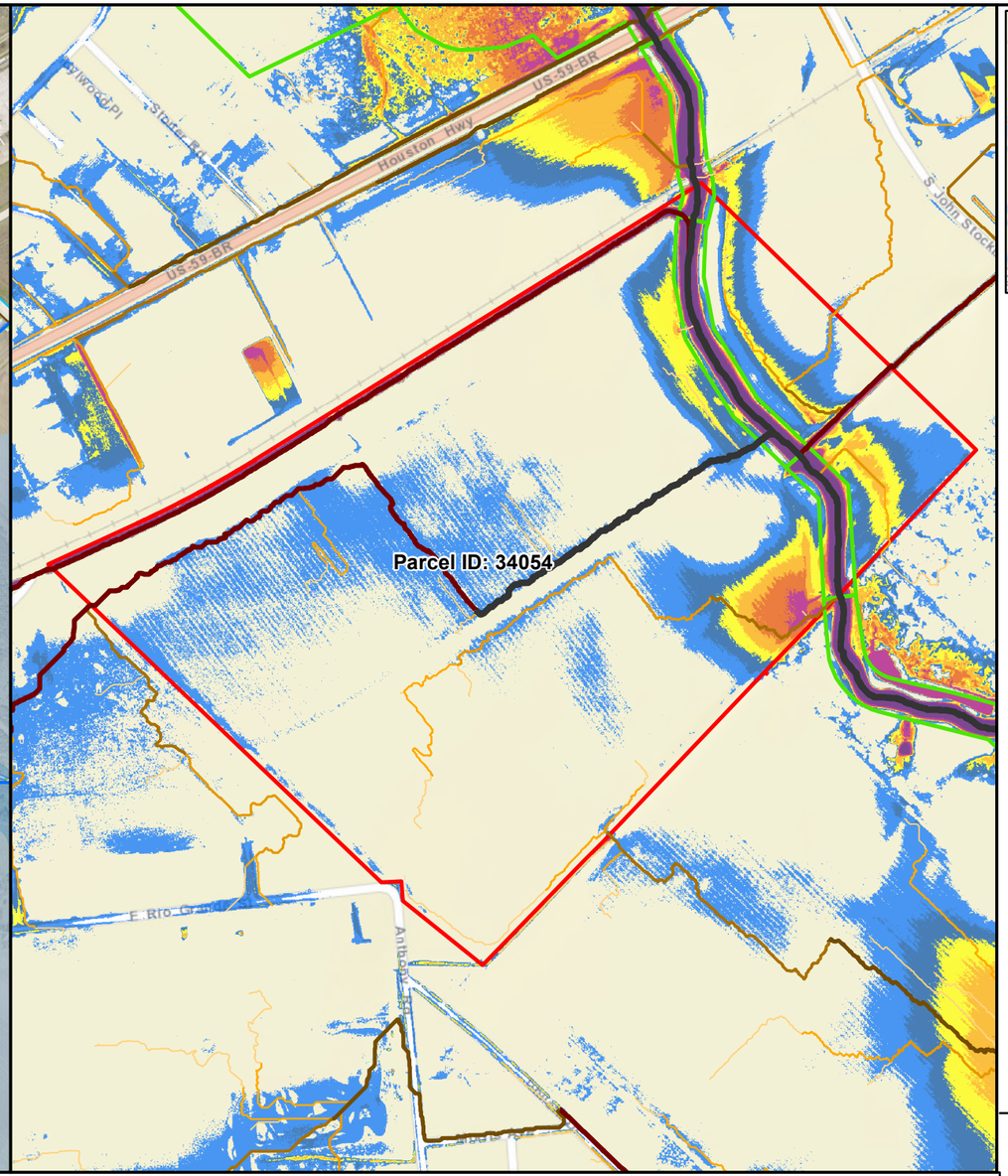
City of Victoria
Storm Drainage Master Plan Update

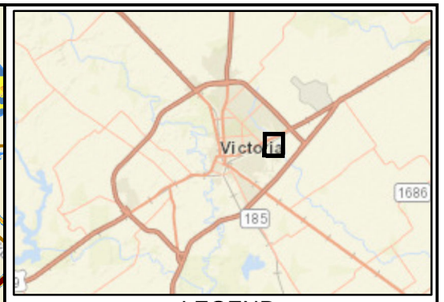
Priority One - Independent Study Area
Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.1

User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Constraints Map 33561.mxd







LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 400 800

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34054	Property Size (ac)	224
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain and Floodway	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential Error on Current FEMA Maps, Potential for Ponding Water	2020 Preliminary FEMA maps indicate that the extent of the 100 yr Flood Plain on this parcel will expand significantly when the new maps are adopted. Overland flow analysis indicates that ponding to 2.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Southern Pacific Ditch & Lone Tree Creek	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow	X		128 Ac + from west	Future development needs to consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other	X			The existing 72" storm sewer pipe, located along the southeast property line, is currently at capacity.
Recommendation	Route detention pond outfall to Lone Tree Creek or Southern Pacific Ditch and limit discharge to pre-development conditions.				

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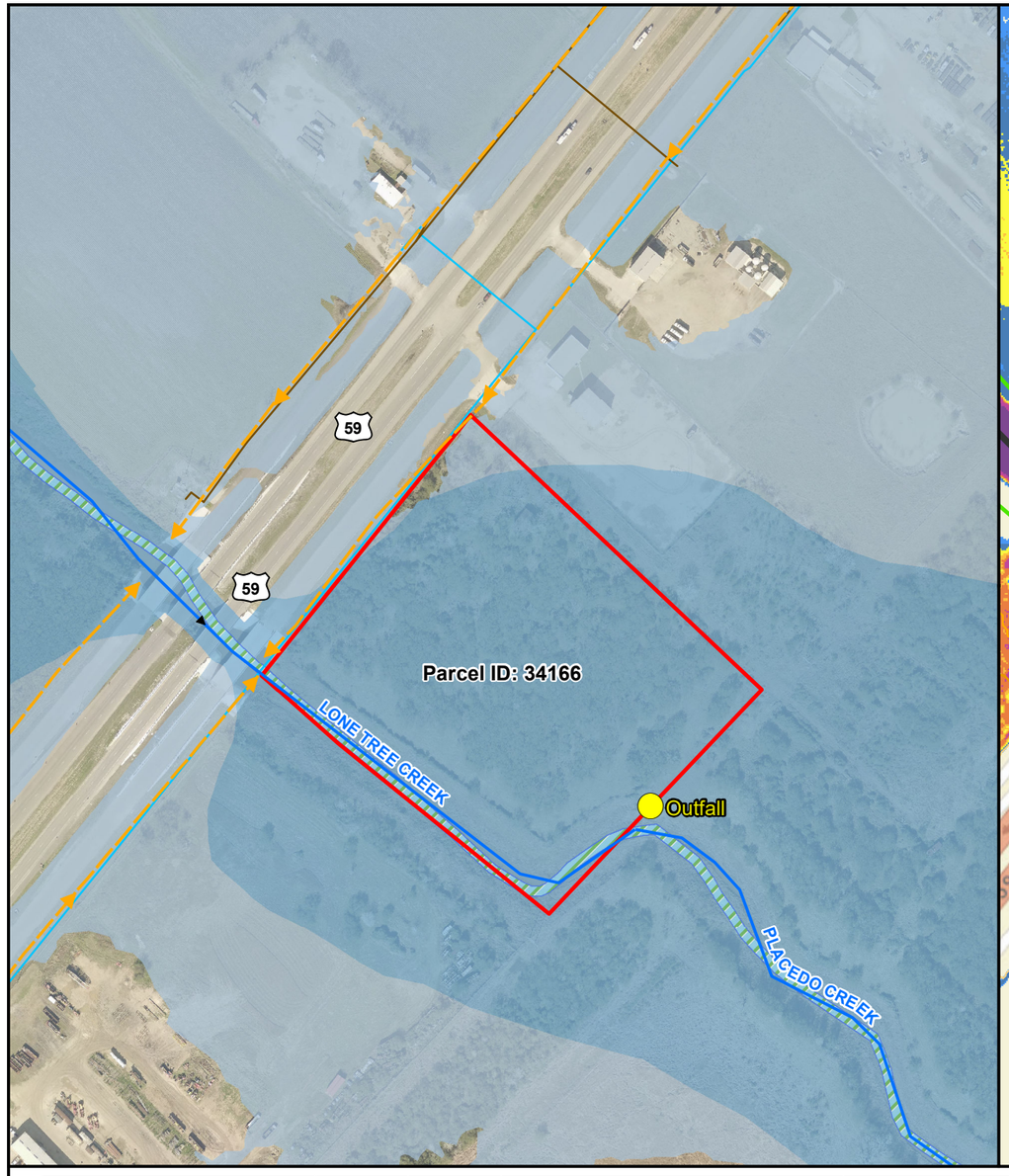
THE CITY OF VICTORIA TEXAS

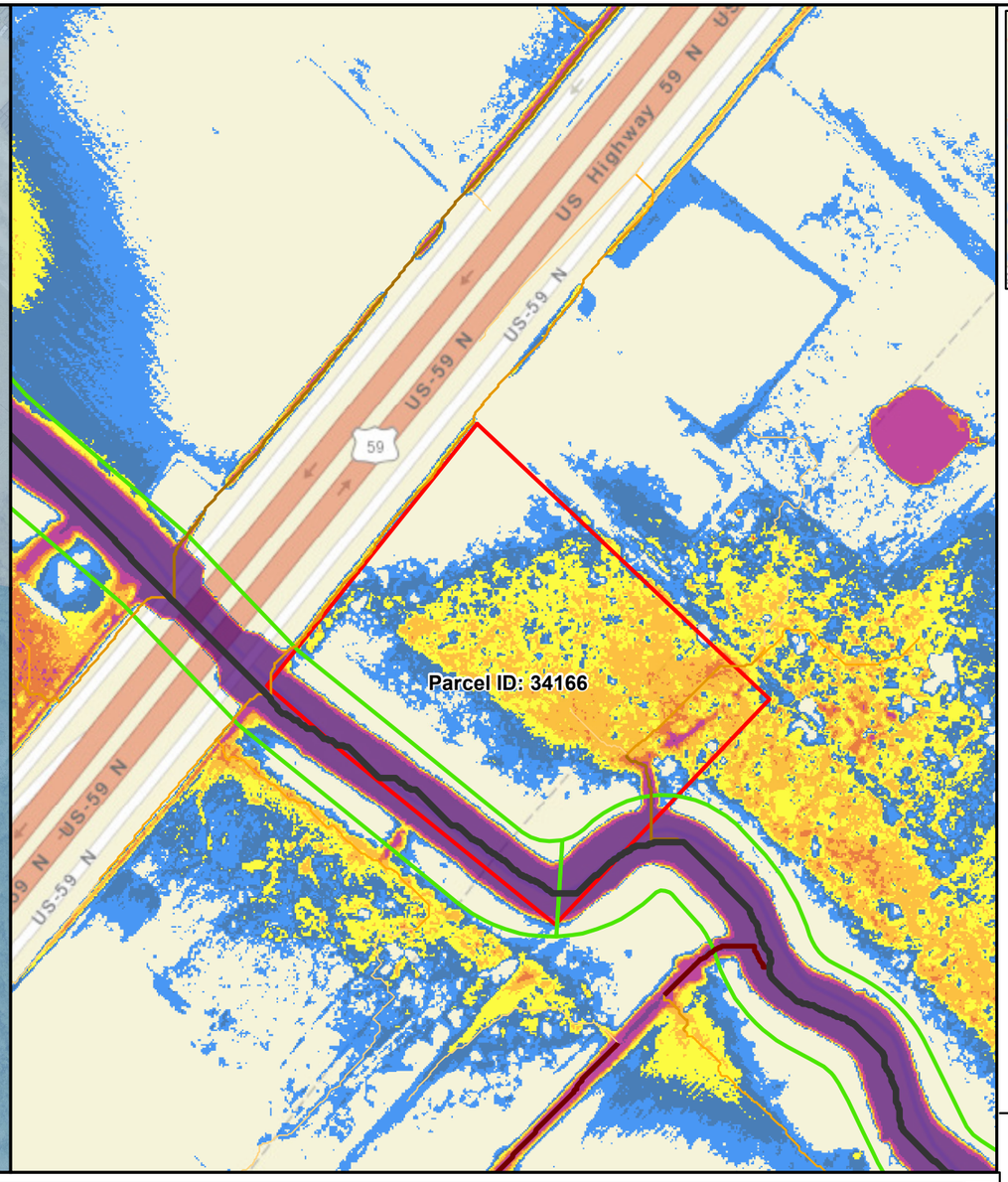
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.2

User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Constraints Map 34054.mxd





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34166	Property Size (ac)	11
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain and Floodway	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 3' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Lone Tree Creek	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation	Consider land uses that are compatible with Floodplain and Floodway propperties.				

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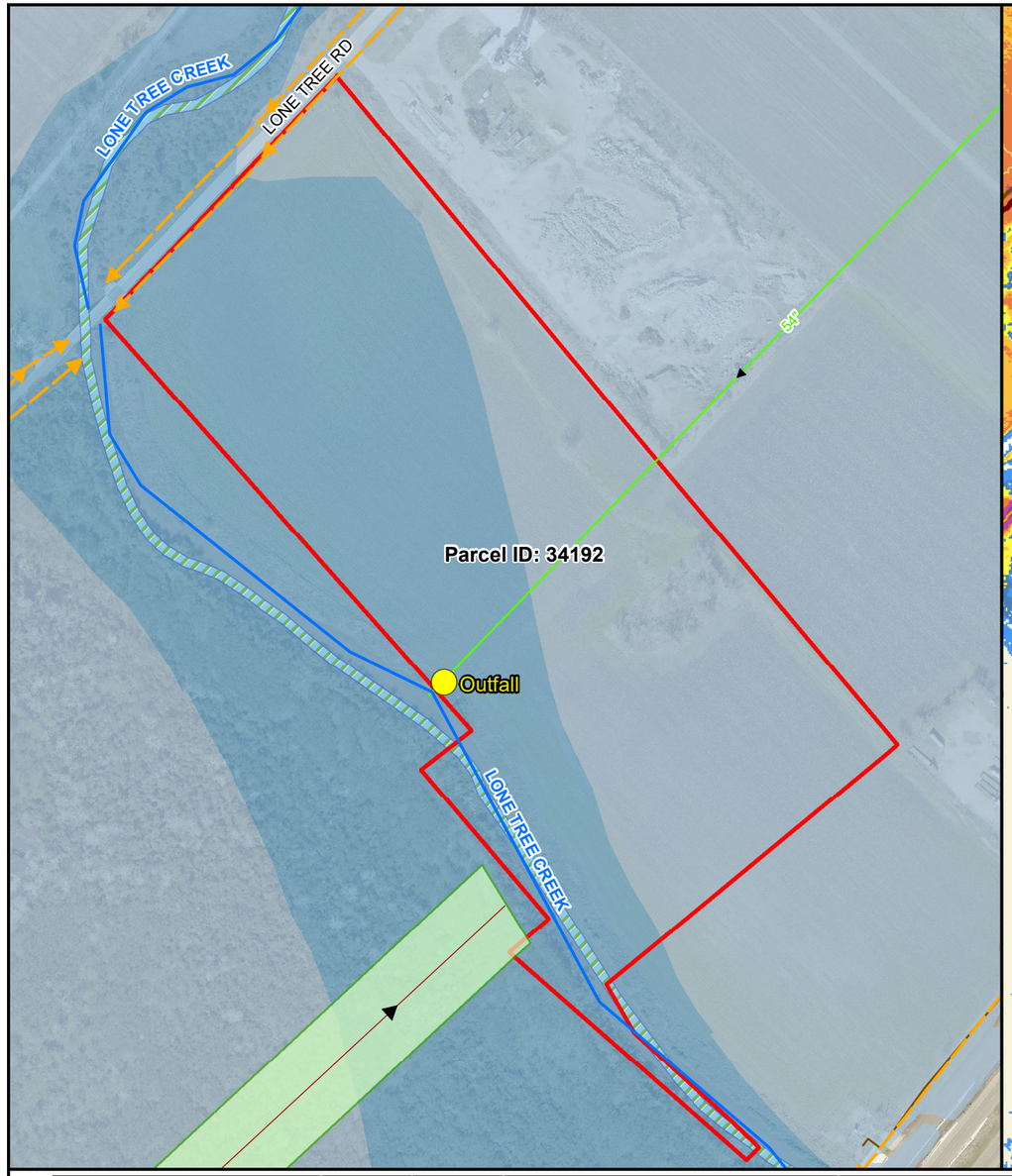
THE CITY OF VICTORIA TEXAS

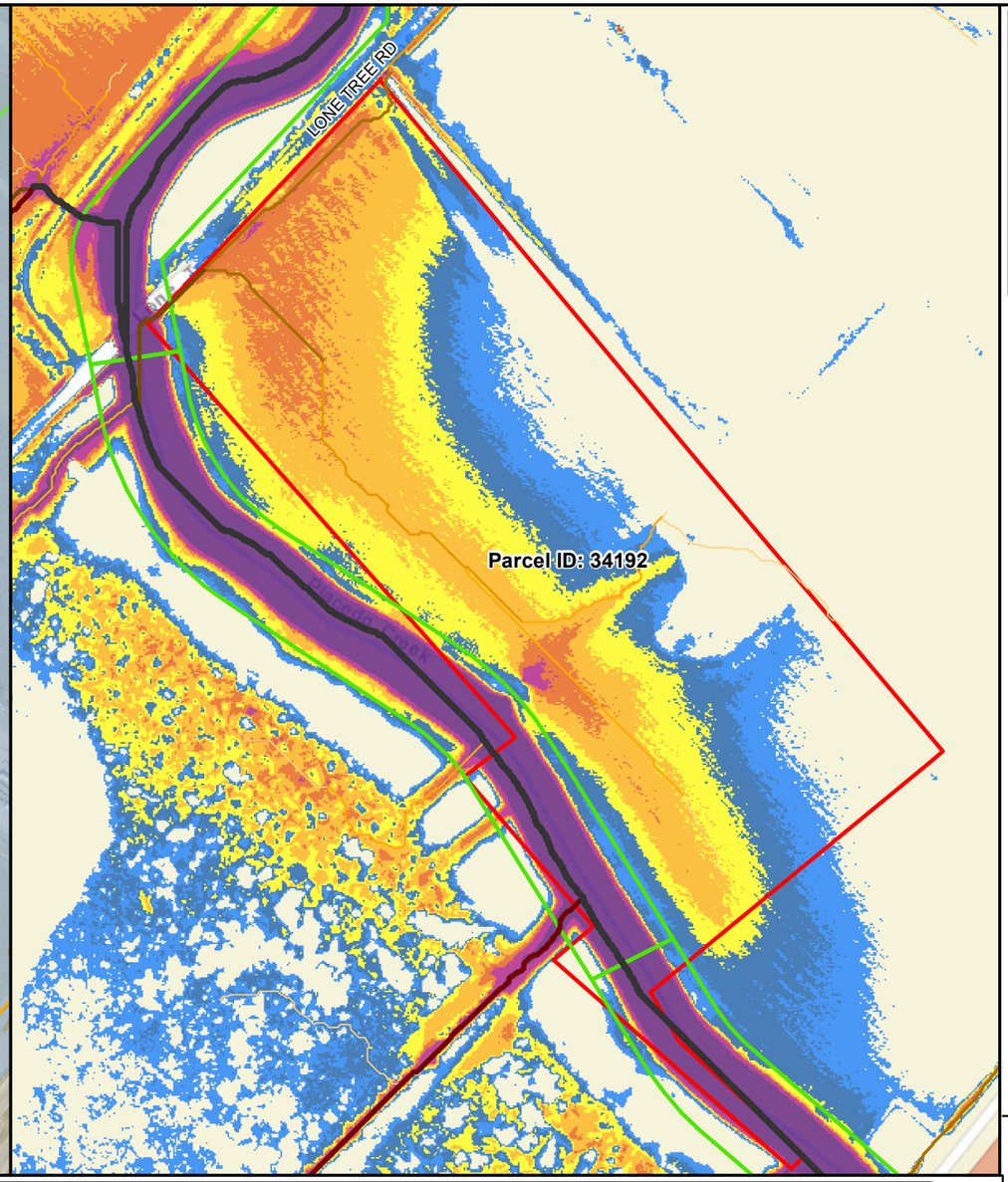
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.3

User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Constraints Map 34166.mxd





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34192	Property Size (ac)	28
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain and Floodway	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 2.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Lone Tree Creek	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication		X		
9	Other				
Recommendation		Consider land uses that are compatible with Floodplain and Floodway properties.			

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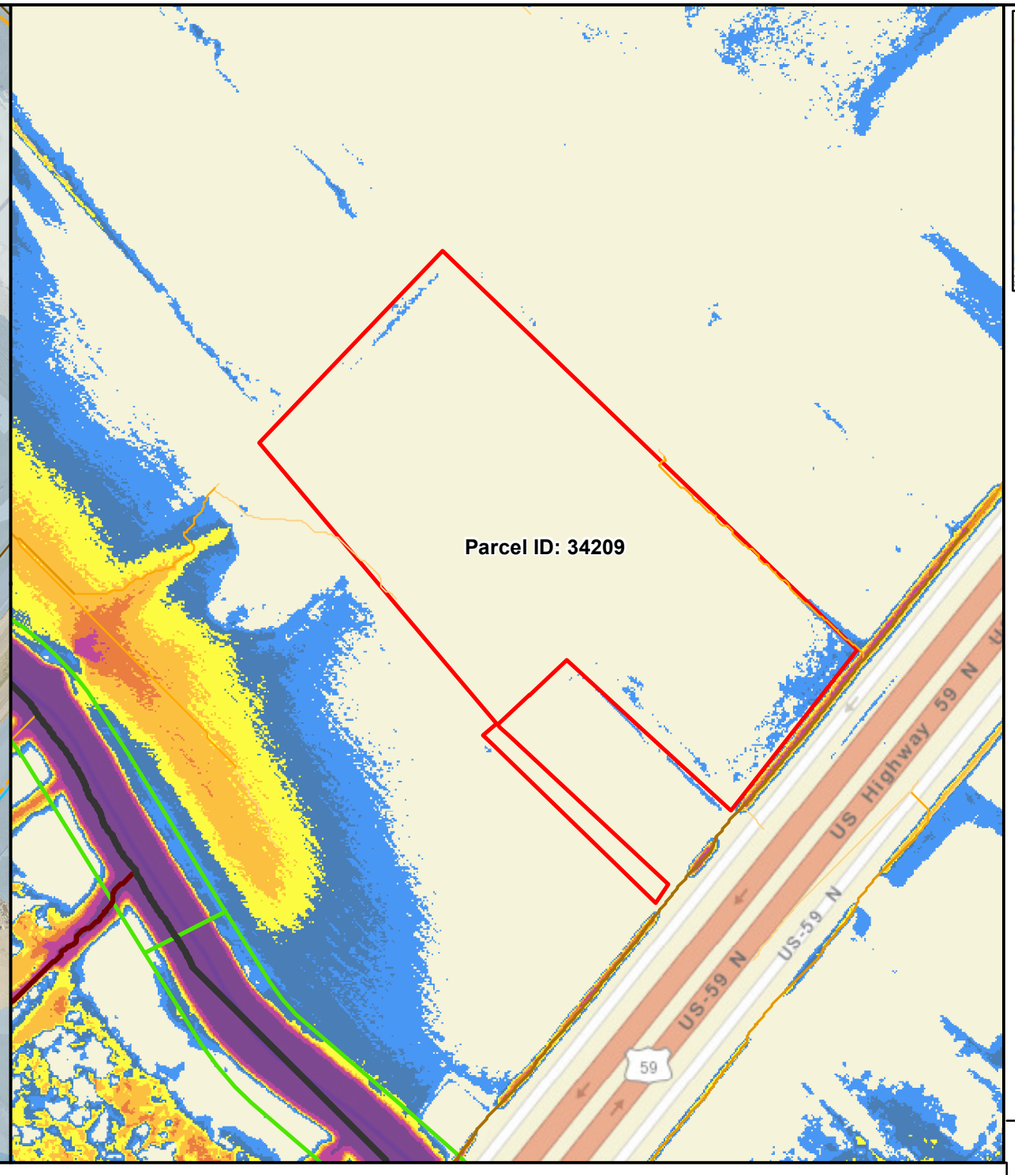
THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.4



LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34209	Property Size (ac)	14
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		Parcel is not shown to be in the FEMA 100 yr Flood Plain according to the Effective Map dated 8/4/1987. See "Other Flood Risk" below.
2	Other Flood Risk	X		Potential Error on Current FEMA Maps	2020 Preliminary FEMA maps indicate that this parcel will be 100% within the 100 yr Flood Plain when the new maps are adopted.
3	Outfall Channel		X		This parcel has direct access to an existing 54" storm sewer along the northwest property line.
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other				
Recommendation	Investigate ground elevation vs flood plain elevation and plan development accordingly. Route detention pond outfall to existing 54" storm sewer and limit discharge to pro-rata share of outfall capacity.				

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.5

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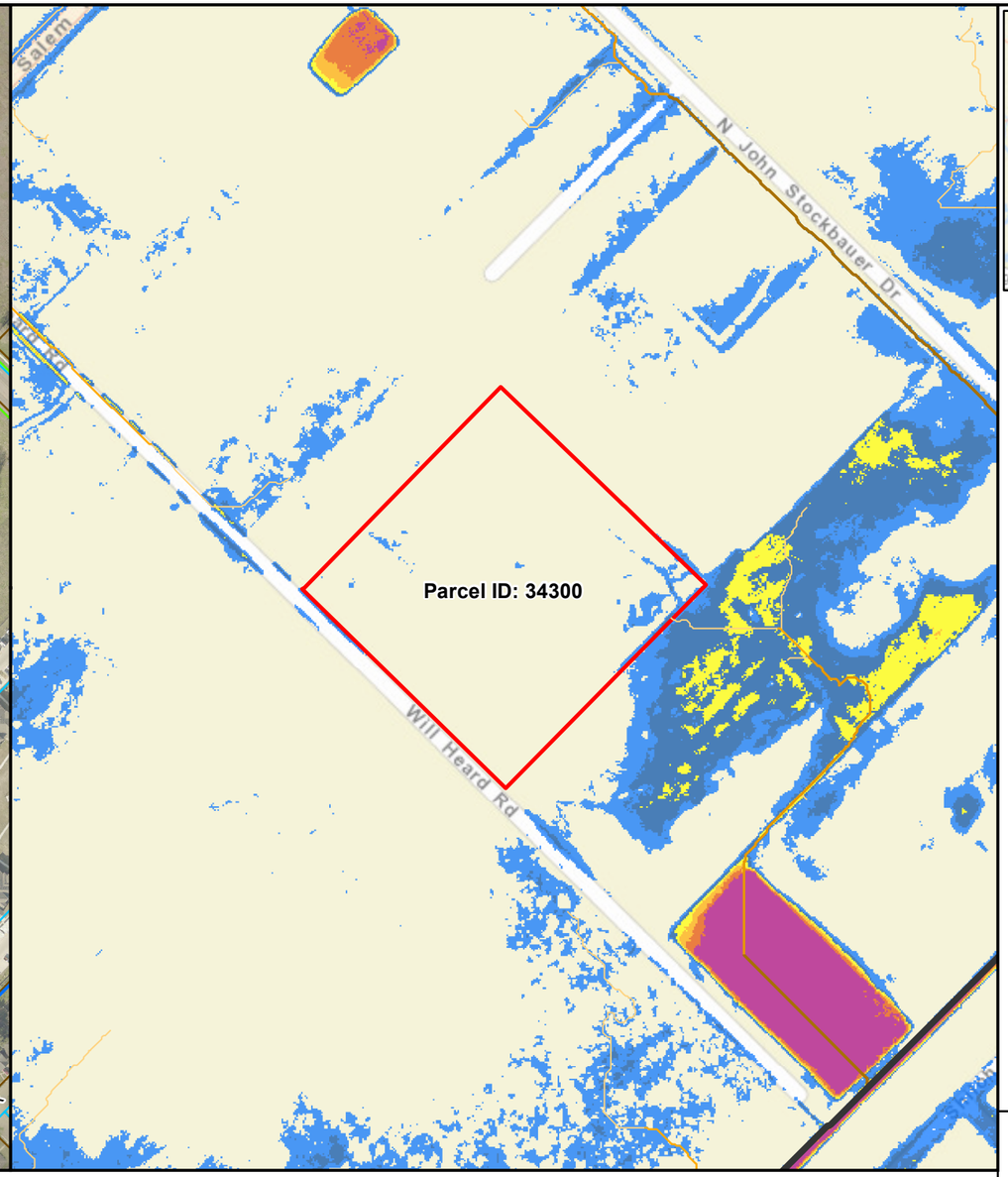

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34300	Property Size (ac)	7
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 2' may occur on portions of this parcel during heavy rains.
3	Outfall Channel		X		This parcel lacks an outfall with adquate depth and capacity.
4	Limited Outfall Depth	X		600' of Offsite Required Access Ditch	Utilize Existing City ROW to access Shenandoah Ditch.
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation		Route detention pond discharge to Shenandoah Ditch and limit discharge to pro-rate share of ditch existing ditch capacity.			

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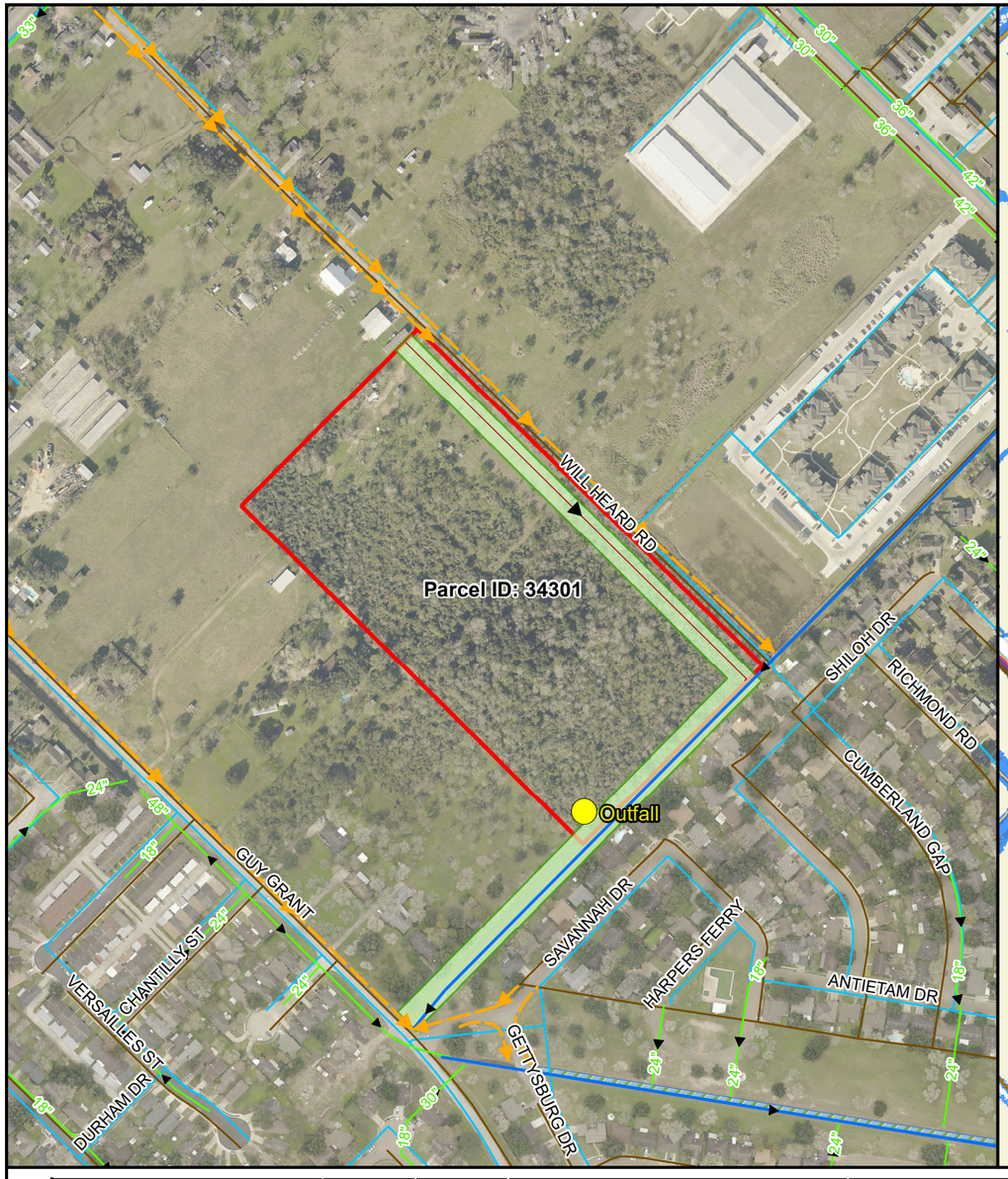
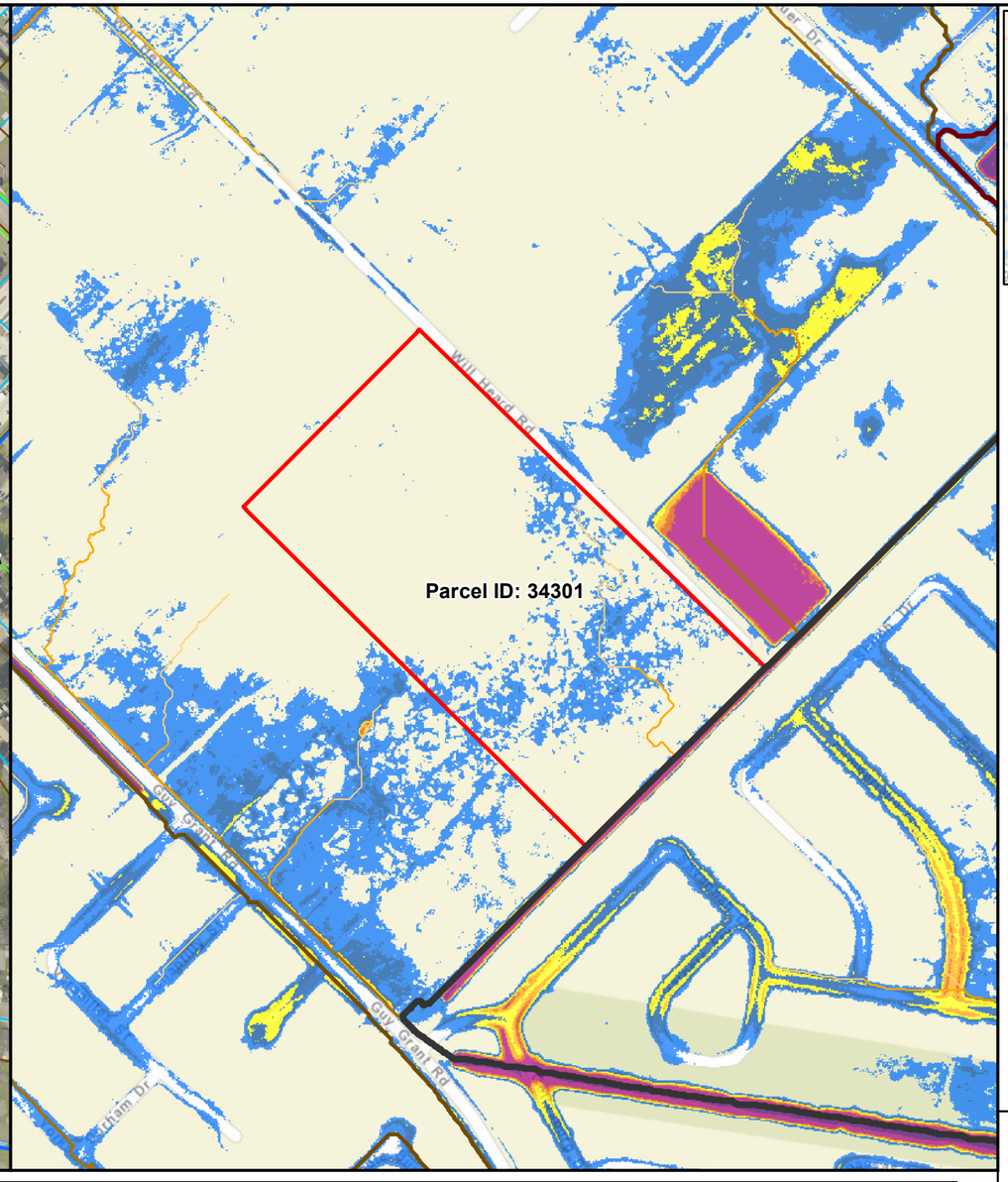
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.6





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 200 400

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34301	Property Size (ac)	20
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 2' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Shanendoah Ditch	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication	X			
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation		Route detention pond outfall to Shenandoah Ditch and limit discharge to pro-rata share o existing ditch capacity.			

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.7

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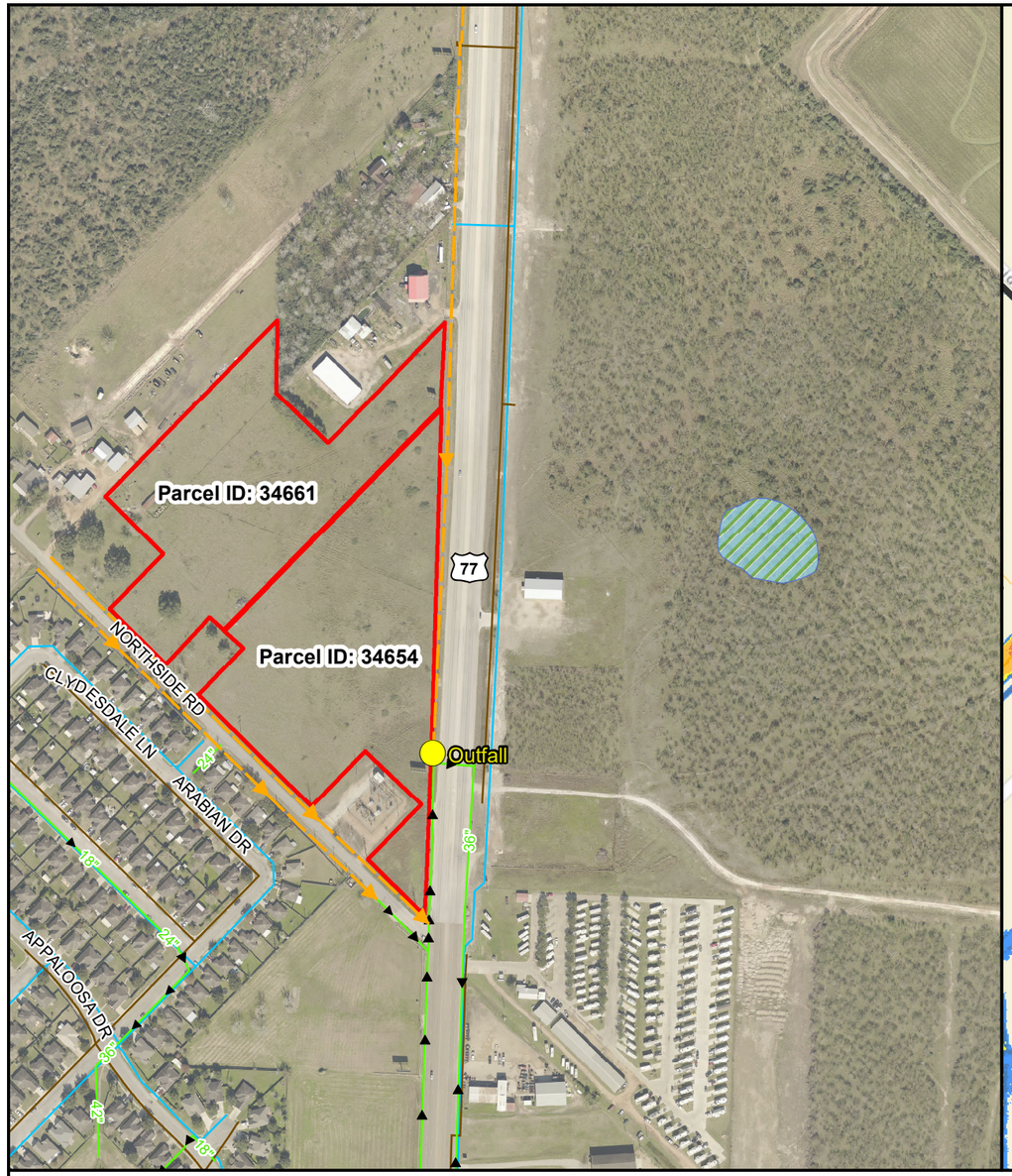

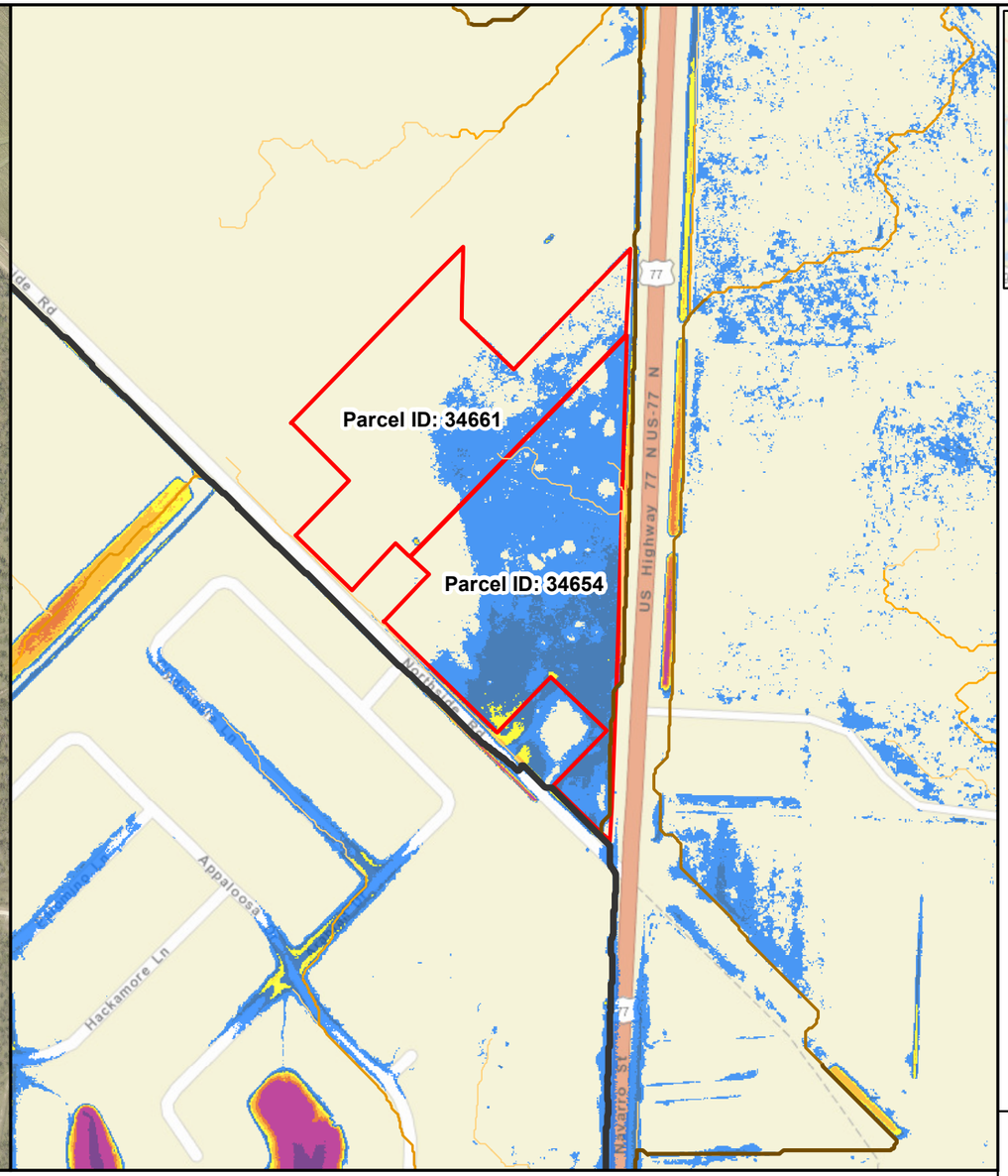

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 200 400

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34654 & 34661	Property Size (ac)	18
Watershed	North Outfall		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 1.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel		X		Outfall is to a TxDOT underground storm sewer.
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other				
Recommendation	Route detention pond outfall to TxDOT underground storm sewer and limit discharge to pro-rata share of pipe capacity.				

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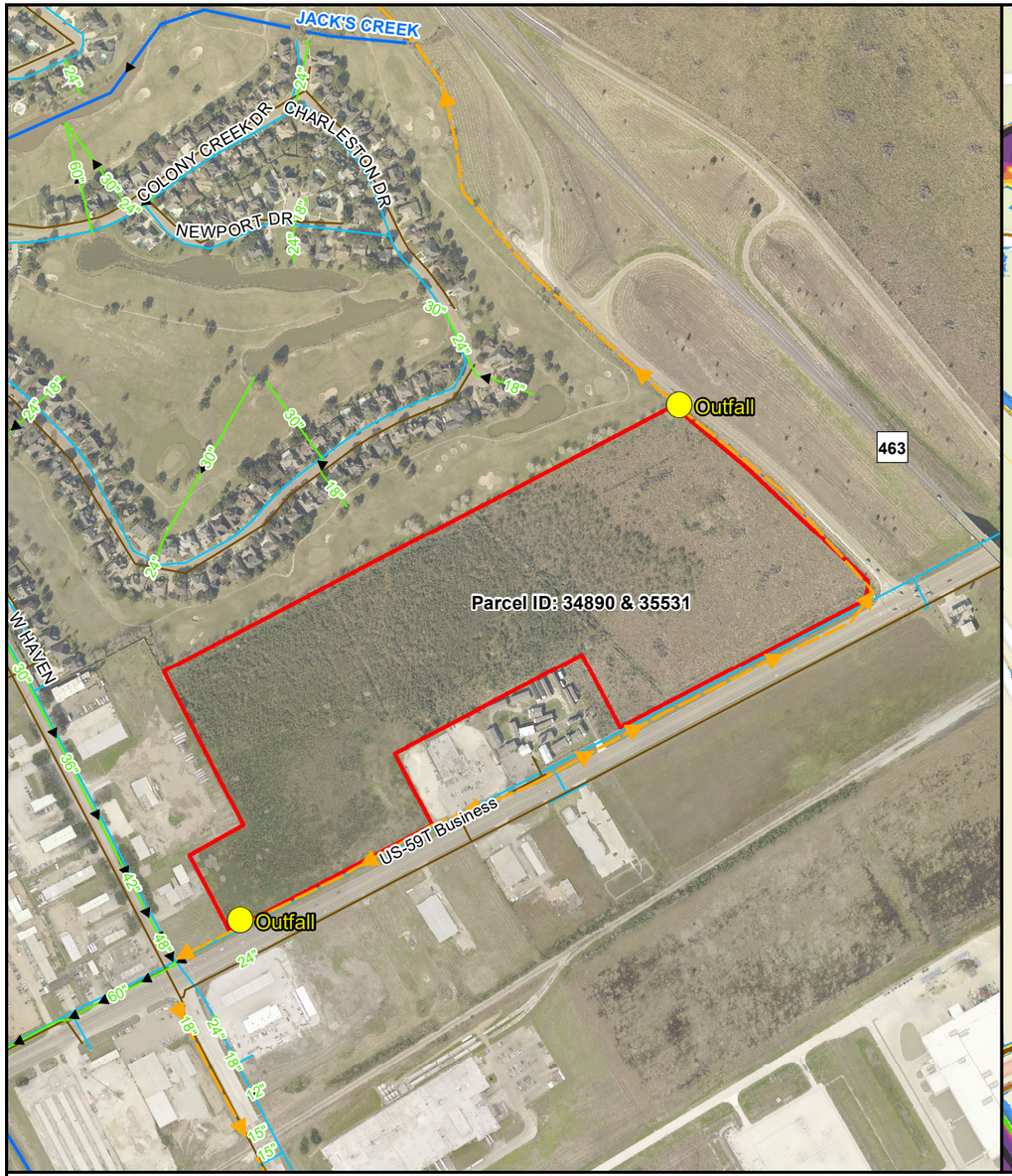
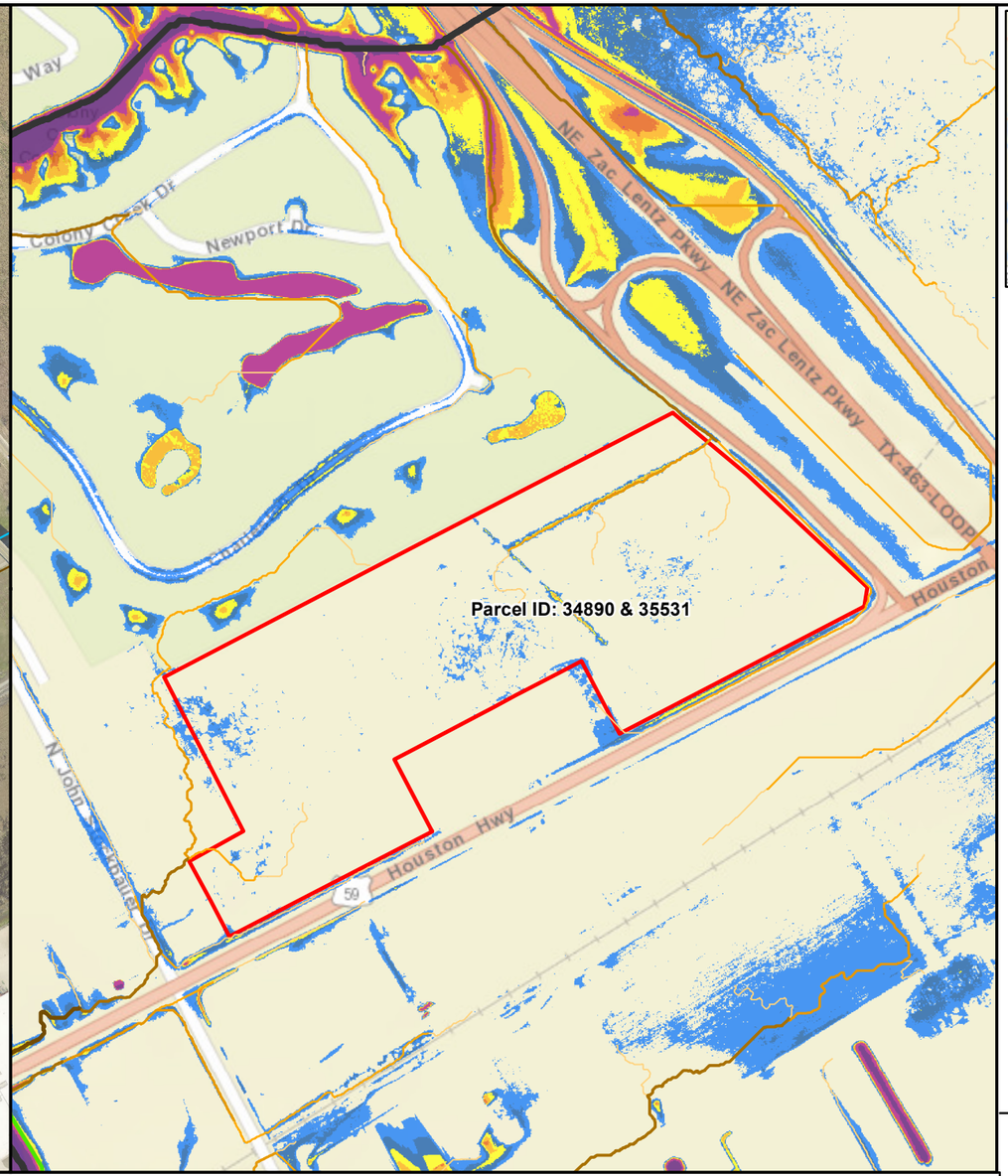
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.8





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 300 600

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	34890, 35531	Property Size (ac)	55
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel		X		Outfall is to TxDOT roadside ditches on US 59B and Loop 463.
4	Limited Outfall Depth	X		Roadside Ditch, Less than 3 ft of Depth	
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other				
Recommendation	Route detention pond outfall to TxDOT roadside ditch and limit discharge to pro-rata share of ditch capacity. Investigate the extension of underground storm sewer pipe from the US 59B/John Stockbauer intersection. Limit detention pond discharge to pro-rata share of pipe or ditch capacity.				

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.9

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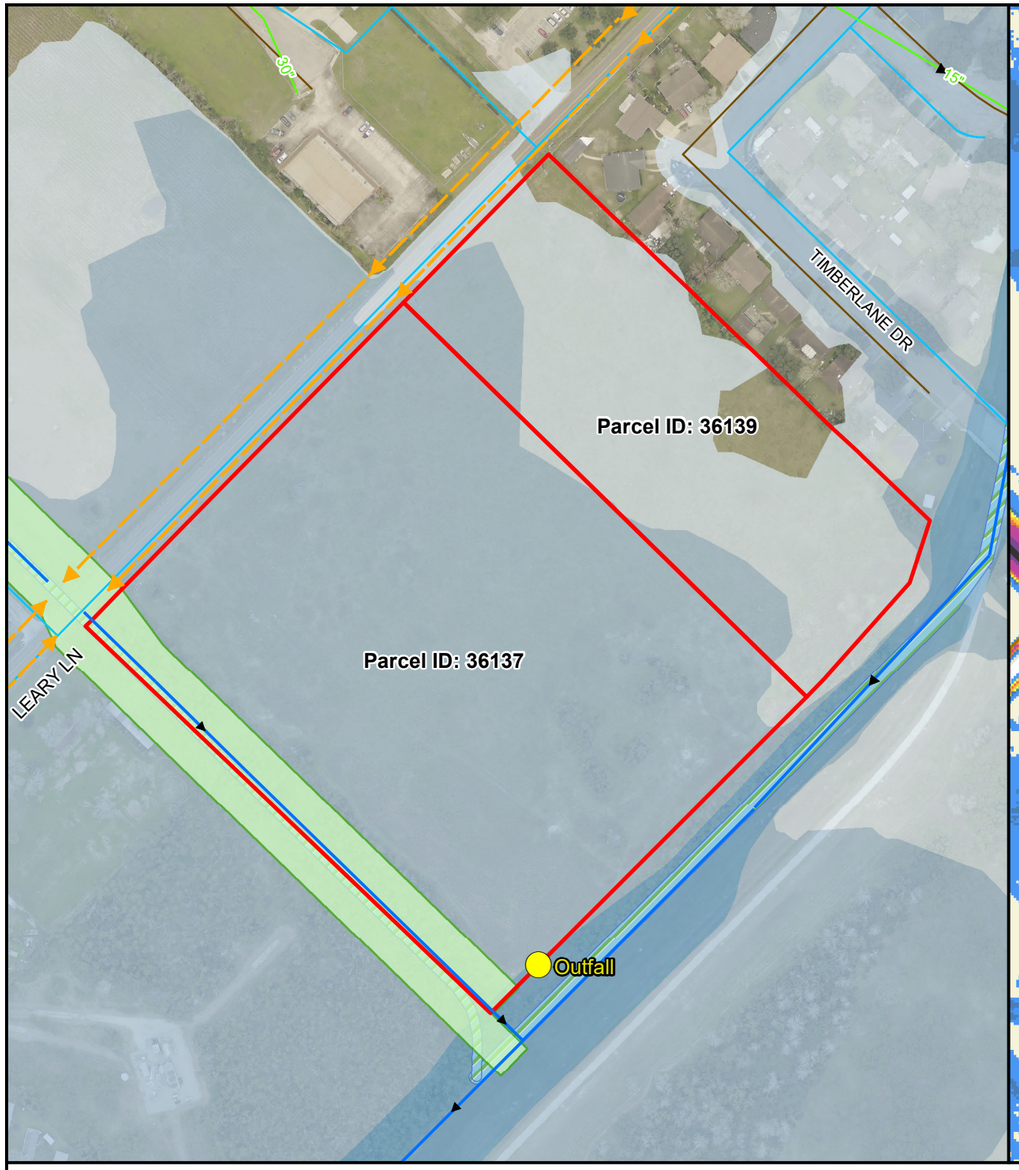

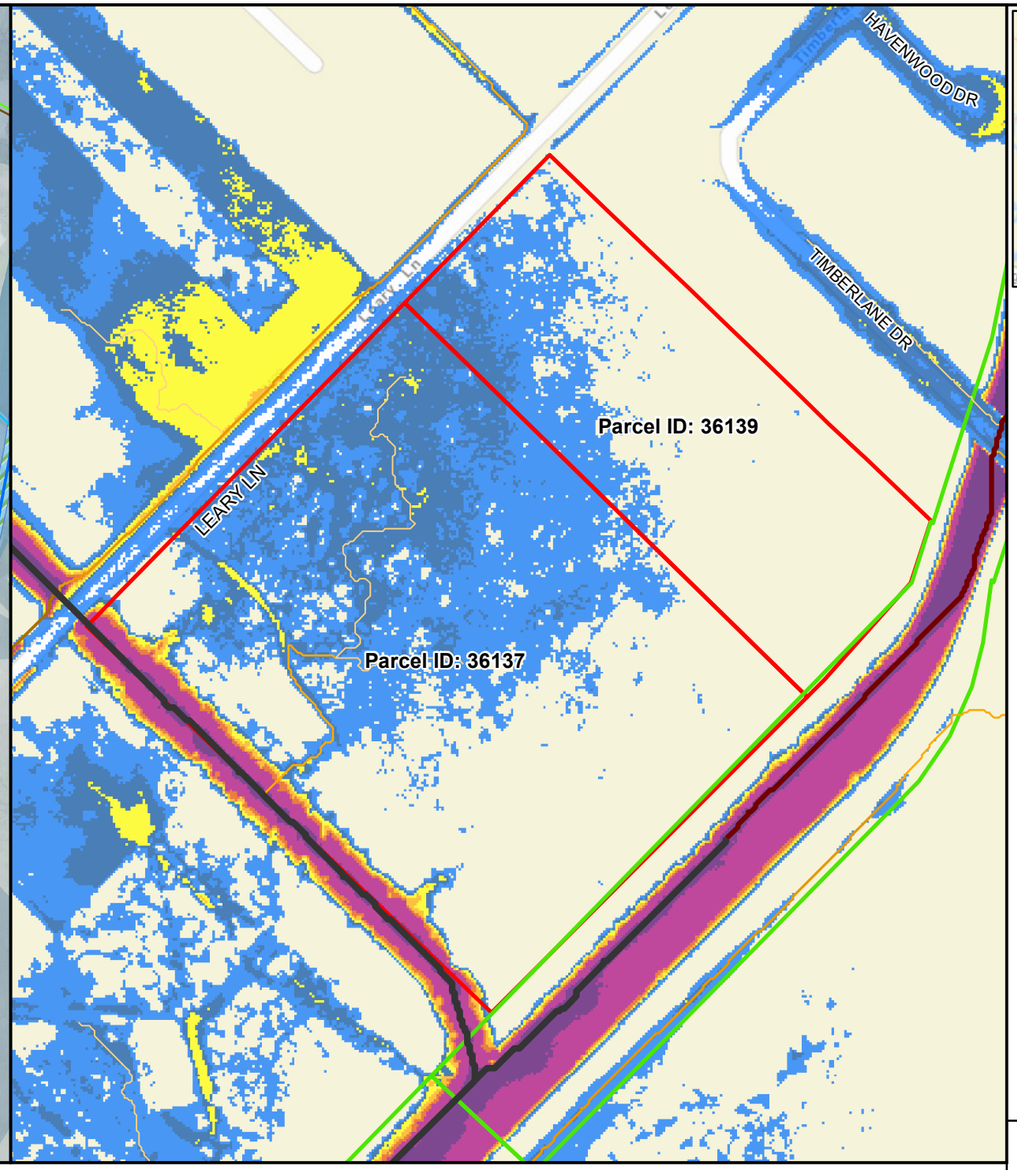

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 100 200

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	36137, 36139	Property Size (ac)	15
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 2.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Shenandoah Ditch & Lone Tree Creek	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation		Route detention pond discharge to Lone Tree Creek and/or Shenandoah Ditch and limit discharge to pre-development conditions.			

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

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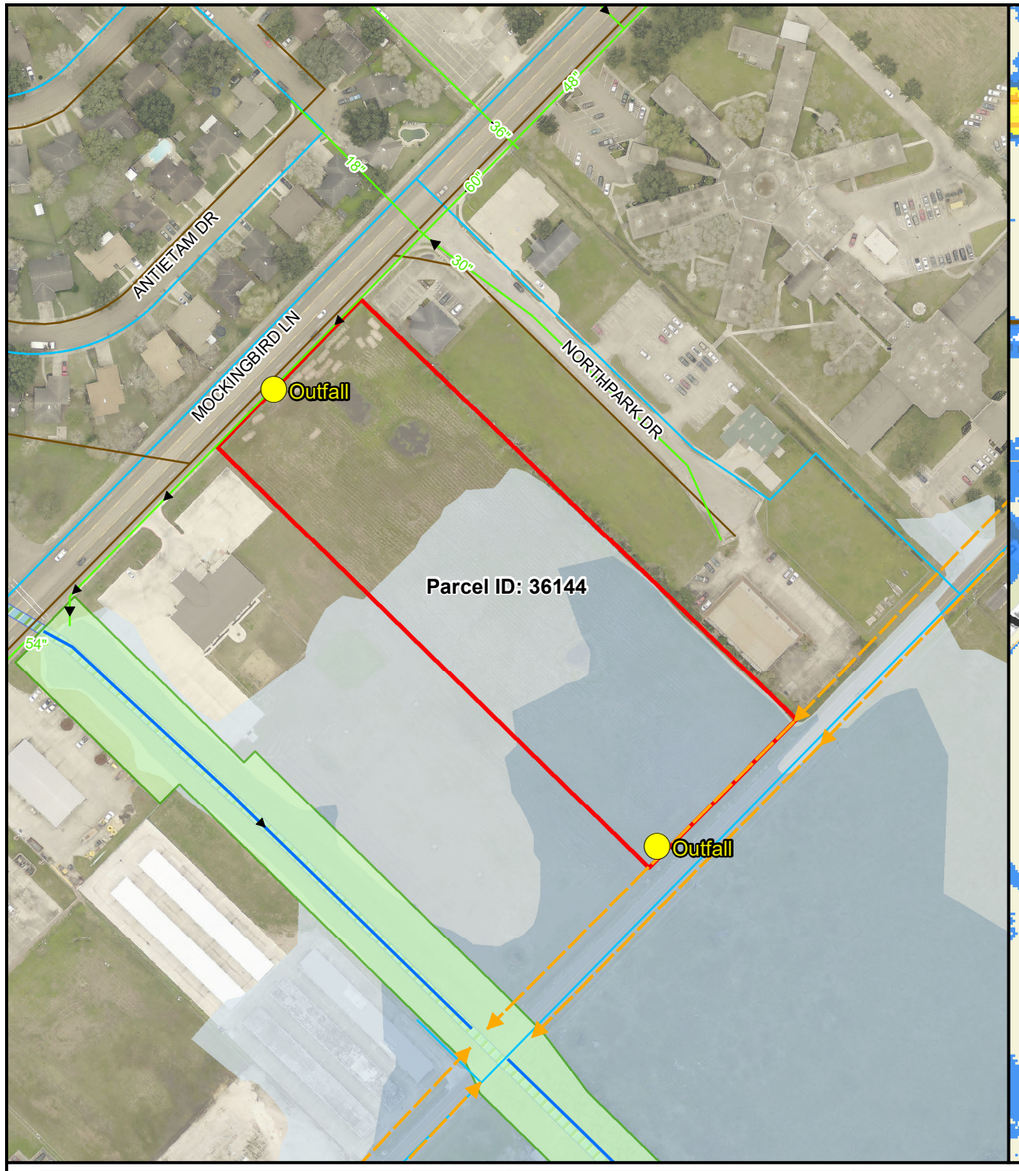

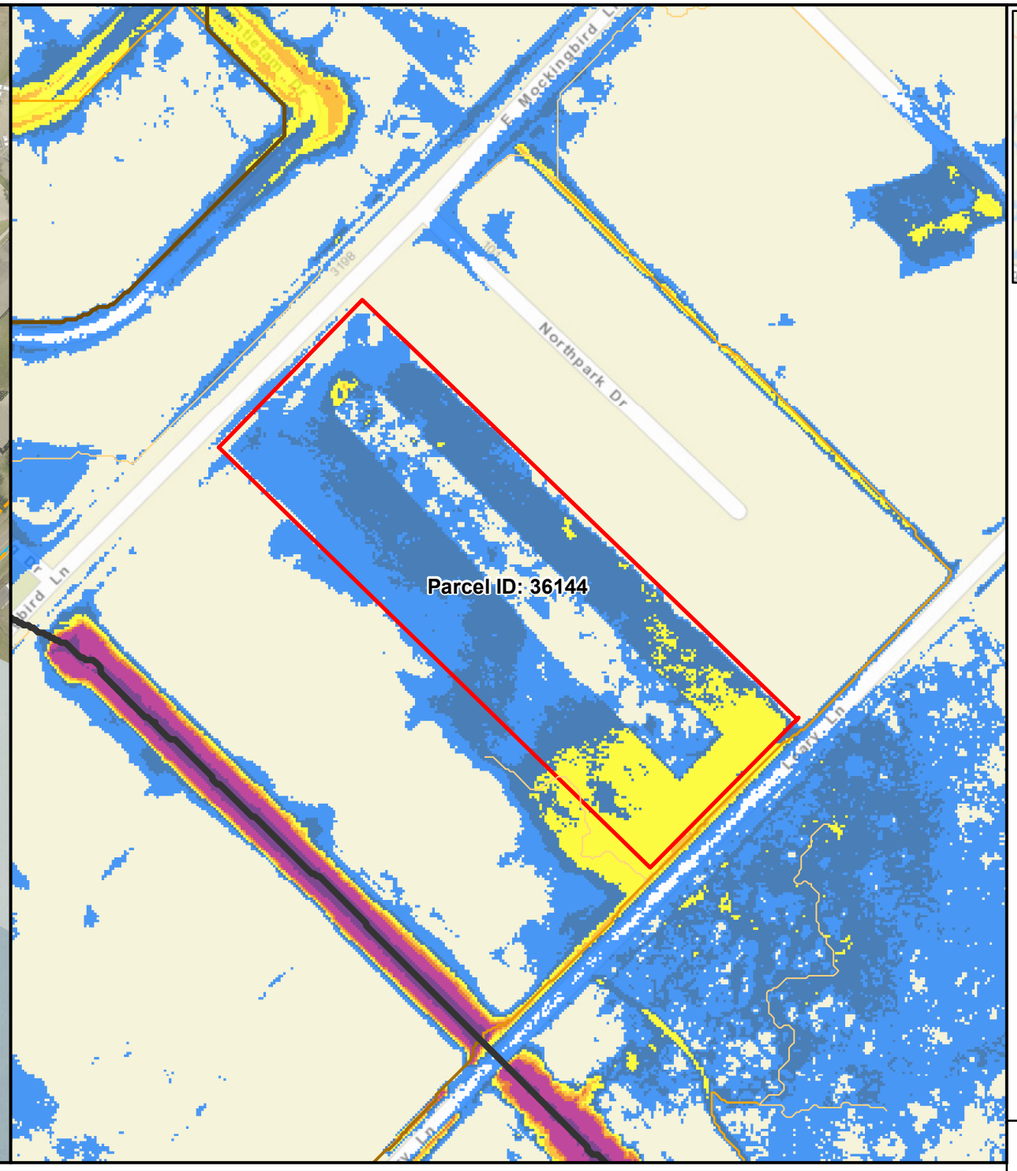

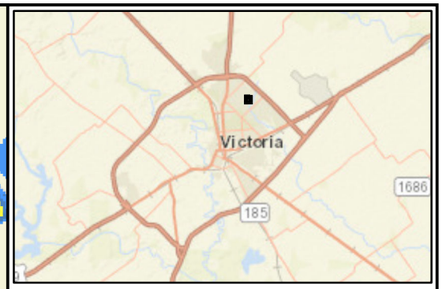

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 100 200

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	36144	Property Size (ac)	5
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 2' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X			
4	Limited Outfall Depth		X		60" Storm Sewer in Mockingbird Ln
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation	Route detention pond discharge to 60" underground storm sewer in Mockingbird and/or roadside ditch is Leary Ln. Investigate routing pond discharge to Shenandoah Ditch via an offsite easement or within Leary Ln right-of-way.				

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

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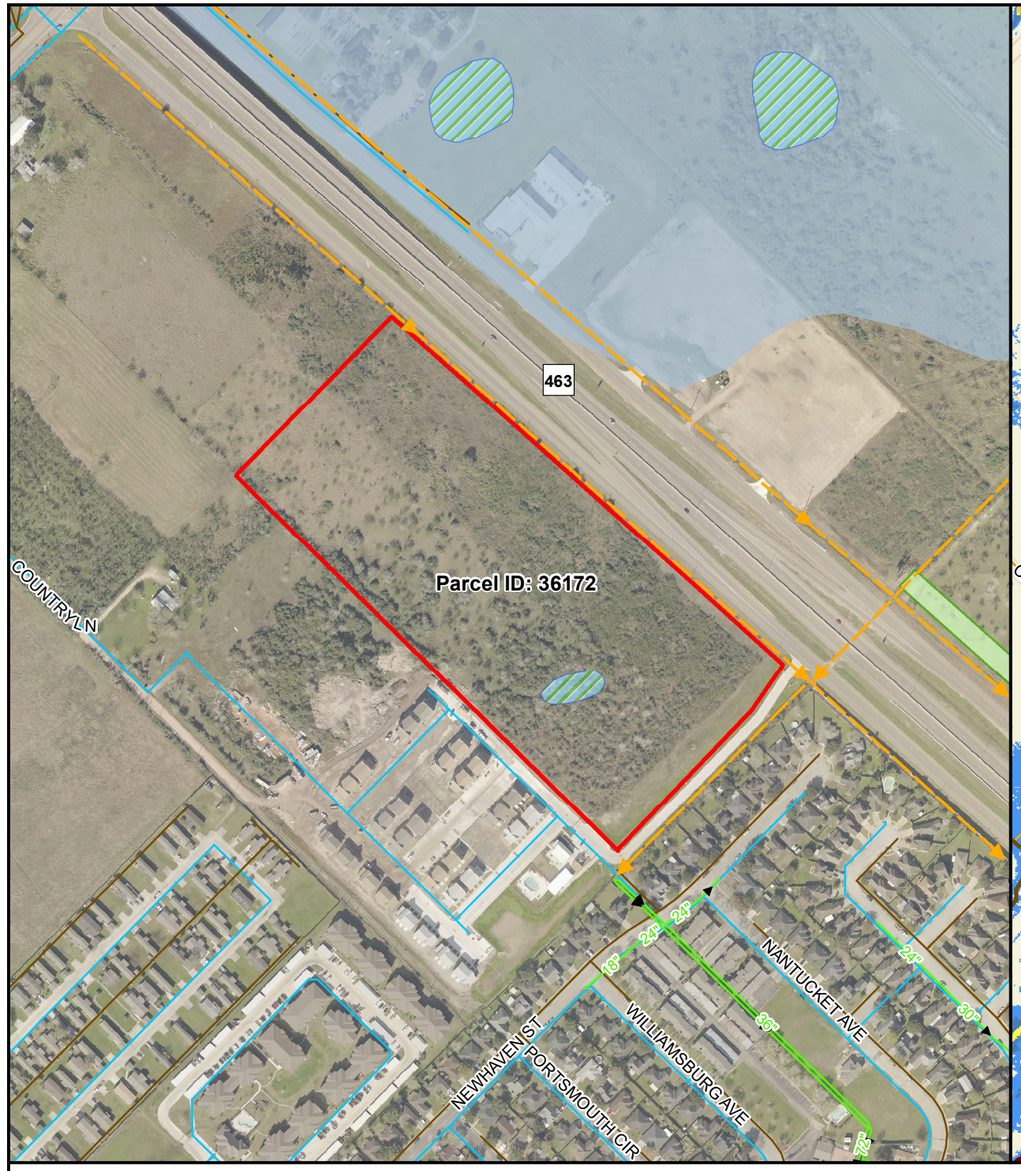

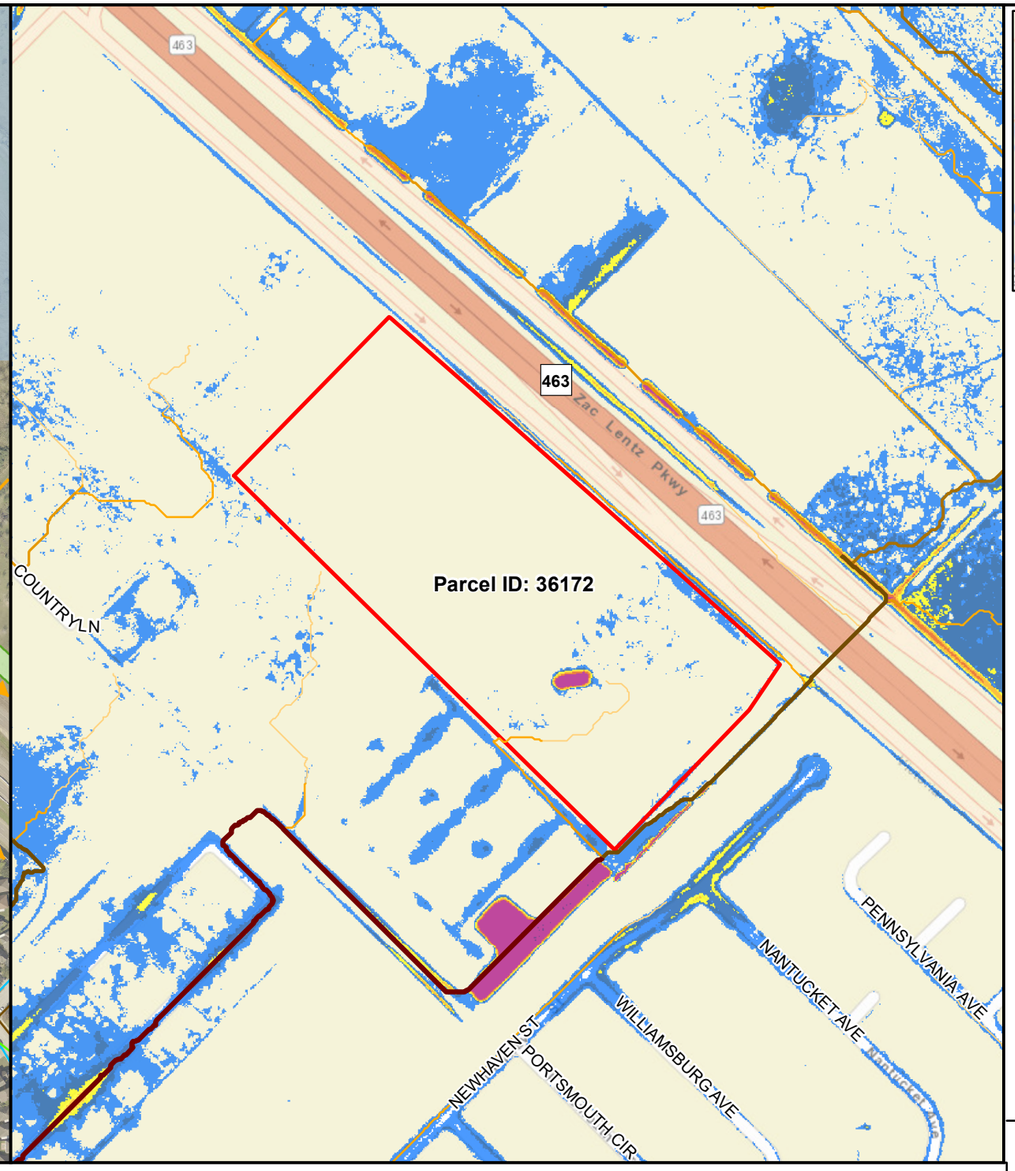

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 200 400

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	36172	Property Size (ac)	20
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 2' may occur on portions of this parcel during heavy rains.
3	Outfall Channel		X		Outfall is to TxDOT roadside ditch on Loop 463.
4	Limited Outfall Depth	X		Roadside Ditch, Less than 3 ft of Depth	
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other				
Recommendation		Route detention pond outfall to TxDOT roadside ditch and limit discharge to pro-rata share of ditch capacity.			

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.12

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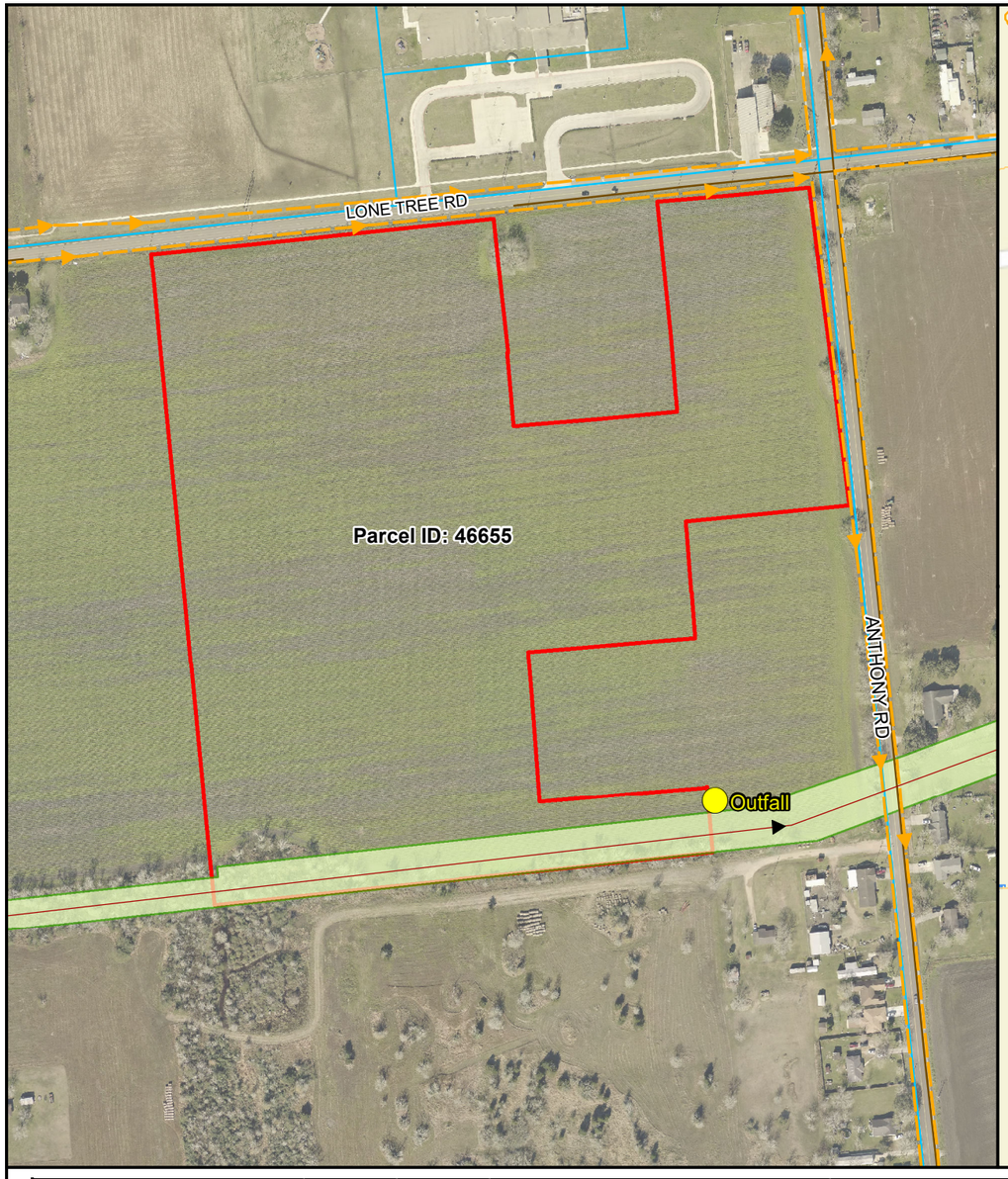

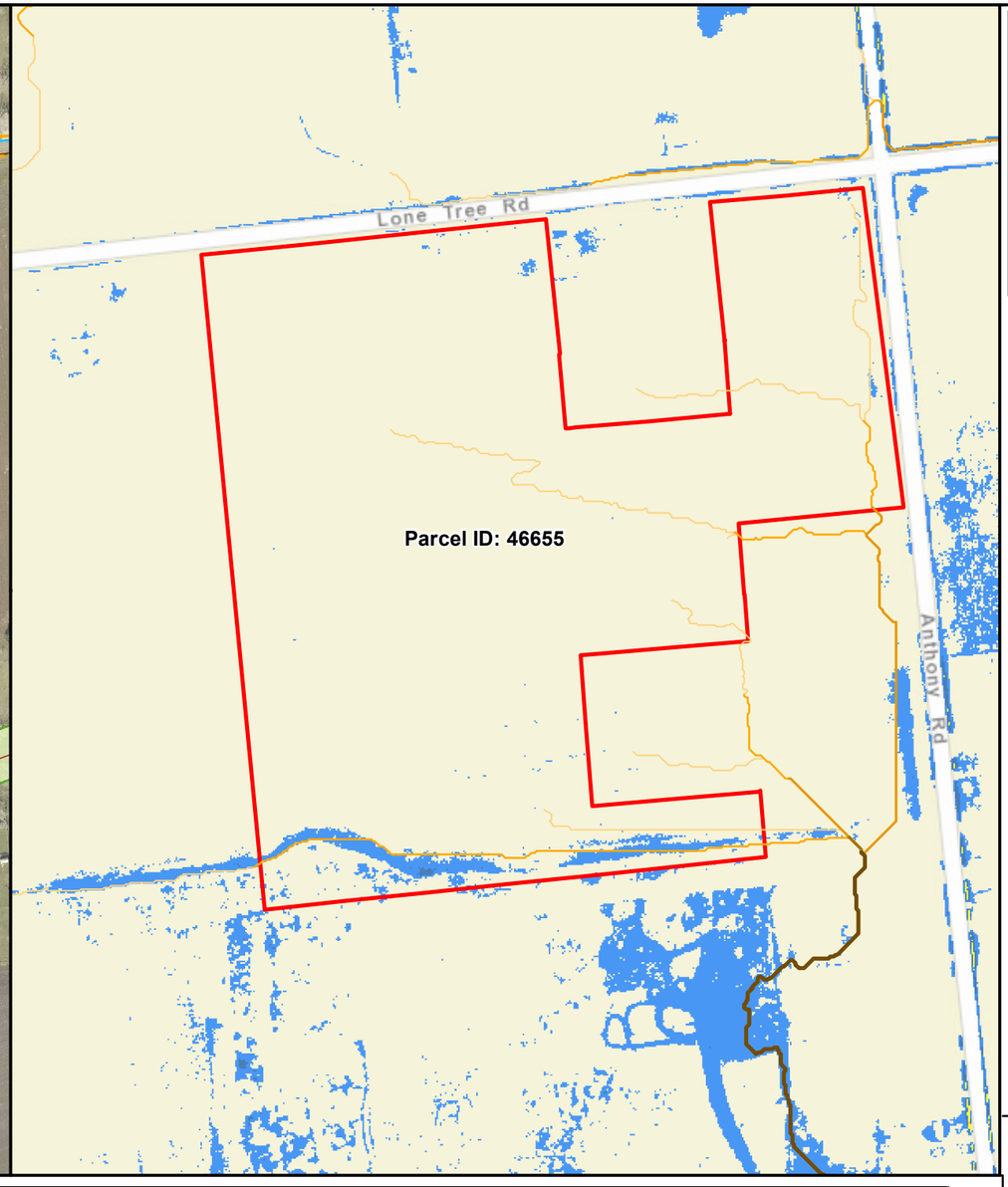

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	46655	Property Size (ac)	21
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel		X		Outfall is not available for this parcel. The property drains overland across the tracts to the east and south.
4	Limited Outfall Depth	X		Surface Drainage Only	Outfall is not available for this parcel. The property drains overland across the tracts to the east and south.
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication	X			
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation	Drainage options include: 1) obtain easements and make improvements to discharge to Lone Tree Creek; 2) utilize surface drainage along existing flow paths and limit impervious cover to 20%.				

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.13

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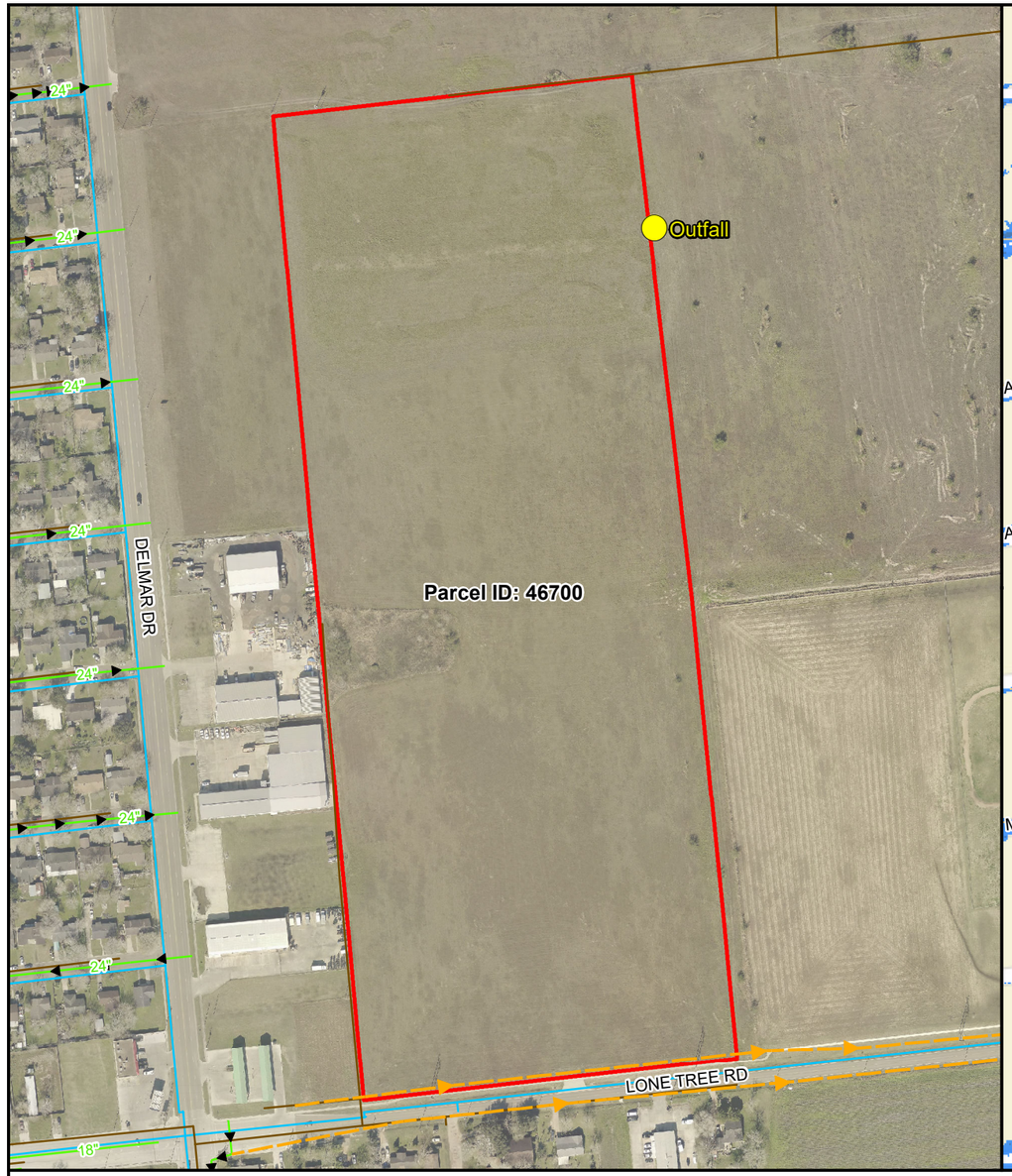

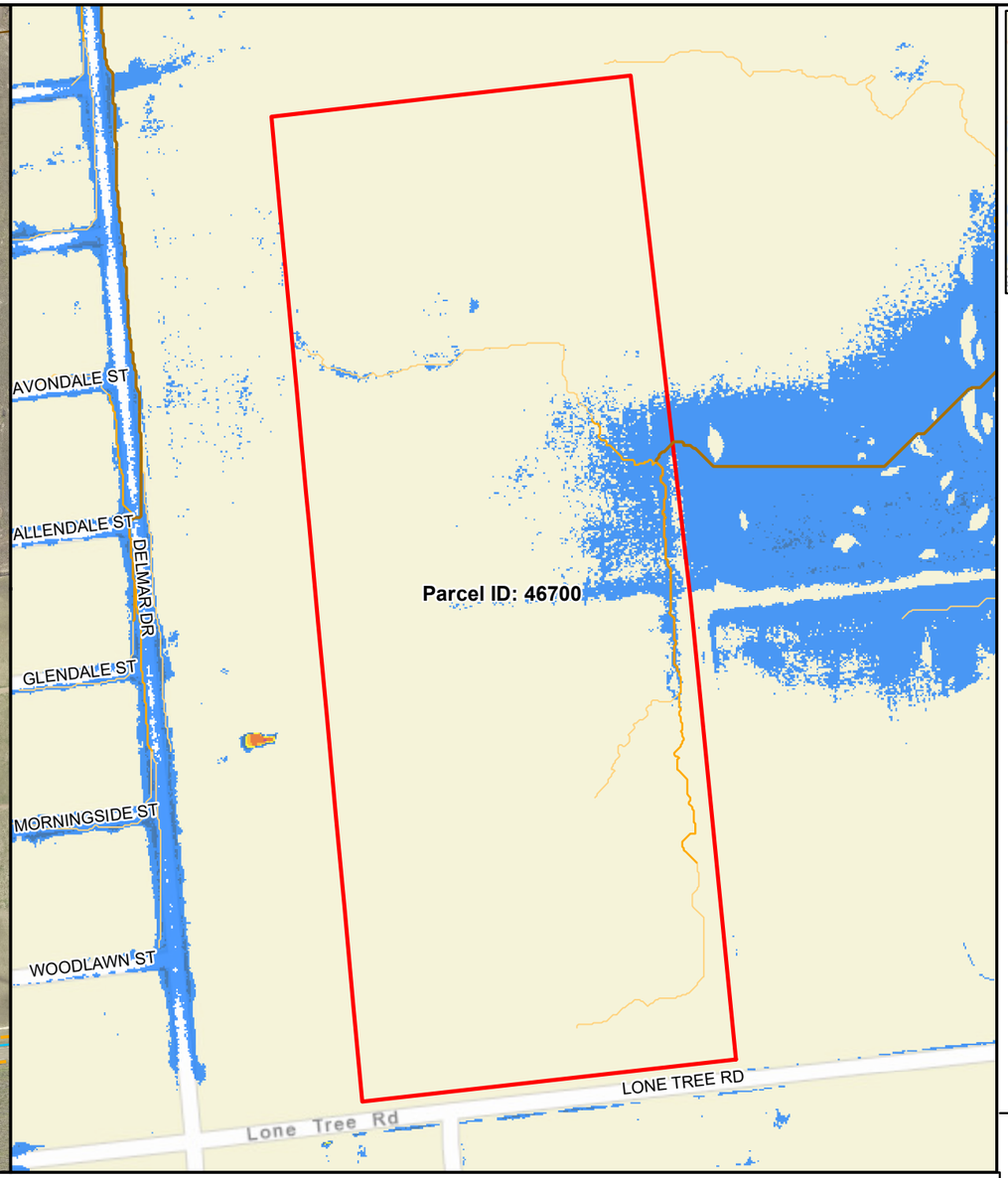

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	46700	Property Size (ac)	34
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel		X		Outfall is not available for this parcel. The property drains overland across the tract to the east.
4	Limited Outfall Depth	X		Surface Drainage Only	Outfall is not available for this parcel. The property drains overland across the tract to the east.
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other				
Recommendation		Drainage options include: 1) obtain easements and make improvements to discharge to Lone Tree Creek; 2) utilize surface drainage along existing flow paths and limit impervious cover to 20%.			

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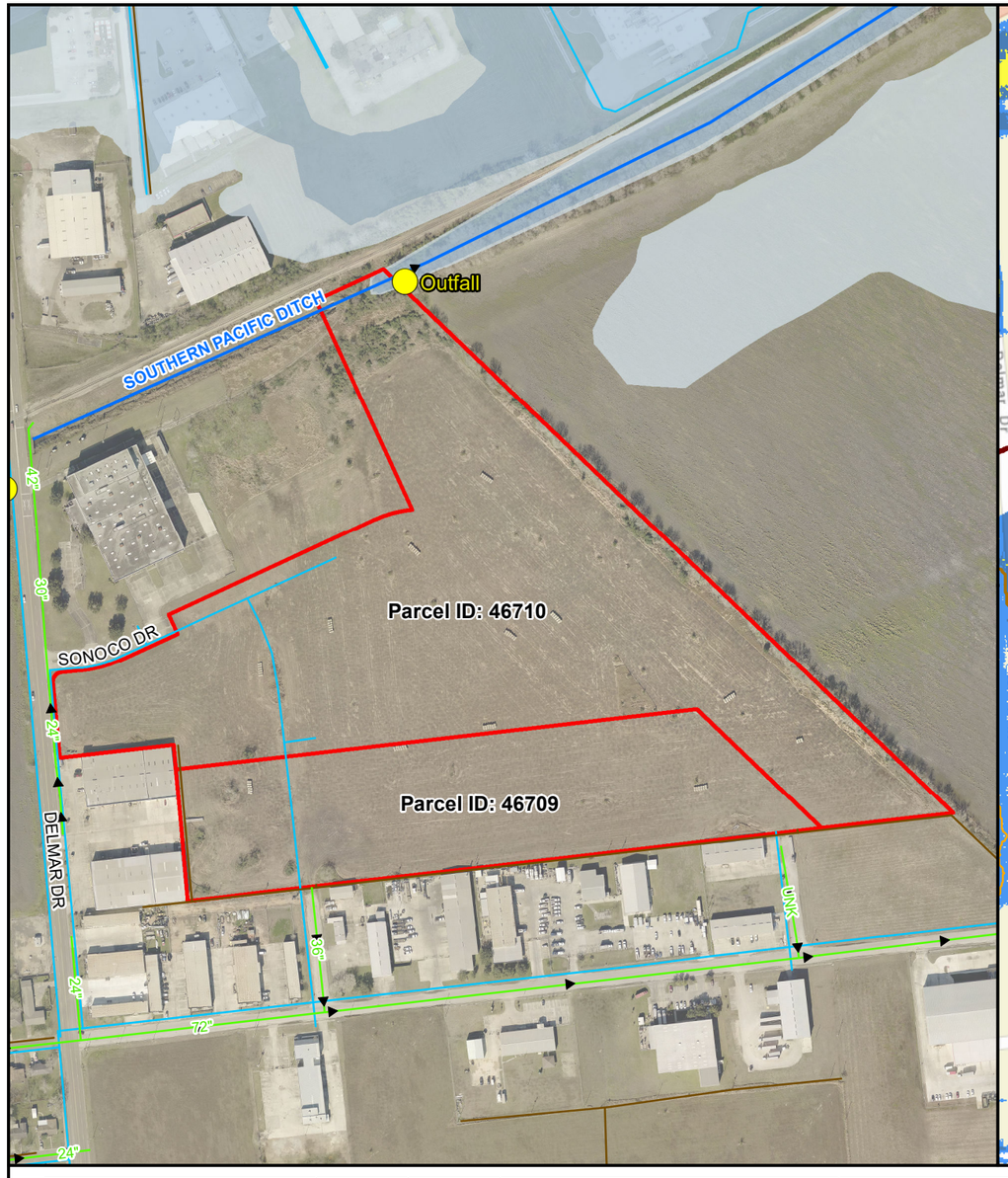
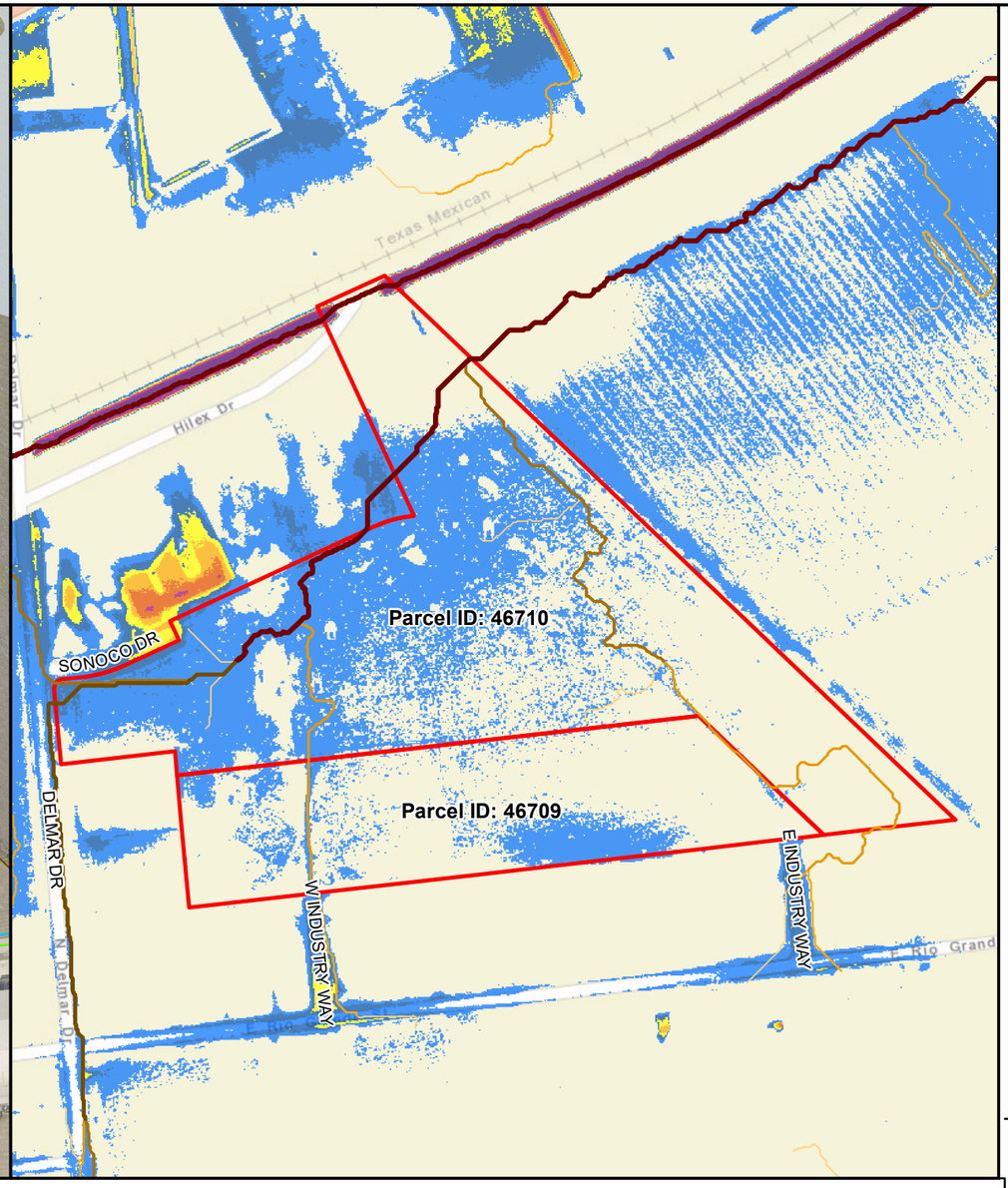
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.14





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 200 400

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	46709, 46710	Property Size (ac)	40
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel	X		Southern Pacific Ditch	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow	X		Potential for 64 Ac + Offsite Area	There is the potential for overland flow from Delmar Dr to enter this property from the west. Future development should consider offsite flows during the the design.
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation	Route detention pond outfall to South Pacific Ditch and limit discharge to pre-development conditions.				

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City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.15

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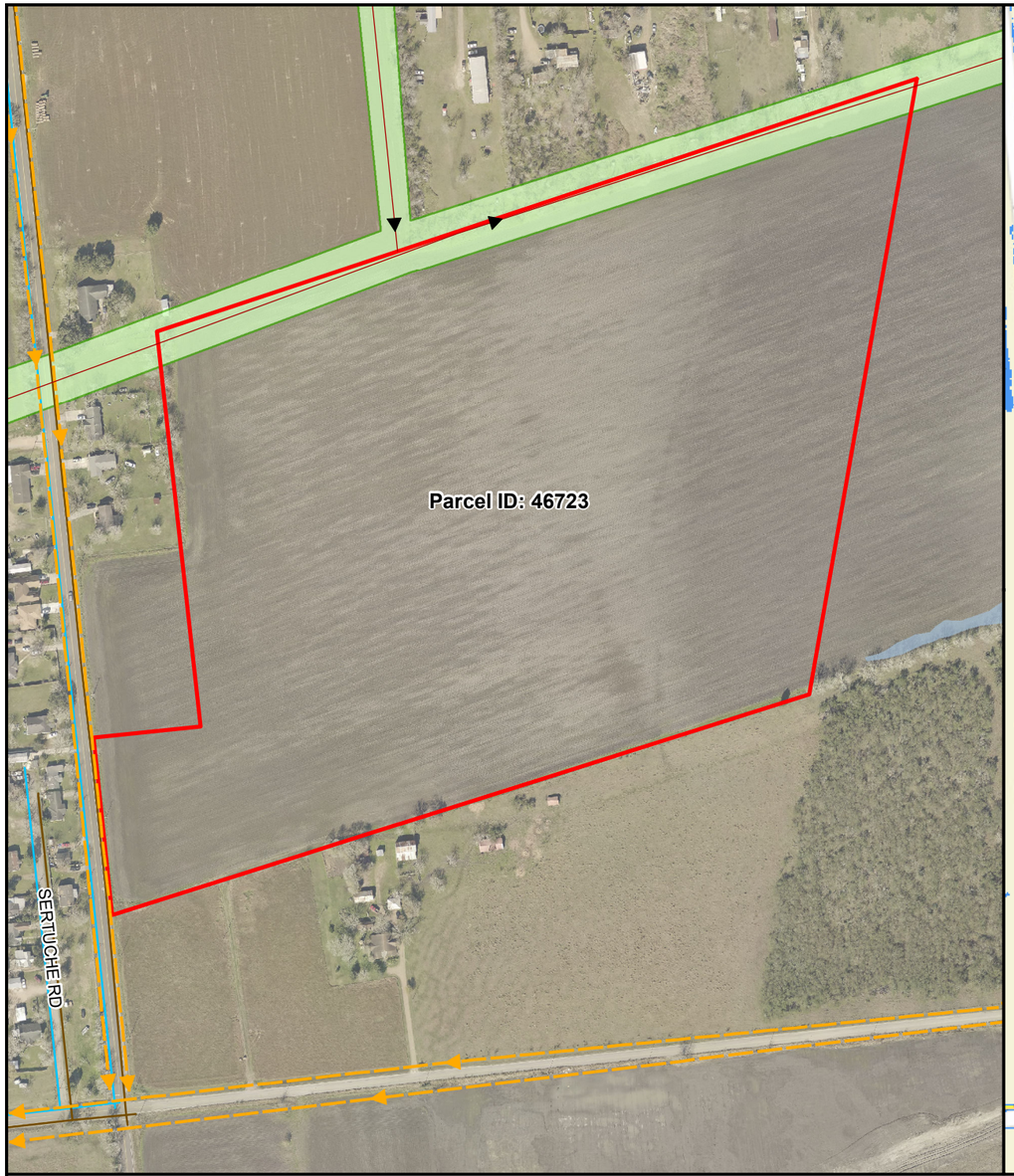

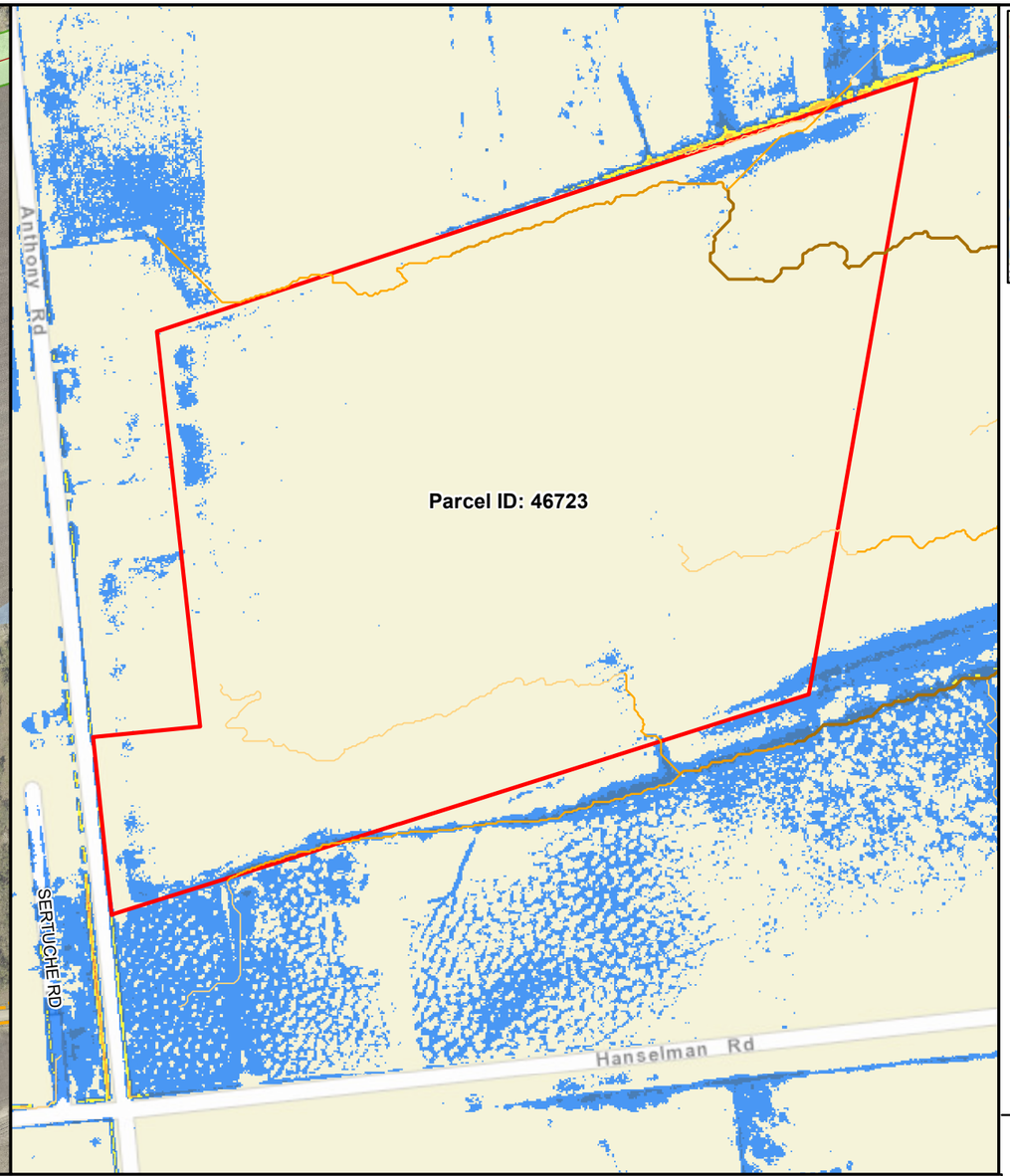

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

0 150 300

N

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	46723	Property Size (ac)	38
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel		X		Outfall is not available for this parcel. The property drains overland across the tract to the east.
4	Limited Outfall Depth	X		Surface Drainage Only	Outfall is not available for this parcel. The property drains overland across the tract to the east.
5	Offsite Overland Flow	X		8 Ac + from Southwest	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication	X			
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation		Drainage options include: 1) obtain easements and make improvements to discharge to Lone Tree Creek; 2) utilize surface drainage along existing flow paths and limit impervious cover to 20%.			

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.16

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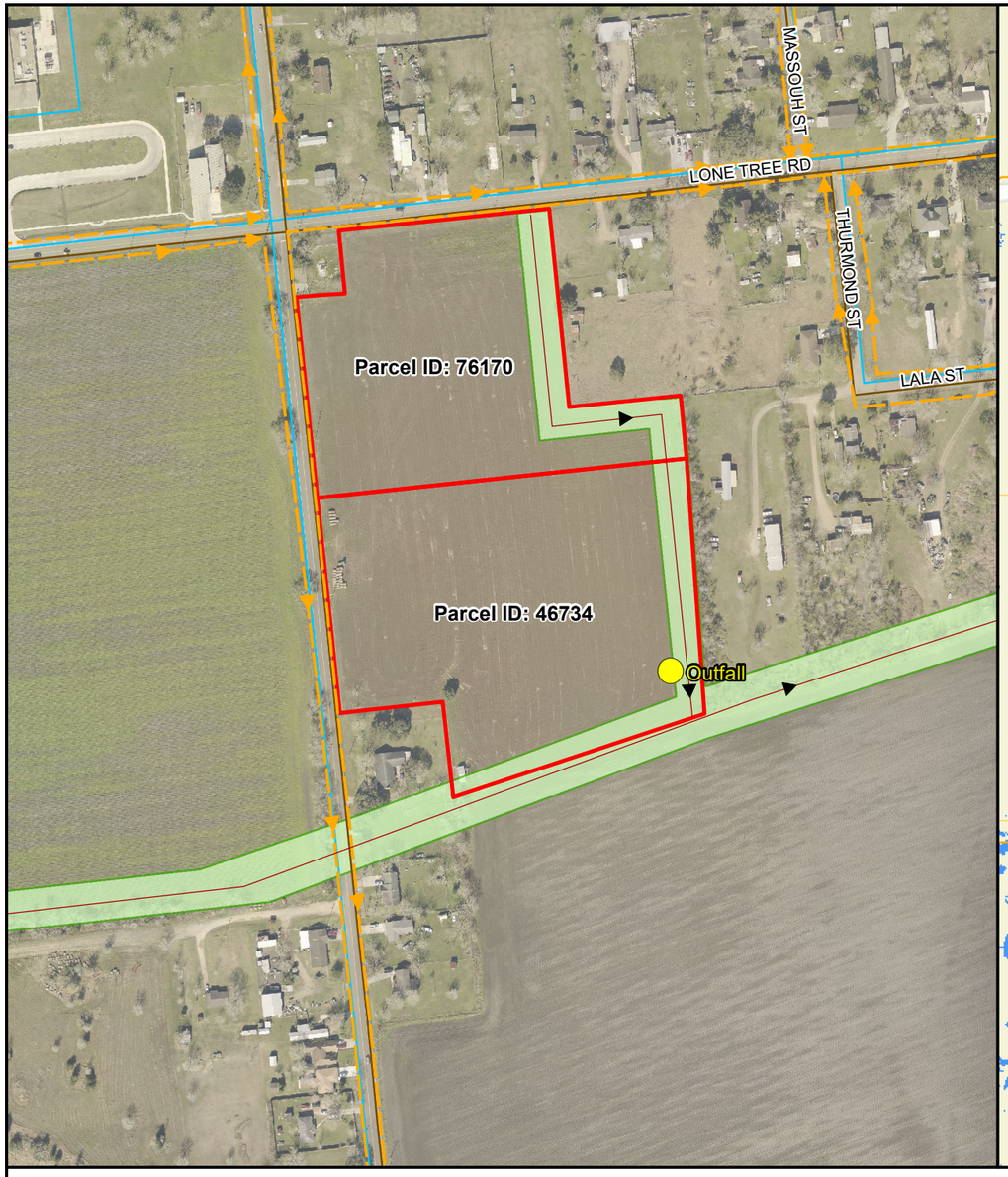

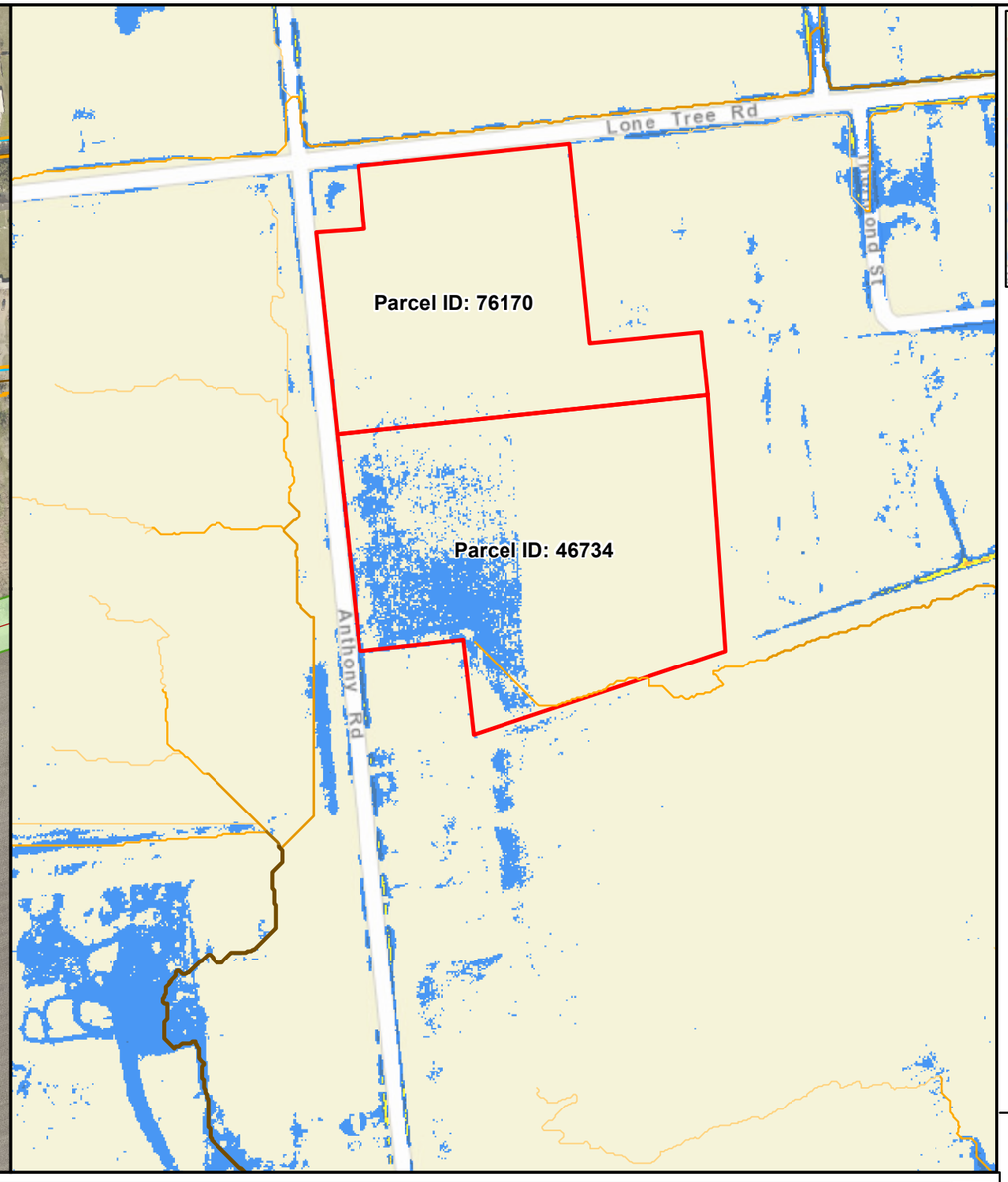

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	46734, 76170	Property Size (ac)	16
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel		X		Outfall is to an existing rear yard swale flowing to the east.
4	Limited Outfall Depth	X		Minor Ditch, Less than 3 ft of Depth	
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication	X			
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation	Route detention outfall to existing minor ditch and limit dicharge to pro-rata share of outfall capacity.				

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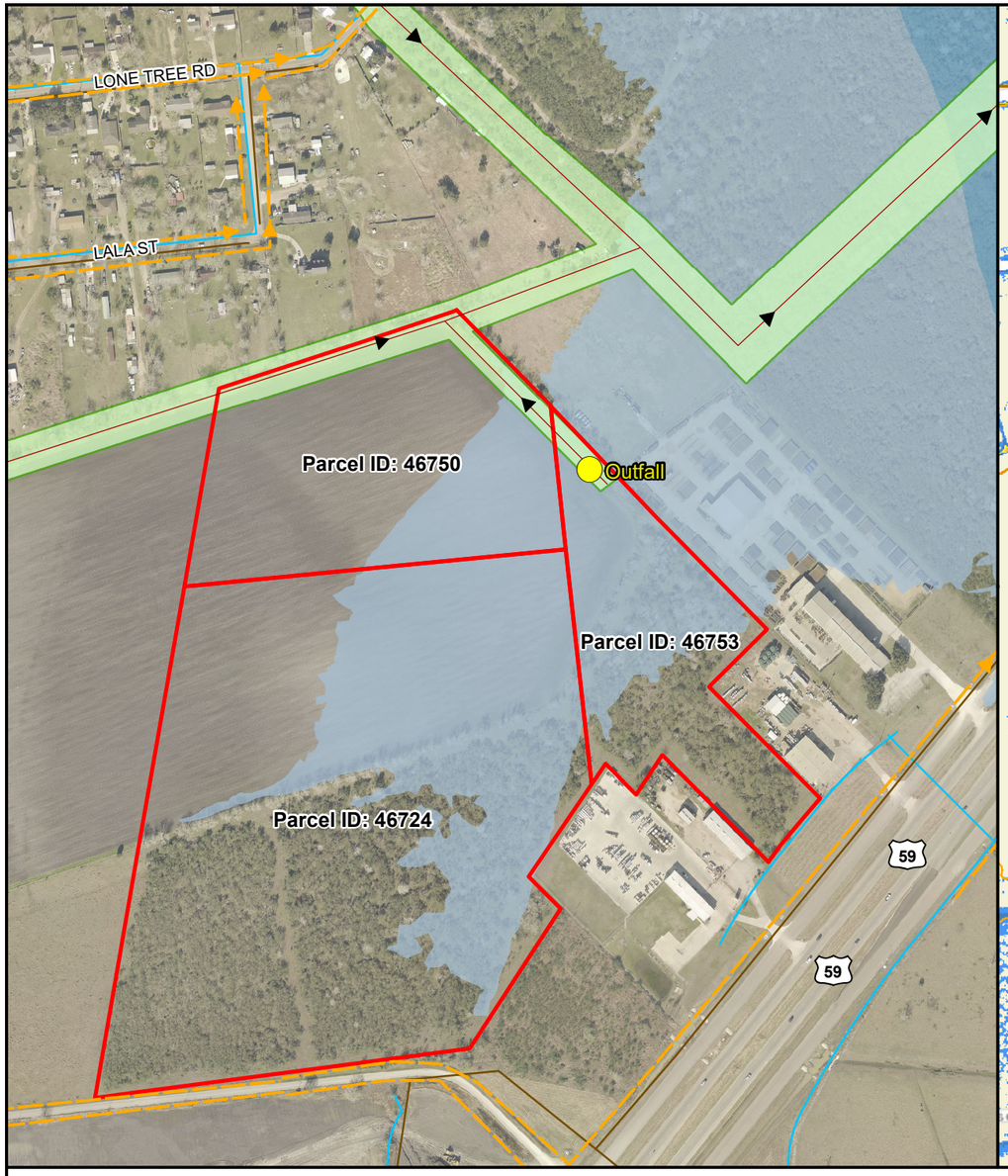
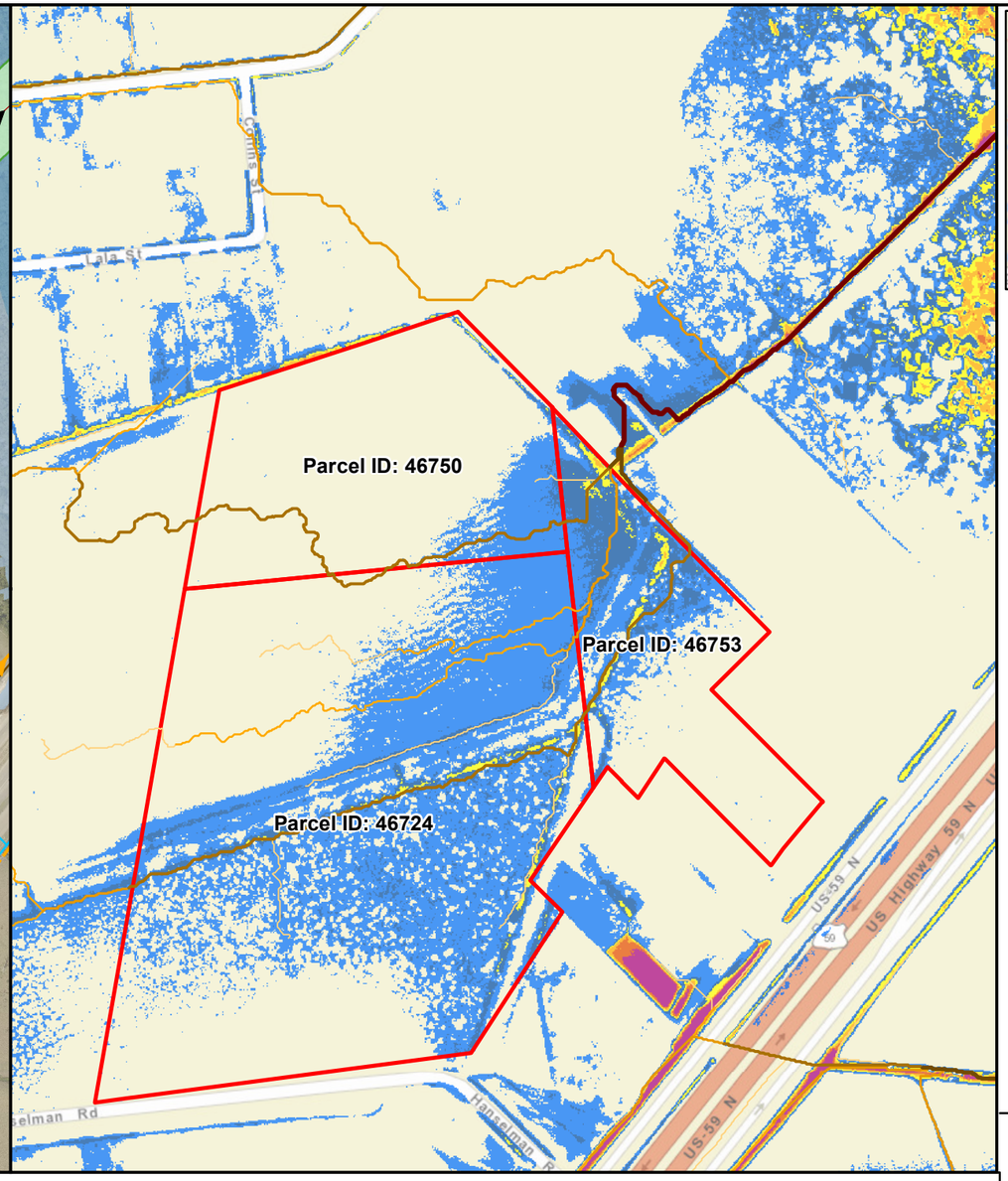
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.17





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 200 400

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	46724, 46750, 46753	Property Size (ac)	53
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential Error on Current FEMA Maps, Potential for Ponding Water	2020 Preliminary FEMA maps indicate that the extent of the 100 yr Flood Plain on this parcel will expand significantly when the new maps are adopted. Overland flow analysis indicates that ponding to 2' may occur on portions of this parcel during heavy rains.
3	Outfall Channel		X		Outfall is to a shallow ditch flowing east.
4	Limited Outfall Depth	X		Minor Ditch, Less than 3 ft of Depth	
5	Offsite Overland Flow	X		64 Ac + Offsite Area from west	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication	X			
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation		Route detention outfall to existing minor ditch and limit dicharge to pro-rata share of outfall capacity.			

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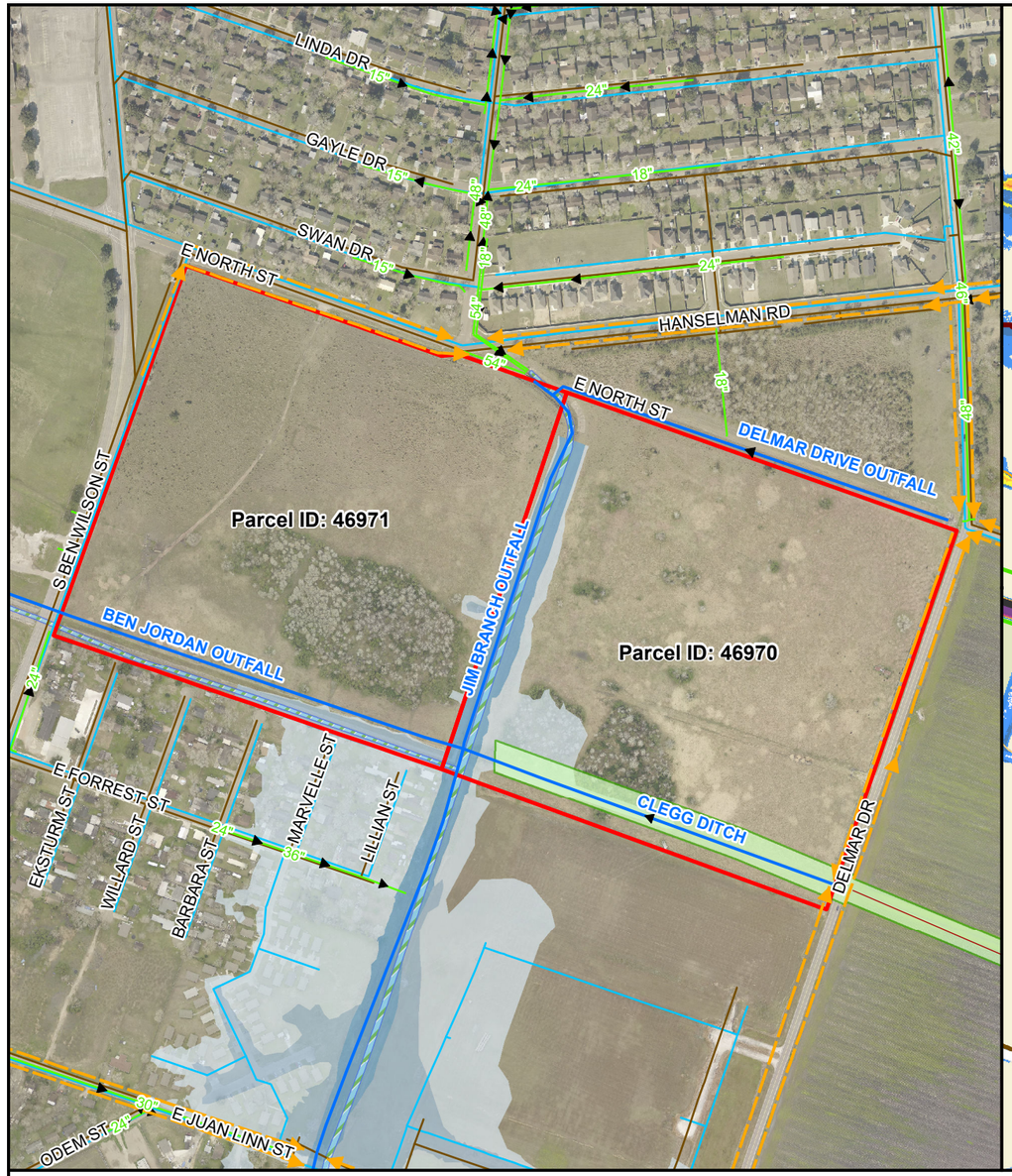
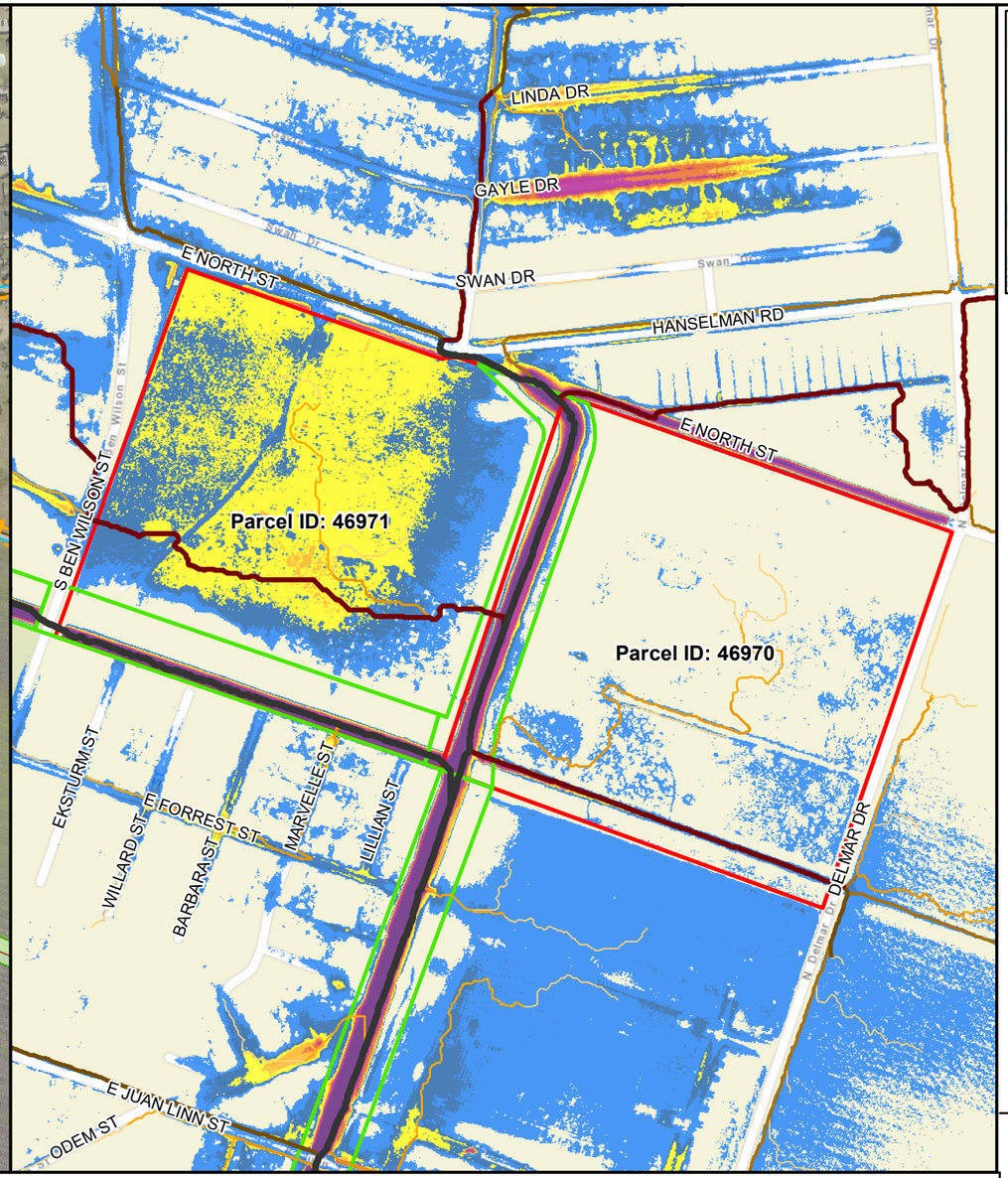
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.18





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 250 500

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	46971, 46970	Property Size (ac)	80
Watershed	Jim Branch Outfall		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 1.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel		X		Outfall is a shallow ditch to the west.
4	Limited Outfall Depth	X		Minor Ditch, Less than 3 ft of Depth	Outfall depth is limited.
5	Offsite Overland Flow	X		16 Ac + Offsite Area from East	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication	X			
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation	Drainage options include: 1) obtain downstream easements and make improvments through parcel #47025 to the Jim Branch Outfall; 2) utilize existing culvert under Delmar Dr and restrict detention pond outfall to pro-rata share of culvert capacity.				

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.19

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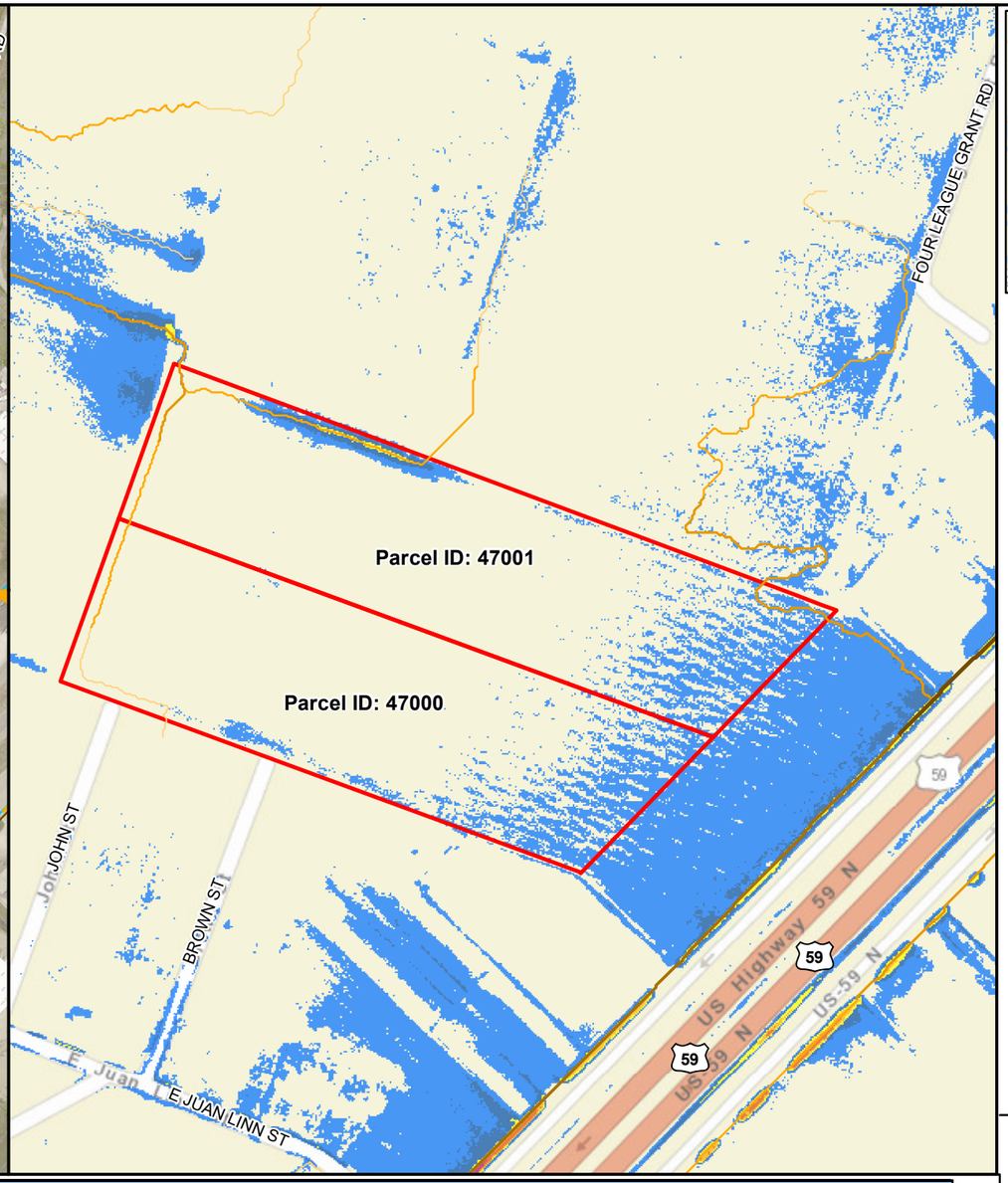

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	47000, 47001	Property Size (ac)	19
Watershed	Jim Branch Outfall		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel		X		There is no adequate outfall available for this property. The east portion drains overland to US 59 roadside ditch. The west portion drians overland to parcel #47023.
4	Limited Outfall Depth	X		Minor Ditch, Less than 3 ft of Depth	
5	Offsite Overland Flow	X		24 Ac + Offsite Area from North	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication	X			
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation		Drainage options include: 1) obtain downstream easements and make improvments through parcels #47023 and #47025 to the Jim Branch Outfall; 2) utilize surface drainage along existing flow paths and limit impervious cover to 20%.			

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City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.20

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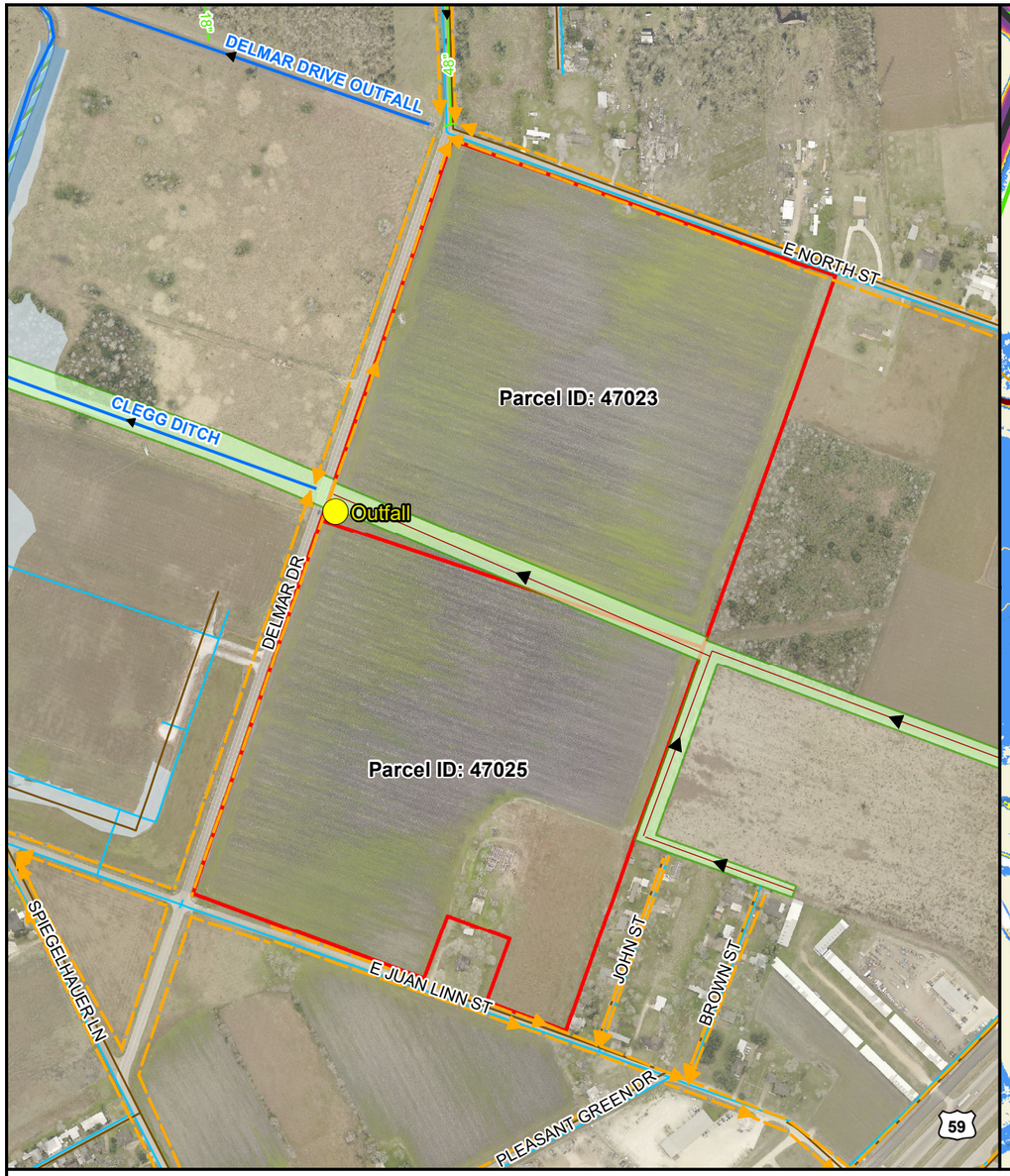

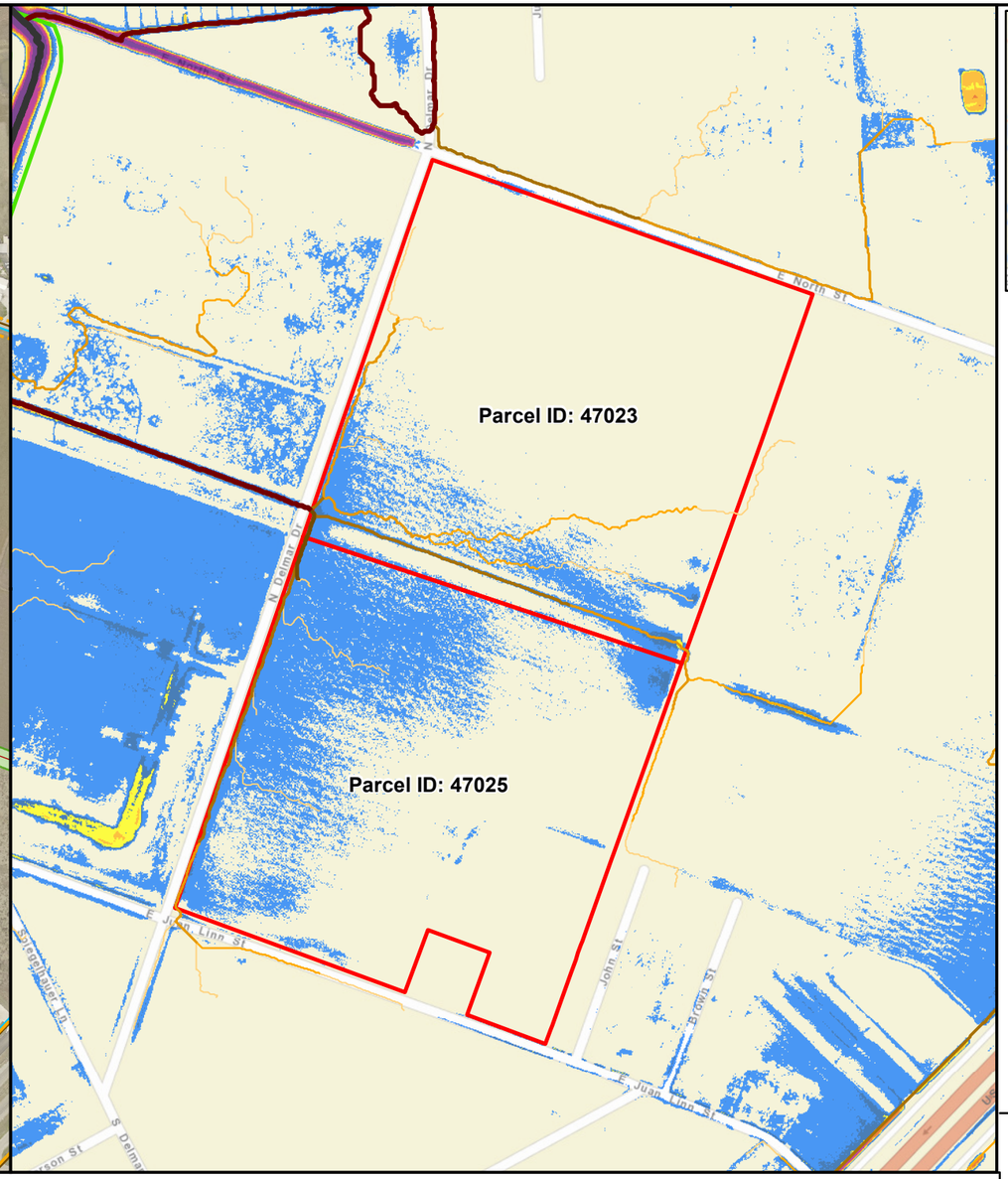

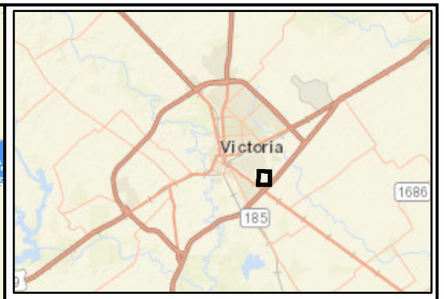

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 250 500

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	47023, 47025	Property Size (ac)	80
Watershed	Jim Branch Outfall		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain and Floodway	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 1.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Jim Branch Outfall	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow	X		128 Ac + Offsite Area from West	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation	Route detention pond outfall to Jim Branch Outfall and limit discharge to pre-development conditions.				

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.21

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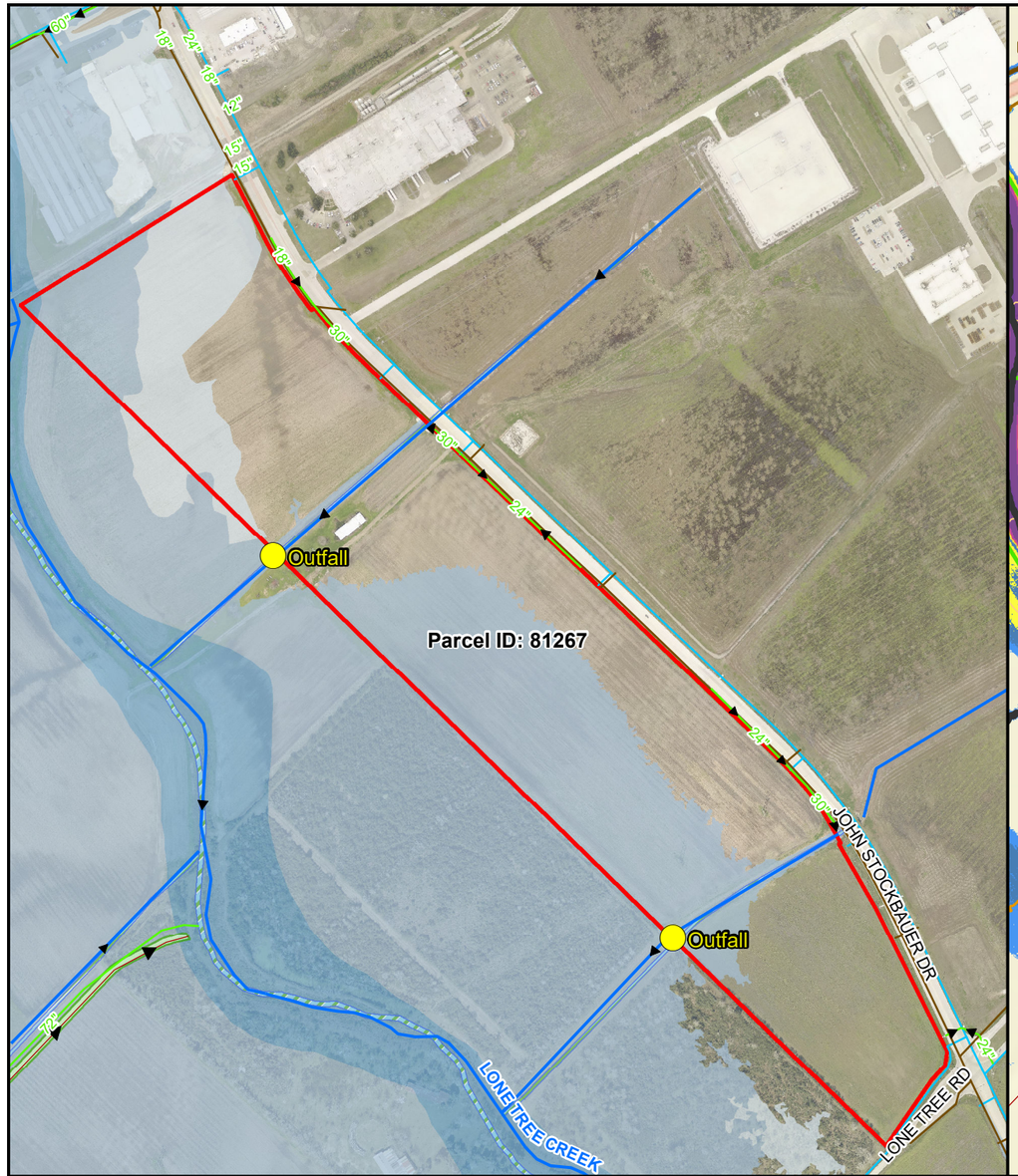

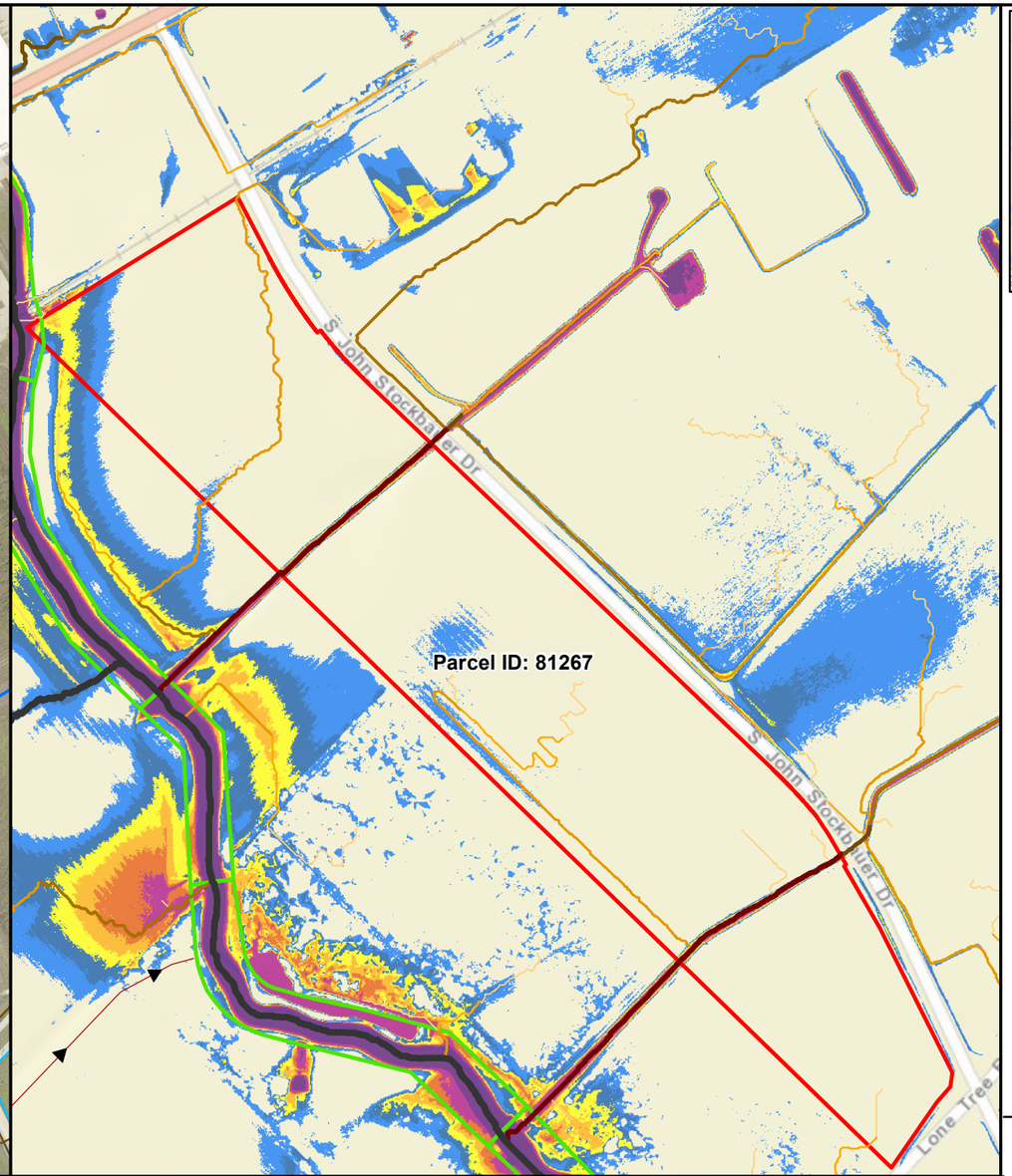

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 250 500

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	81267	Property Size (ac)	85
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential Error on Current FEMA Maps	2020 Preliminary FEMA maps indicate that the extent of the 100 yr Flood Plain on this parcel will expand significantly when the new maps are adopted.
3	Outfall Channel	X		Two Unnamed Ditches from J. Stockbauer	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow	X		16 Ac + Offsite Area from North	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation	Route detention pond outfall to the existing unnamed draiange ditches and limit discharge to pre-development conditions.				

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City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.22

User Name: camille.cotsakis
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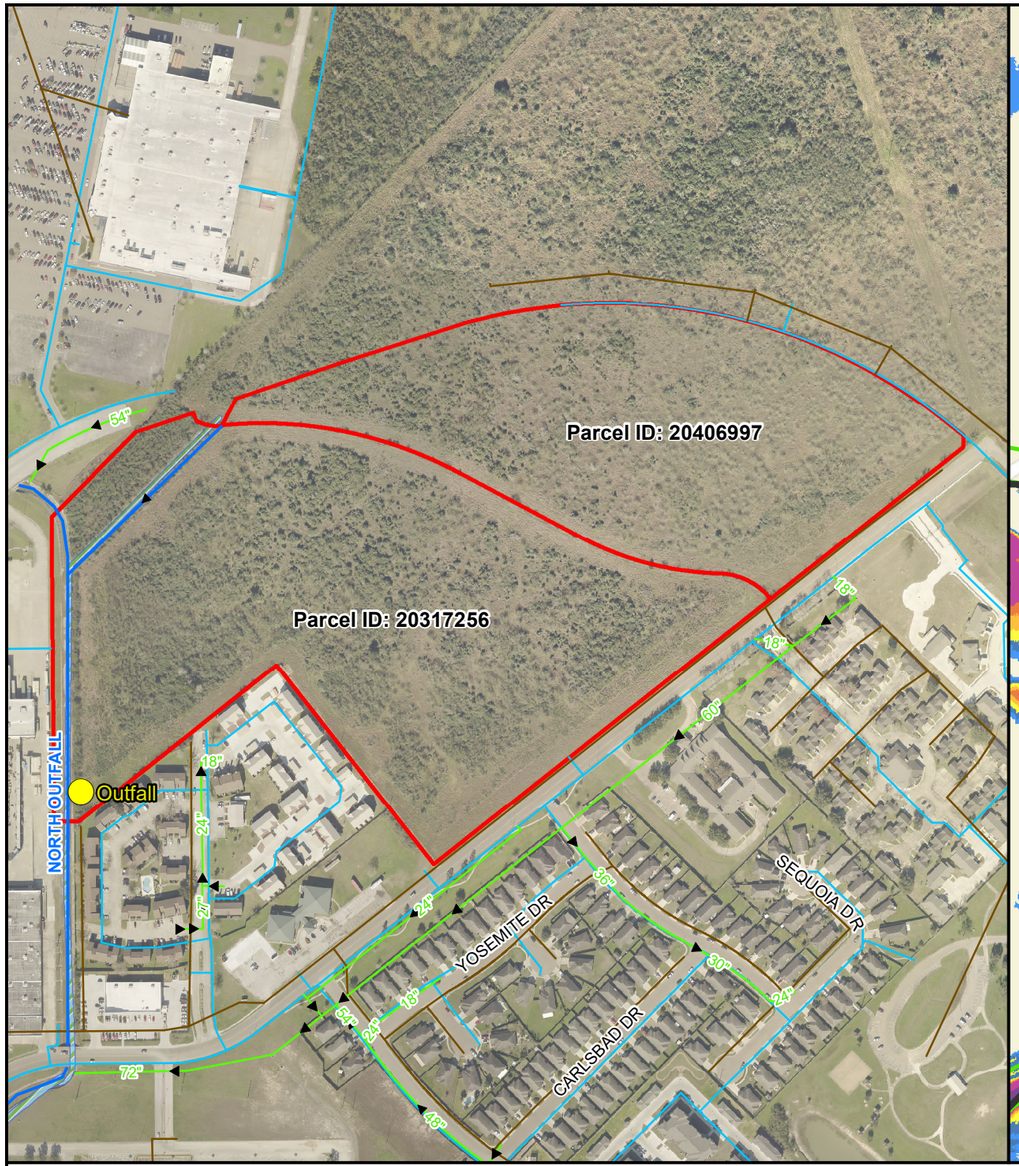

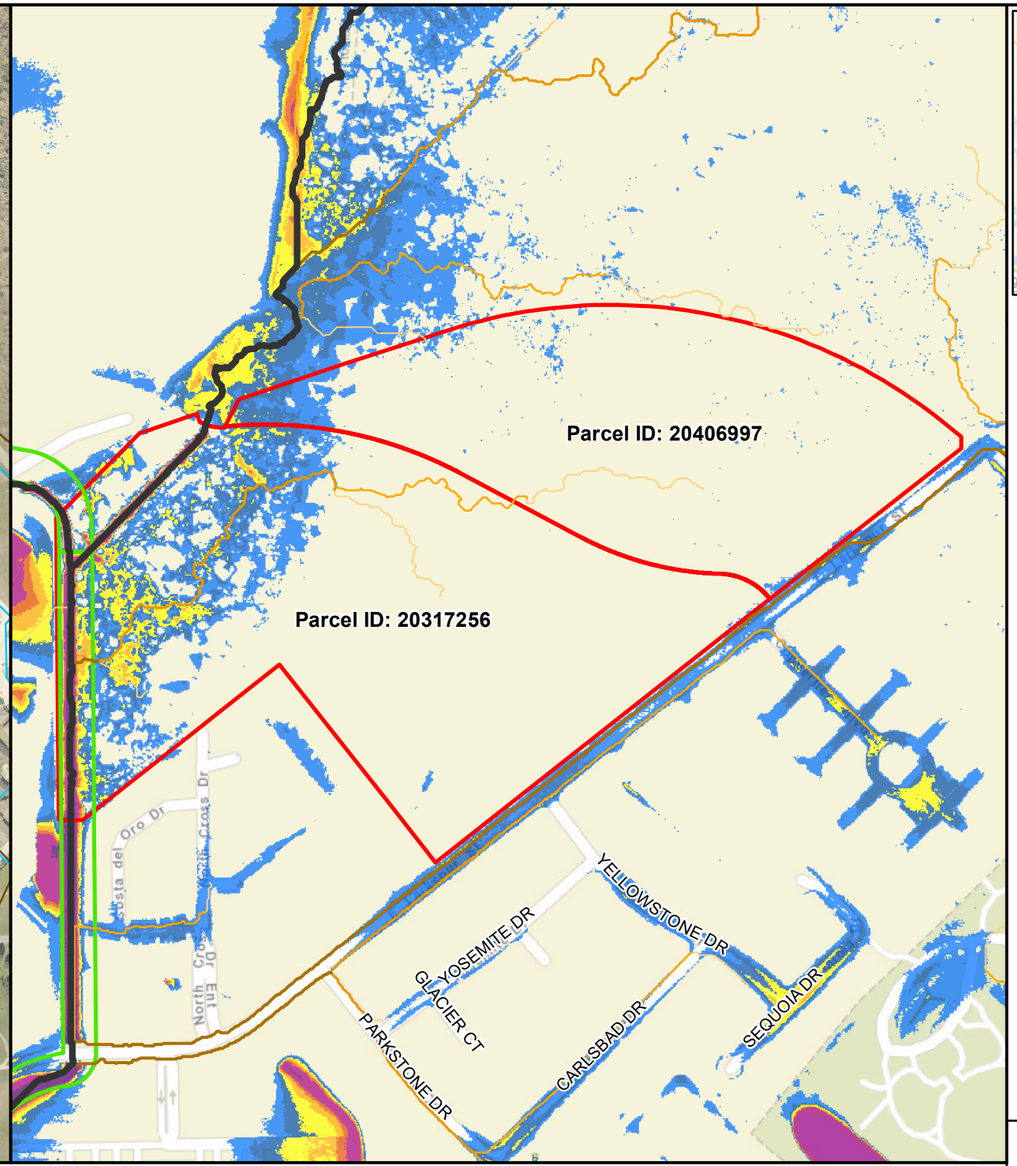

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 200 400

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	20406997, 20317256	Property Size (ac)	52
Watershed	North Outfall		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		US 77 Outfall	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation		Route detention pond discharge to US 77 Ditch and limit discharge to pre-development conditions.			

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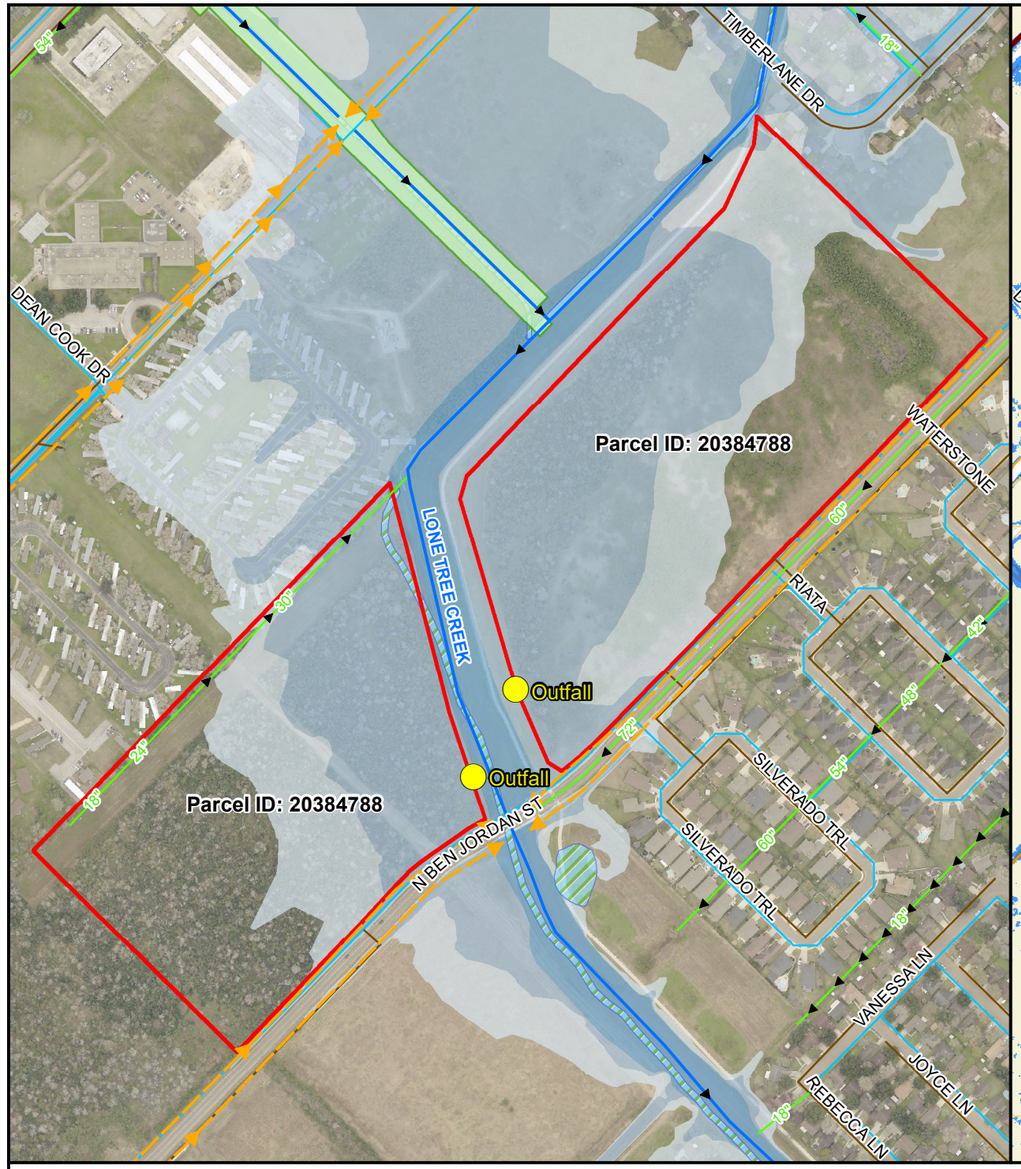
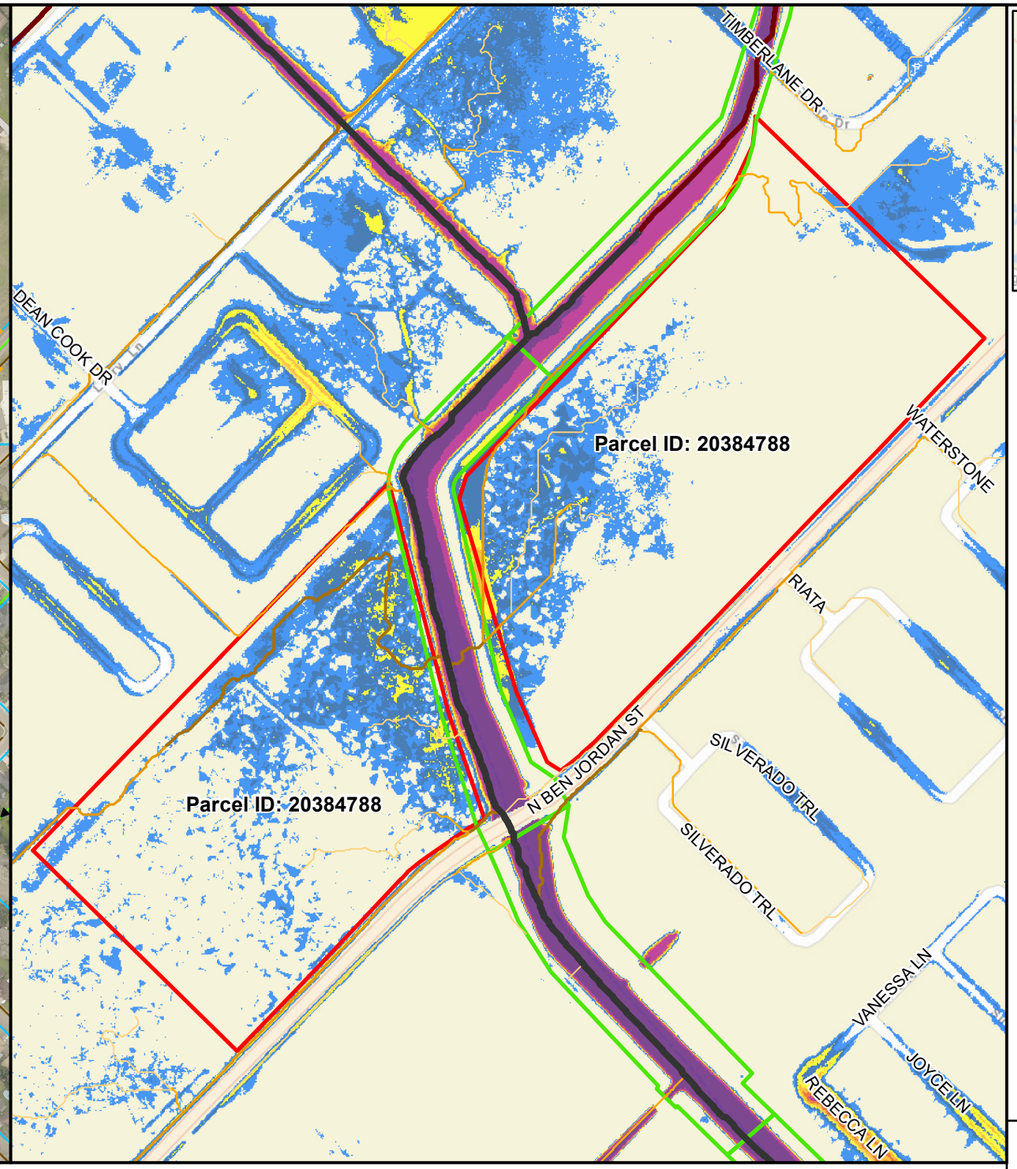
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.23

User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Constraints Map 20317256_20406997.mxd





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 200 400

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	20384788	Property Size (ac)	56
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 3-5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Lone Tree Creek	All master plan drainage improvements have been made to this reach of Lone Tree Creek.
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication		X		
9	Other				
Recommendation		Route detention pond discharge to Lone Tree Creek and limit discharge based on pre-development conditions.			

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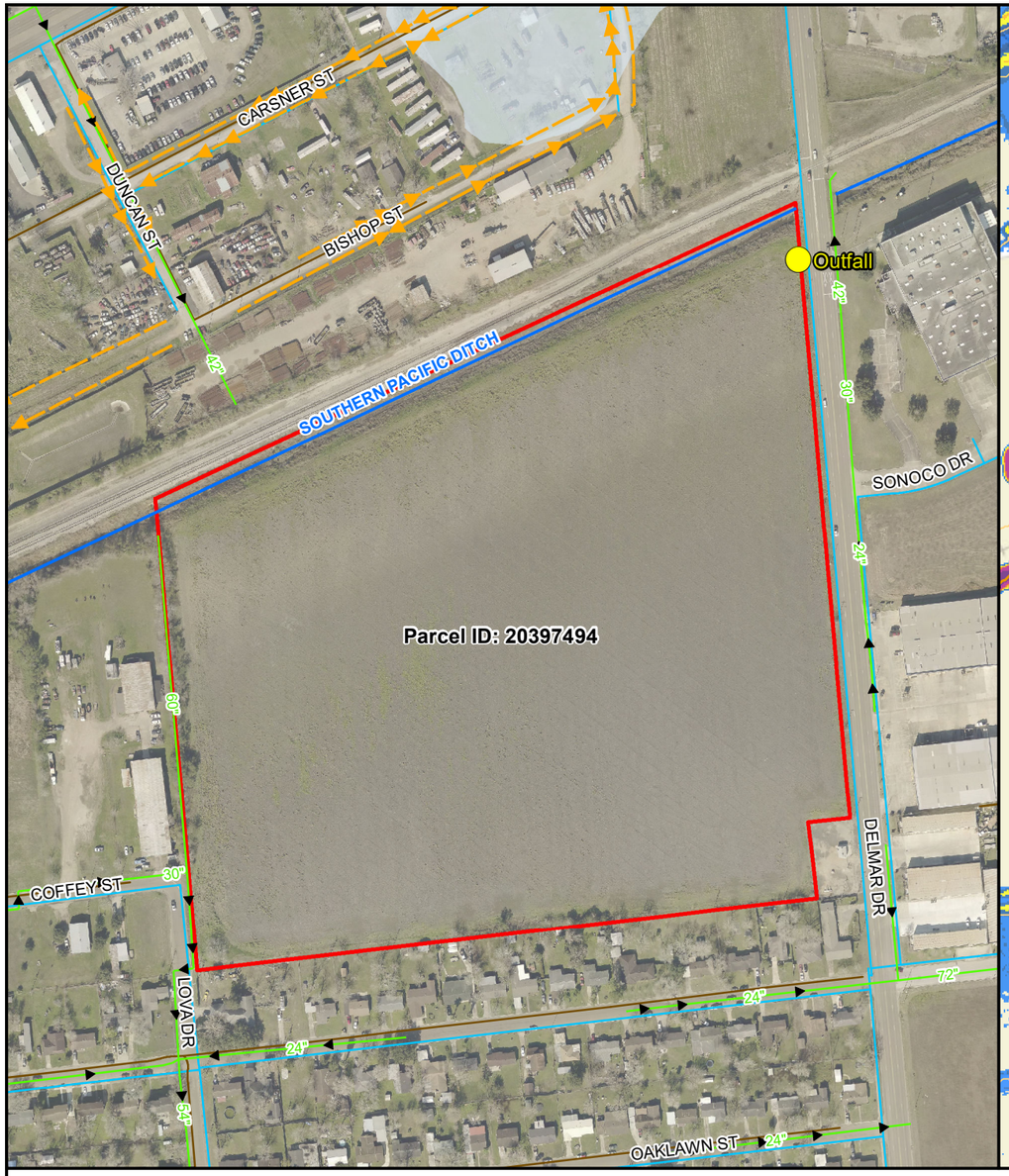
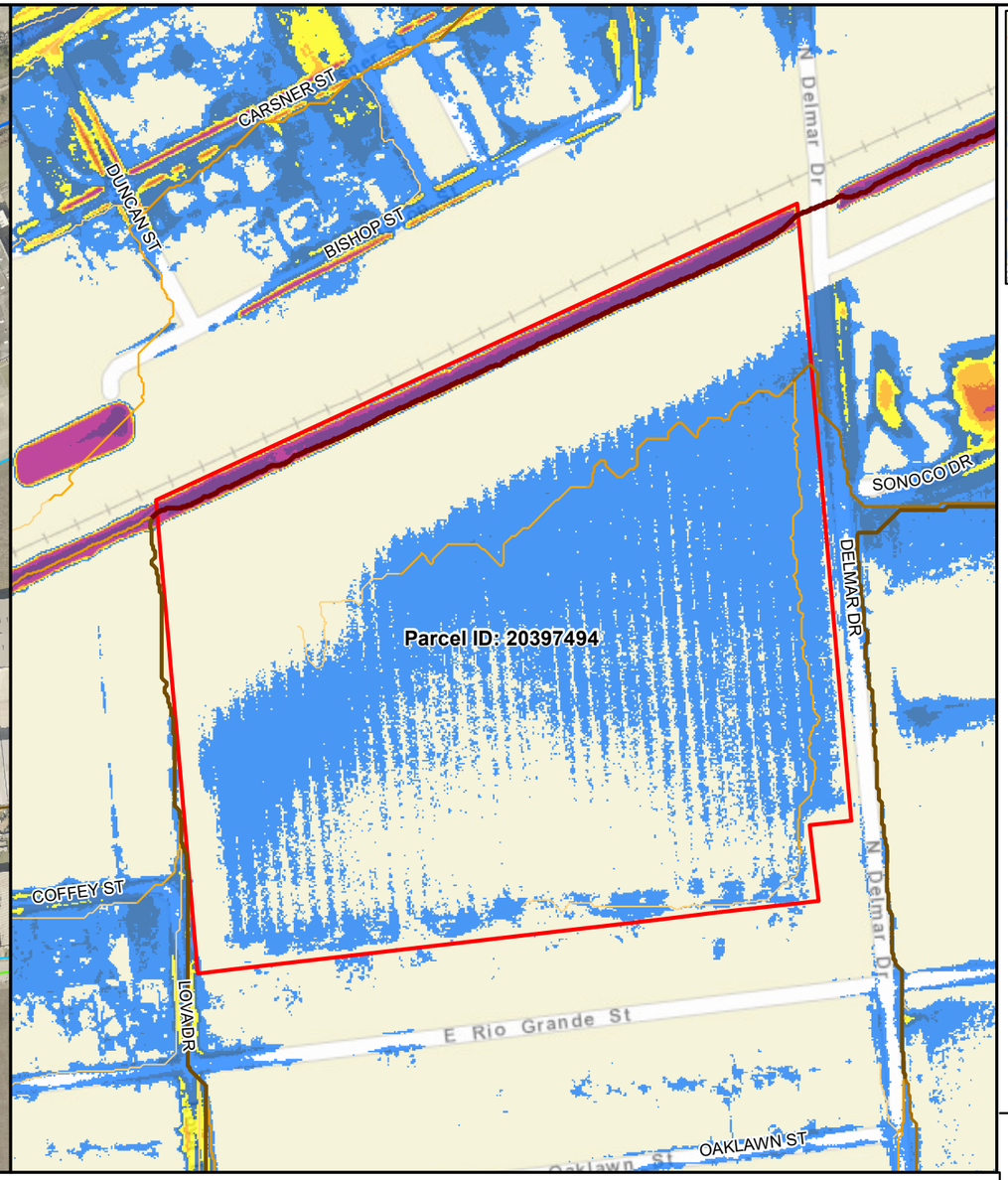
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.24





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	20397494	Property Size (ac)	35
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk		X		
3	Outfall Channel	X		Southern Pacific Ditch	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow	X		Potential for 64 Ac + Offsite Area	There is the potential for overland flow from Lova Dr along the west property line of this parcel. Future development should to consider offsite flow during the the design.
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation		Route detention pond outfall to South Pacific Ditch and limit discharge to pre-development conditions.			

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Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.25

User Name: camille.cotsakis
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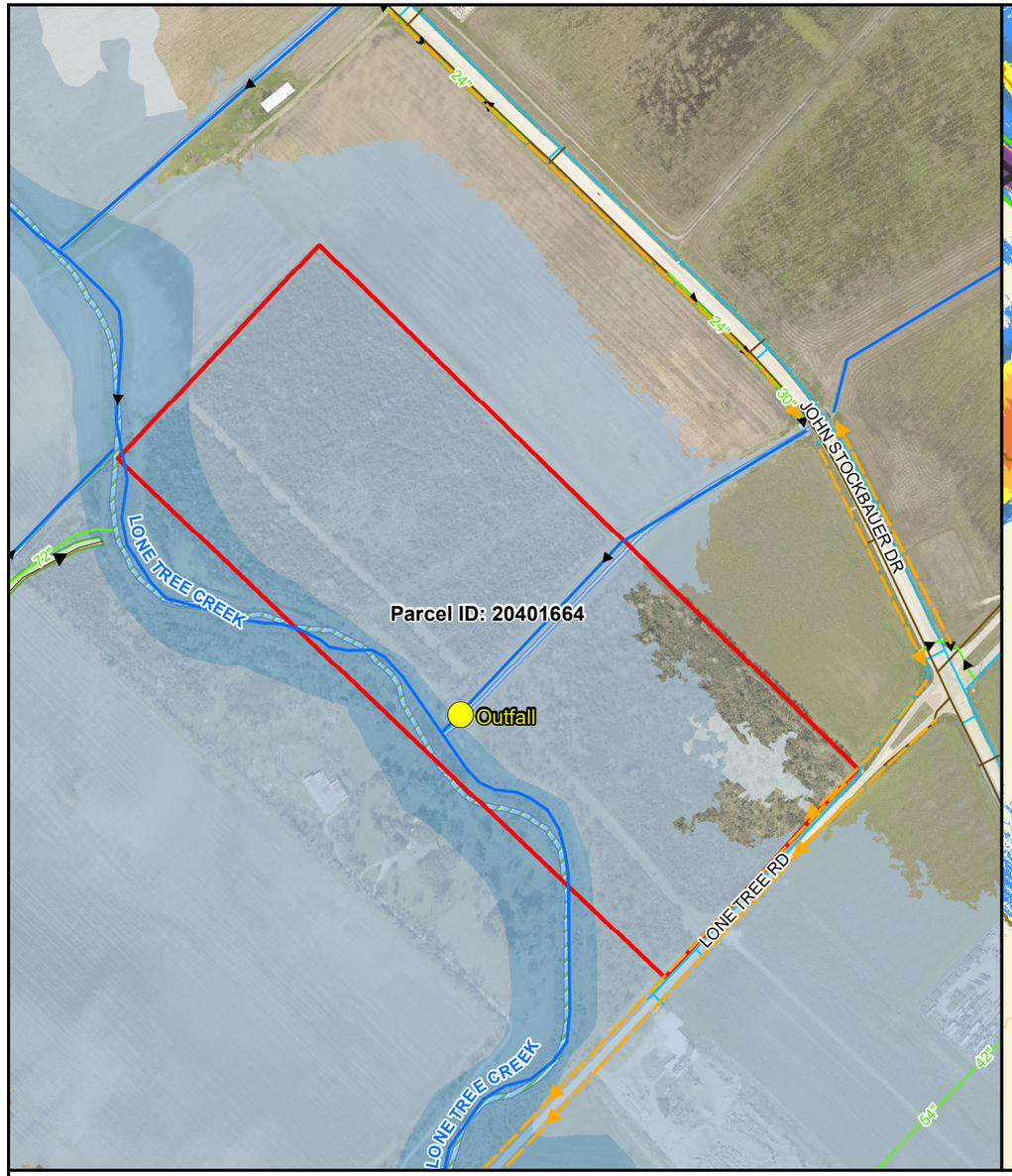

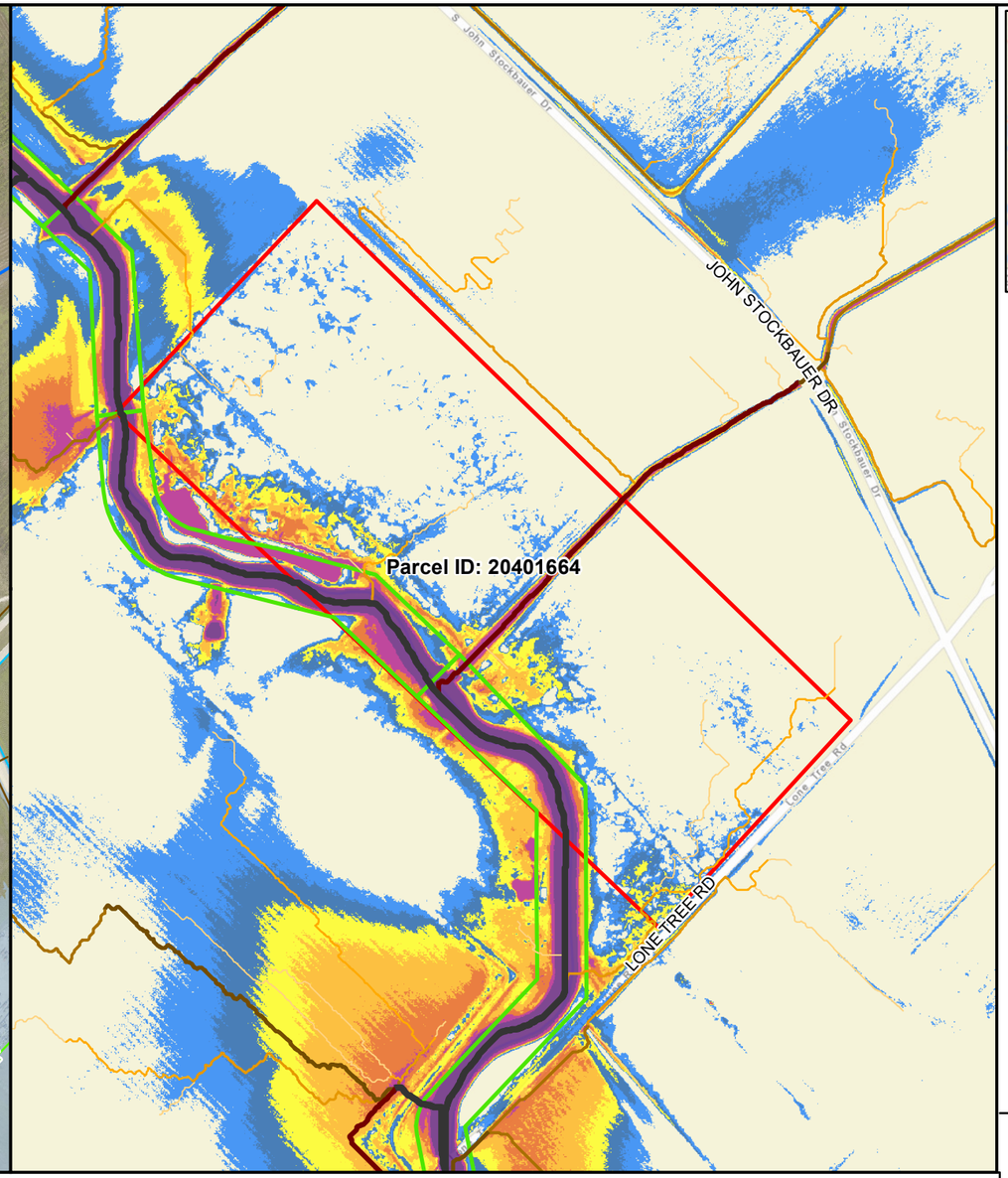

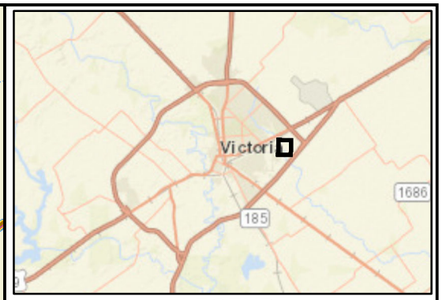

LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 250 500

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	20401664	Property Size (ac)	66
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 3-5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Unnamed Ditch from J. Stockbauer	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow		X		
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
9	Other				
Recommendation		Route detention pond outfall to unnamed drainage ditch and limit dischage to pre-development conditions.			

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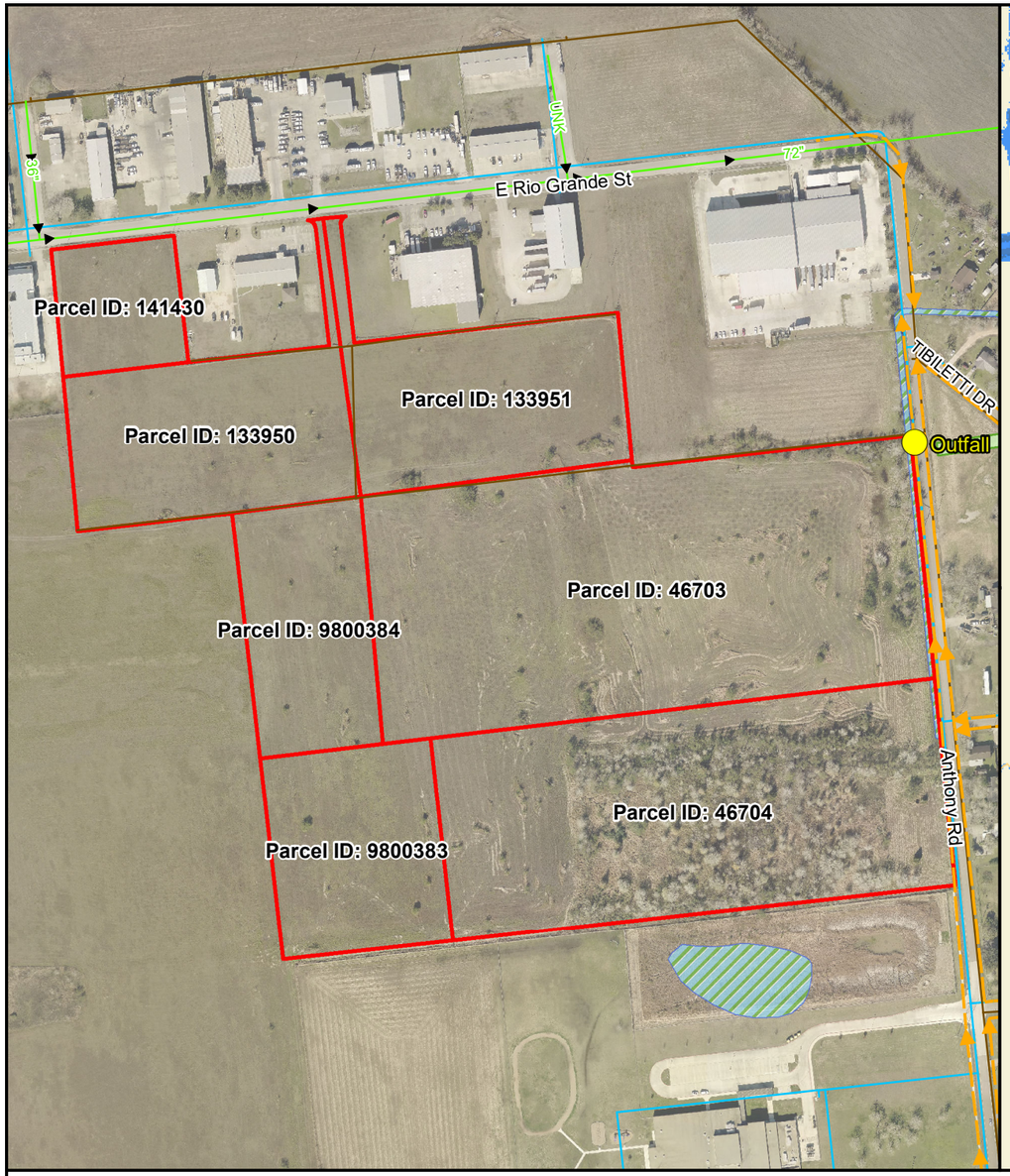
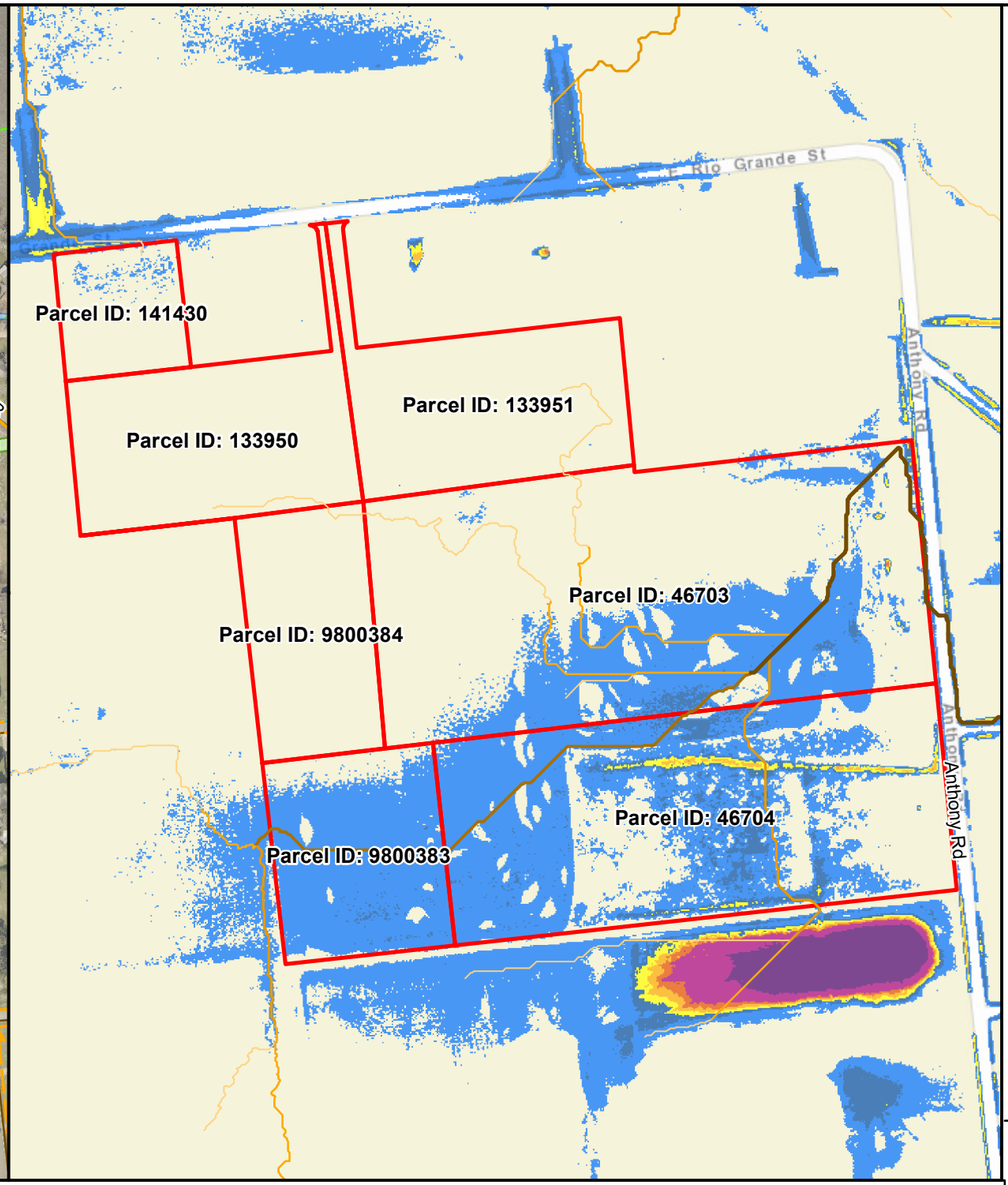
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.26





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 150 300

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	141430, 133950, 133951, 9800384, 46703, 9800383, 46704	Property Size (ac)	52
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk		X		
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 1.5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel		X		Outfall for this property is limited by the roadside ditches along Anthony Rd. When Anthony Rd ditch capacity is exceeded, drainage moves to Morris Ave, Tibiletti Dr, and Hyak Ave.
4	Limited Outfall Depth	X		Surface Drainage Only	Outfall is not available for this parcel. The property currently drains overland, down and across Anthony Rd.
5	Offsite Overland Flow	X		32 Ac + Offsite Area from West	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pro-rata share of outfall capacity.
7	Drianage Easement Dedication		X		
9	Other	X			Downstream drainage improvments have been proposed by the SDMP that would benefit this parcel .
Recommendation		Drainage options include: 1) obtain easements and make improvements to discharge to Lone Tree Creek; 2) utilize surface drainage along existing flow paths and limit impervious cover to 20%.			

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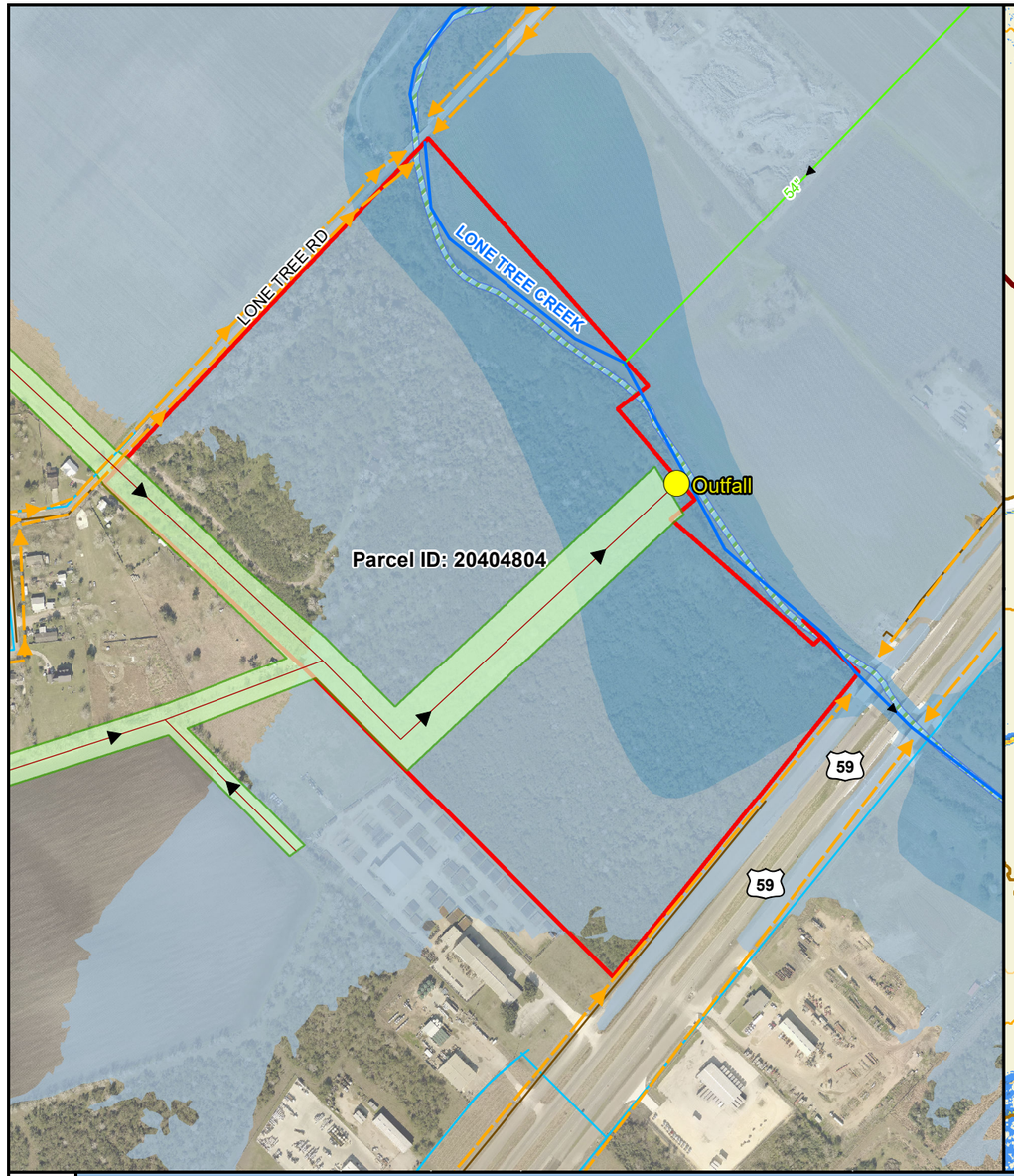
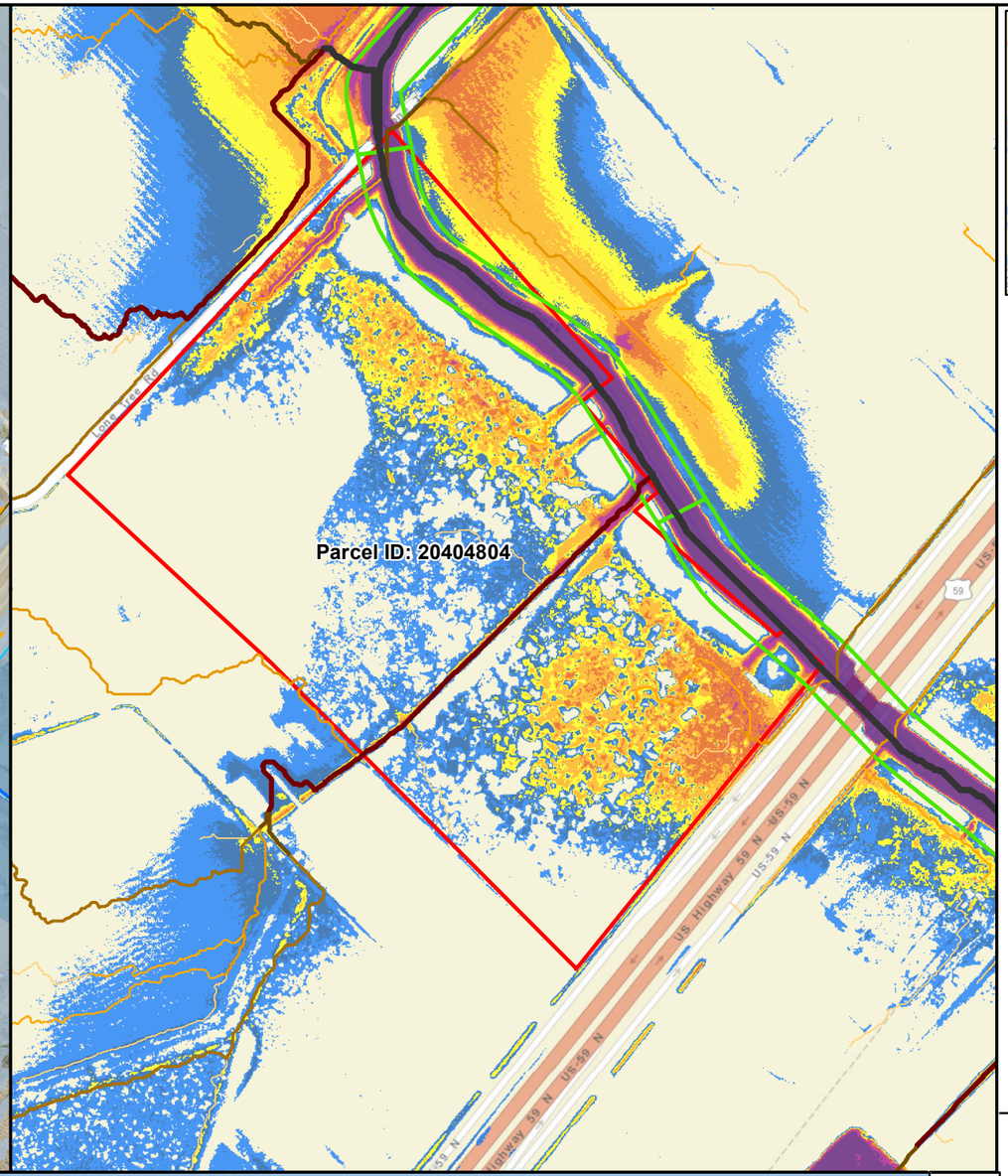
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.27

User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Constraints Map Roth Real Propoerty Investments.mxd





LEGEND

- Outfall
- Roadside Ditch
- Stream
- Proposed Channel
- COV Storm Sewer
- COV Sanitary Sewer
- COV Water Line
- Proposed Easement
- Parcel
- Wetland
- Ultimate Channel ROW

FEMA Flood Hazard Zones (Preliminary)

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

Overland Flow Path (acre)

- 4
- 8
- 16
- 32
- 64
- 128
- 256

Approximate 100-Yr Flood Depth (ft)

- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5- 3
- 3 - 5
- > 5

N

0 250 500

Aerial Source:
2020 City of Victoria
ESRI World Street Map

General Parcel Information			
Parcel ID	20404804	Property Size (ac)	74
Watershed	Lone Tree Creek		

	Item	Yes	No	Evaluation	Comments
1	FEMA Flood Risk	X		Zone AE Floodplain and Floodway	Stormwater Permit & No Net Rise Certificate By Engineer Required, FEMA Map Revision Required
2	Other Flood Risk	X		Potential for Ponding Water	Overland flow analysis indicates that ponding to 5' may occur on portions of this parcel during heavy rains.
3	Outfall Channel	X		Lone Tree Creek	
4	Limited Outfall Depth		X		
5	Offsite Overland Flow	X		128 Ac + Offsite Area from Southwest	Future development should consider offsite flow (Provide drainage easement or redirect flow to outfall channel)
6	Detention Required	X			Release rate based on pre-development conditions.
7	Drianage Easement Dedication	X			
8	Wetlands		X		
9	Other				
Recommendation		Route detention pond outfall to Lone Tree Creek and limit discharge to pre-development conditions.			

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Storm Drainage Master Plan Update

Priority One - Independent Study Area
Development Constraints Map

September 2021	Project No. 400022	Exhibit No. 2.28

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Appendix 2.1
Proposed Improved Outfalls

Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.

LEGEND

- Proposed Structure
- Proposed Storm Sewer
- Stream
- Proposed Drainage Easement
- Study Parcel

0 200 400

N

Aerial Source:
2020 City of Victoria

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City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Project A - The Gardens Apartment Diversion

September 2021	Project No. 400022	Exhibit No. 2.1.1

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Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Overview Maps\A - Buhler Property Diversion.mxd

LEGEND

- Proposed Structure
- Proposed Storm Sewer
- Stream
- Proposed Drainage Easement
- Study Parcel

0 250 500

Aerial Source:
2020 City of Victoria

N

Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.

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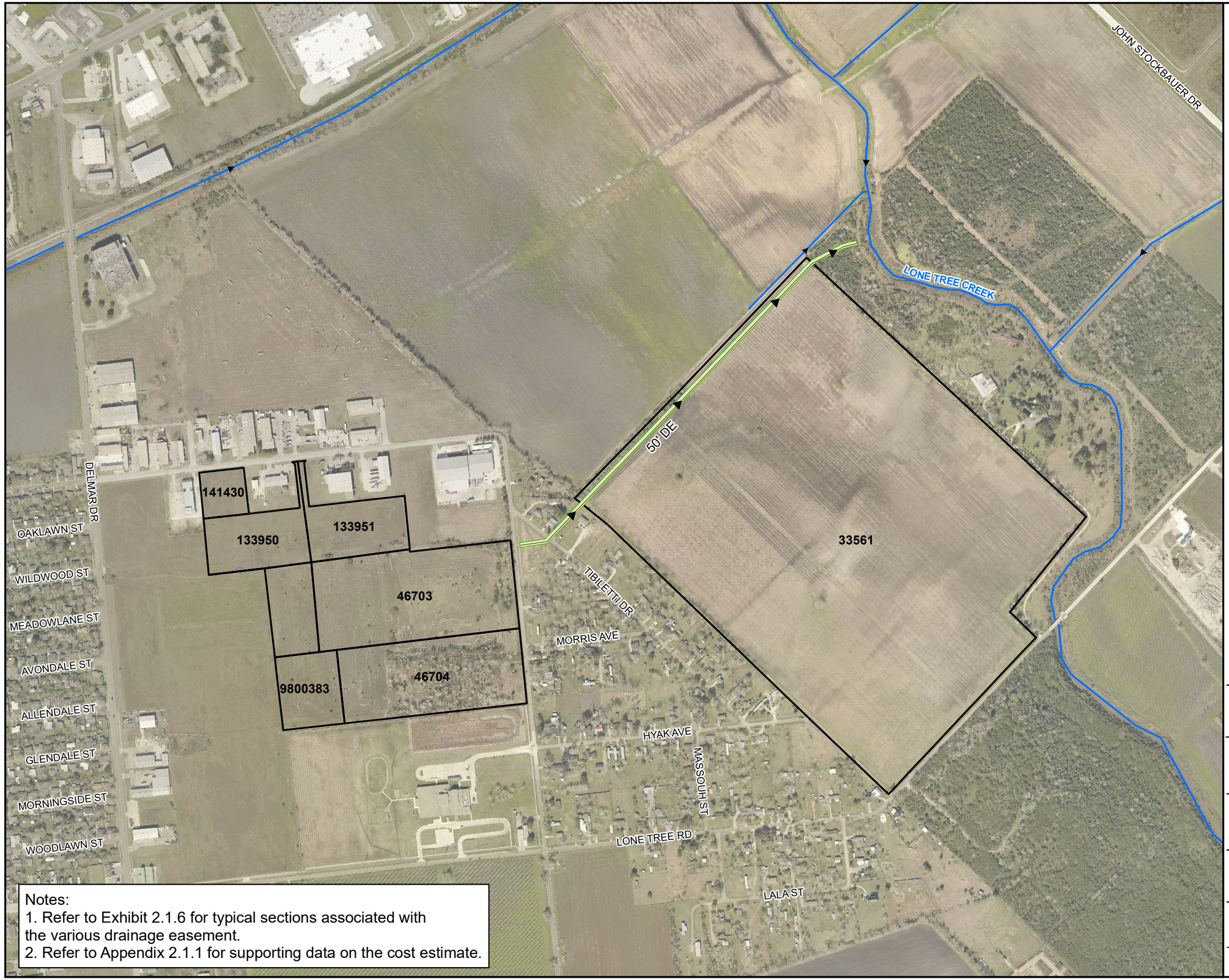
THE CITY OF VICTORIA TEXAS

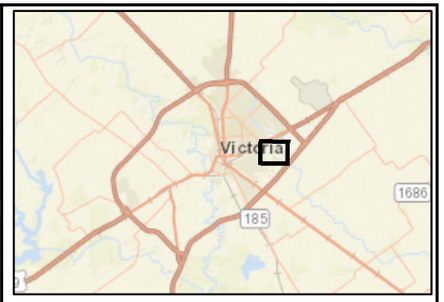
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Project B - Shenandoah Ditch

September 2021	Project No. 400022	Exhibit No. 2.1.2

User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Overview MapsB - Shenandoah Ditch.mxd





LEGEND

- Proposed Structure
- Proposed Storm Sewer
- Stream
- Proposed Drainage Easement
- Study Parcel

0 300 600

Aerial Source:
2020 City of Victoria

N

Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.

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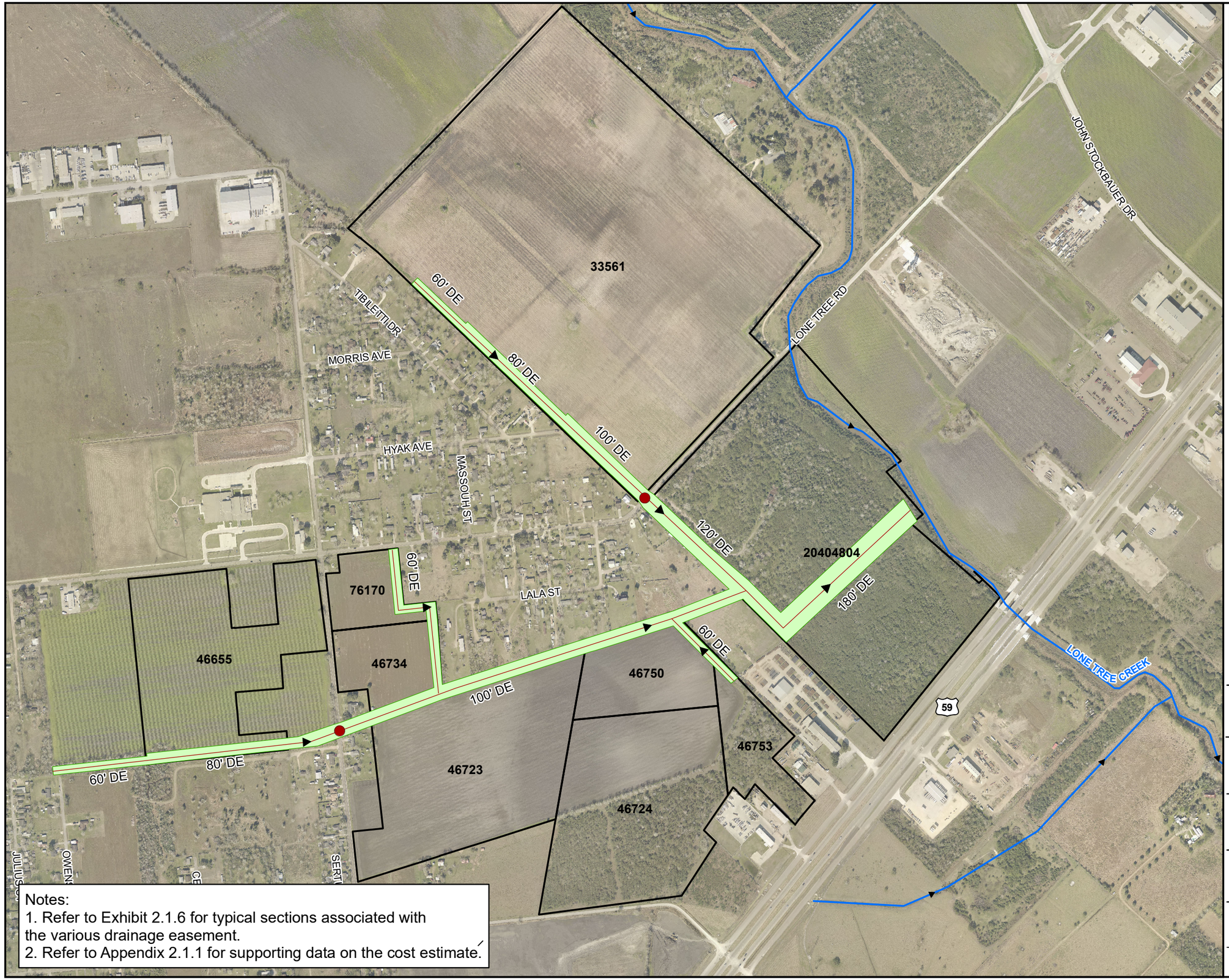
THE CITY OF VICTORIA TEXAS

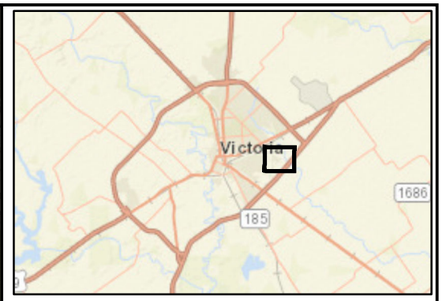
City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Project C - Anthony Road Outfall

September 2021	Project No. 400022	Exhibit No. 2.1.3

User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Overview Maps\C - Anthony Road Outfall.mxd





LEGEND

- Proposed Structure
- Proposed Storm Sewer
- Stream
- Proposed Drainage Easement
- Study Parcel

0 300 600

N

Aerial Source:
2020 City of Victoria
ESRI World Street Map

Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.

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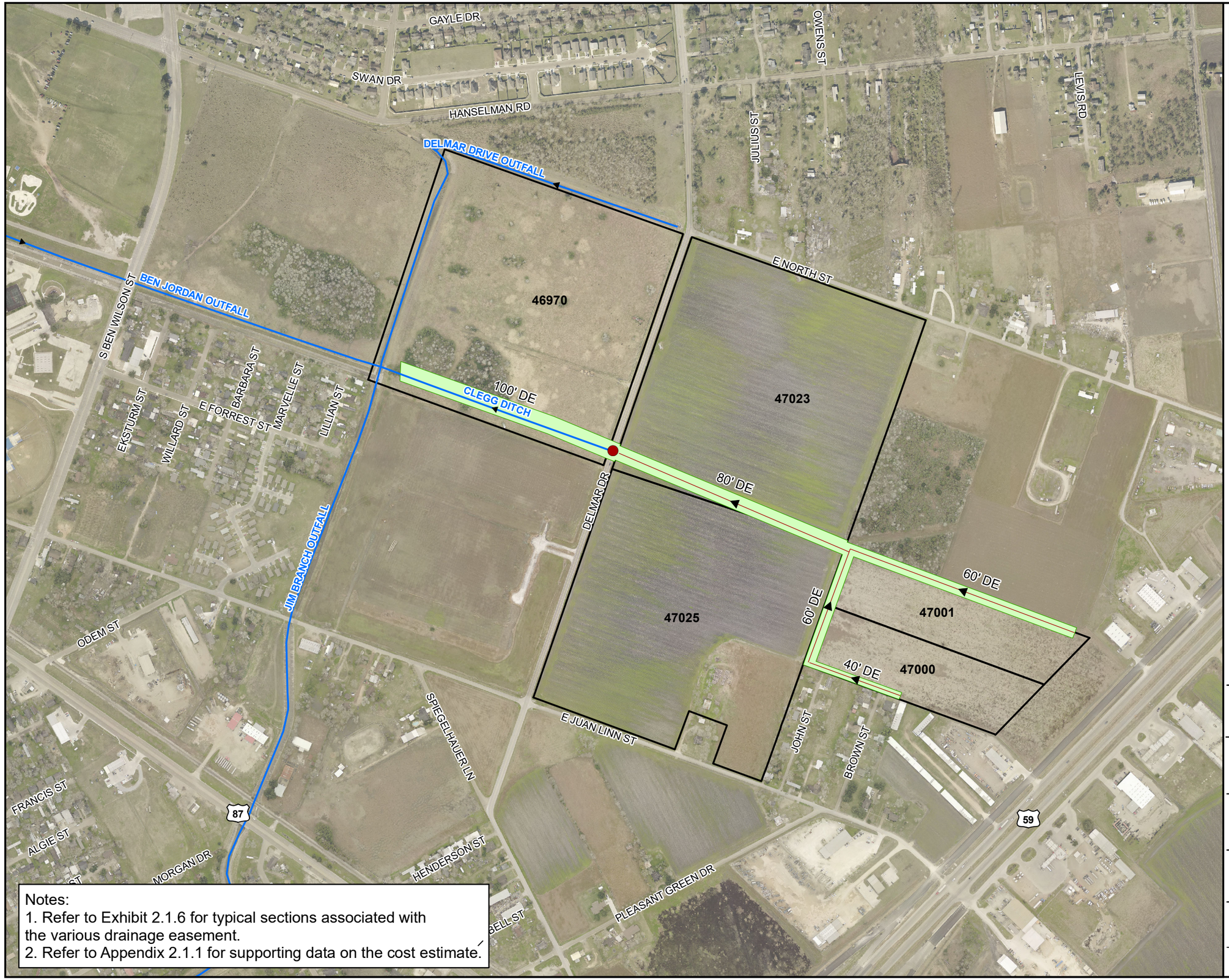
THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Project D - Lone Tree Road Outfall

September 2021	Project No. 400022	Exhibit No. 2.1.4



LEGEND

- Proposed Structure
- Stream
- Proposed Storm Sewer
- Proposed Drainage Easement
- Study Parcel

0 250 500

N

Aerial Source:
2020 City of Victoria
ESRI World Street Map

Notes:
1. Refer to Exhibit 2.1.6 for typical sections associated with the various drainage easement.
2. Refer to Appendix 2.1.1 for supporting data on the cost estimate.

CivilTech Engineering, Inc.
11821 Telge Rd
Cypress, Texas 77429
Tel: 281-304-0200
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urbanvictoria.com · TREF# F-160

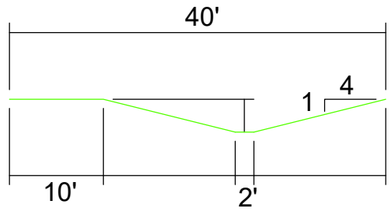
THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

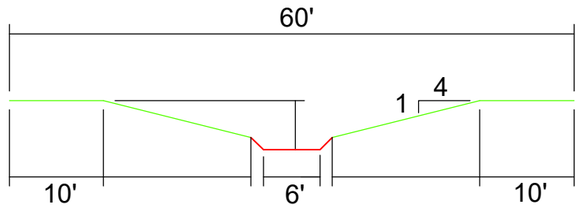
Priority One - Independent Study Area
Project E - Clegg Ditch Outfall

September 2021	Project No. 400022	Exhibit No. 2.1.5

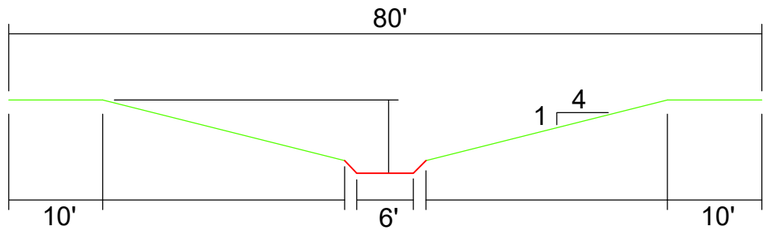
User Name: camille.cotsakis
Document Path: O:\2020\400022\GIS\Exhibits\September Parcel Update\Overview Maps\E - Jim Branch Outfall.mxd



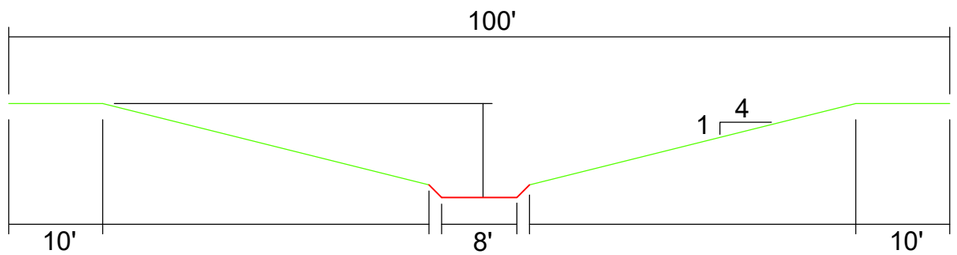
Approximate Typical Section For Drainage Areas Serving Up to 16 Acres. Actual Channel Section To Be Determined In Project Design Phase.



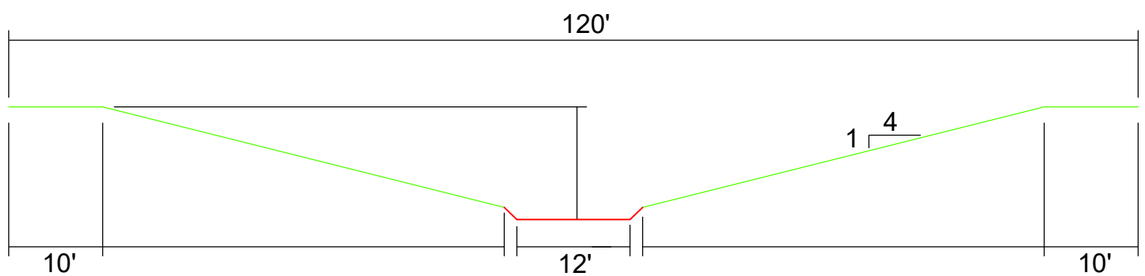
Approximate Typical Section For Drainage Areas Serving Up to 32 Acres. Actual Channel Section To Be Determined In Project Design Phase.



Approximate Typical Section For Drainage Areas Serving Up to 64 Acres. Actual Channel Section To Be Determined In Project Design Phase.



Approximate Typical Section For Drainage Areas Serving Up to 128 Acres. Actual Channel Section To Be Determined In Project Design Phase.



Approximate Typical Section For Drainage Areas Serving Up to 256 Acres. Actual Channel Section To Be Determined In Project Design Phase.

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THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Priority One - Independent Study Area
Typical Sections for Preliminary Drainage Easement Evaluation

September 2021	Project No. 400022	Exhibit No. 2.1.6

2021 Storm Drainage Master Plan Update													
CONSTRUCTION COST ESTIMATE													
		Project A - Buhler Property Diversion				**Project B - Shenandoah Ditch**				**Project C - Anthony Rd Outfall**			
ITEM #	**DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENDED PRICE**	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENDED PRICE**	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENDED PRICE**
1.	Barricading and Traffic Control	1	LS	$ 5,000.00	$ 5,000.00	1	LS	$ 30,000.00	$ 30,000.00	1	LS	$ 15,000.00	$ 15,000.00
2.	Storm Water Pollution Prevention (Install, maintain and remove BMP's required by the SW3P)	1	LS	$ 5,000.00	$ 5,000.00	1	LS	$ 25,000.00	$ 25,000.00	1	LS	$ 15,000.00	$ 15,000.00
3.	Clearing and Grubbing of Easement Area	2.0	AC	$ 3,000.00	$ 6,000.00	8.0	AC	$ 3,000.00	$ 24,000.00	6.0	AC	$ 5,000.00	$ 30,000.00
4.	Topsoiling, Sodding, or HydroMulch	2.0	AC	$ 7,000.00	$ 14,000.00	8.0	AC	$ 7,000.00	$ 56,000.00	6.0	AC	$ 7,000.00	$ 42,000.00
5.	Drainage Ditch Excavation	2,000	CY	$ 8.00	$ 16,000.00	38,100	CY	$ 8.00	$ 304,800.00	12,000	CY	$ 8.00	$ 96,000.00
6.	Haul Off of Excavated Material	2,000	CY	$ 8.00	$ 16,000.00	38,100	CY	$ 8.00	$ 304,800.00	12,000	CY	$ 8.00	$ 96,000.00
7.	Concrete Pilot Channel (6' Bottom x 1' Deep)	950	LF	$ 100.00	$ 95,000.00	1280	LF	$ 100.00	$ 128,000.00				
8.	Concrete Pilot Channel (8' Bottom x 1' Deep)					2740	LF	$ 120.00	$ 328,800.00				
9.	Concrete Pilot Channel (12' Bottom x 1' Deep)												
10.	Drainage Structure (50 square feet)					126	LF	$ 3,000.00	$ 378,000.00				
11.	Drainage Structure (100 square feet)					195	LF	$ 6,000.00	$ 1,170,000.00				
12.	Storm Sewer Pipe (72" dia)									3150	LF	$ 200.00	$ 630,000.00
13.	Junction Box									6	EA	$ 12,000.00	$ 72,000.00
14.	Large Stone Rip Rap	2,500	SF	$ 25.00	$ 62,500.00	5,000	SF	$ 25.00	$ 125,000.00	7,500	SF	$ 25.00	$ 187,500.00
15.	Utility Relocation and Adjustments					5	EA	$ 10,000.00	$ 50,000.00	4	EA	$ 10,000.00	$ 40,000.00
16.	Roadway Repairs					1	LS	$ 50,000.00	$ 50,000.00	1	LS	$ 20,000.00	$ 20,000.00
17.	Wetland Delineation and Permitting	1	LS	$ 5,000.00	$ 5,000.00	1	LS	$ 50,000.00	$ 50,000.00	1	LS	$ 10,000.00	$ 10,000.00
	Subtotal				$ 224,500.00				$ 3,024,400.00				$ 1,253,500.00
18.	Mobilization Design & Contingency (25%)				$ 56,125.00				$ 756,100.00				$ 313,375.00
Total Estimate		**Project A - Buhler Property Diversion**			**$ 280,625.00**	**Project B - Shenandoah Ditch**			**$ 3,780,500.00**	**Project C - Anthony Rd Outfall**			**$ 1,566,875.00**

2021 Storm Drainage Master Plan Update									
CONSTRUCTION COST ESTIMATE									
		Project D - Lone Tree Road Outfall				**Project E - Jim Branch East Outfall**			
ITEM #	**DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENDED PRICE**	**QUANTITY**	**UNIT**	**UNIT PRICE**	**EXTENDED PRICE**
1.	Barricading and Traffic Control	1	LS	$ 10,000.00	$ 10,000.00	1	LS	$ 5,000.00	$ 5,000.00
2.	Storm Water Pollution Prevention (Install, maintain and remove BMP's required by the SW3P)	1	LS	$ 30,000.00	$ 30,000.00	1	LS	$ 20,000.00	$ 20,000.00
3.	Clearing and Grubbing of Easement Area	26.0	AC	$ 3,000.00	$ 78,000.00	9.0	AC	$ 5,000.00	$ 45,000.00
4.	Topsoiling, Sodding, or HydroMulch	26.0	AC	$ 7,000.00	$ 182,000.00	9.0	AC	$ 7,000.00	$ 63,000.00
5.	Drainage Ditch Excavation	92,100	CY	$ 8.00	$ 736,800.00	36,000	CY	$ 8.00	$ 288,000.00
6.	Haul Off of Excavated Material	92,100	CY	$ 8.00	$ 736,800.00	36,000	CY	$ 8.00	$ 288,000.00
7.	Concrete Pilot Channel (6' Bottom x 1' Deep)	5115	LF	$ 100.00	$ 511,500.00	3295	LF	$ 100.00	$ 329,500.00
8.	Concrete Pilot Channel (8' Bottom x 1' Deep)	3920	LF	$ 120.00	$ 470,400.00	1205	LF	$ 120.00	$ 144,600.00
9.	Concrete Pilot Channel (12' Bottom x 1' Deep)	2570	LF	$ 160.00	$ 411,200.00				
10.	Drainage Structure (50 square feet)	78	LF	$ 3,000.00	$ 234,000.00				
11.	Drainage Structure (100 square feet)	80	LF	$ 6,000.00	$ 480,000.00	75	LF	$ 6,000.00	$ 450,000.00
12.	Storm Sewer Pipe (72" dia)								
13.	Junction Box								
14.	Large Stone Rip Rap	15,000	SF	$ 30.00	$ 450,000.00	2,500	SF	$ 25.00	$ 62,500.00
15.	Utility Relocation and Adjustments	3	EA	$ 10,000.00	$ 30,000.00				
16.	Roadway Repairs	2	EA	$ 10,000.00	$ 20,000.00	1	LS	$ 10,000.00	$ 10,000.00
17.	Wetland Delineation and Permitting	1	LS	$ 20,000.00	$ 20,000.00	1	LS	$ 15,000.00	$ 15,000.00
	Subtotal				$ 4,400,700.00				$ 1,720,600.00
18.	Mobilization Design & Contingency (25%)				$ 1,100,175.00				$ 430,150.00
Total Estimate		**Project D - Lone Tree Road Outfall**			**$ 5,500,875.00**	**Project E - Jim Branch East Outfall**			**$ 2,150,750.00**

Attachment No. 3
Technical Memorandum No. 3 – Drainage Criteria Manual Update

CivilTech
Engineering, Inc.
Civil Engineering
Water Resources
Transportation
Structures
Economic Analysis
GIS
Land Development
Construction Services

Attachment 3

TO: Ken Gill, P.E., – City of Victoria

FROM: Mike McGovern, P.E., CFM – CivilTech Engineering Inc.

DATE: March 12, 2021

RE: Task D - Drainage Criteria Review & Update

CivilTech Engineering, Inc. (CivilTech) was contracted by the City of Victoria to prepare an update to the City of Victoria Storm Drainage Master Plan. Under Priority 2 (Task D), the tasks include reviewing the current detention criteria for the City and recommending any necessary updates and evaluating the changes in rainfall totals and rainfall intensities based on the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 parameters. This memorandum presents the method and results of these tasks.

1. Drainage Criteria Manual Updates

The City of Victoria Drainage Criteria Manual, dated May 2007, was reviewed under this task. The following table outlines the recommended updates to the current manual.

Table 3.1 – Recommended Updates to COV Drainage Criteria Manual

Criteria Description	Victoria Current	Victoria Proposed
Design Year for Basis of Calculation		
Local Streets	5 Year	5 Year
Collectors / Arterials	10 Year/25 Year	10 Year/25 Year
Outfalls	100 Year	100 Year
Maximum Flooding Depth		
Local Streets	1' at lowest point	1' at lowest point
Collector	1' at lowest point	1' at lowest point
Arterial	1' at lowest point	1' at lowest point
Outfall	1' at Freeboard	1' at Freeboard
Detention Design Frequency	100 Year	100 Year
Storm Sewer Minimize Size	18"	18"
Detention for Residential Subdivisions	None[1]	Required/100 Year
Detention for Commercial	200' from street; increase in impervious cover	Development or Redevelopment greater than 1 acre
Detention for Residential Lots	None	None
Detention Exemptions	Infill Development less than 5 acres	Lower Spring Creek and directly adjacent to Guadalupe River

1. Temporary detention required if downstream improvements had not been made per SDMP

Additionally, the following is recommended in terms of detention for development:

- Permanent detention should be required for all new developments. Remove the reference to temporary detention that currently is outlined in the Drainage Criteria Manual.

- Detention shall be based on the SCS method using pre and post analysis.
- Parcels outfalling directly into primary channels shall discharge at pre-development rates.
- Parcels discharging into pipes or roadside ditches less than 3 feet deep will discharge based on the pro-rated capacity of the outfall pipe or roadside ditch.

Suggested detention exemptions are recommended below:

- Redevelopment (remodels and additions) shall only be required to detain based on increase in impervious cover.
- Development of 1 acre or less with less than 65% impervious cover shall be exempt. Detention shall be required if the impervious cover is greater than 65%.
- Low density developments of any parcel size so long as the percent impervious cover is less than 20% shall be exempt.
- Parcels that drain directly to the Guadalupe River shall be exempt.
- Development within the lower reaches of Spring Creek, downstream of Briggs Blvd, shall be exempt.

An analysis was completed to determine the relationship between the recommended minimum detention rate as a function of the increase in impervious cover within the City. Based on the results, the following equation is recommended to be used for future development:

$$S = 0.0023 * (IC) + 0.1571 \quad (3.1)$$

Where:

S = Storage Rate (ac-ft/ac)

IC = Increase In Impervious Cover (as a percentage)

Supporting data for the development of the minimum detention rate function is provided in **Appendix 3.1**.

2. Rainfall Intensity Methodology

The NOAA's Atlas 14 update is part of a continuous study on precipitation frequency estimates and is the official document of such estimates. The most recent update on the rainfall intensity parameters was in 2018. The intensities given in the update are based on annual exceedance probability or recurrence intervals (Perica et al. 2018). Intensity parameters for 7 recurrence intervals were gathered: 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr, and 500-yr as part of NOAA's update. As seen in **Eq. (3.2)**, The intensity (in/hr), I, can be found through the relationship between the time of concentration, t_c, and intensity coefficients b, d, and e.

$$I = \frac{b}{(t_c + d)^e} \quad (3.2)$$

E, b, and d coefficients are based on the coefficients developed by the Texas Department of Transportation (TxDOT) for Victoria County, Zone 1, as referenced below in **Section 3** and shown in **Table 3.2.** This assumes the Partial Duration Series (PDS) methodology is used. Further discussion on the PDS methodology is discussed below in **Section 4.**

Table 3.2 – Rainfall Intensity-Duration-Frequency Coefficients for Victoria County, Zone 1

	Design Annual Exceedance Probability						
Coefficient	50% (2-year)	20% (5-year)	10% (10-year)	4% (25-year)	2% (50-year)	1% (100-year)	0.2% (500-year)
e	0.8101	0.7804	0.7604	0.7380	0.7225	0.7085	0.6843
b	70.9681	75.5535	79.5429	85.3431	89.3288	93.5238	106.9345
d (min)	13.6559	12.6298	12.0342	11.4559	11.0258	10.8231	11.5302

3. References

The following technical documents were referenced:

1. *National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11 Version 2.0: Texas,* Perica, S., Pavlovic, S., St. Laurent, M., Trypaluk, C., Unruh, D., Wihite, O. (2018)
2. *City of Victoria Drainage Criteria Manual,* dated May 2007, prepared by PBS&J, Inc.
3. *Recommendations for: Rainfall Depths and Intensities in Harris County*, dated March 2019, prepared by HCFCD
4. *E, b, and d values developed by TxDOT, as outlined on the following website: https://ftp.txdot.gov/pub/txdot/hou/resources/houston-district-ebdlkup-user-manual.pdf*

4. Comparison of Partial Duration Series and Annual Maximum Series

A review was completed by the Harris County Flood Control District (HCFCD) to determine the differences between the use of Partial Duration Series (PDS) and Annual Maximum Series (AMS). The findings of both series are outlined below:

- The disadvantage of AMS is that rainfall datasets contain only the highest annual rainfall in a given year but may omit a peak rainfall within a given year that may not be the highest yet is greater than the peak of another year's rainfall.
- The disadvantage of PDS is that rainfall datasets contain all peak rainfalls above a certain threshold, thereby creating difficulty in establishing statistical independence, particularly among flood events.
- For storm events greater than a 10-yr event (10% AEP), PDS and AMS rainfall estimates are approximately the same.

HCFCD concluded the difference in depth-duration-frequency values for a 10-yr storm event and greater were negligible between AMS and PDS and recommends using PDS, as PDS seems to be more appropriate for design/analysis of smaller storm events as well.

5. Atlas 14 Rainfall

Table 3.3 outlines the updated rainfall totals for the City of Victoria based on the NOAA Atlas 14 rainfall data for the 24-hour storm event. These rainfall totals are based on the partial duration series.

Table 3.3: City of Victoria Rainfall Depth (24-hour Storm Event)

Storm Event (years)	Annual Exceedance Probability (AEP) (%)	Rainfall (inches)
2	50%	4.74
5	20%	6.29

Storm Event (years)	Annual Exceedance Probability (AEP) (%)	Rainfall (inches)
10	10%	7.69
25	4%	9.77
50	2%	11.50
100	1%	13.40
500	0.2%	18.70

Comparison tables for the rainfall intensity-duration-frequency (IDF) data and total rainfall data for the City of Victoria can be found in **Appendix 3.2.**

6. Recommendations

It is recommended that the following updates be adopted in the City of Victoria Drainage Criteria Manual.

- Adopt a minimum detention storage requirement based on the increased impervious cover associated with a project.
- Adopt TxDOT Atlas 14 e, b, and d values for drainage design.
- Adopt of NOAA Atlas 14 rainfall data for the City for stormwater detention analysis and design.

Appendix 3.1
Detention Rate Supporting Calculations

Appendix 3.1 – Detention Rate Evaluation and Supporting Calculations

CivilTech Engineering, Inc. (CEI) was contracted by the City of Victoria to perform a detention evaluation to establish detention requirements of proposed developments within the City based on impervious cover associated with a proposed development. This analysis was completed by evaluating drainage areas of various sizes to determine an average storage rate curve that could easily be applied to proposed developments within the City.

The following tasks were performed:

- Selected 10 undeveloped parcels based on location and drainage area size.
- Determined the 100-year flow rates for the undeveloped conditions.
- Determined the 100-year flow rates for the developed conditions (varying % impervious cover)
- Estimated the detention requirements and generated storage rate curves for each parcel.

The analyses and associated results are summarized as follows.

1. Drainage Area and Land Use

10 parcels located within the City of Victoria were selected for the analysis. These parcels were selected based on their location and drainage area size, ranging from 3 acres to 56 acres, as summarized in **Table 3.1.1** and shown on **Exhibit 3.1.A** and **Exhibit 3.1.B.**

Table 3.1.1: Parcel ID and Drainage Area used for Analysis

Parcel No.	Drainage Area (acres)
34169	19.38
36130	25.73
36144	5.00
36193	2.98
46643	9.80
46734	15.60
47025	38.96
20317256	31.73
20384788	56.11
20397494	35.22

Land use determination was based on the CoV Drainage Criteria Manual (CoV DCM), May 2007, current parcel data, and aerial imagery. All of the sites considered for the analysis were undeveloped under existing conditions. For the proposed condition, the impervious cover was assumed to be 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% and 90% for each drainage area and the proposed flow for each impervious cover percentage was calculated.

2. Time of Concentration (NRCS Method):

NRCS method was used to determine the time of concentration, t_c. The time of concentration is expressed as:

$$t_c = t_{sh} + t_{sc} + t_{ch} + t_{ss}$$

Where: t_c = total time of concentration (hr)

t_{sh} = sheet flow travel time (hr)
t_{sc} = shallow concentrated flow travel time (hr)
t_{ch} = channel flow travel time (hr)
t_{ss} = storm sewer flow travel time (hr)

Sheet flow travel time (t_{sh}) in hours is computed as:

$$t_{sh} = \frac{0.007(n_{ol}L_{sh})^{0.8}}{(P_2)^{0.5}S_{sh}^{0.4}}$$

Where: n_{ol} = overland flow roughness coefficient

L_{sh} = sheet flow length (ft)
P_2 = 2-year, 24-h rainfall depth (in) (based on Atlas 14 Update rainfall data)
S_{sh} = sheet flow slope (ft/ft)

Shallow concentrated flow travel time (t_{sc}) in hours is computed as:

$$t_{sc} = \frac{L_{sc}}{3600KS_{sc}^{0.5}}$$

Where: L_{sc} = shallow concentrated flow length (ft)

K = 16.13 for unpaved surface, 20.32 for paved surface
S_{sc} = shallow concentrated flow slope (ft/ft)

Storm sewer flow travel time (t_{ss}) in hours is computed using velocity method computed as:

$$t_{ss} = \frac{L_{ss}}{60\mathrm{v}}$$

Where:

L_{ss} = storm sewer flow length (ft)
v = storm sewer velocity considered (3.0 ft/s)

For the existing condition, the time of concentration was developed using existing condition (Generally sheet flow = Short Grass Prairie and shallow concentrated flow = undeveloped).

For the proposed condition, the sheet flow was assumed to be concrete and shallow concentrated length was assumed to be converted in the storm sewer and the time of concentration was calculated using the formula described. The minimum time of concentration was assumed to be 10 minutes.

3. Flow Calculation

SCS method was used to calculate flows generated from the drainage areas. The required parameters are described below.

3.1 Curve Number

Curve Numbers for the drainage areas considered were based on the City of Victoria's Drainage Criteria Manual. The soil data were obtained from the web soil survey website of Natural Resources Conservation Services (NRCS). The Hydrologic Soil Group of D was assigned for the selected drainage areas. The drainage areas were considered undeveloped under existing conditions. Based on Table 4-4 of CoV DCM, a curve number (CN) of 77 was determined to represent the hydrologic conditions of the selected sites, as shown in **Figure 3.1.1**. For proposed condition, it was assumed that the change in impervious cover would not impact the curve number, so the curve number for the drainage area in the proposed condition was assumed to be same as that of the existing condition.

Table 4-4
NRCS (SCS) Curve Numbers

Land Use Code	City of Victoria Description	NRCS (SCS) TR-55 Category	Hydrologic Soil Group			
			A	B	C	D
11	Residential - Single Family	Residential: 1/4 acre	61	75	83	87
12	Residential - Dup/Two Family	Residential: 1/5 acre (43% Imp.)	64	77	84	88
13	Residential - Multi-family	Residential: 1/8 acre or less	77	85	90	92
14	Residential - Manu. Housing	Residential: 1/5 acre (43% Imp.)	64	77	84	88
15	Residential - Group Homes	Residential: 1/8 acre or less	77	85	90	92
21	Commercial - Retail	Commercial and Business	89	92	94	95
22	Commercial - Office Services	Commercial and Business	89	92	94	95
23	Commercial - Wholesale	Commercial and Business	89	92	94	95
31	Industrial	Industrial	81	88	91	93
41	Utilities	Industrial	81	88	91	93
51	Public - Open Space	Open Space: Fair Condition	49	69	79	84
52	Public - Building/Facility	Industrial	81	88	91	93
53	Quasi/Public - Open Space	Open Space: Fair Condition	49	69	79	84
54	Quasi/Public - Building/Facility	Industrial	81	88	91	93
61	Agriculture	Fallow: Crop Residue Cover (Good)	74	83	88	90
71	Undeveloped Land	Brush: Fair Condition	35	56	70	77

Figure 3.1.1: NRCS Curve Number from City of Victoria's Drainage Criteria Manual (May 2007)

3.2 Lag Time

Lag time (t_L) was defined as 60% of time of concentration and expressed as:

$$t_L = 0.6t_c$$

Where:

t_c = total time of concentration (min)
t_L = lag time (min)

3.3 Rainfall Depths

The rainfall depths for the project location were obtained from the Point Precipitation Frequency Estimate table obtained from National Oceanic and Atmospheric Administration (NOAA) for City of Victoria (Latitude: 28.8617, Longitude: -96.9301). The rainfall depth values for the various storm frequencies and durations used in developing the hydrographs are shown in **Table 3.1.2**.

Table 3.1.2: NOAA Atlas 14 Rainfall Depth

	PRECIPITATION FREQUENCY ESTIMATES (inches)						
AEP (years)	**2**	**5**	**10**	**25**	**50**	**100**	**500**
5-min	0.57	0.69	0.79	0.93	1.03	1.13	1.37
10-min	0.90	1.10	1.26	1.48	1.65	1.81	2.16
15-min	1.14	1.38	1.58	1.85	2.05	2.25	2.71
30-min	1.61	1.95	2.22	2.59	2.87	3.15	3.81
60-min	2.13	2.59	2.97	3.49	3.88	4.27	5.24
2-hr	2.70	3.35	3.89	4.65	5.24	5.85	7.42
3-hr	3.04	3.83	4.50	5.44	6.18	6.97	9.02
6-hr	3.63	4.65	5.55	6.84	7.88	9.00	12.00
12-hr	4.17	5.44	6.58	8.25	9.62	11.10	15.20
24-hr	4.74	6.29	7.69	9.77	11.50	13.40	18.70

4. Required Detention Volume

Detention volume required was determined by integrating the area between the existing outflow hydrograph and proposed outflow hydrograph. The hydrologic conditions remained the same between existing and proposed conditions except for the impervious cover. The proposed flows were calculated assuming the change in impervious cover as defined in **Section 1.** The hydrologic information is presented in **Table 3.1.3**. Utilizing the information, proposed outflows for each impervious cover percentage were calculated for all the drainage areas.

Figure 3.1.2 shows the existing and proposed outflow hydrographs for DA 46734. This assumes 0% impervious cover under existing conditions and 20% impervious cover under proposed conditions. The area between the two hydrographs shaded in green indicates the required detention volume.

The storage rate was computed by dividing the calculated detention volume by the drainage area. The calculated storage rate for each drainage area and corresponding impervious cover is shown in **Table 3.1.4**. The storage rates for all the analyzed drainage areas were averaged and plotted against the percent impervious cover to produce a linear relationship, shown in **Figure 3.1.3** and the equation below. This relationship can be easily used to determine the required detention volume for future development in City of Victoria.

$$y = 0.0023x + 0.1571$$

Where:

y = storage rate required (ac-ft/ac)

x = impervious cover percentage (%)

Note: The relationship is valid for change in impervious cover above 10%.

Table 3.1.3: SCS Method Calculation Parameters

Parcel ID/ Drainage Area ID	Drainage Area (acres)	Hydrologic Soil Type	CN-Value	Time of Concentration (min)		Lag Time (min)	
				Existing	Proposed	Existing	Proposed
34169	19.40	D	77	24.03	10.00	14.42	6.00
36130	25.70	D	77	50.20	10.00	30.12	6.00
36144	5.00	D	77	26.10	10.00	15.66	6.00
36193	3.00	D	77	31.20	10.00	18.72	6.00
46643	9.80	D	77	36.60	10.00	21.96	6.00
46734	15.60	D	77	28.48	10.00	17.09	6.00
47025	39.00	D	77	57.49	14.05	34.49	8.43
20317256	31.70	D	77	69.71	13.02	41.82	7.81
20384788	28.10	D	77	41.59	12.51	24.96	7.51
20397494	35.20	D	77	53.64	14.87	32.18	8.92

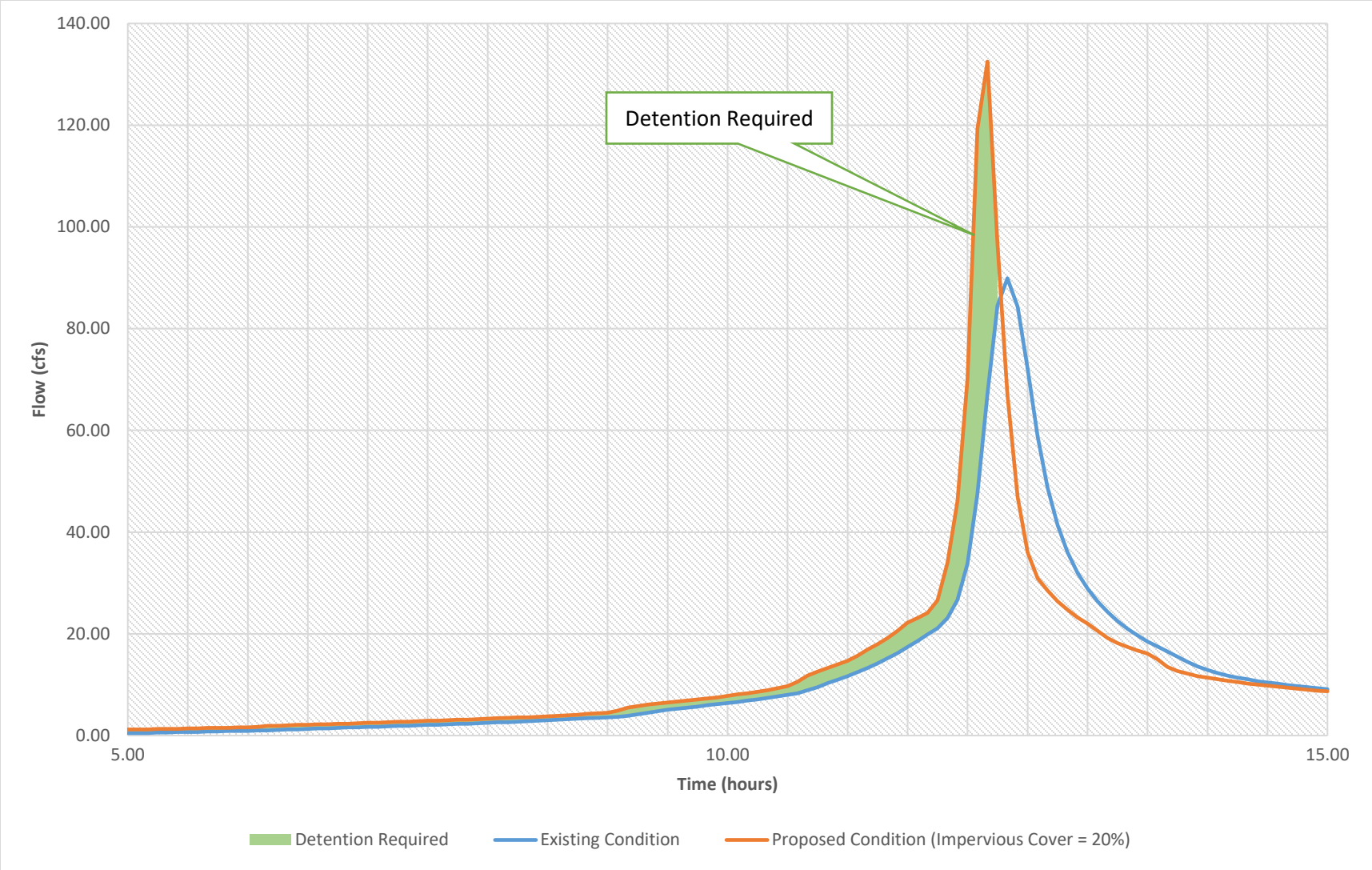


Figure 3.1.2: Detention Requirement - DA 46734 (Impervious = 20%)

Table 3.1.4 Calculated Storage Rates Based on Varying Percent Impervious Covers

Parcel ID		34169	36130	36144	36193	46643	46734	47025	20317256	20384788	20397494	Average
Area(acres)		19.40	25.70	5.00	3.00	9.80	15.60	39.00	31.70	28.10	35.20	-
Impervious %	**10**	0.116	0.221	0.128	0.158	0.176	0.14	0.221	0.257	0.179	0.205	**0.180**
	20	0.138	0.244	0.152	0.178	0.198	0.163	0.244	0.28	0.201	0.228	**0.203**
	30	0.161	0.267	0.174	0.201	0.22	0.185	0.267	0.303	0.224	0.251	**0.225**
	40	0.184	0.289	0.194	0.221	0.242	0.208	0.289	0.326	0.247	0.274	**0.247**
	50	0.206	0.312	0.216	0.245	0.265	0.231	0.312	0.348	0.269	0.296	**0.270**
	60	0.229	0.335	0.24	0.268	0.288	0.253	0.335	0.371	0.292	0.319	**0.293**
	70	0.252	0.358	0.264	0.292	0.31	0.276	0.358	0.394	0.315	0.342	**0.316**
	80	0.276	0.381	0.286	0.315	0.333	0.299	0.381	0.417	0.338	0.365	**0.339**
	90	0.298	0.403	0.308	0.336	0.355	0.322	0.403	0.44	0.36	0.388	**0.361**

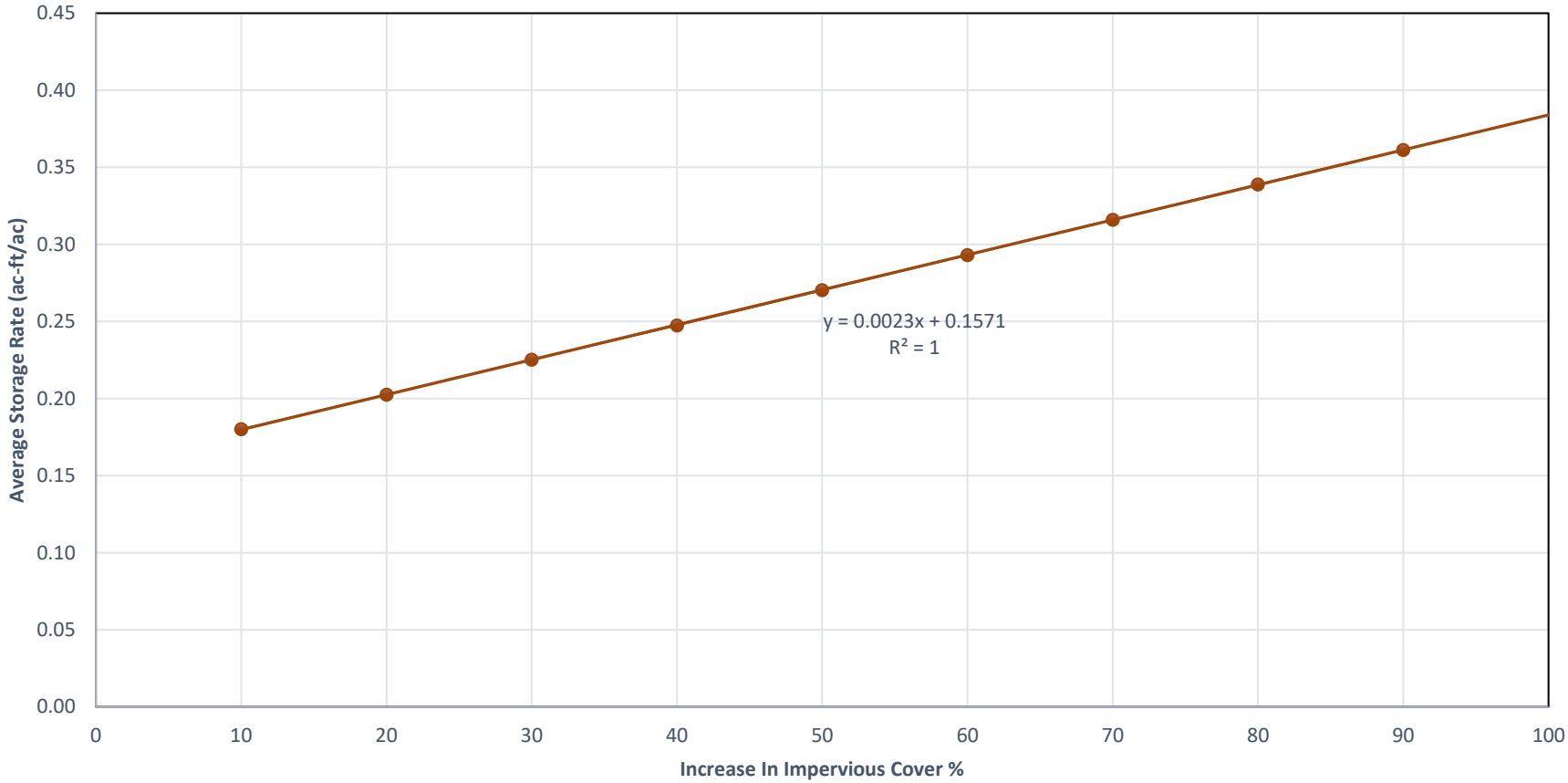
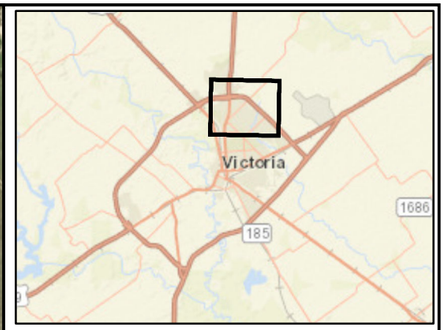


Figure 3.1.3: Storage Rate vs % Impervious Cover



LEGEND

- Stream
- Drainage Area

FEMA Flood Hazard Zones
FLD_ZONE, FLOODWAY

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

N

0 1,500 3,000

Aerial Source: 2020 City of Victoria

CivilTech Engineering, Inc.
11821 Telge Rd
Cypress, Texas 77429
Tel: 281-304-0200
Fax: 281-304-0210

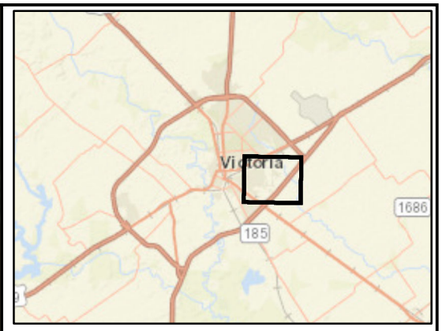
THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Drainage Area Location For Detention Analysis

OCTOBER 2021	Project No. 40022	Exhibit No. 3.1.A

User Name: animesh.pradhan
Document Path: C:\Users\animesh.pradhan\OneDrive - Woolpert\Desktop\Completed Project\400022_City of Victoria\CoV-detention_calc\Study_Parcels1.mxd



LEGEND

- Drainage Area
- Stream

FEMA Flood Hazard Zones
FLD_ZONE, FLOODWAY

- Regulatory Floodway
- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard

N

0 1,000 2,000

Aerial Source: 2020 City of Victoria

CivilTech Engineering, Inc.
11821 Telge Rd
Cypress, Texas 77429
Tel: 281-304-0200
Fax: 281-304-0210

THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Drainage Area Location For Detention Analysis

OCTOBER 2021	Project No. 40022	Exhibit No. 3.1.B

User Name: animesh.pradhan
Document Path: O:\2020\400022\GIS\Exhibits\MXDs\Study Parcels.mxd

Appendix 3.2
IDF and Rainfall Data Comparison

Table 3.2.1: Rainfall Intensity-Duration-Frequency Coefficients for Victoria County, Texas (Pre-Atlas 14)

	Design Annual Exceedance Probability (Design Annual Recurrence Interval)					
Coefficient	50% (2-year)	20% (5-year)	10% (10-year)	4% (25-year)	2% (50-year)	1% (100-year)
e	0.815	0.782	0.755	0.752	0.745	0.730
b	68	75	78	90	97	99
d (min)	9.0	8.6	8.6	8.6	8.6	9.0

Table 3.2.2: Rainfall Intensity-Duration-Frequency (IDF)Data for Victoria County, Texas
NOAA Pre-Atlas 14 vs Atlas 14

t_c	2-YR INTENSITY			5-YR INTENSITY		
	PRE-ATLAS 14	ATLAS 14	%	PRE-ATLAS 14	ATLAS 14	%
(MIN)	IN/HR	IN/HR		IN/HR	IN/HR	
10	6.17	5.47	-11.34	7.63	6.62	-13.15
15	5.10	4.68	-8.18	6.33	5.67	-10.47
30	3.43	3.33	-3.02	4.31	4.04	-6.23
60	2.16	2.18	1.06	2.75	2.67	-3.00
120	1.30	1.35	3.85	1.68	1.67	-0.89
180	0.95	1.00	4.99	1.25	1.25	-0.08
360	0.55	0.58	6.35	0.74	0.74	0.84
720	0.32	0.34	7.24	0.43	0.44	1.37
1440	0.18	0.19	7.87	0.25	0.26	1.70

Table 3.2.2 (cont.): Rainfall Intensity-Duration-Frequency (IDF)Data for Victoria County, Texas
NOAA Pre-Atlas 14 vs Atlas 14

t_c	10-YR INTENSITY			25-YR INTENSITY		
	PRE-ATLAS 14	ATLAS 14	%	PRE-ATLAS 14	ATLAS 14	%
(MIN)	IN/HR	IN/HR		IN/HR	IN/HR	
10	8.58	7.57	-11.75	9.99	8.88	-11.10
15	7.17	6.48	-9.59	8.35	7.61	-8.90
30	4.95	4.63	-6.29	5.77	5.46	-5.32
60	3.20	3.08	-3.96	3.74	3.66	-2.37
120	1.99	1.94	-2.63	2.33	2.33	-0.13
180	1.49	1.46	-2.22	1.75	1.77	0.92
360	0.90	0.88	-1.92	1.06	1.08	2.42
720	0.54	0.53	-1.94	0.63	0.66	3.69
1440	0.32	0.31	-2.13	0.38	0.40	4.85
t_c	50-YR INTENSITY			100-YR INTENSITY		
	PRE-ATLAS 14	ATLAS 14	%	PRE-ATLAS 14	ATLAS 14	%
(MIN)	IN/HR	IN/HR		IN/HR	IN/HR	
10	10.99	9.89	-9.98	11.54	10.88	-5.68
15	9.20	8.48	-7.87	9.73	9.34	-3.96
30	6.38	6.10	-4.33	6.83	6.75	-1.05
60	4.16	4.11	-1.23	4.50	4.57	1.58
120	2.60	2.64	1.35	2.85	2.96	3.84
180	1.96	2.01	2.66	2.16	2.27	5.02
360	1.19	1.24	4.69	1.32	1.41	6.90
720	0.71	0.76	6.56	0.81	0.87	8.66
1440	0.43	0.46	8.35	0.49	0.54	10.37

Table 3.2.3: Rainfall Totals in Inches for the City of Victoria (Pre-Atlas 14)

Recurrence Interval (Years)	Rainfall Duration									
	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
2	0.54	0.91	1.17	1.68	2.21	2.62	2.86	3.39	3.86	4.5
5	0.61	1.04	1.34	2.02	2.72	3.4	3.75	4.51	5.35	6.25
10	0.67	1.14	1.47	2.27	3.09	3.94	4.39	5.32	6.38	7.5
25	0.75	1.3	1.67	2.63	3.62	4.64	5.14	6.3	7.58	8.9
50	0.82	1.42	1.83	2.91	4.03	5.2	5.83	7.11	8.66	10.1
100	0.89	1.54	1.99	3.19	4.44	5.81	6.35	7.92	9.75	11.5
500	1.06	1.85	2.39	3.91	5.49	7.26	8.03	10	12.37	14.55

Durations from 5-60 minutes were developed using Hydro35; remaining values developed using TP-40

Figure 3.2.1: Rainfall Totals Based on Average Recurrence Intervals (Pre-Atlas 14)

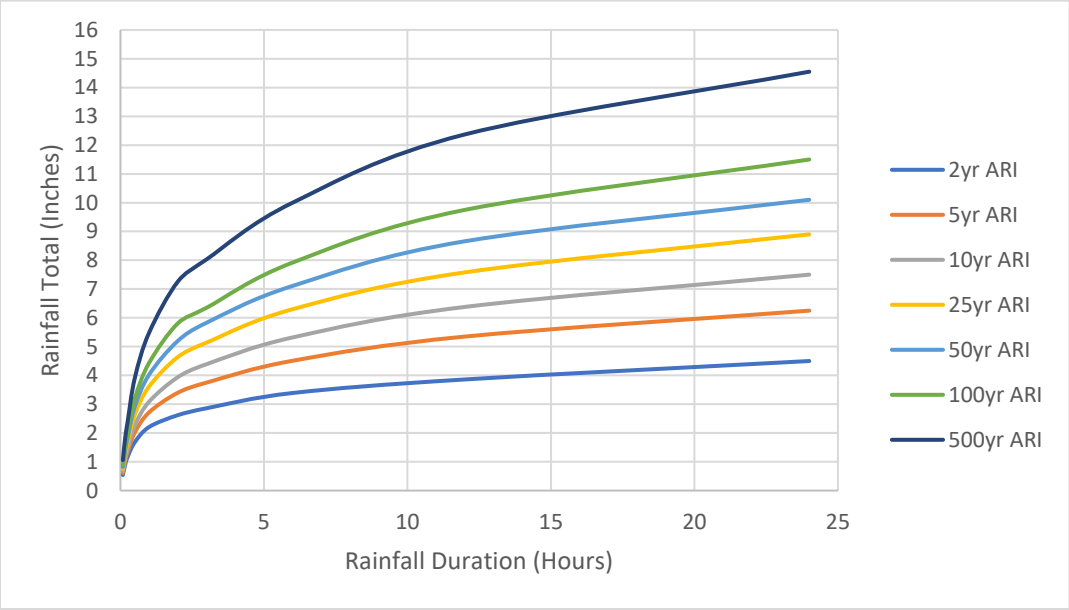
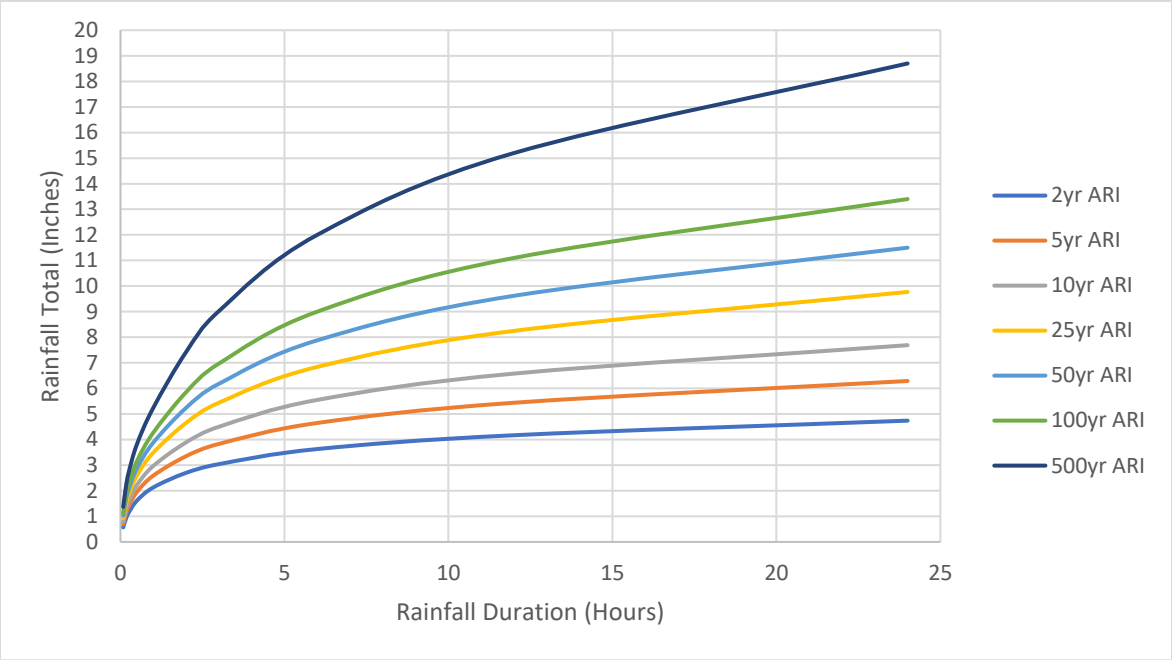


Table 3.2.4: Point Precipitation Frequency Estimates (Atlas 14)

Recurrence Interval (years)	Rainfall Duration									
	5-min	10-min	15-min	30-min	60-min	2-hr	3-hr	6-hr	12-hr	24-hr
2	0.57	0.90	1.14	1.61	2.13	2.70	3.04	3.63	4.17	4.74
5	0.69	1.10	1.38	1.95	2.59	3.35	3.83	4.65	5.44	6.29
10	0.79	1.26	1.58	2.22	2.97	3.89	4.50	5.55	6.58	7.69
25	0.93	1.48	1.85	2.59	3.49	4.65	5.44	6.84	8.25	9.77
50	1.03	1.65	2.05	2.87	3.88	5.24	6.18	7.88	9.62	11.50
100	1.13	1.81	2.25	3.15	4.27	5.85	6.97	9.00	11.10	13.40
500	1.37	2.16	2.71	3.81	5.24	7.42	9.02	12.00	15.20	18.70

NOAA Atlas 14 Volume 11 Version 2
Data type: Precipitation depth
Time series type: Partial duration
Project area: Texas
Location name (ESRI Maps): Victoria, Texas, USA
Station Name: VICTORIA RGNL AP
Latitude: 28.8617°
Longitude: -96.9301°
Elevation (USGS): 115 ft

Figure 3.2.2: Rainfall Totals Based on Average Recurrence Intervals (Atlas 14)



Attachment No. 4
Technical Memorandum No. 4 – Storm Sewer System Evaluation

CivilTech
Engineering, Inc.

Civil Engineering
Water Resources
Transportation
Structures
Economic Analysis
GIS
Land Development
Construction Services

Attachment 4

TO: Ken Gill, P.E., – City of Victoria

FROM: Mike McGovern, P.E., CFM – CivilTech Engineering Inc.

DATE: February 5, 2021

RE: Task E – Storm Sewer System Evaluation

CivilTech Engineering, Inc. (CivilTech) was contracted by the City of Victoria to prepare an update to the City of Victoria Storm Drainage Master Plan. Under Priority 3 (Task E), the following analyses were completed:

- Compute flow paths and generate associated shapefiles throughout the City.
- Perform a 100-year sheet flow analysis using Rain-On-Grid modeling.
- Evaluate the performance of the existing storm sewer system and determine the associated level of service.
- Determine the effects partially blocked pipes have on the storm sewer.
- Estimate the cost to clean and televise the existing storm sewer system, as well as the cost to replace all storm sewer pipe less than 18-inches.

This memorandum summarizes these analyses and the associated results.

1. Flow Path Analysis

A flow path analysis was completed for the City of Victoria. The ArcHydro tool in GIS was used to generate contributing drainage areas and associated sheet flow paths based on the 2018 LiDAR data. A range of contributing drainage areas and flow paths were established as part of the analysis. This includes the following drainage area sizes: 4, 8, 16, 32, 64, 128, and 256 acres. Visual inspection using Google Earth and aerial imagery information was used to modify the overland flow paths where necessary to account for such things as drainage culverts throughout the City. This is necessary to continue a flow path in instances where a roadway or other feature falsely blocks the travel of flow in the LiDAR dataset. The overland flow paths for all drainage area sizes are provided on the GIS page, along with the associated 16 acre contributing drainage areas.

2. Sheet Flow Analysis

The Rain-On-Grid modeling technique using HEC-RAS was used to complete a sheet flow analysis throughout the City. This analysis was completed to determine estimated flood depths throughout the City during a 100-year storm event. Specifically, results from this analysis highlight potential localized flooding that may occur outside of the typical floodplain. For the analysis, it was assumed the existing storm sewer systems were designed to handle a 2-year storm event. To account for the capacity of the storm sewers, the 2-year precipitation data was removed from the 100-year precipitation data, and the resulting hyetograph was applied to the 2D mesh in HEC-RAS. Major drainage crossings, such as roadway culverts, were added to the 2D mesh to ensure

flow was not falsely blocked and backing up behind a roadway or other feature above natural ground. Results of the analysis are provided on **Exhibit 4.1** and the GIS page under the SDMP Approximate 100 Yr Ponding Depth layer.

3. Storm Sewer Level of Service (LOS) Methodology

There are four parameters needed to determine the storm sewer LOS for a specific area. The four parameters include: the drainage area servicing the storm sewer system, the land use condition, the runoff rate associated with the drainage area, and the design capacity of the storm sewer. In general, the storm sewer systems identified for this analysis were determined based on systems that service drainage areas between 1 and 200 acres.

3.1 System Drainage Area

The base drainage areas for this analysis were taken from the data developed for the 2007 Storm Drainage Master Plan, prepared by PBS&J. The drainage areas were further divided based on LiDAR data and aerial imagery to isolate drainage areas associated with the main storm sewer trunkline system within the City. In total, 171 storm sewer service areas were determined, see **Exhibit 4.2 – 4.10** for reference. Areas that drain directly to open channels were omitted from the LOS determination.

3.2 Land Use

Land use determination was based on the City of Victoria's current parcel data and the runoff coefficient data from the City of Victoria Drainage Criteria Manual. Each parcel code was modified to reflect the development codes most appropriate to the current land use as shown in **Table 4.1.** For the purpose of this analysis a single composite C-value was determined for each drainage area. The drainage areas and associated C-values can be found in **Table 4.1.1**, in **Appendix 4.1**.

Table 4.1: Runoff Coefficient Values for Land Use Types

Code	Land Use Type	Description	C-Value Range	Chosen C-Value	% Impervious
U	Undeveloped	Unimproved areas, ditches	0.18-0.25	0.25	0%
R1	Residential	Single Family Homes	0.3-0.5	0.45	38%
HD	Industrial	Heavy industrial or commercial areas	0.6-0.9	0.70	85%
T	Transportation	Streets, Roadways	0.85-0.95	0.90	100%

3.3 Peak Runoff Rate Determination

Site runoff curves were developed to approximate the peak runoff rate associated with each drainage area. The runoff curves were developed using Atlas 14 rainfall and based on rational method peak flows calculated for 24 sample drainage areas that vary in size from 1 acre to 200 acres and varying in land use (undeveloped, residential, commercial, transportation). This approach follows a similar approach applied in the 2007 PBS&J SDMP. See Equation 4.1 for the rational method formula. Runoff rates were developed for seven Atlas 14 storm events: 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr, and 500-yr.

$$Q = CiA, \qquad i \text{ in } in./hr \tag{4.1}$$

A regression analysis was performed to determine the best-fit line for the data for each of the four land use types. It was determined the power equation resulted in the best-fit line. The final runoff rates developed for this analysis for each storm event and land use type are shown below in **Tables 4.2 – 4.5.** Backup data, including the raw unadjusted peak flow rates, corresponding runoff curves, and power equations used to develop the peak flow rates can be found in **Appendix 4.1.**

Table 4.2: Adjusted Peak Flow Rates for Undeveloped Areas

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates (cfs)						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	1.22	1.47	1.68	1.97	2.20	2.42	2.93
10.0	0.77	0.97	1.14	1.35	1.51	1.67	2.04
50.0	0.56	0.73	0.86	1.03	1.16	1.29	1.58
100.0	0.49	0.64	0.77	0.92	1.04	1.16	1.42
200.0	0.42	0.57	0.68	0.82	0.93	1.04	1.27

Table 4.3: Adjusted Peak Flow Rates for Residential Areas

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates (cfs)						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	2.53	3.06	3.50	4.10	4.55	4.98	5.97
10.0	2.01	2.44	2.79	3.28	3.66	4.05	4.91
50.0	1.71	2.08	2.38	2.81	3.14	3.50	4.28
100.0	1.60	1.94	2.23	2.62	2.94	3.29	4.04
200.0	1.49	1.81	2.08	2.45	2.75	3.09	3.81

Table 4.4: Adjusted Peak Flow Rates for Commercial Areas

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates (cfs)						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	4.59	5.56	6.36	7.45	8.29	9.11	10.85
10.0	3.21	3.89	4.46	5.24	5.84	6.43	7.79
50.0	2.51	3.04	3.48	4.09	4.57	5.05	6.18
100.0	2.25	2.73	3.13	3.68	4.11	4.54	5.59
200.0	2.02	2.45	2.81	3.31	3.70	4.09	5.06

Table 4.5: Adjusted Peak Flow Rates for Transportation Areas

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates (cfs)						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	5.19	6.29	7.19	8.42	9.37	10.31	12.36
10.0	4.13	5.00	5.72	6.72	7.49	8.26	10.04
50.0	3.52	4.26	4.88	5.74	6.41	7.08	8.68
100.0	3.28	3.98	4.56	5.37	5.99	6.62	8.15
200.0	3.06	3.71	4.26	5.01	5.60	6.20	7.66

Peak runoff rates were determined from the developed runoff curves based on the drainage area and composite C-value. For areas that had a C-value different than the four assumed land use values, flows were interpolated from the runoff curve data based on the composite C-value associated with the drainage area.

3.4 Storm Sewer Pipe Flowing Full Capacity

The pipe flowing full capacity was calculated for each storm sewer system based on Manning's equation. The storm sewer physical characteristics (size, slope, type) were taken from the City of Victoria' storm sewer database. For storm sewer pipes with no slope data, a slope was defined based on a pipe flow velocity of 3 ft/sec. **Table 4.6** below presents the Manning's n roughness values used in calculating flow velocity. The supporting data for the pipe flowing full capacity is provided in **Appendix 4.1**.

Table 4.6: Manning's n Roughness Coefficients

Storm Sewer Type	Manning's n Roughness Value
RCP, RCB, Other, Unknown	0.013
CMP	0.024
HDPE	0.012

3.5 Results

The estimated storm sewer level of service was based on the evaluation of the most downstream section of the storm sewer system, i.e, the storm sewer system outfall pipe. Upstream storm sewer pipes, with smaller contributing drainage areas were not evaluated as part of this study. The level of service for the evaluated outfall pipes was determined based on a comparison of the outfall pipe flowing full capacity to the approximated runoff rate for the various storm events associated with the outfall pipe service area.

Of the 171 outfall pipes evaluated, 18 outfall pipes were found to have a LOS greater than the 2-yr flow based on the outfall capacity analysis. In coordination with the City and based on a review of the current drainage criteria manual, an original LOS was approximated for each storm sewer system using the date of installation to determine the design capacity. The original LOS storm sewer data, along with the storm sewer outfall pipe capacity data, is provided on the City of Victoria Master Drainage Plan ArcGIS webpage developed by CivilTech under this study: https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f.

4. Pipe Capacity Determination

Blockage in pipes is most commonly caused by sediment and debris. As the cross-sectional area of blockage increases along the pipe, there is a reduction in flow capacity, thus decreasing the level of service that a conduit can provide.

When calculating the flow capacity for blocked pipes, hypothetical values for blocked percentages were assumed at 25% height increments (i.e., 25% blockage = 3 in. blockage for a 12 in. diameter pipe, 50% blockage = 6 in. blockage for a 12 in. diameter pipe, etc.). Common pipe sizes ranging from 12 in. diameter to 72 in. diameter were selected for the analysis.

The flow type within the pipe was assumed to be open channel flow (flow under the influence of atmospheric pressure), and Manning's equation Eq. (4.3) in conjunction with the continuity equation Eq. (4.4) were used to correlate flow rate with pipe characteristics.

The pipe flow area was calculated using Eq. (4.2). Flow velocity was found through Eq. (4.3). The Manning's n roughness values and slope were assumed to be 0.013 and 0.003 ft/ft respectively. Finally, the volumetric flow in cfs was determined using Eq. (4.4).

$$A = \frac{r^2(\theta - \sin\theta)}{2}, \quad \theta \text{ in radian} \tag{4.2}$$

$$V = \frac{1}{n} K R^{\frac{2}{3}} S^{\frac{1}{2}} \tag{4.3}$$

$$Q = VA \tag{4.4}$$

4.1 Results

The results indicate that pipe capacity is reduced with the increase of pipe blockage. This trend can be seen in **Figure 4.1**.

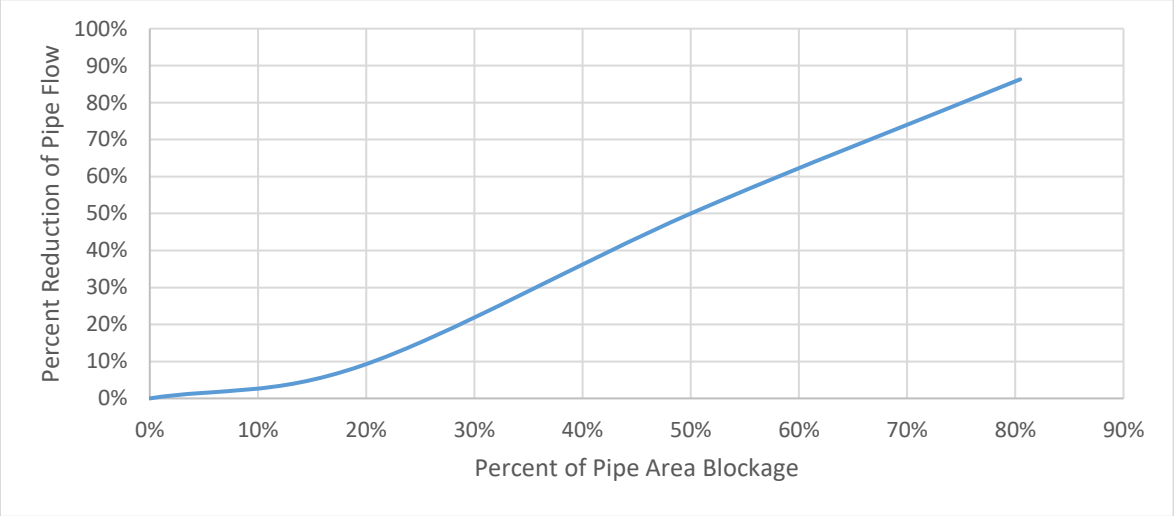


Figure 4.1: Reduction in Pipe Capacity with Increasing Pipe Blockage

This trend of decreasing flow capacity is consistent through all of the different pipe sizes analyzed. The flow rates for pipes of various sizes under four blockage conditions are presented in **Table 4.7**.

Table 4.7: Pipe Capacity for Various % Blockage

Diameter (in)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
12	1.95	1.78	0.98	0.27
15	3.54	3.23	1.77	0.48
18	5.75	5.25	2.88	0.79
24	12.39	11.30	6.20	1.70
30	22.47	20.49	11.23	3.08
36	36.53	33.31	18.27	5.00
42	55.11	50.25	27.55	7.55

Diameter (in)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
48	78.68	71.74	39.34	10.78
54	107.71	98.22	53.85	14.75
60	142.65	130.08	71.33	19.54
66	183.93	167.72	91.97	25.20
72	231.97	211.52	115.98	31.77

It is also observed that the capacity reduction experienced is greater the larger the pipe size is. For instance, trapped sediment and debris have a greater impact on flow for a 48 in. pipe compared to a 12 in. pipe as shown in **Figure 4.2**.

In addition, it can be seen the pipe capacity starts to be affected significantly by the sedimentation and debris in the pipe when the blockage exceeds approximately 15%.

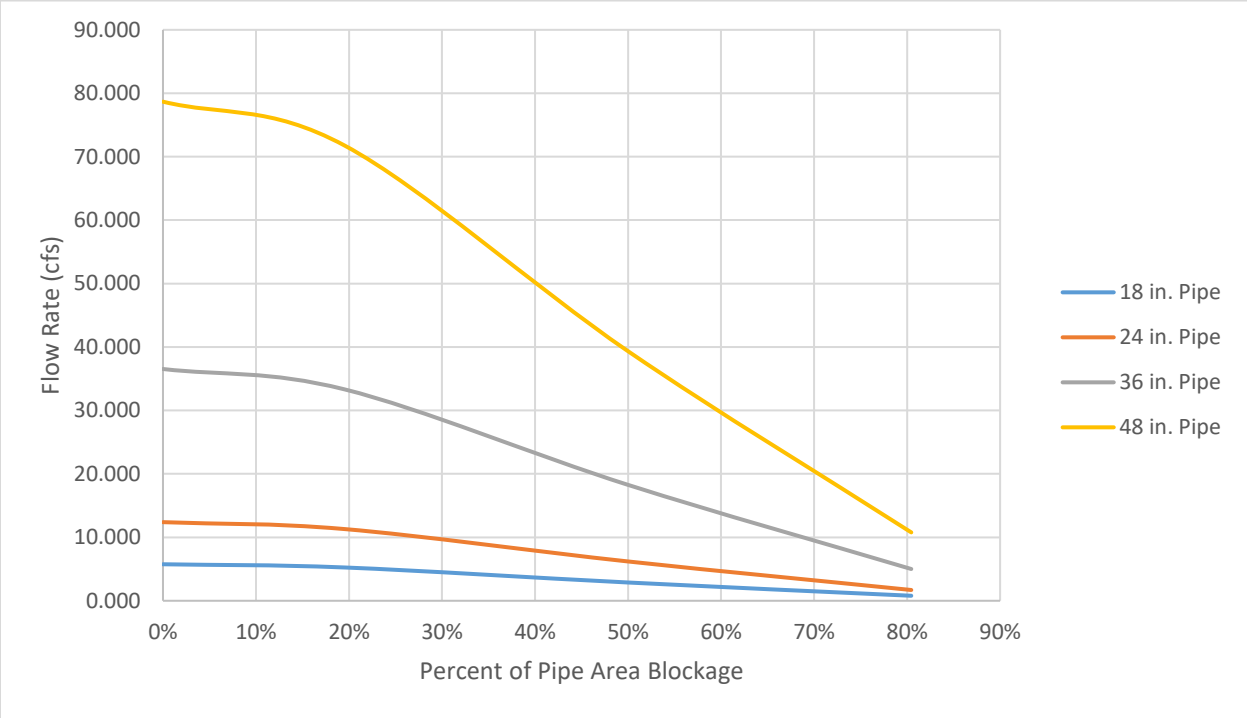


Figure 4.2: Reduction in Pipe Capacity with Increasing Sedimentation

5. Preliminary Cost Estimate for Cleaning Storm Sewers

Approximately 1,129,208 feet (or approximately 214 miles) of storm sewer was identified within the City of Victoria. A breakdown of storm sewer sizes per watershed are shown below in **Table 4.8**. Note that **Table 4.8** only depicts the most common pipe sizes. 16,064 feet of storm sewer, with atypical pipe dimensions, are not shown in the table below.

Table 4.8: Pipe Distribution of Storm Sewer Per Watershed

Watershed	< 18”	18”	24”	30”	36”	42”	48”	54”	> 60”
Jim Branch Outfall	28,938	44,025	37,552	17,230	13,219	6,700	9,225	5,446	4,524

Watershed	< 18"	18"	24"	30"	36"	42"	48"	54"	> 60"
Lone Tree Creek	27,882	61,282	63,538	29,986	25,805	23,197	11,202	10,902	30,357
Mockingbird Outfall	739	3,955	5,369	3,893	7,426	1,989	-	-	1,605
Marcado Creek	-	-	-	-	-	-	-	-	-
North Outfall	1,087	16,329	13,482	6,628	3,529	1,119	838	511	4,304
Spring Creek	1,774	22,265	20,409	9,608	17,000	12,399	8,614	3,968	10,569
South Outfall	5,618	14,060	13,345	3,997	2,846	2,911	1,068	917	7,411
Second Street Outfall	26,404	22,843	15,234	7,171	7,354	2,803	5,648	974	13,069
Whispering Creek	8,255	25,223	20,211	11,990	9,561	8,133	7,718	4,831	3,090
West Outfall	55,084	38,979	44,730	31,182	15,249	9,723	6,580	3,118	11,062
Other	2,063	2,683	1,354	3,579	2,792	635	658	-	-
Total	**157,844**	**251,644**	**235,224**	**125,264**	**104,781**	**69,609**	**51,551**	**30,667**	**5,991**

A preliminary cost estimate was developed for the level of effort needed to clean all identified storm sewers within the City. This cost estimate did not include pipes smaller than 18", as those are recommended to be replaced, as outlined in **Section 4**. The cost estimate is based on average cleaning bid data taken from vendors and data received from the City and includes the cost for televising the systems.

The equation developed to determine the cost to televise and clean storm sewer is shown in Equation 4.4.

$$Unit\ Price\ (\frac{\$}{LF}) = \$4.5 + (D * \$0.40) \quad (4.4)$$

Where: D = Pipe Diameter in Inches

The total cost was estimated to be $16,621,061. **Table 4.9** presents a summary of the storm sewer cleaning cost estimate per watershed.

Table 4.9: Total Costs by Watershed for Storm Sewer Cleaning

Total Costs by Watershed for Storm Sewer Cleaning		
Improvement	**Length (ft)**	**Cost**
Jim Branch Outfall	137,973	$2,214,726
Lone Tree Creek	264,543	$4,679,759
Mockingbird Outfall	24,237	$414,671
Marcado Creek	0	$0
North Outfall	46,856	$743,424
Spring Creek	106,195	$1,956,044
South Outfall	46,555	$805,420
Second Street Outfall	75,305	$1,346,699
Whispering Creek	93,896	$1,575,169
West Outfall	163,534	$2,693,726
Other	11,701	$191,425
Total Cost:	**970,795**	**$16,621,061**

6. Cost Estimate to Replace All Storm Sewer Pipe Less than 18-Inches

A review of the existing storm sewer database identified 157,844 feet (30 miles) of storm sewer pipe that are less than 18-inches. The distribution of the pipes less than 18-inches by watershed is shown below in **Table 4.10**.

Table 4.10: Pipe Distribution of Storm Sewer Less Than 18" Per Watershed

Watershed	6"	8"	10"	12"	15"
Jim Branch Outfall	-	-	1,908	10,896	16,134
Lone Tree Creek	75	750	3,694	15,303	8,060
Mockingbird Outfall	-	-	-	681	58
Marcado Creek	-	-	-	-	-
North Outfall	-	-	-	467	620
Spring Creek	-	-	-	1,607	167
South Outfall	-	-	177	2,929	2,512
Second Street Outfall	-	69	239	15,290	10,806
Whispering Creek	-	-	-	1,495	6,760
West Outfall	-	53	1,719	31,192	22,120
Other	-	87	-	517	1,459
Total	**75**	**959**	**7,737**	**80,377**	**68,696**

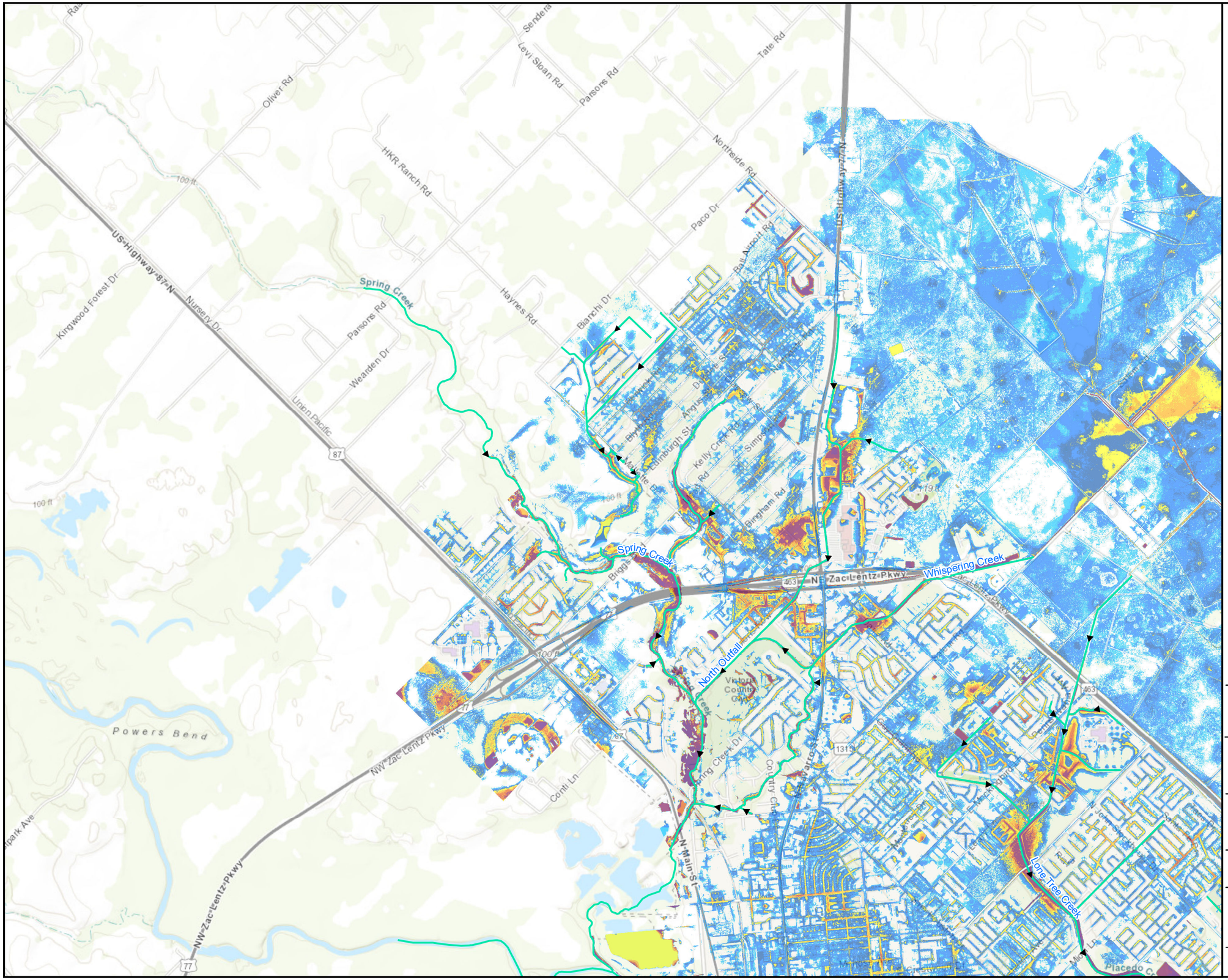
It is recommended to replace these smaller storm sewer pipe sizes with an 18-inch pipe. The approximate cost to replace the 157,844 feet of storm sewer with 18-inch pipe is $39,461,000. The estimated unit cost for an 18-inch reinforced concrete pipe was $250 per linear foot. A summary of the replacement cost per watershed is provided in **Table 4.11**. The cost includes a 25% contingency.

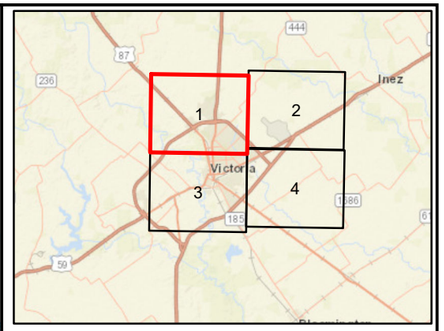
Table 4.11 – Storm Sewer Replacement Cost Per Watershed

Watershed	Length (ft)	Cost
Jim Branch Outfall	28,938	$7,234,500
Lone Tree Creek	27,882	$6,970,500
Mockingbird Outfall	739	$184,750
Marcado Creek	0	$0
North Outfall	1,087	$271,750
Spring Creek	1,774	$443,500
South Outfall	5,618	$1,404,500
Second Street Outfall	26,404	$6,601,000
Whispering Creek	8,255	$2,063,750
West Outfall	55,084	$13,771,000
Other	2,063	$515,750
Total Cost:	**157,844**	**$39,461,000**

Exhibit 4.1a – 4.1d

Rain on Grid Approximate 100 Yr Ponding Depth





LEGEND

Open Channel

Approximate 100 Yr Ponding Depth (ft)

- < 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 5
- > 5

N

0 1,500 3,000

Basemap: ESRI World Imagery

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City of Victoria
Rain on Grid
Approximate 100 Yr Ponding Depth

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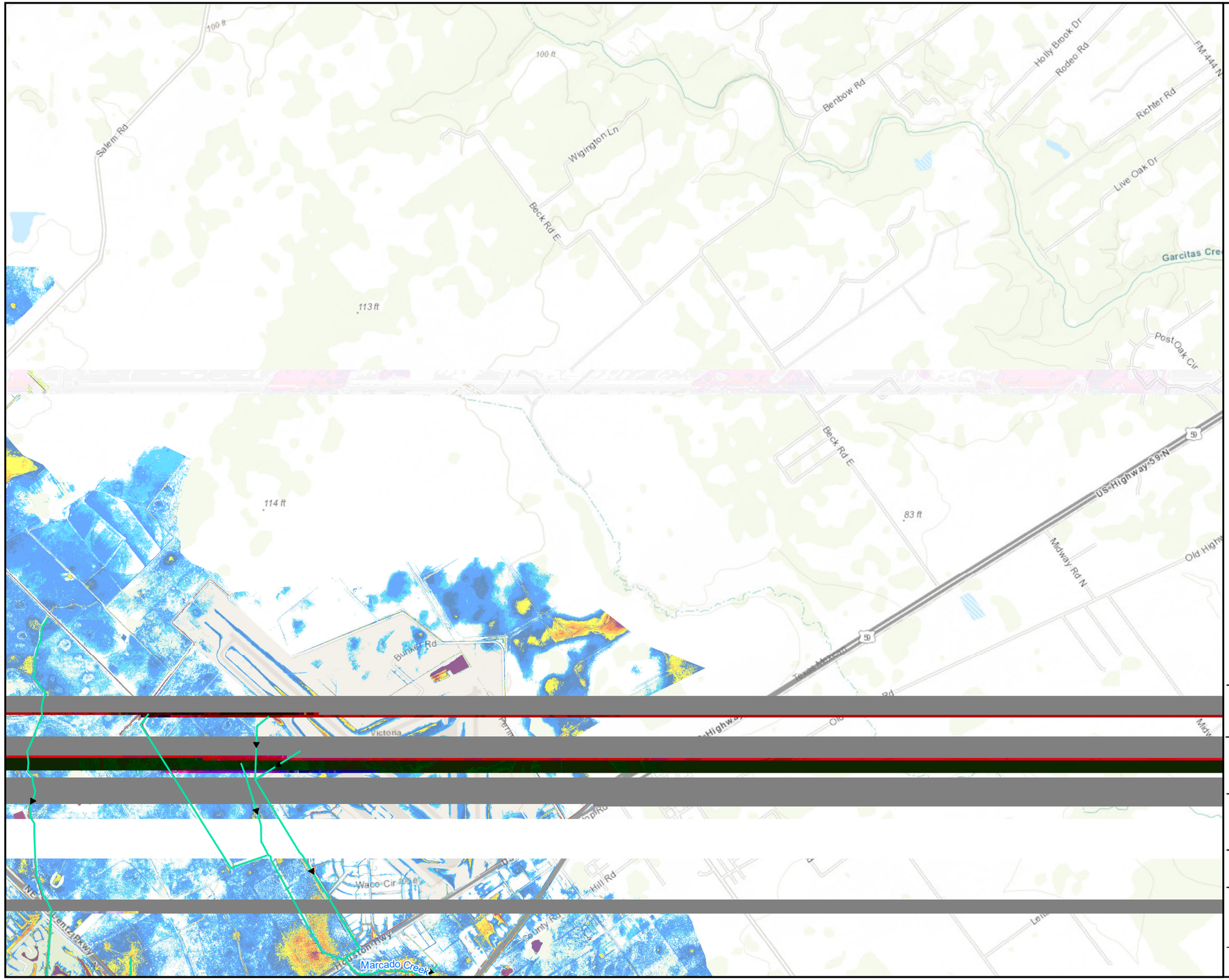

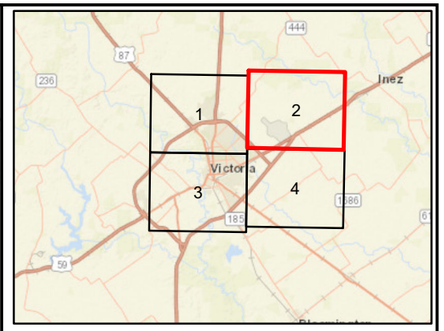

LEGEND

Open Channel

Approximate 100 Yr Ponding Depth (ft)

- < 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 5
- > 5

N

0 1,500 3,000

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Rain on Grid
Approximate 100 Yr Ponding Depth

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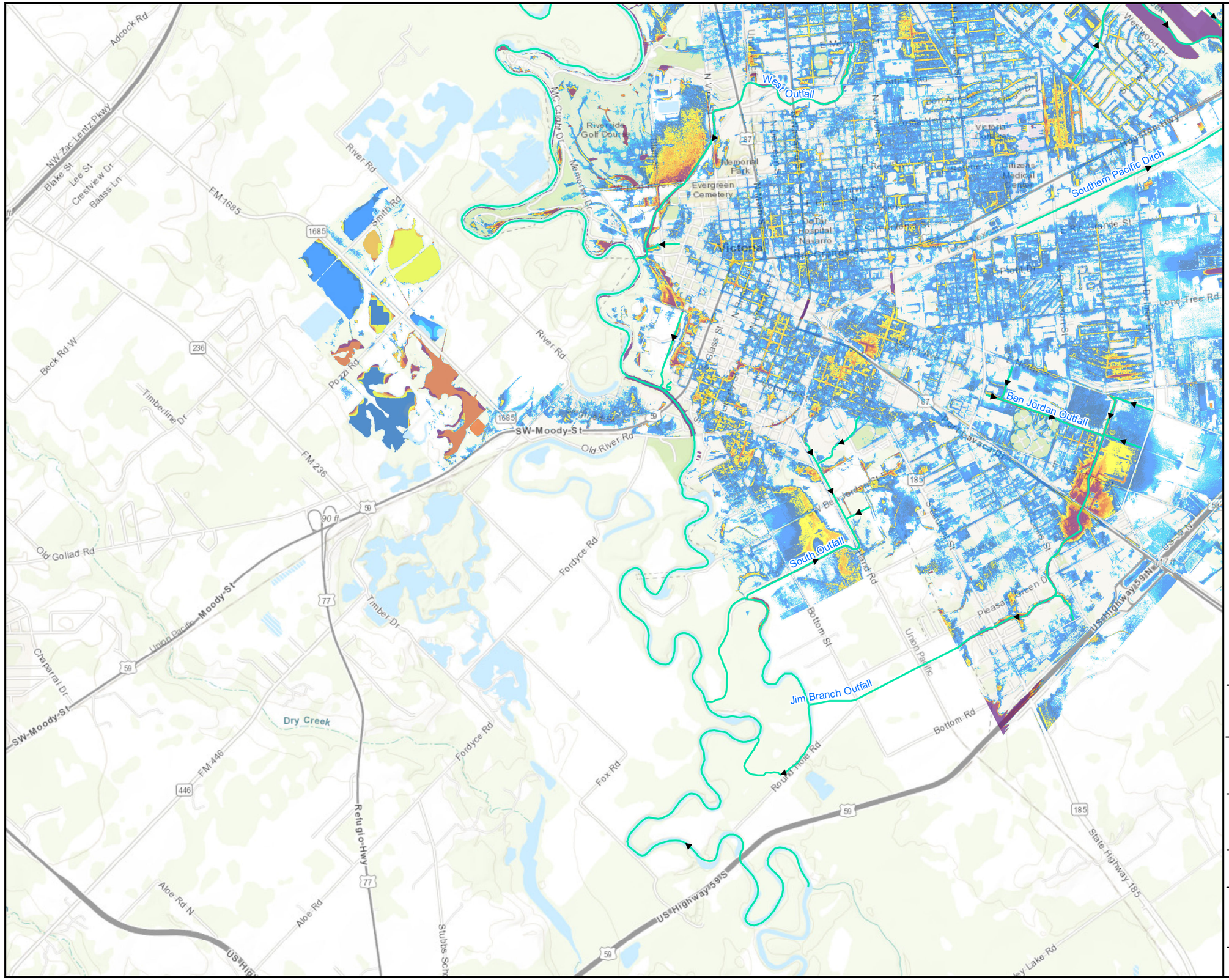

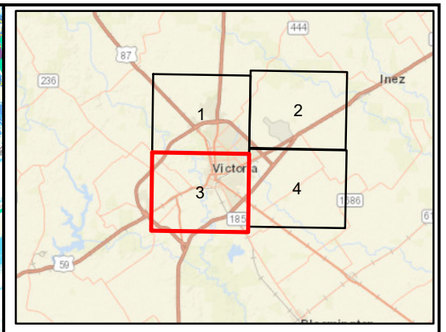

LEGEND

Open Channel

Approximate 100 Yr Ponding Depth (ft)

- < 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 5
- > 5

N

0 1,500 3,000

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City of Victoria
Rain on Grid
Approximate 100 Yr Ponding Depth

November 2021	Project No. 400022	Exhibit No. 4.1c

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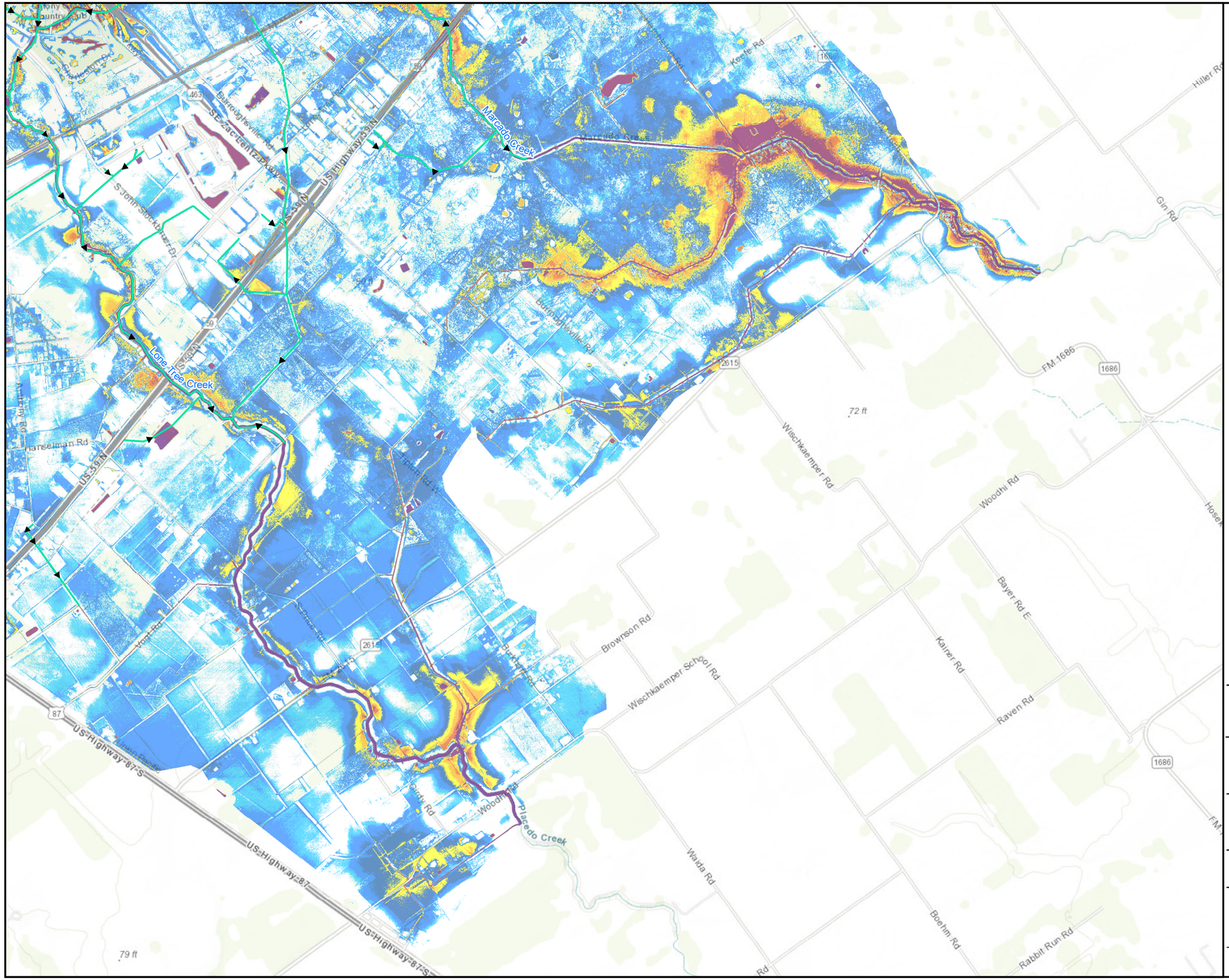

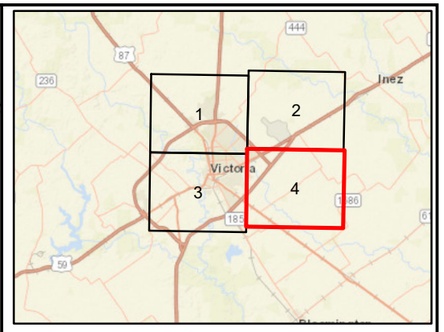

LEGEND

Open Channel

Approximate 100 Yr Ponding Depth (ft)

- < 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 5
- > 5

N

0 1,500 3,000

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Rain on Grid
Approximate 100 Yr Ponding Depth

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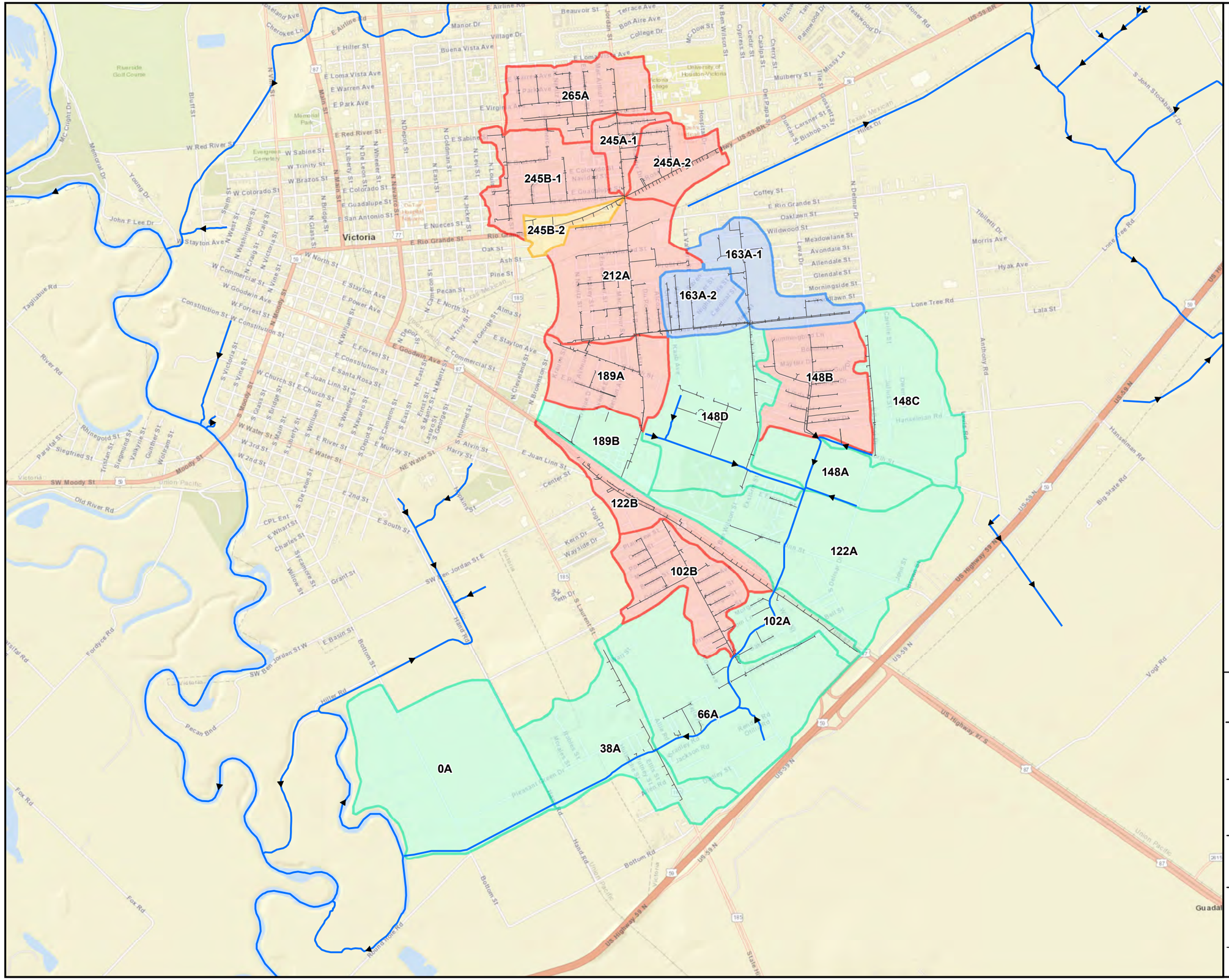
Exhibit 4.2 – 4.10

Storm Sewer Level of Service



LEGEND

- Open Channel
- Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

N

0 1,000 2,000

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Storm Sewer Level of Service
Jim Branch Outfall

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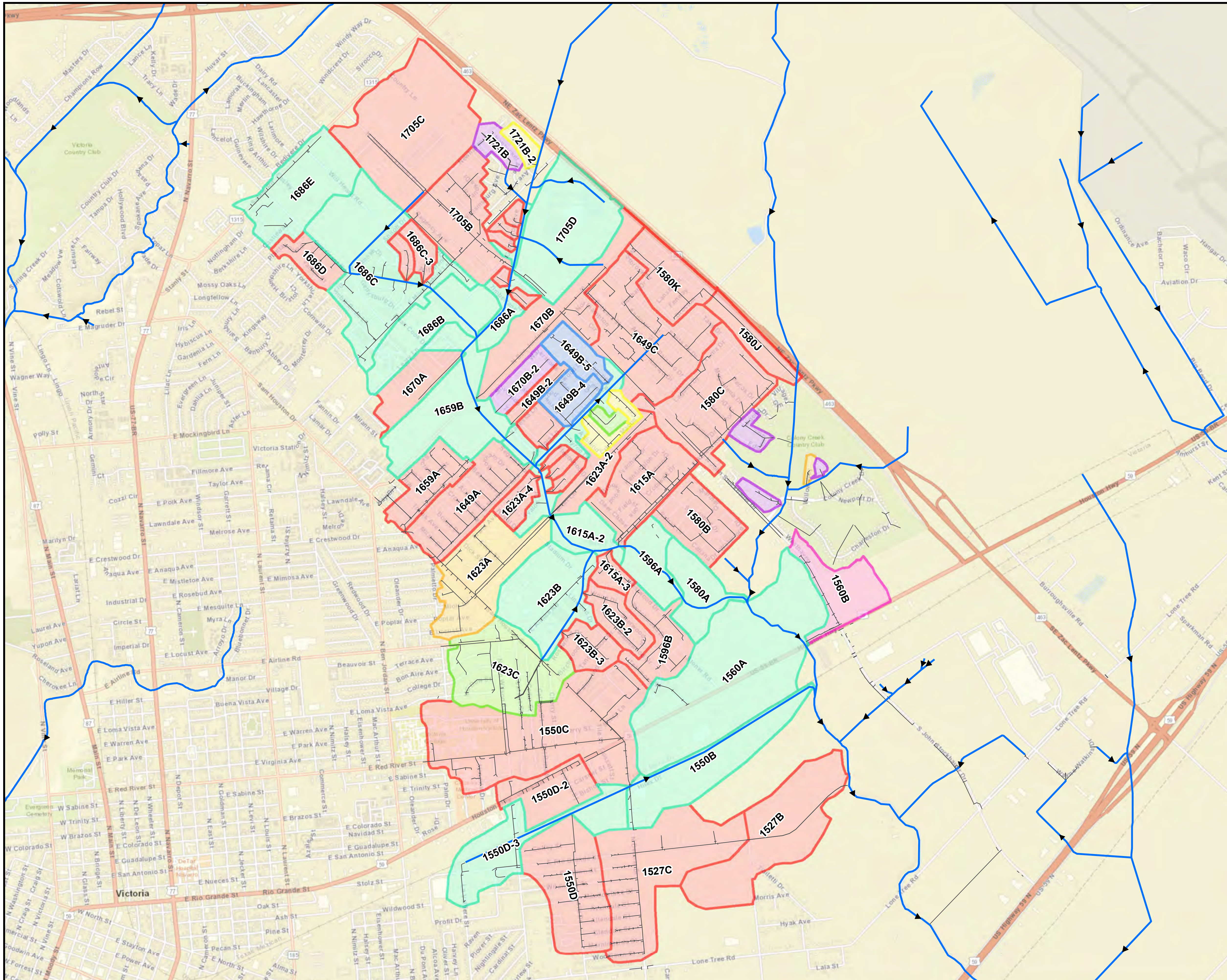

LEGEND

Open Channel

Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

0 1,000 2,000

N

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Storm Sewer Level of Service
Lone Tree Creek

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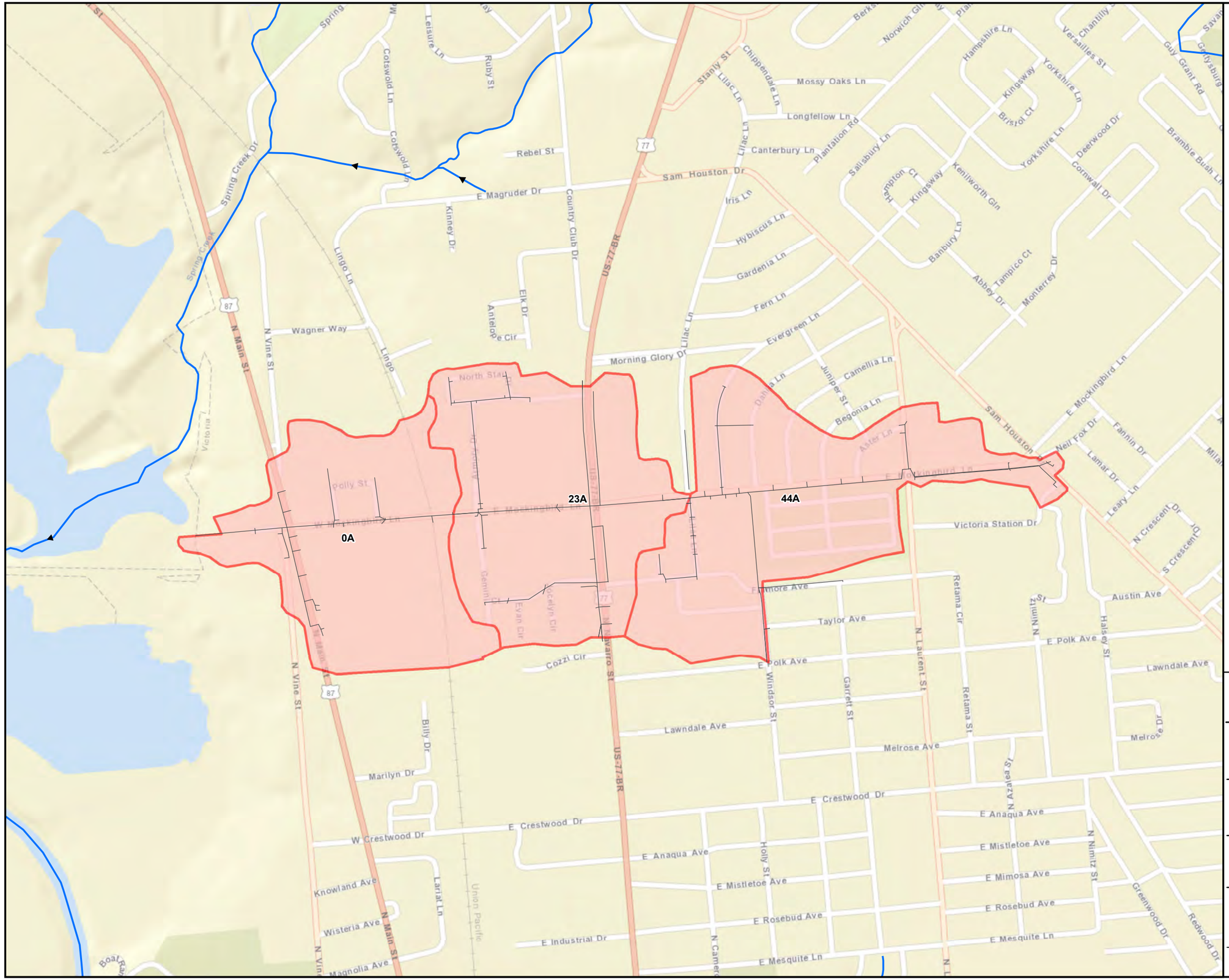

LEGEND

Open Channel

Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

N

0 500 1,000

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Storm Sewer Level of Service
Mockingbird Outfall

September 2021	Project No. 400022	Exhibit No. 4.4

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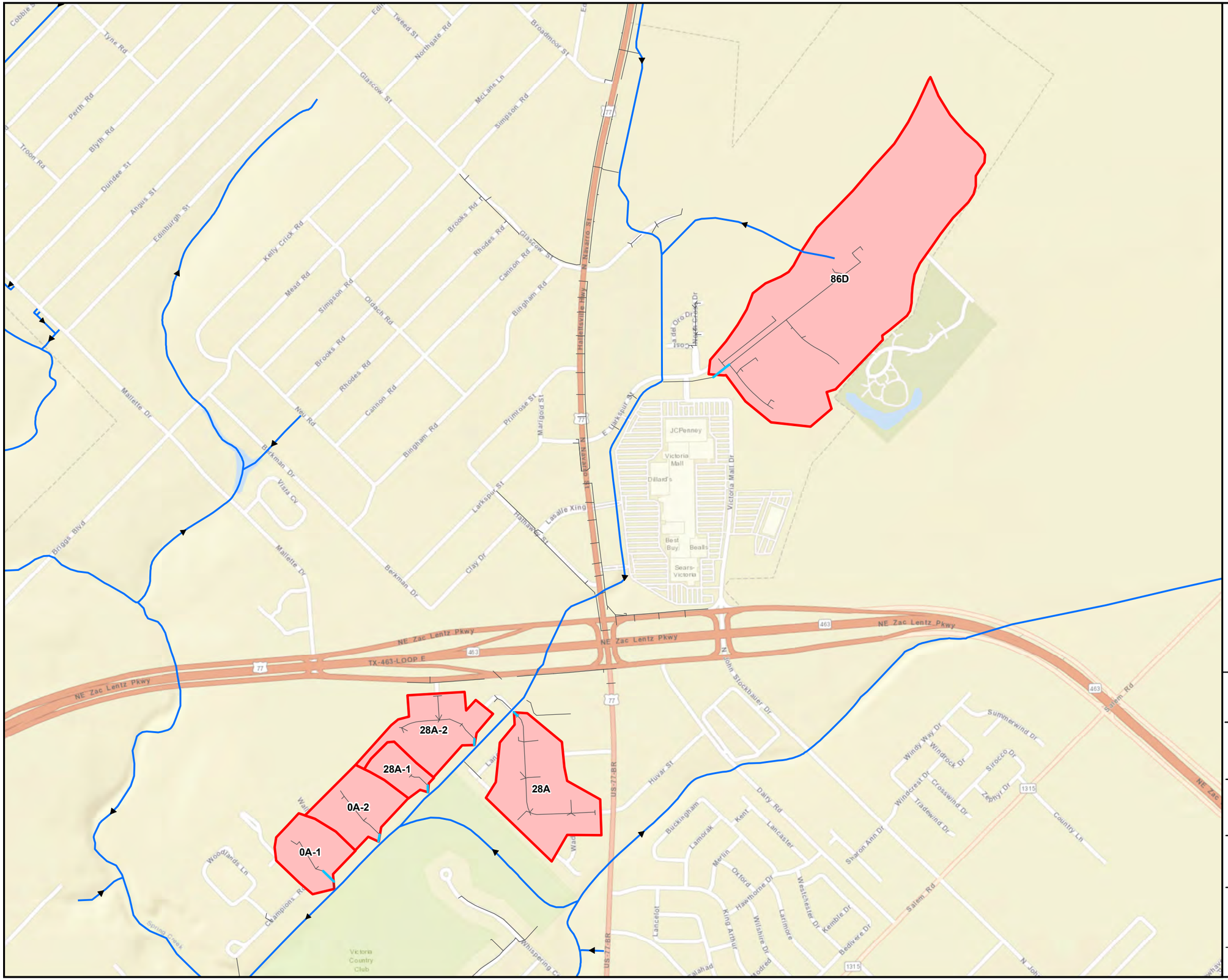

LEGEND

- Open Channel
- Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

N

0 500 1,000

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Storm Sewer Level of Service
North Outfall

September 2021	Project No. 400022	Exhibit No. 4.5

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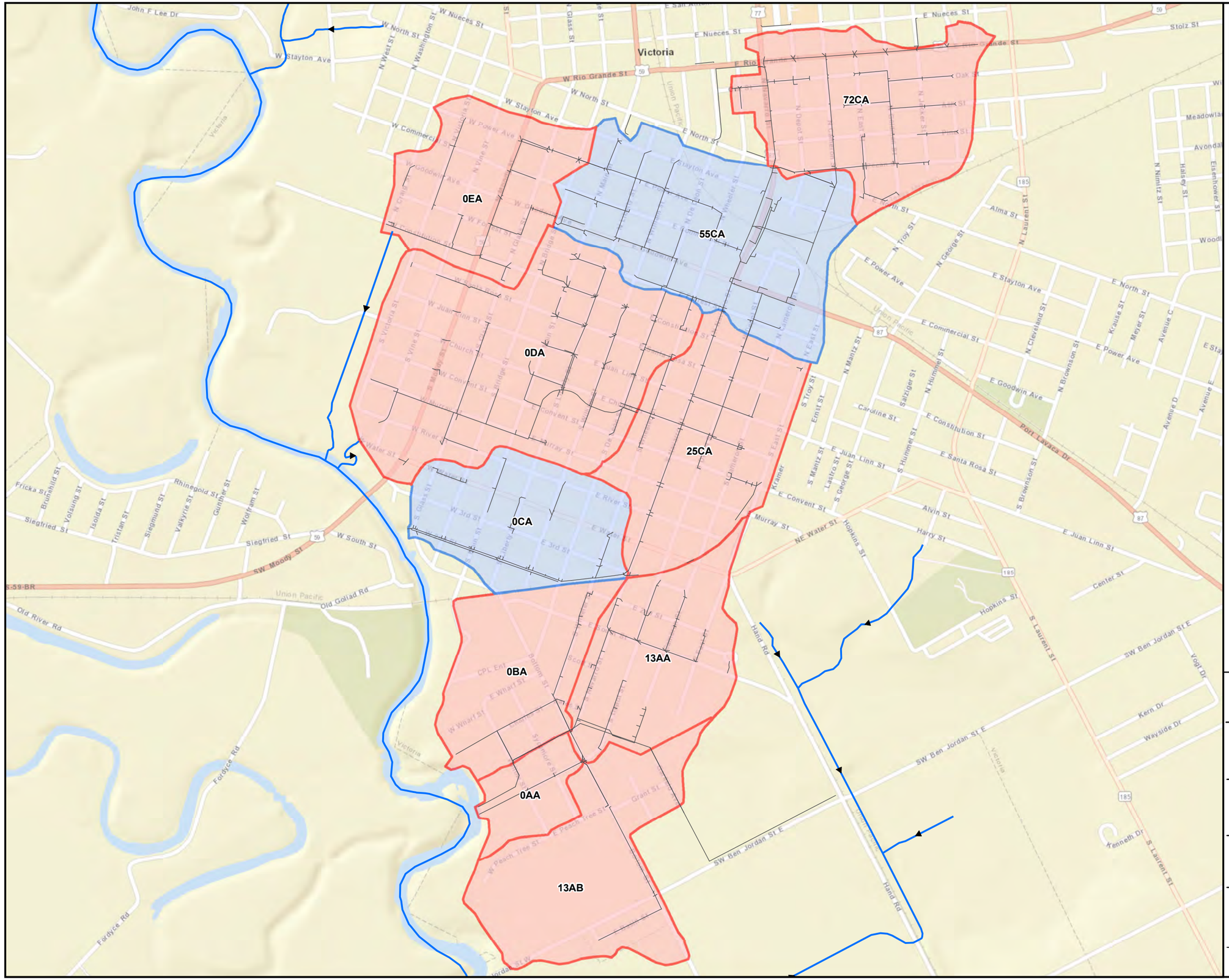

LEGEND

- Open Channel
- Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

N

0 500 1,000

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Storm Drainage Master Plan Update

Storm Sewer Level of Service
Second Street Outfall

September 2021	Project No. 400022	Exhibit No. 4.6

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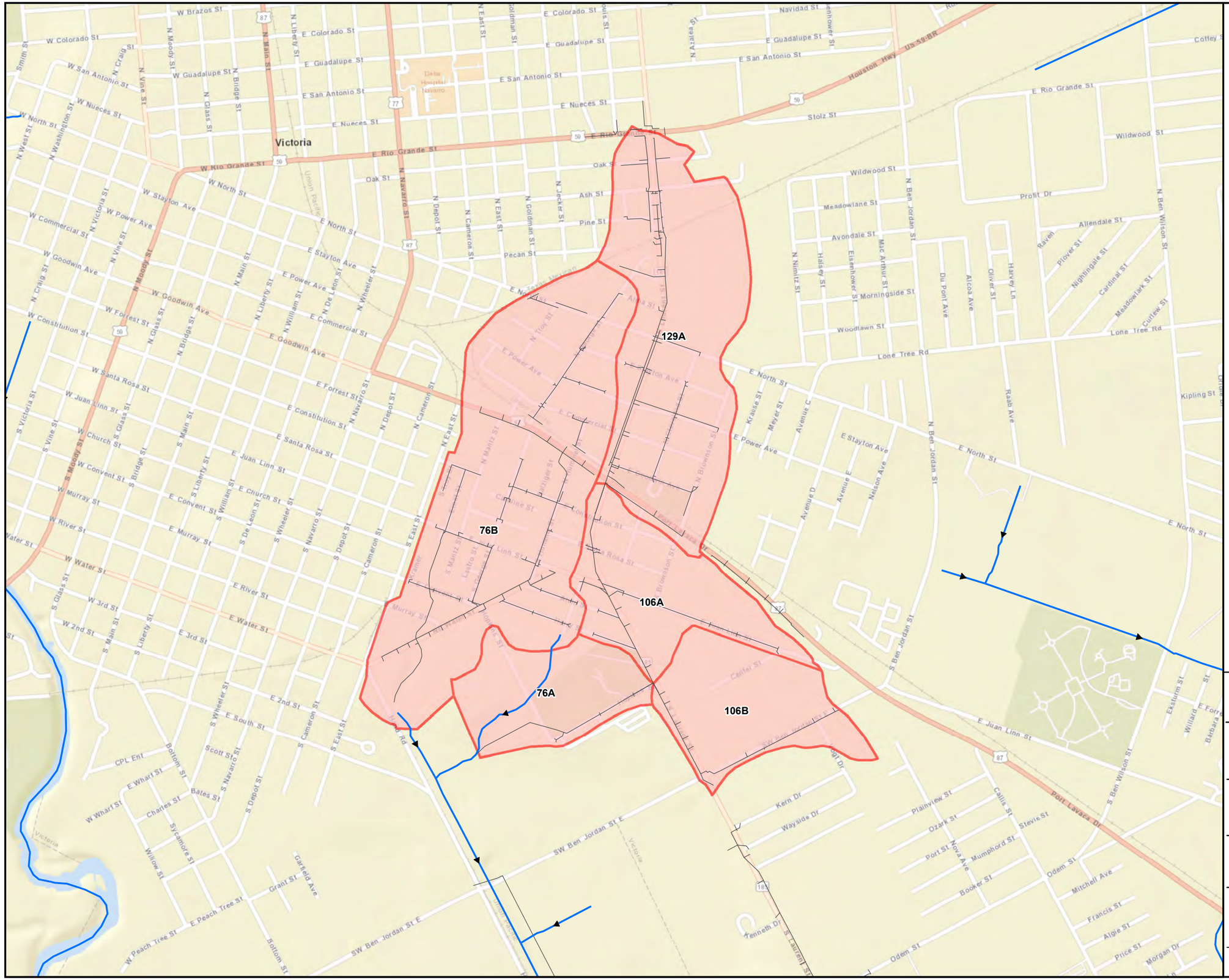

LEGEND

- Open Channel
- Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

N

0 500 1,000

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Storm Drainage Master Plan Update

Storm Sewer Level of Service
South Outfall

September 2021	Project No. 400022	Exhibit No. 4.7

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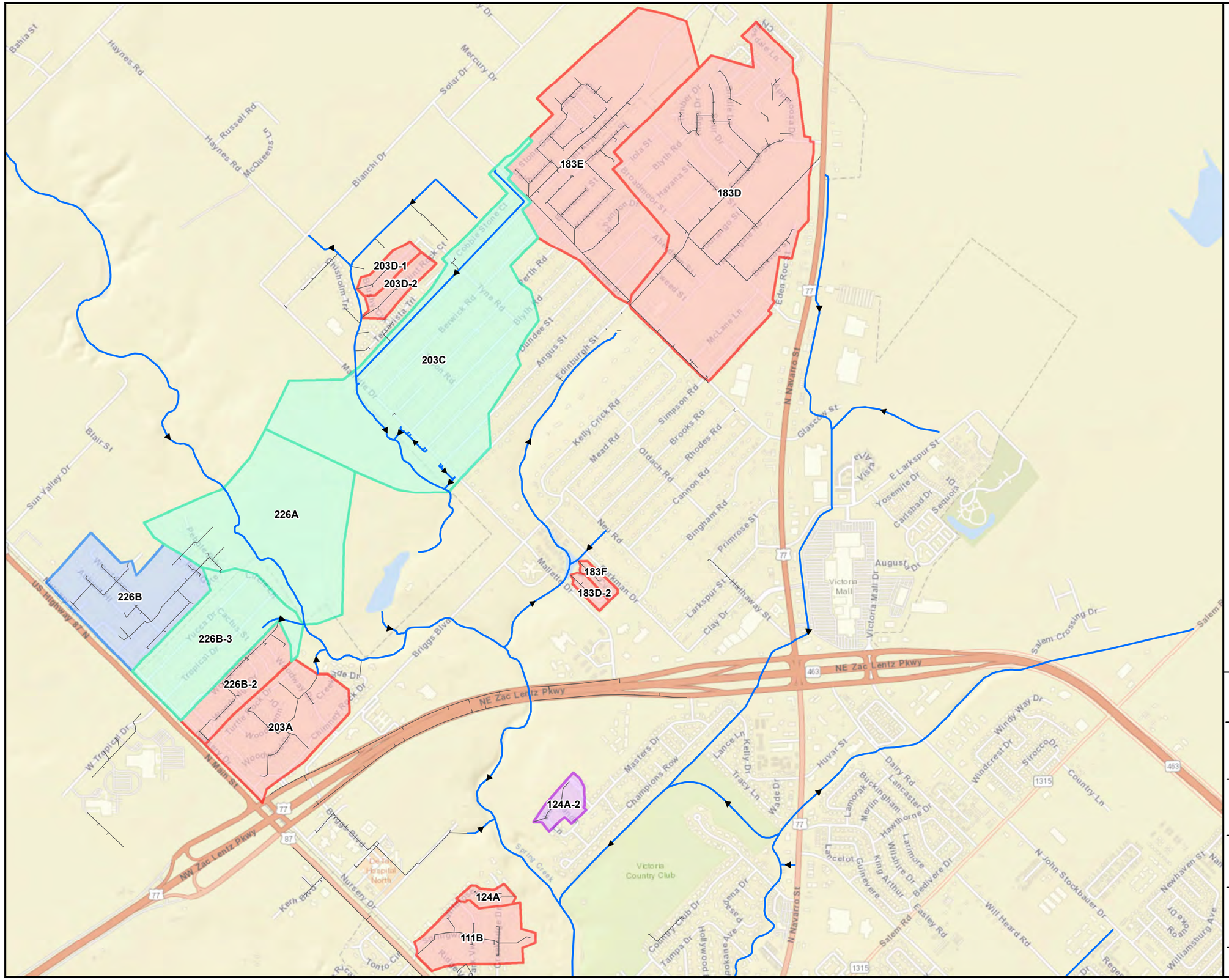

LEGEND

- Open Channel
- Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

0 800 1,600

N

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Storm Sewer Level of Service
Spring Creek

September 2021	Project No. 400022	Exhibit No. 4.8

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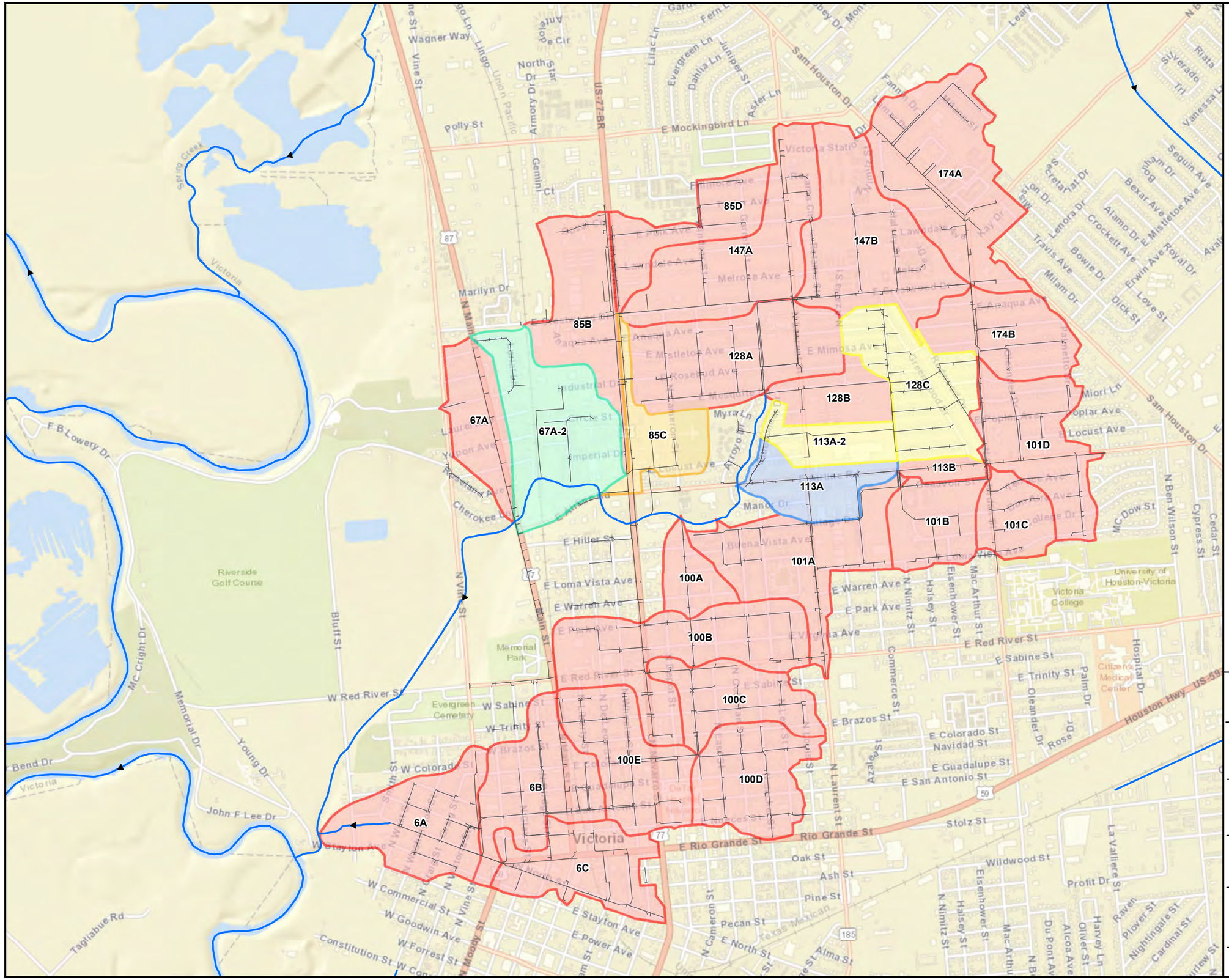

LEGEND

- Open Channel
- Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

N

0 500 1,000

Basemap: ESRI World Street Map

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Storm Sewer Level of Service
West Outfall

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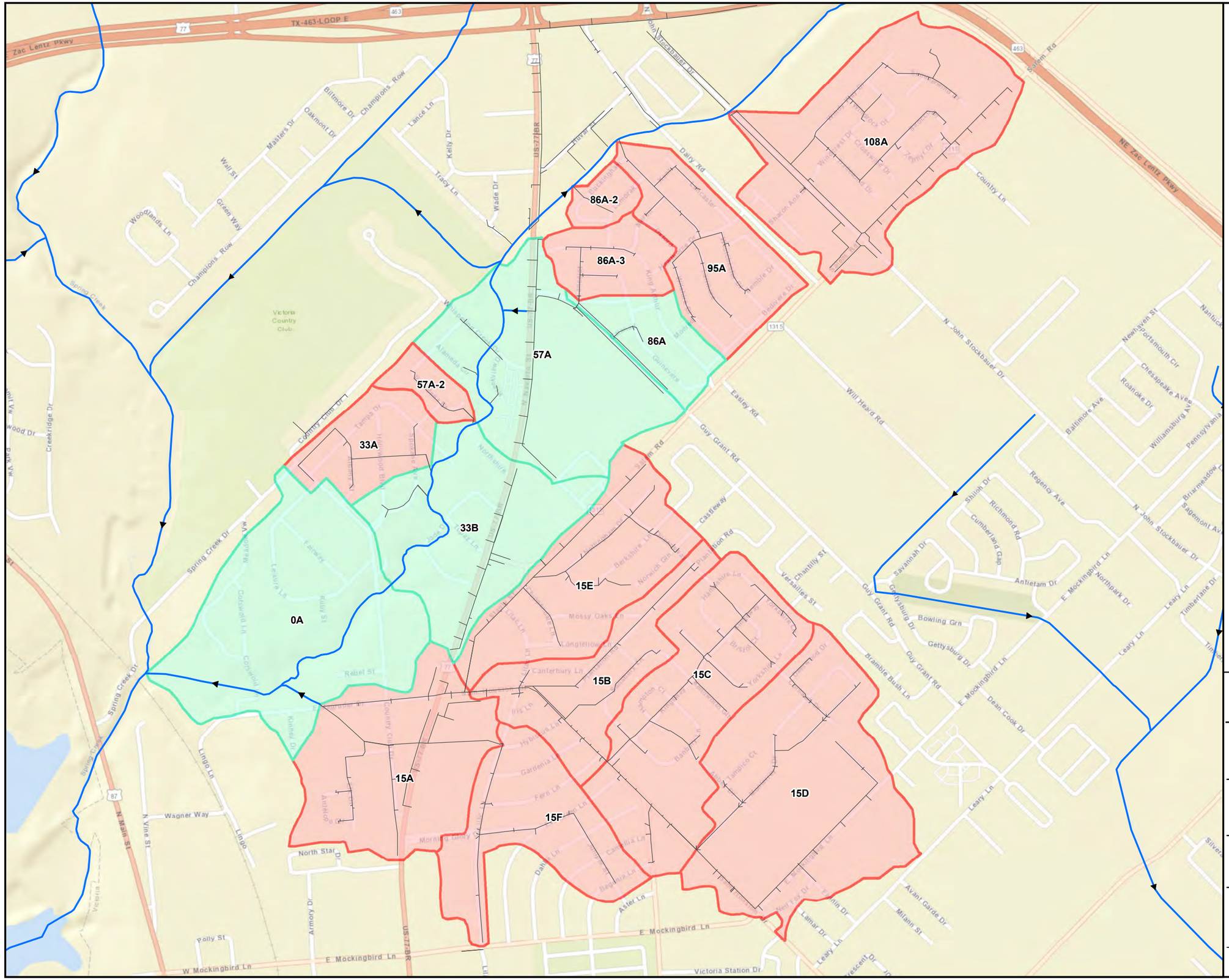

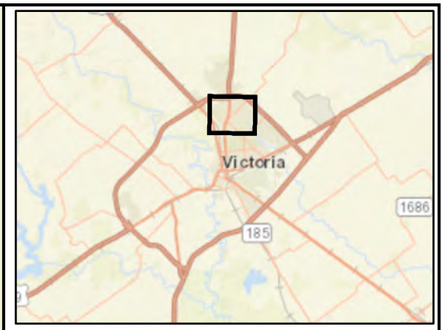

LEGEND

- Open Channel
- Storm Sewer

Storm Sewer Drainage Area

Level of Service

- <2-Yr
- 2-Yr
- 5-Yr
- 10-Yr
- 25-Yr
- 50-Yr
- 100-Yr
- Serviced By Channel

0 500 1,000

N

Basemap: ESRI World Street Map

CivilTech Engineering, Inc.
11821 Telge Rd
Cypress, Texas 77429
Tel: 281-304-0200
Fax: 281-304-0210

URBAN engineering
2004 N. Commerce, Victoria, Texas 77901 361.578.9836

THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Storm Sewer Level of Service
Whispering Creek

September 2021	Project No. 400022	Exhibit No. 4.10

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Appendix 4.1
Composite C-Value and Peak Flow Rates

Table 4.1.1: Unadjusted Undeveloped Drainage Area Peak Flows

Basin ID	Drainage Area ID	Weighted C-Value	Drainage Area (ac)	Composite DA	Composite C-Value
JB	265A	0.635	120.9	120.9	0.635
JB	245A-1	0.641	39.5	160.4	0.636
JB	245A-2	0.655	72.6	72.6	0.655
JB	245B-1	0.694	124.1	124.1	0.694
JB	245B-2	0.744	29.3	29.3	0.744
JB	212A	0.661	190.8	577.3	0.665
JB	189A	0.601	108.0	685.3	0.655
JB	163A-2	0.569	64.0	64.0	0.569
JB	163A-1	0.522	96.7	96.7	0.522
JB	148D	0.647	221.2	381.9	0.602
JB	148B	0.542	145.2	145.2	0.542
JB	148C	0.450	168.3	168.3	0.450
JB	148A	0.259	100.1	413.5	0.436
JB	122B	0.736	79.5	79.5	0.736
JB	102B	0.561	122.8	122.8	0.561
LT	1649B-2	0.509	13.2	13.2	0.509
LT	1670B-2	0.541	23.6	23.6	0.541
LT	1686D	0.558	25.2	114.7	0.544
LT	1580J	0.502	30.7	84.0	0.573
LT	1623A-2	0.539	34.9	34.9	0.539
LT	1670A	0.555	41.0	41.0	0.555
LT	1659A	0.568	47.4	47.4	0.568
LT	1596B	0.554	50.0	50.0	0.554
LT	1580K	0.614	53.2	53.2	0.614
LT	1560B	0.507	53.7	53.7	0.507
LT	1580B	0.568	57.4	57.4	0.568
LT	1649A	0.556	81.1	81.1	0.556
LT	1670B	0.543	84.3	84.3	0.543
LT	1705B	0.637	86.4	261.8	0.520
LT	1686E	0.540	89.5	89.5	0.540
LT	1623A	0.640	97.6	97.6	0.640
LT	1623C	0.608	104.0	104.0	0.608
LT	1550D	0.540	104.9	104.9	0.540
LT	1580C	0.598	111.6	111.6	0.598
LT	1527B	0.280	128.1	275.0	0.392
LT	1649C	0.573	133.1	133.1	0.573
LT	1527C	0.489	146.9	146.9	0.489

Basin ID	Drainage Area ID	Weighted C-Value	Drainage Area (ac)	Composite DA	Composite C-Value
LT	1705C	0.463	175.5	175.5	0.463
LT	1550C	0.662	224.9	224.9	0.662
LT	1615A	0.562	79.3	79.3	0.562
LT	1550D-2	0.728	48.8	48.8	0.728
LT	1721B	0.606	16.0	16.0	0.606
LT	1721B-2	0.570	10.4	10.4	0.570
LT	1580H	0.572	11.3	11.3	0.572
LT	1580B-2	0.573	8.2	8.2	0.573
LT	1580D	0.616	3.2	3.2	0.616
LT	1580D-2	0.580	2.2	2.2	0.580
LT	1615A-3	0.650	13.2	13.2	0.650
LT	1623B-2	0.574	31.4	31.4	0.574
LT	1623B-3	0.553	27.1	27.1	0.553
LT	1623A-4	0.559	16.8	16.8	0.559
LT	1623A-5	0.538	5.5	5.5	0.538
LT	1623A-6	0.533	6.6	6.6	0.533
LT	1623A-7	0.548	3.5	3.5	0.548
LT	1649B-3	0.579	15.6	15.6	0.579
LT	1649B-4	0.566	24.7	24.7	0.566
LT	1649B-5	0.543	25.2	25.2	0.543
LT	1686A-2	0.583	3.0	3.0	0.583
LT	1686A-3	0.572	3.8	3.8	0.572
LT	1705A-2	0.568	4.6	4.6	0.568
LT	1705A-3	0.594	4.2	4.2	0.594
LT	1705A-4	0.586	4.1	4.1	0.586
LT	1686C-2	0.509	7.8	7.8	0.509
LT	1686C-3	0.567	14.7	14.7	0.567
LT	1649B-6	0.581	11.6	11.6	0.581
LT	1649B-7	0.538	7.3	7.3	0.538
LT	1649B-8	0.574	6.7	6.7	0.574
MO	0A	0.688	80.9	267.1	0.673
MO	23A	0.675	89.8	186.2	0.667
MO	44A	0.659	96.4	96.4	0.659
NO	86D	0.430	100.9	100.9	0.430
NO	0A-1	0.549	10.6	10.6	0.549
NO	0A-2	0.559	11.9	11.9	0.559
NO	28A-1	0.555	5.4	5.4	0.555
NO	28A-2	0.587	14.7	14.7	0.587

Basin ID	Drainage Area ID	Weighted C-Value	Drainage Area (ac)	Composite DA	Composite C-Value
NO	28A	0.599	24.7	24.7	0.599
SC	226B	0.519	74.2	74.2	0.519
SC	203A	0.539	72.1	72.1	0.539
SC	183D	0.549	295.9	295.9	0.549
SC	226B-2	0.555	32.1	32.1	0.555
SC	183E	0.516	200.2	200.2	0.516
SC	111B	0.524	57.6	57.6	0.524
SC	203D-1	0.543	9.2	9.2	0.543
SC	203D-2	0.541	11.6	11.6	0.541
SC	183F	0.600	4.0	4.0	0.600
SC	183D-2	0.550	4.2	4.2	0.550
SC	124A	0.548	6.3	6.3	0.548
SC	124A-2	0.555	10.6	10.6	0.555
SO	106B	0.646	52.9	52.9	0.646
SO	76A	0.578	44.6	273.5	0.645
SO	106A	0.603	55.8	176.0	0.661
SO	76B	0.638	174.8	174.8	0.638
SO	129A	0.688	120.2	120.2	0.688
SS	13AB	0.401	83.5	83.5	0.401
SS	13AA	0.601	67.0	67.0	0.601
SS	0AA	0.483	20.6	171.2	0.489
SS	0BA	0.627	61.1	61.1	0.627
SS	0CA	0.620	63.4	351.9	0.644
SS	0DA	0.658	156.5	156.5	0.658
SS	25CA	0.616	86.9	288.5	0.649
SS	55CA	0.650	112.4	201.7	0.663
SS	72CA	0.680	89.3	89.3	0.680
SS	0EA	0.644	66.5	66.5	0.644
WC	15A	0.676	85.1	389.1	0.632
WC	15F	0.575	54.5	54.5	0.575
WC	15C	0.592	89.6	202.3	0.635
WC	15D	0.670	112.7	112.7	0.670
WC	15B	0.608	47.3	249.6	0.630
WC	15E	0.613	65.0	65.0	0.613
WC	95A	0.571	48.8	48.8	0.571
WC	33A	0.547	27.0	27.0	0.547
WC	108A	0.627	111.8	111.8	0.627
WC	57A-2	0.531	9.7	9.7	0.531

Basin ID	Drainage Area ID	Weighted C-Value	Drainage Area (ac)	Composite DA	Composite C-Value
WC	86A-2	0.565	8.6	8.6	0.565
WC	86A-3	0.582	21.8	21.8	0.582
WO	174A	0.631	107.7	107.7	0.631
WO	174B	0.560	54.1	54.1	0.560
WO	85B	0.679	63.9	63.9	0.679
WO	6A	0.560	66.9	192.6	0.630
WO	6B	0.640	67.3	125.7	0.667
WO	6C	0.699	58.4	58.4	0.699
WO	100E	0.672	64.4	64.4	0.672
WO	100D	0.661	59.8	59.8	0.661
WO	100C	0.617	47.5	171.8	0.653
WO	100B	0.643	95.8	267.6	0.650
WO	100A	0.608	21.9	289.5	0.647
WO	128B	0.656	33.4	100.8	0.596
WO	101C	0.587	29.2	95.4	0.599
WO	101B	0.605	39.1	134.5	0.601
WO	113B	0.698	9.5	9.5	0.698
WO	128A	0.607	91.7	442.3	0.619
WO	147B	0.654	98.0	259.8	0.625
WO	85D	0.599	43.7	43.7	0.599
WO	147A	0.614	90.8	90.8	0.614
WO	85C	0.583	34.4	78.1	0.592
WO	101A	0.649	78.7	213.2	0.619
WO	128C	0.566	67.5	67.5	0.566
WO	101D	0.605	66.2	66.2	0.605
WO	113A	0.676	36.7	128.9	0.618
WO	67A	0.599	41.0	41.0	0.599
WO	113A-2	0.674	24.8	92.2	0.595

Table 4.1.2: Unadjusted Undeveloped Drainage Area Peak Flows

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	1.2	1.5	1.7	2.0	2.2	2.4	2.9
10.0	16.1	19.5	22.4	26.3	29.3	32.3	39.5
50.0	35.1	42.9	49.5	58.8	66.0	73.5	92.4
100.0	45.9	56.4	65.4	78.0	87.9	98.2	124.7
200.0	89.4	110.2	127.9	153.0	172.7	193.3	246.3

Table 4.1.3: Unadjusted Residential Drainage Area Peak Flows

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	2.4	2.9	3.3	3.9	4.4	4.8	5.8
10.0	20.8	25.2	28.8	33.8	37.7	41.5	50.5
50.0	101.9	123.4	141.2	165.7	184.7	203.6	247.7
100.0	139.9	170.0	195.3	230.5	257.9	285.9	355.2
200.0	291.1	353.7	406.4	479.7	536.6	594.8	738.8

Table 4.1.4: Unadjusted Commercial Drainage Area Peak Flows

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	4.3	5.2	6.0	7.0	7.8	8.6	10.3
10.0	36.6	44.3	50.7	59.5	66.3	72.9	88.1
50.0	118.1	143.1	164.0	192.9	215.4	238.0	292.6
100.0	226.4	274.3	314.3	369.8	412.7	456.1	560.7
200.0	397.3	482.1	553.3	652.1	728.7	806.7	997.9

Table 4.1.5: Unadjusted Transportation Drainage Area Peak Flows

Drainage Area Size (ac)	Atlas 14 Storm Event Peak Flow Rates						
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
1.0	4.9	6.0	6.8	8.0	8.9	9.8	11.8
10.0	46.1	55.8	63.8	74.8	83.4	91.8	110.9
50.0	168.1	203.7	233.4	274.6	306.5	338.7	416.3
100.0	335.9	407.0	466.4	548.7	612.5	676.9	832.1
200.0	591.4	717.6	823.5	970.5	1084.7	1200.7	1485.3

Figure 4.1.1: Unadjusted Undeveloped Drainage Area Peak Flows

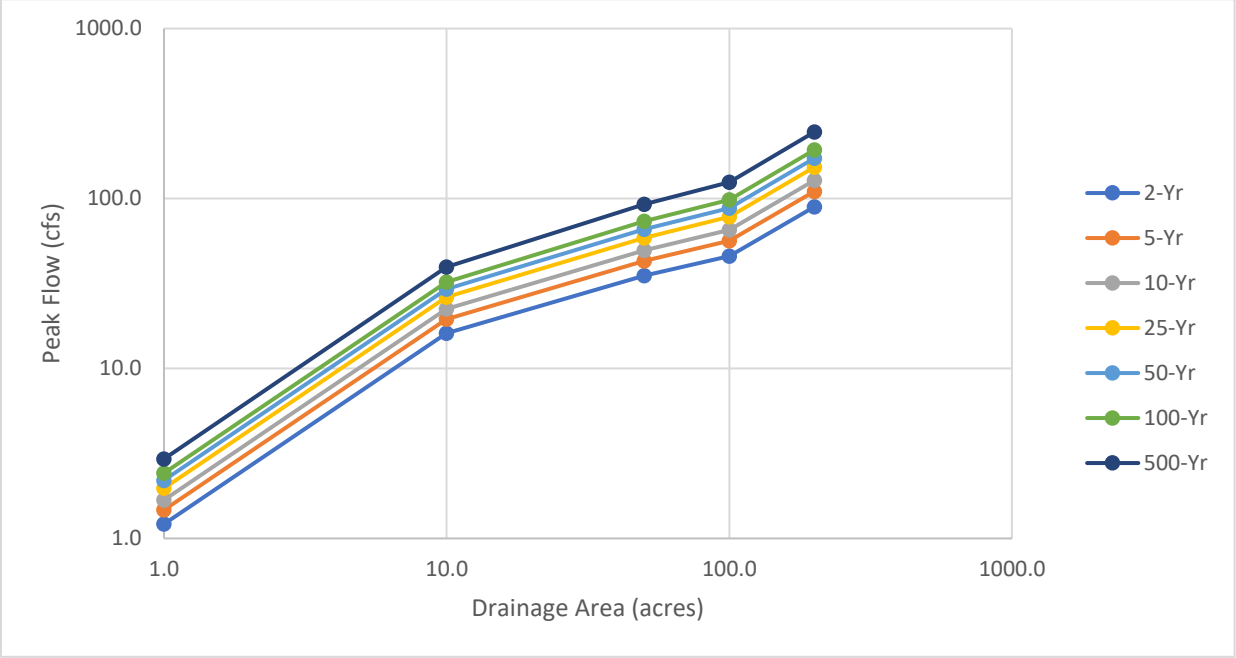


Figure 4.1.2: Adjusted Undeveloped Drainage Area Peak Flows

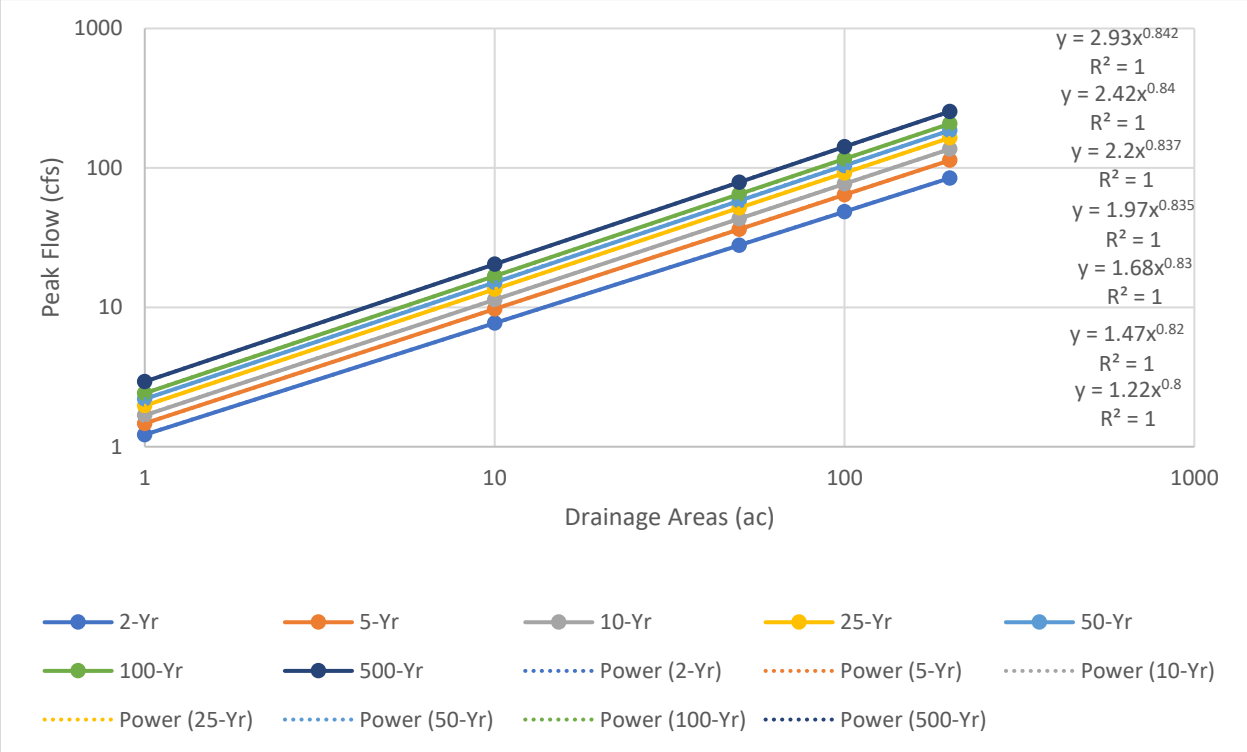


Figure 4.1.3: Unadjusted Residential Drainage Area Peak Flows

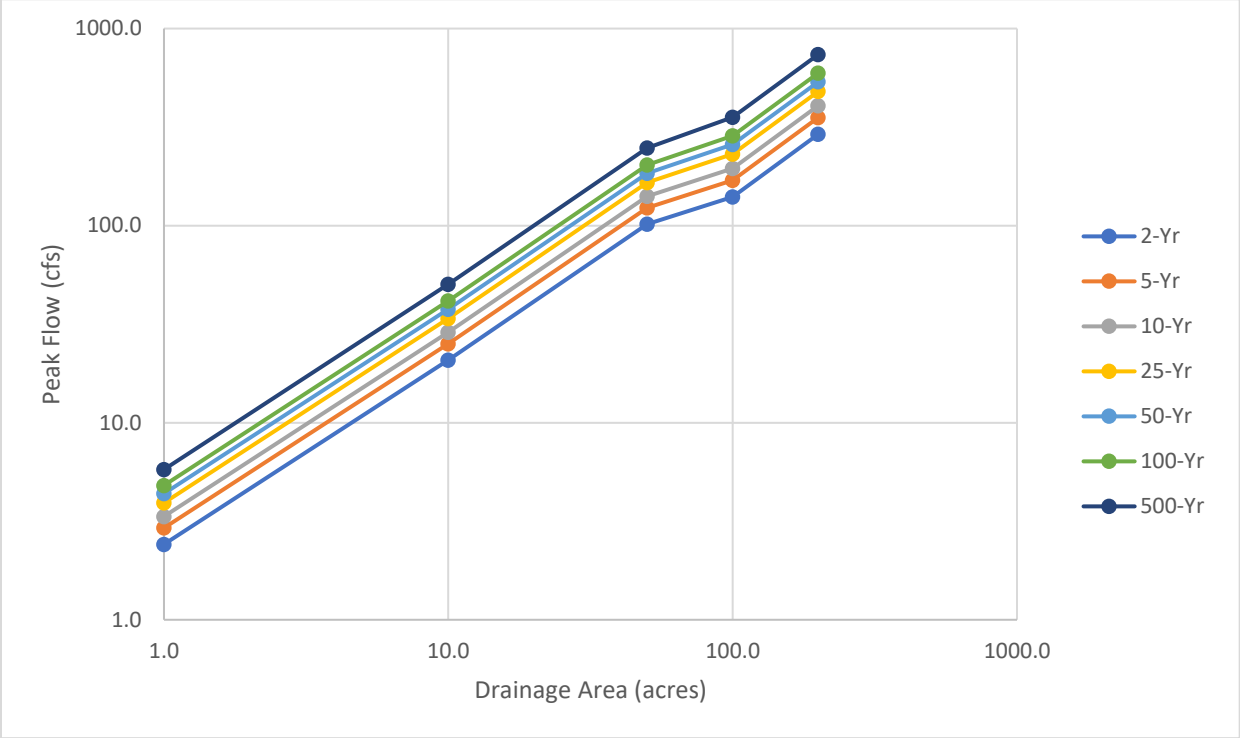


Figure 4.1.4: Adjusted Residential Drainage Area Peak Flows

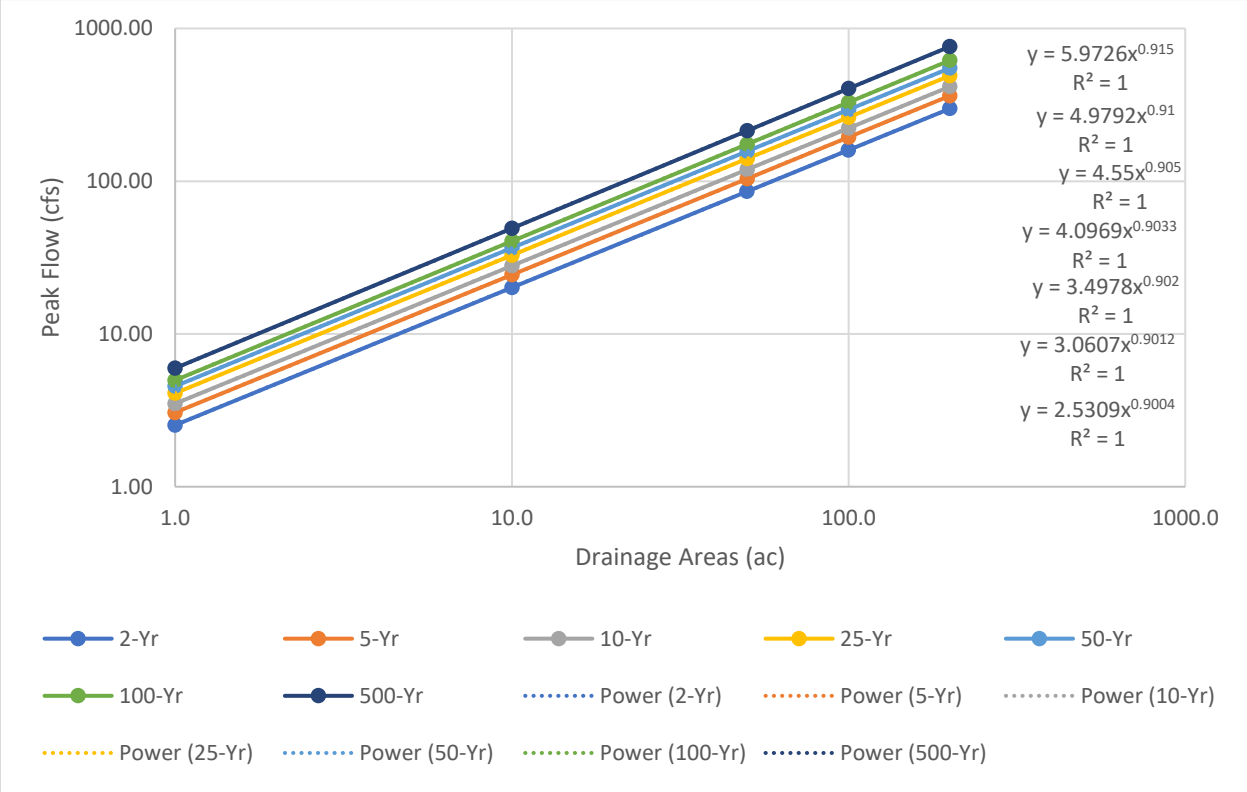


Figure 4.1.5: Unadjusted Commercial Drainage Area Peak Flows

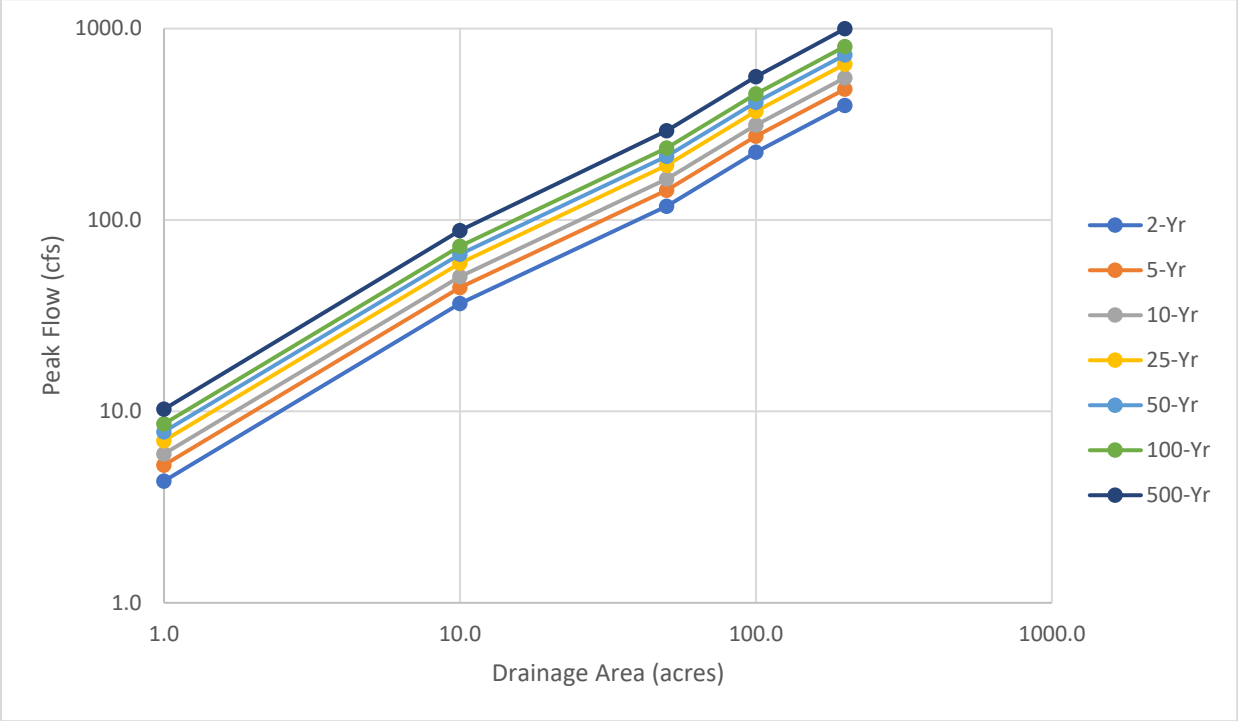


Figure 4.1.6: Adjusted Commercial Drainage Area Peak Flows

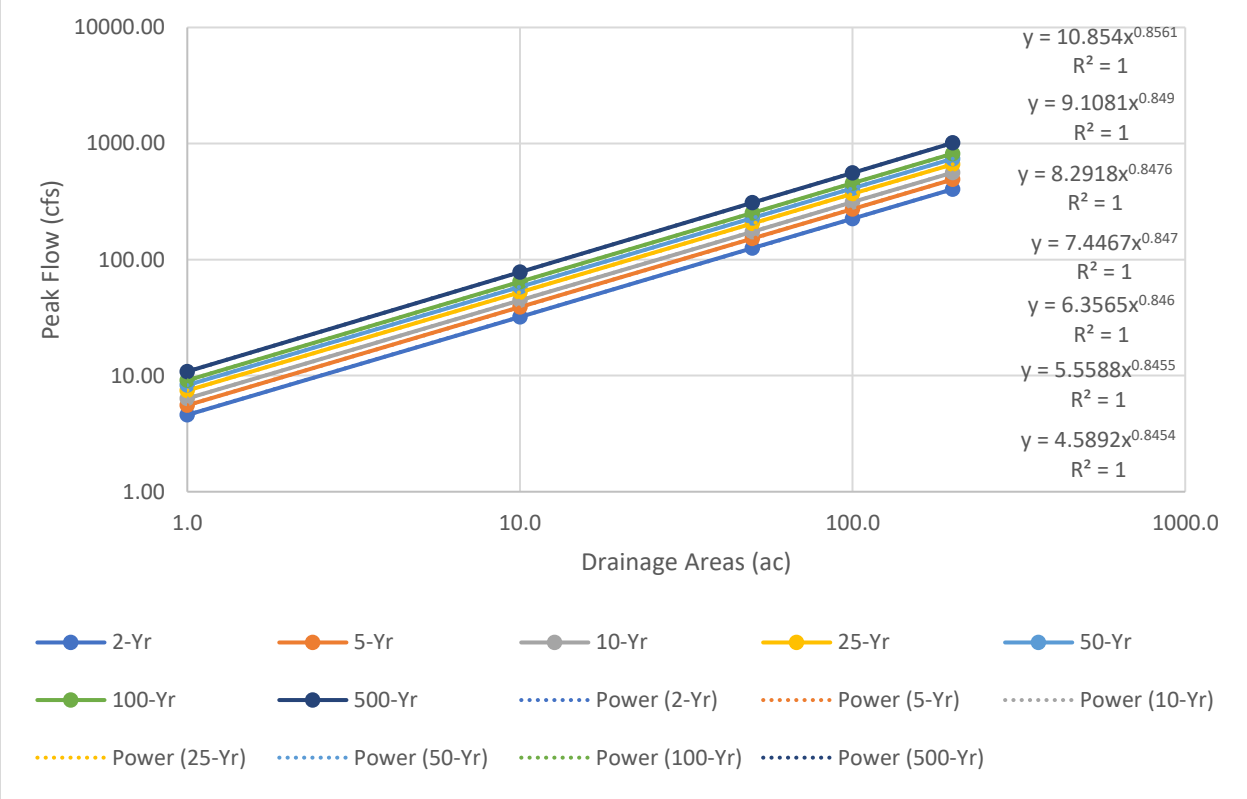


Figure 4.1.7: Unadjusted Transportation Drainage Area Peak Flows

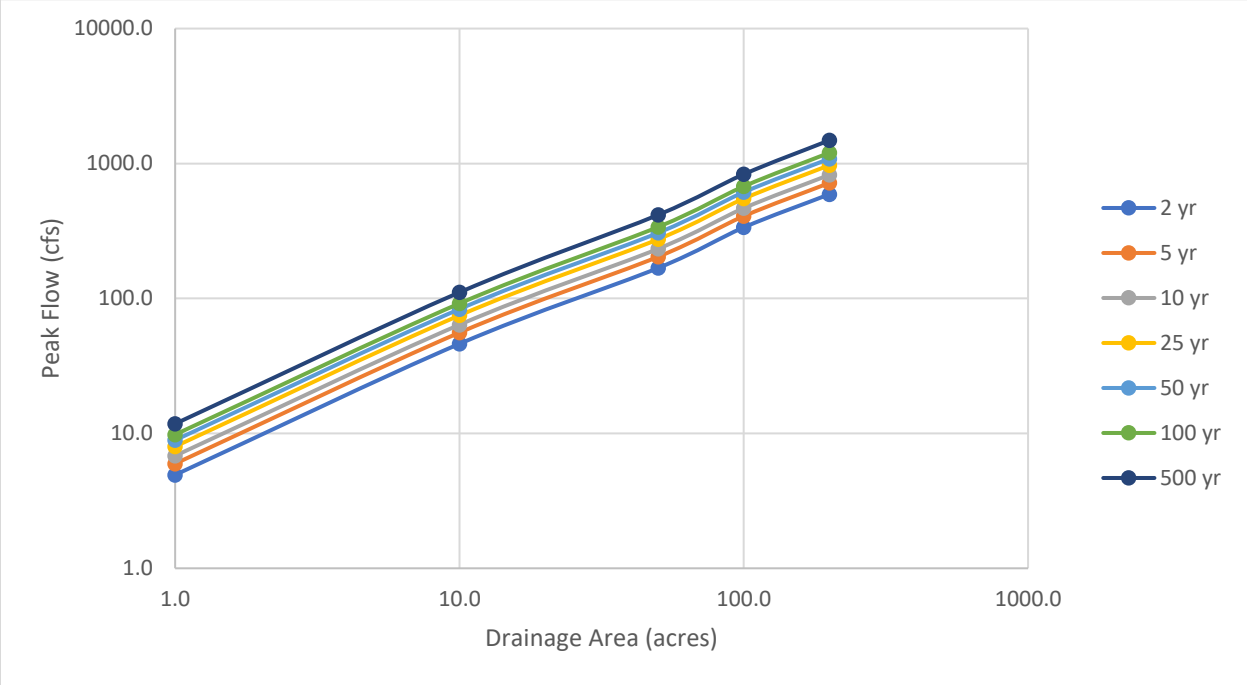
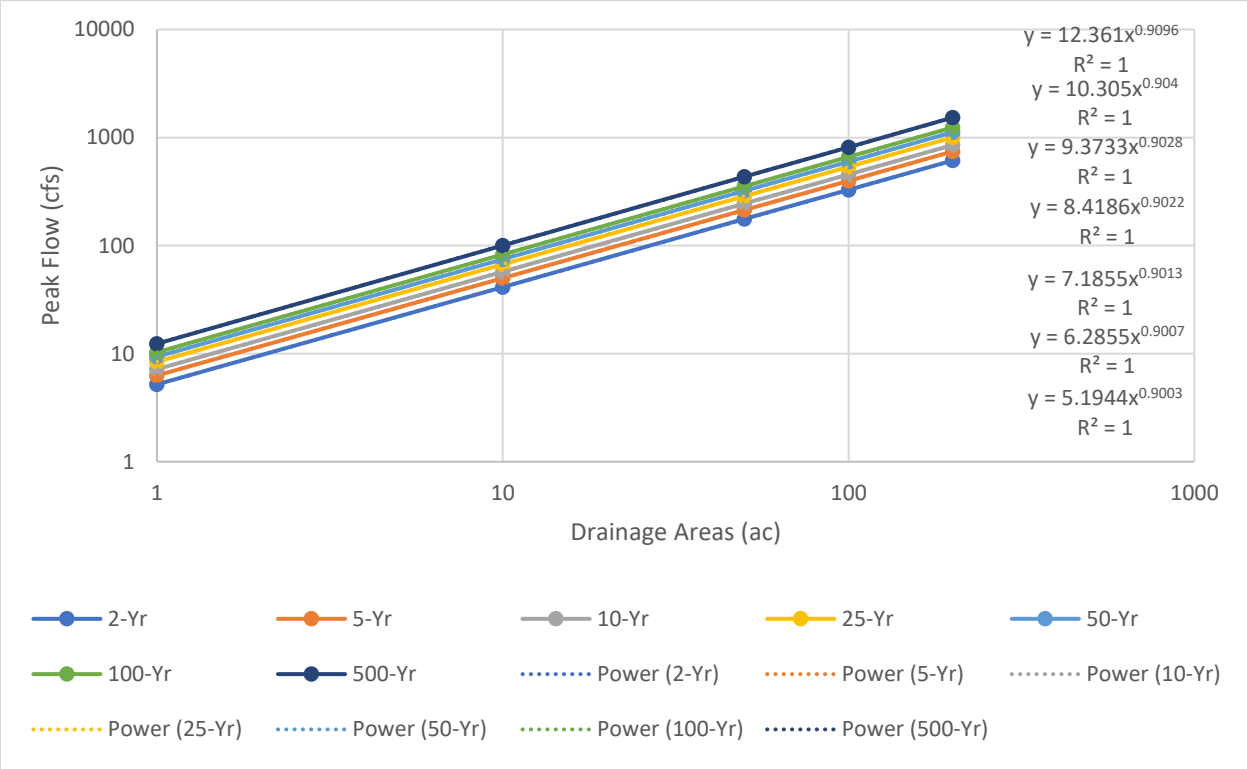


Figure 4.1.8: Adjusted Transportation Drainage Area Peak Flows



Attachment No. 5
Technical Memorandum No. 5 – Roadside Open Ditch Evaluation

CivilTech
Engineering, Inc.
Civil Engineering
Water Resources
Transportation
Structures
Economic Analysis
GIS
Land Development
Construction Services

Attachment 5

TO: Ken Gill, P.E., – City of Victoria

FROM: Mike McGovern, P.E., CFM – CivilTech Engineering Inc.

DATE: May 20, 2021

RE: Task F: Roadside Open Ditch Evaluation

CivilTech Engineering, Inc. (CivilTech) was contracted by the City of Victoria to prepare an update to the City of Victoria Storm Drainage Master Plan. Under Priority 4 (Task F), the following items were evaluated as part of this task:

- Determine the effect that partially blocked roadside ditches have on total conveyance capacity.
- Evaluation of existing roadside open ditches and driveway culverts within the City.
- Preliminary cost estimates for cleaning of roadside ditches and replacement of driveway culverts.

This memorandum summarizes these task items and associated results.

1. Roadside Ditch Capacity Determination

Roadside ditch flow obstructions are most commonly caused by sediment and debris. Roadside ditches within the City generally range in depth between 0.5 ft to 4 ft with bottom widths varying between 0 ft to 5 ft.

When calculating the flow capacity for roadside ditches, hypothetical values for blocked percentages were assumed at 25% height increments (i.e., 25% blockage = 1 ft. blockage for a 4 ft. ditch depth, 50% blockage = 2 ft. blockage for a 4 ft. ditch depth, etc.). The analysis had varying bottom widths (BW) ranging from 0 ft. bottom width to 5 ft. bottom width for every 0.5 ft. ditch depth increment.

The flow type within the ditch segment was assumed to be open channel flow (flow under the influence of atmospheric pressure), and Manning's equation Eq. (5.1) in conjunction with the continuity equation Eq. (5.2) were used to correlate flow rate with the roadside ditch characteristics.

The cross-sectional ditch area was calculated using Eq. (5.3) and the Hydraulic Radius was calculated using Eq. (5.4). Flow velocity was found through Eq. (5.1). The Manning's n roughness values (n), side slopes (Z) and channel slope (S) were assumed to be 0.04, 4, and 0.001 ft/ft respectively. Finally, the volumetric flow in cfs was determined using Eq. (5.2).

$$V = \frac{1}{n} K R^{\frac{2}{3}} S^{\frac{1}{2}} \tag{5.1}$$

$$Q = VA \tag{5.2}$$

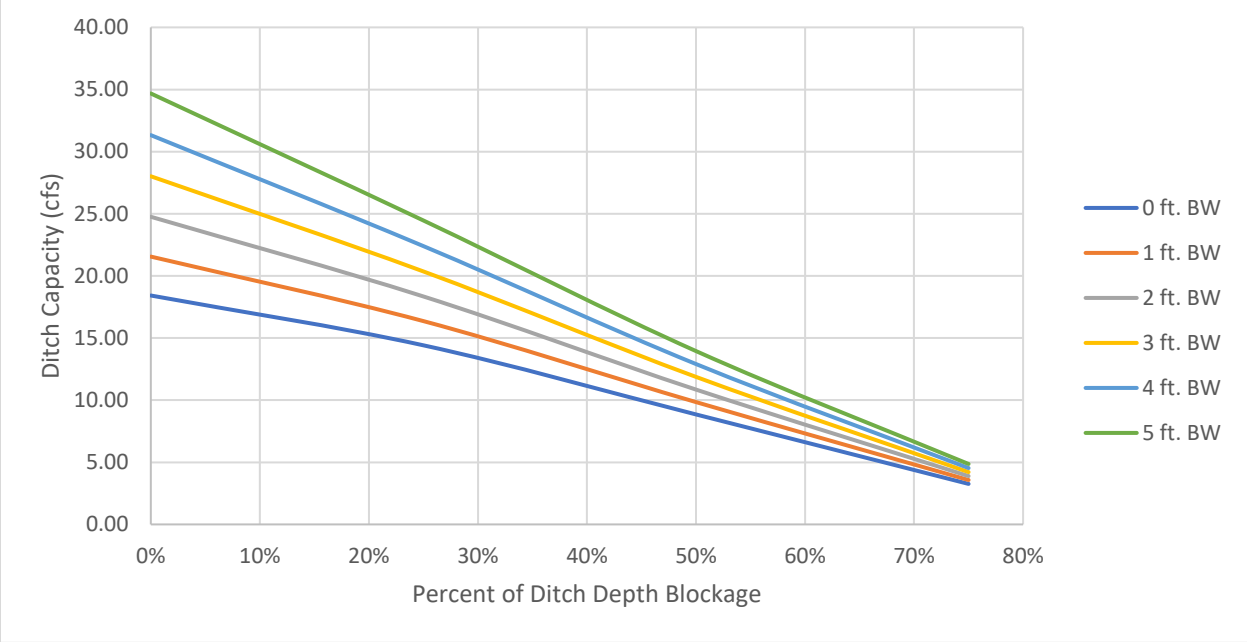
$$A = bd + Zd^2, \qquad Z \text{ in } ft/ft \tag{5.3}$$

$$R = \frac{bd+Zd^2}{b+2d\sqrt{Z^2+1}} \tag{5.4}$$

1.1. Results

The results indicate that ditch capacity is reduced with the increase in siltation and sedimentation. An example of this trend can be seen in **Figure 5.1** for a ditch depth of 2 ft. Please see **Appendix 5.1** for analyses on other commonly found ditch depths.

Figure 5.1: Reduction in Ditch Capacity with Increasing Sedimentation (2 ft. Ditch Depth)



This trend of decreasing flow capacity is consistent through all different ditch depths analyzed. The flow rates for a ditch capacity of 2 ft. under four different blockage conditions are presented in **Table 5.1**. Please refer to **Appendix 5.1** for the ditch capacity for other ditch depth conditions.

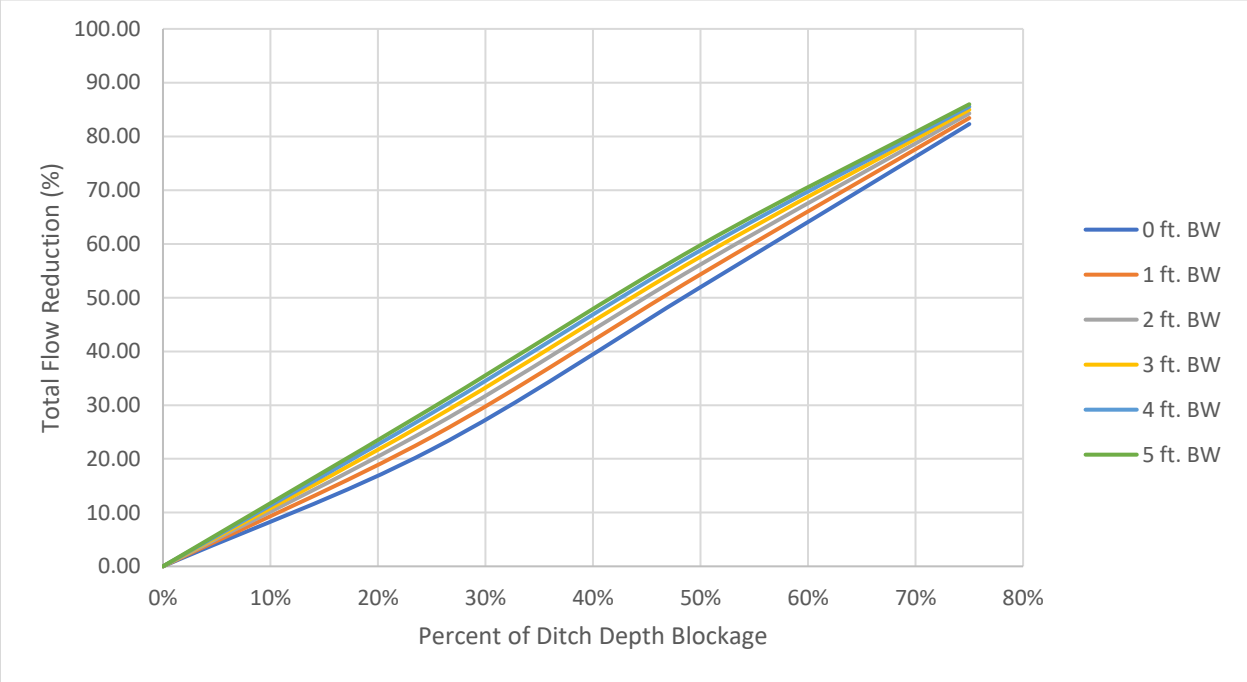
Table 5.1: Ditch Capacity Under Various Blockage Conditions for a 2 ft. Ditch Depth

Design Depth (ft)	Design Bottom Width (ft)	Full Flow (cfs)	25% Ditch Depth Blockage (cfs)	50% Ditch Depth Blockage (cfs)	75% Ditch Depth Blockage (cfs)
2	0	18.42	14.41	8.85	3.26
2	0.5	19.98	15.38	9.34	3.42
2	1	21.55	16.36	9.84	3.57
2	1.5	23.15	17.35	10.35	3.73
2	2	24.76	18.34	10.85	3.89
2	2.5	26.38	19.35	11.36	4.05
2	3	28.02	20.36	11.87	4.21

Design Depth (ft)	Design Bottom Width (ft)	Full Flow (cfs)	25% Ditch Depth Blockage (cfs)	50% Ditch Depth Blockage (cfs)	75% Ditch Depth Blockage (cfs)
2	3.5	29.67	21.37	12.39	4.37
2	4	31.33	22.40	12.91	4.54
2	4.5	33.00	23.42	13.43	4.70
2	5	34.68	24.46	13.95	4.86

It is also observed in **Figure 5.2** that the capacity reduction experienced is greater the larger the design bottom width is. For instance, trapped sediment and debris have a greater impact on flow for a 4 ft. bottom width ditch compared to a ditch with a 1 ft. bottom width under the same depth conditions, as shown above. Please refer to **Appendix 5.1** for the percentage flow reductions for other ditch depth conditions.

Figure 5.2: Increased Flow Reduction for a 2 ft. Ditch Depth Under Various Blockage Conditions



2. Preliminary Cost Estimate for Ditch Regrading/Cleaning

A preliminary cost estimate was developed for level of effort needed to regrade and clean ditches for all the identified roadside ditches within the City. The unit cost to regrade and clean the roadside ditches was determined to be $25/LF. The cost depicted below includes a 25% contingency. The total cost for regrading the roadside ditches was estimated to be $15,030,664. **Table 5.2** presents a summary of the roadside ditch regrading cost estimate per watershed.

Table 5.2: Total Roadside Ditch Regrading and Cleaning Costs by Outfall

Major Channel Outfalls	Total Length of Ditch (ft.)	Cost
Jim Branch Outfall	76,868	$1,921,709
Lone Tree Creek	143,589	$3,589,730

Major Channel Outfalls	Total Length of Ditch (ft.)	Cost
Mockingbird Outfall	42,656	$73,290
Marcado Creek	2,932	$1,066,401
North Outfall	16,086	$402,141
Spring Creek	199,133	$4,978,317
South Outfall	20,361	$509,032
Second Street Outfall	44,791	$1,119,775
Whispering Creek	8,678	$216,945
West Outfall	20,501	$512,516
Other	25,632	$640,807
Total Cost:	**601,227**	**$15,030,664**

Additionally, roadside ditches within the City were evaluated to identify priority roadside ditches in critical need of being cleaned and regraded. Based on the evaluation, 23 miles of ditch were identified as being priority ditches to be cleaned and regraded. The cost to regrade these specific ditches was approximated to be $2,961,444.

Two cost estimates were evaluated for the driveway culverts throughout the City: the cost to clean the driveway culverts and the cost to replace the driveway culverts. The cost estimate was done assuming all driveway culverts within the City are 24" pipes. The unit cost to clean the driveway culverts was found to be $11.60/LF, while the cost to replace the driveway culverts was determined to be $500/LF. The cost to replace the driveway culverts includes installation of the new culvert, two safety end treatments (SETs), and the cost to replace the driveway. The cost estimate contains a 25% contingency.

Table 5.3: Total Driveway Culvert Replacement Costs by Outfall

Major Channel Outfalls	Total Length of Driveway Culverts (ft.)	Cost to Clean Driveway Culverts	Cost to Replace Driveway Culverts
Jim Branch Outfall	11,851	$137,469	$5,925,401
Lone Tree Creek	15,047	$174,551	$7,523,732
Mockingbird Outfall	103	$1,197	$51,579
Marcado Creek	1,855	$21,516	$927,419
North Outfall	1,772	$20,557	$886,081
Spring Creek	35,328	$409,807	$17,664,112
South Outfall	3,005	$34,855	$1,502,355
Second Street Outfall	7,803	$90,514	$3,901,481
Whispering Creek	1,026	$11,901	$512,986
West Outfall	2,519	$29,223	$1,259,632
Other	5,692	$66,029	$2,846,092
Total Cost:	**86,002**	**$997,620**	**$43,000,870**

Priority driveway culverts associated with the 23 miles of priority roadside ditches were identified as being in critical need of being replaced. Approximately 3.3 miles of driveway culverts, or 669 culverts, were identified as being priority culverts to be replaced. The cost to replace these specific driveway culverts was approximated to be $8,697,087. The total cost to regrade the 23 miles of priority roadside ditches and replace the driveway culverts associated with these sections of ditches is $11,658,531.

Appendix 5.1
Ditch Capacity and Flow Reduction

Table 5.1.1: Ditch Capacity Under Various Blockage Conditions (0.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
0.5	0	0.46	0.36	0.22	0.08
0.5	0.5	0.61	0.45	0.27	0.10
0.5	1	0.78	0.56	0.32	0.11
0.5	1.5	0.94	0.66	0.37	0.13
0.5	2	1.11	0.76	0.42	0.15
0.5	2.5	1.29	0.87	0.48	0.16
0.5	3	1.46	0.98	0.53	0.18
0.5	3.5	1.64	1.08	0.59	0.20
0.5	4	1.81	1.19	0.64	0.21
0.5	4.5	1.99	1.30	0.70	0.23
0.5	5	2.17	1.41	0.75	0.25

Figure 5.1.1: Reduction in Ditch Capacity with Increasing Sedimentation (0.5 ft. Ditch Depth)

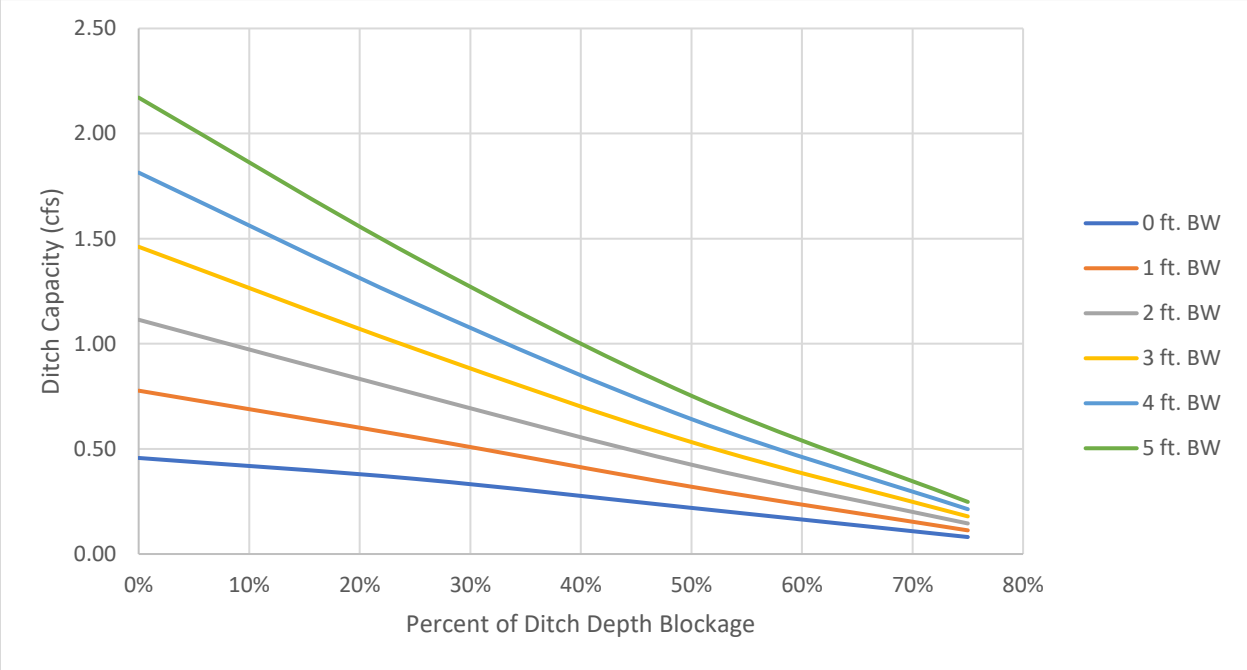


Table 5.1.2: Ditch Capacity Under Various Blockage Conditions (1 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
1	0	2.90	2.27	1.39	0.51
1	0.5	3.39	2.58	1.55	0.56
1	1	3.90	2.89	1.71	0.61
1	1.5	4.41	3.21	1.87	0.66
1	2	4.93	3.53	2.03	0.71
1	2.5	5.46	3.85	2.20	0.77
1	3	5.99	4.18	2.36	0.82
1	3.5	6.53	4.51	2.53	0.87
1	4	7.08	4.84	2.70	0.92
1	4.5	7.62	5.18	2.87	0.98
1	5	8.17	5.52	3.04	1.03

Figure 5.1.2: Reduction in Ditch Capacity with Increasing Sedimentation (1 ft. Ditch Depth)

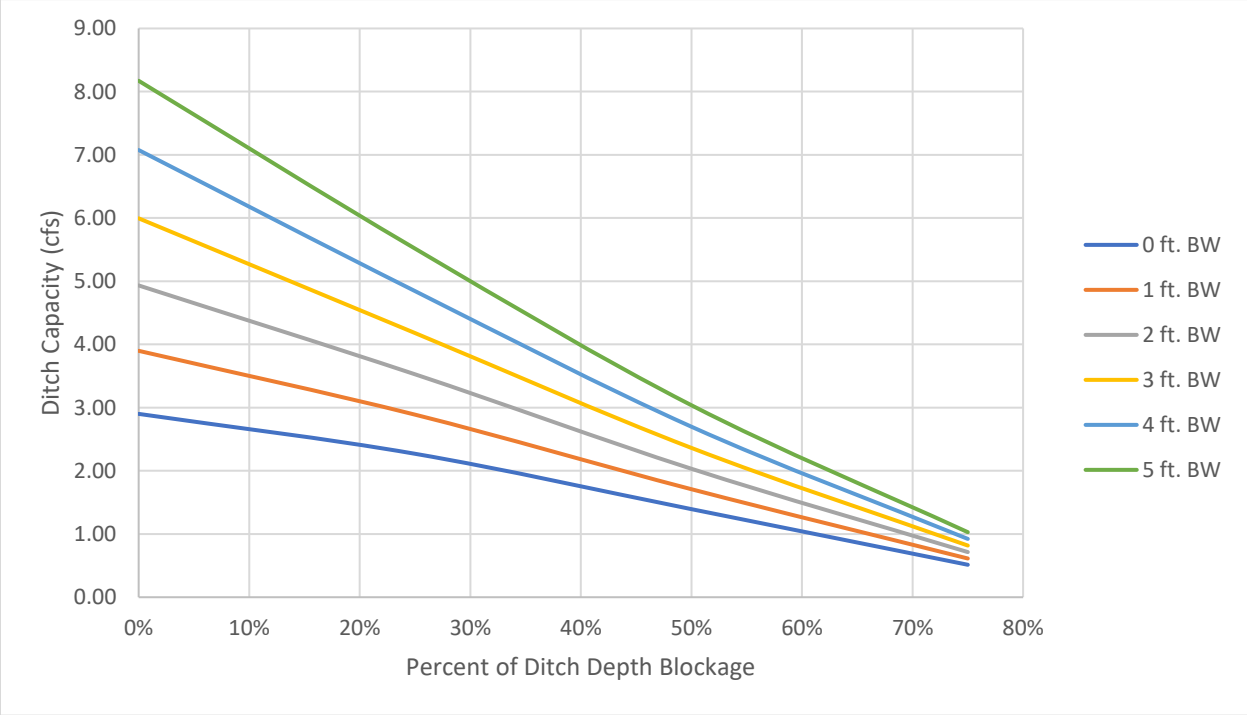


Table 5.1.3: Ditch Capacity Under Various Blockage Conditions (1.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
1.5	0	8.55	6.69	4.11	1.51
1.5	0.5	9.52	7.29	4.42	1.61
1.5	1	10.50	7.90	4.73	1.71
1.5	1.5	11.50	8.52	5.04	1.81
1.5	2	12.50	9.14	5.35	1.91
1.5	2.5	13.52	9.77	5.67	2.01
1.5	3	14.55	10.40	5.99	2.11
1.5	3.5	15.58	11.04	6.31	2.21
1.5	4	16.62	11.68	6.64	2.31
1.5	4.5	17.68	12.32	6.97	2.41
1.5	5	18.73	12.97	7.29	2.51

Figure 5.1.3: Reduction in Ditch Capacity with Increasing Sedimentation (1.5 ft. Ditch Depth)

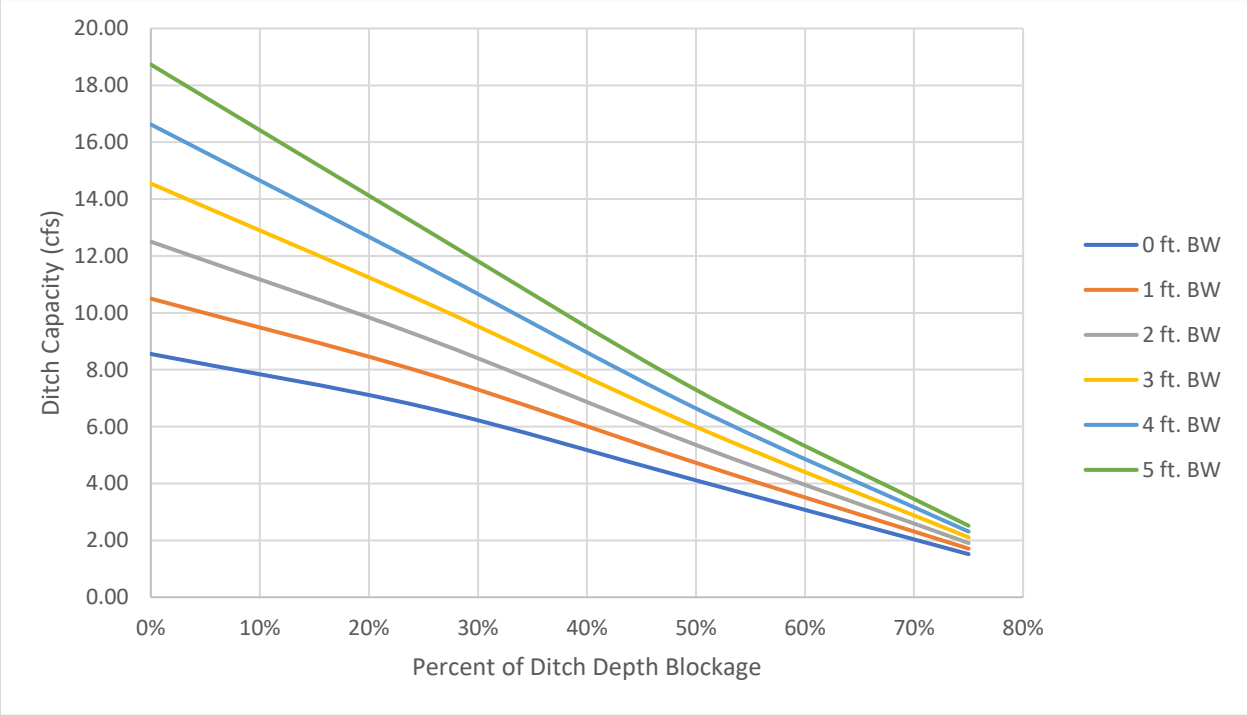


Table 5.1.4: Ditch Capacity Under Various Blockage Conditions (2 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
2	0	18.42	14.41	8.85	3.26
2	0.5	19.98	15.38	9.34	3.42
2	1	21.55	16.36	9.84	3.57
2	1.5	23.15	17.35	10.35	3.73
2	2	24.76	18.34	10.85	3.89
2	2.5	26.38	19.35	11.36	4.05
2	3	28.02	20.36	11.87	4.21
2	3.5	29.67	21.37	12.39	4.37
2	4	31.33	22.40	12.91	4.54
2	4.5	33.00	23.42	13.43	4.70
2	5	34.68	24.46	13.95	4.86

Figure 5.1.4: Reduction in Ditch Capacity with Increasing Sedimentation (2 ft. Ditch Depth)

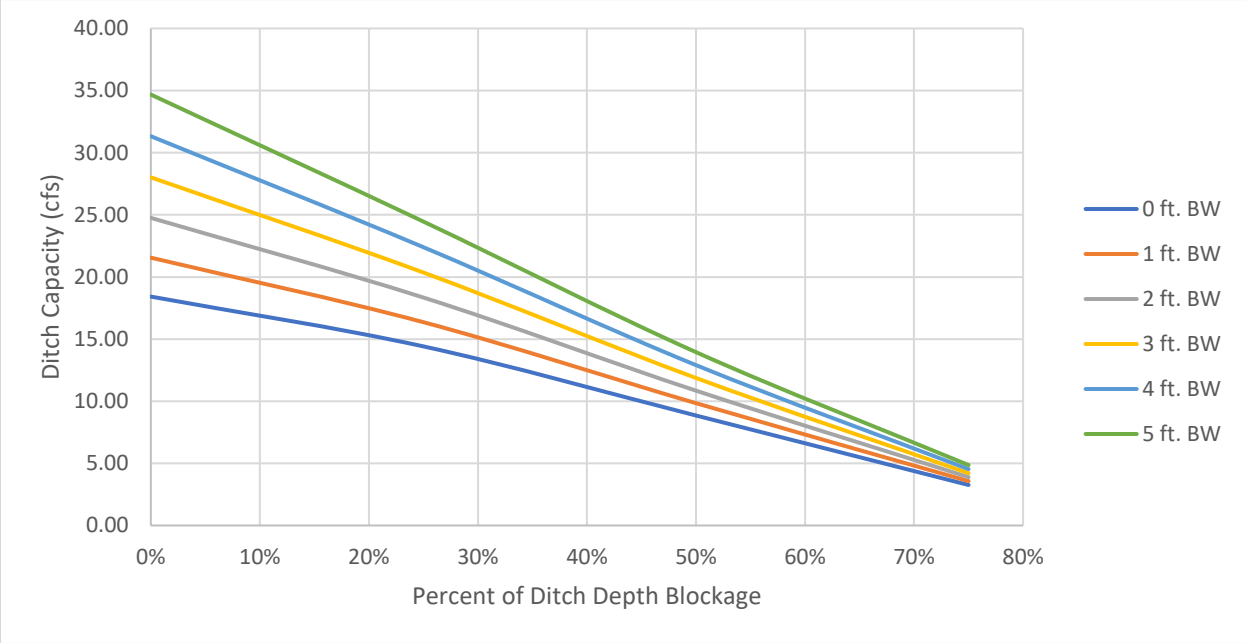


Table 5.1.5: Ditch Capacity Under Various Blockage Conditions (2.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
2.5	0	33.40	26.13	16.05	5.91
2.5	0.5	35.65	27.54	16.76	6.14
2.5	1	37.93	28.95	17.48	6.37
2.5	1.5	40.23	30.38	18.21	6.59
2.5	2	42.55	31.81	18.94	6.82
2.5	2.5	44.89	33.26	19.67	7.05
2.5	3	47.24	34.71	20.41	7.29
2.5	3.5	49.61	36.18	21.15	7.52
2.5	4	51.99	37.65	21.90	7.75
2.5	4.5	54.39	39.12	22.65	7.99
2.5	5	56.80	40.61	23.40	8.22

Figure 5.1.5: Reduction in Ditch Capacity with Increasing Sedimentation (2.5 ft. Ditch Depth)

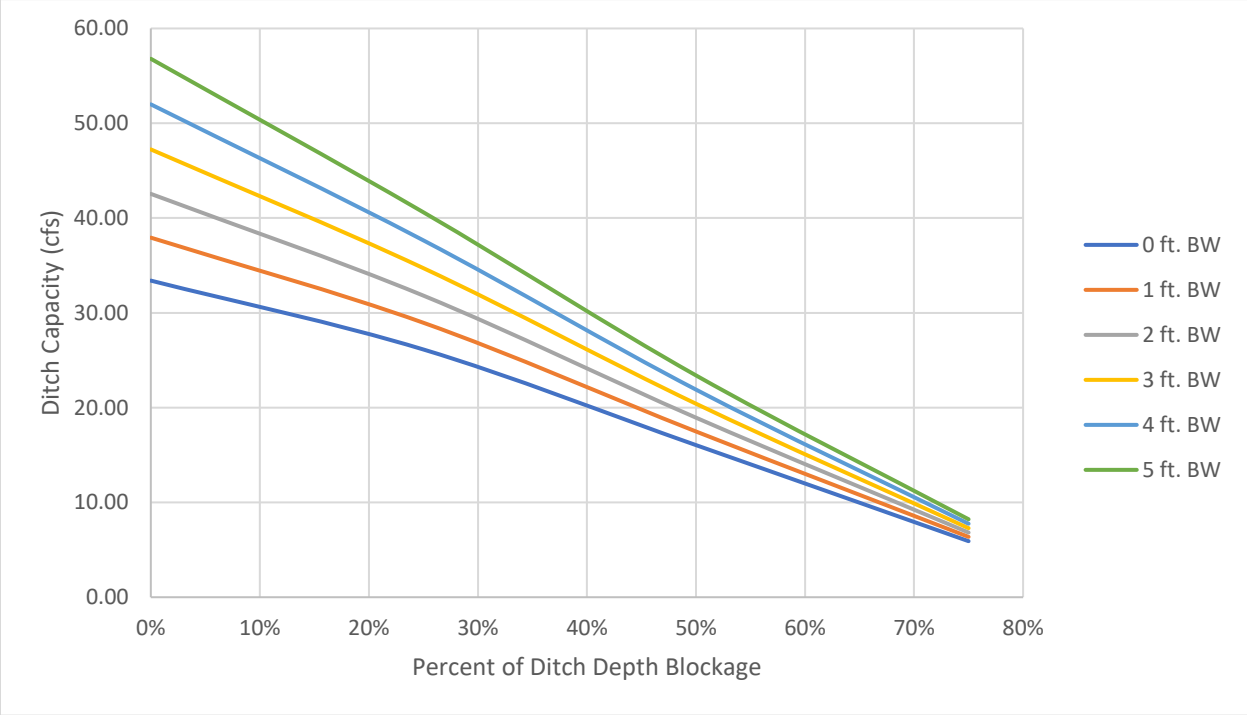


Table 5.1.6: Ditch Capacity Under Various Blockage Conditions (3 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
3	0	54.31	42.49	26.09	9.61
3	0.5	57.36	44.40	27.06	9.92
3	1	60.44	46.31	28.04	10.23
3	1.5	63.55	48.24	29.02	10.54
3	2	66.67	50.17	30.01	10.85
3	2.5	69.82	52.12	31.00	11.16
3	3	72.99	54.08	31.99	11.47
3	3.5	76.18	56.05	32.99	11.79
3	4	79.38	58.03	34.00	12.10
3	4.5	82.60	60.02	35.00	12.42
3	5	85.84	62.01	36.02	12.73

Figure 5.1.6: Reduction in Ditch Capacity with Increasing Sedimentation (3 ft. Ditch Depth)

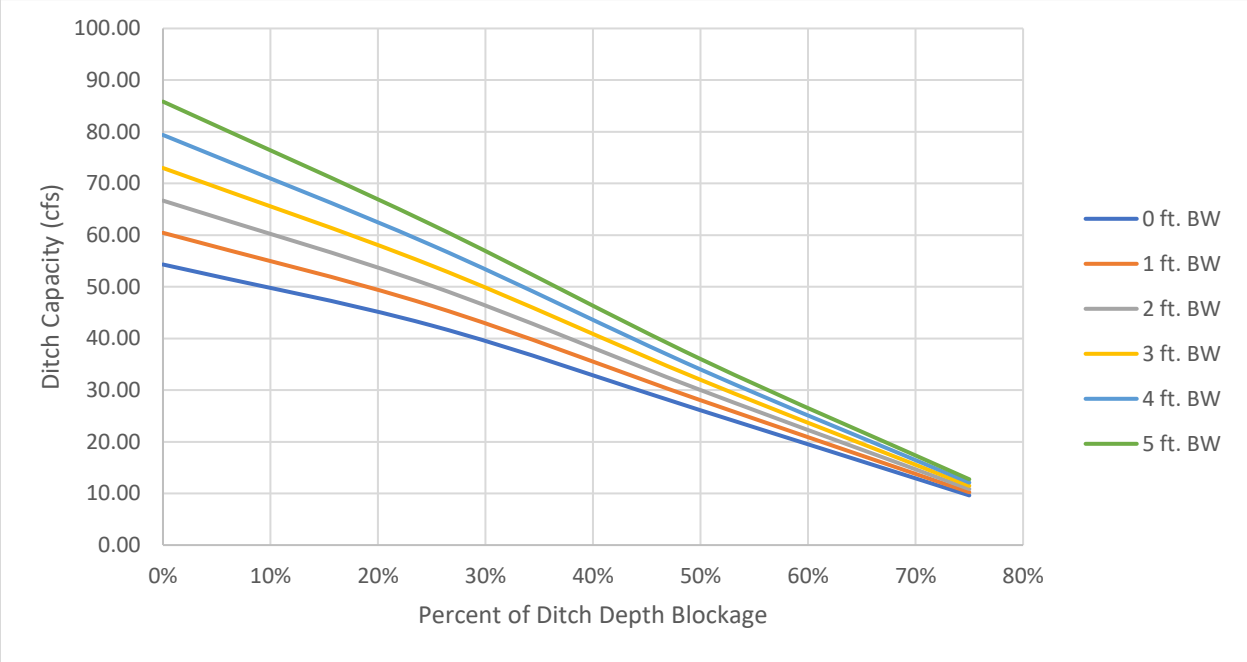


Table 5.1.7: Ditch Capacity Under Various Blockage Conditions (3.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
3.5	0	81.92	64.10	39.36	14.50
3.5	0.5	85.87	66.56	40.61	14.90
3.5	1	89.84	69.03	41.87	15.30
3.5	1.5	93.84	71.51	43.14	15.69
3.5	2	97.87	74.01	44.41	16.10
3.5	2.5	101.92	76.52	45.69	16.50
3.5	3	106.00	79.05	46.97	16.90
3.5	3.5	110.10	81.58	48.26	17.30
3.5	4	114.22	84.13	49.55	17.71
3.5	4.5	118.36	86.68	50.85	18.12
3.5	5	122.51	89.25	52.15	18.53

Figure 5.1.7: Reduction in Ditch Capacity with Increasing Sedimentation (3.5 ft. Ditch Depth)

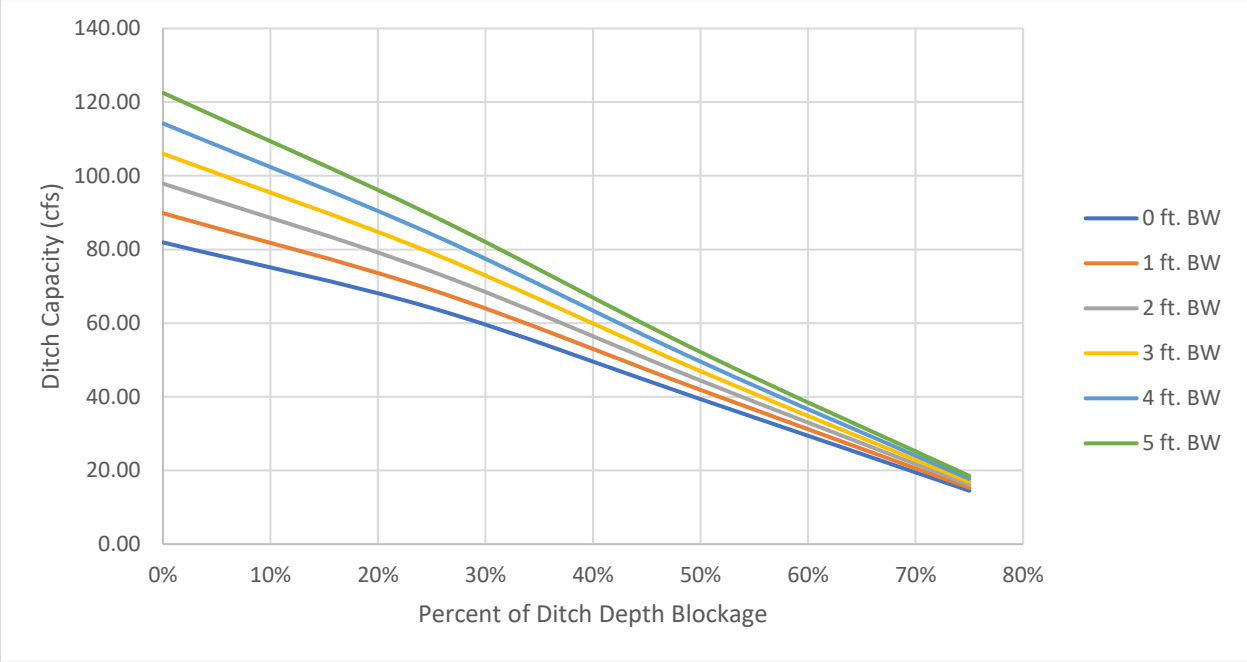


Table 5.1.8: Ditch Capacity Under Various Blockage Conditions (4 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	Full Flow (cfs)	25% Blockage (cfs)	50% Blockage (cfs)	75% Blockage (cfs)
4	0	116.96	91.52	56.20	20.71
4	0.5	121.89	94.58	57.76	21.20
4	1	126.85	97.67	59.33	21.70
4	1.5	131.84	100.77	60.91	22.19
4	2	136.85	103.88	62.50	22.69
4	2.5	141.90	107.01	64.09	23.19
4	3	146.97	110.15	65.69	23.70
4	3.5	152.07	113.31	67.29	24.20
4	4	157.19	116.47	68.90	24.71
4	4.5	162.33	119.65	70.51	25.21
4	5	167.50	122.84	72.13	25.72

Figure 5.1.8: Reduction in Ditch Capacity with Increasing Sedimentation (4 ft. Ditch Depth)

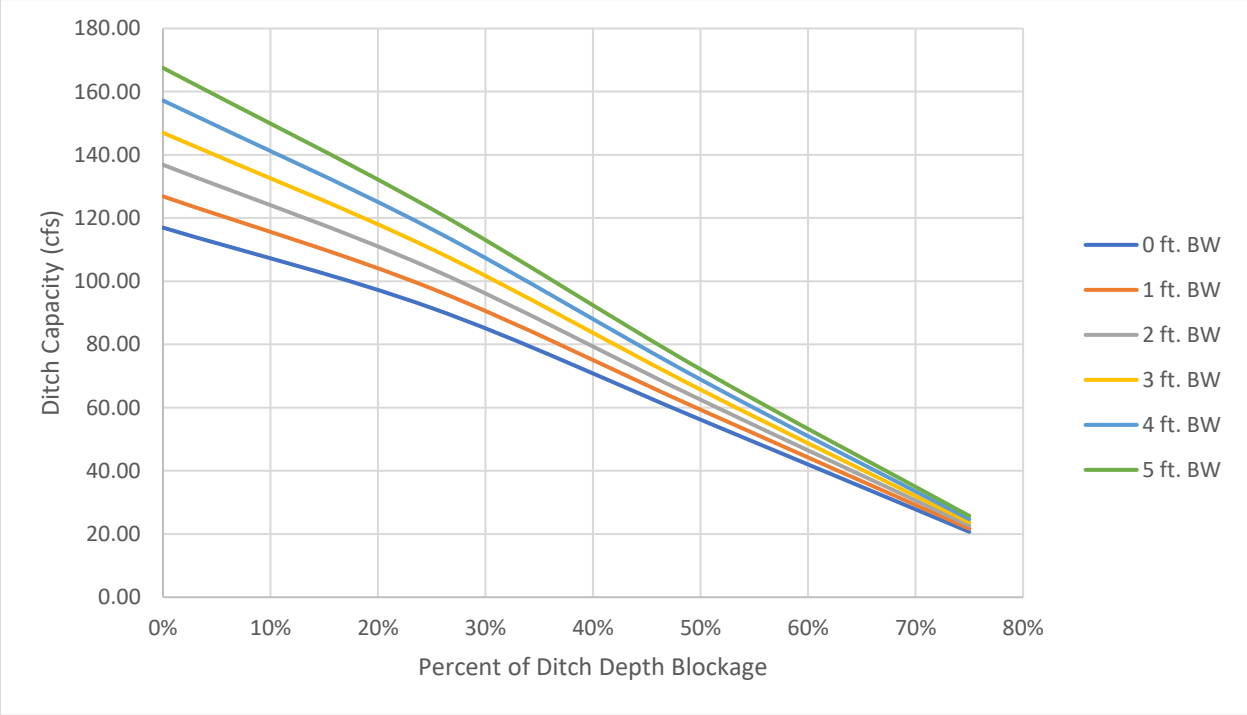


Table 5.1.9: Flow Reduction Under Various Blockage Conditions (0.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	25.90	56.17	84.28
0.5	1	0.00	28.51	58.80	85.52
0.5	1.5	0.00	30.28	60.59	86.36
0.5	2	0.00	31.55	61.87	86.96
0.5	2.5	0.00	32.49	62.83	87.41
0.5	3	0.00	33.22	63.56	87.75
0.5	3.5	0.00	33.80	64.15	88.03
0.5	4	0.00	34.27	64.62	88.25
0.5	4.5	0.00	34.65	65.01	88.43
0.5	5	0.00	34.97	65.33	88.58

Figure 5.1.9: Increased Flow Reduction Under Various Blockage Conditions (0.5 ft. Ditch Depth)

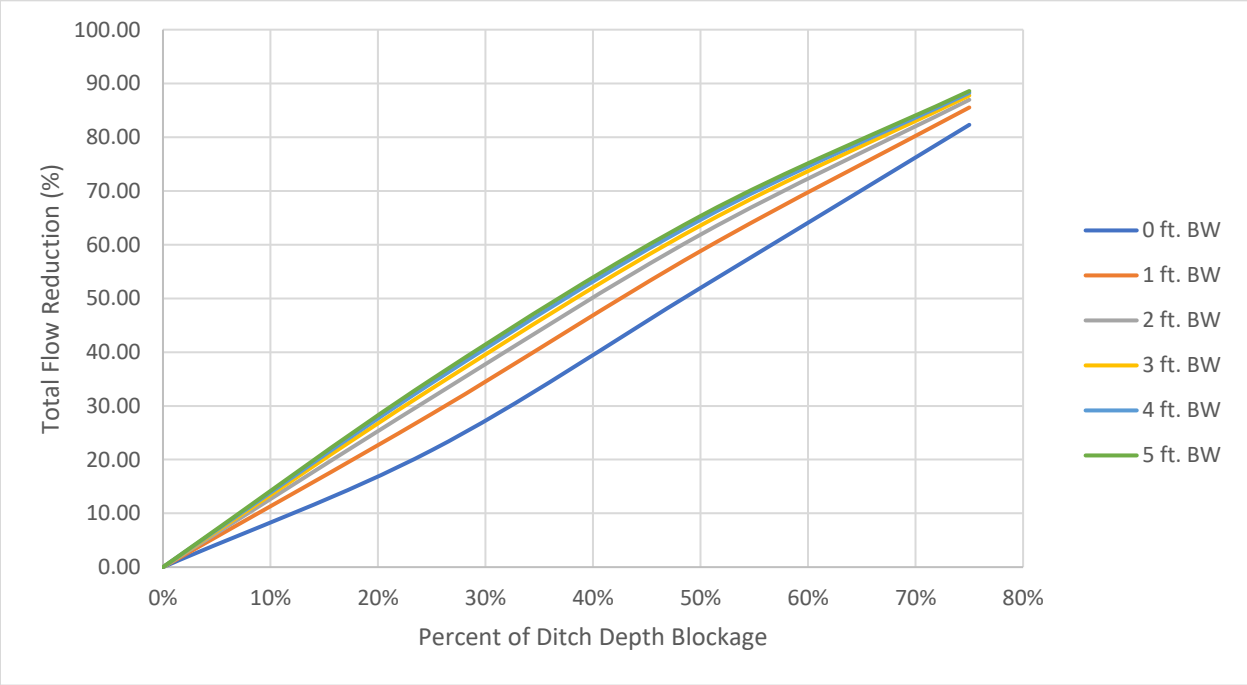


Table 5.1.10: Flow Reduction Under Various Blockage Conditions (1 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	24.09	54.33	83.42
0.5	1	0.00	25.90	56.17	84.28
0.5	1.5	0.00	27.34	57.62	84.97
0.5	2	0.00	28.51	58.80	85.52
0.5	2.5	0.00	29.47	59.78	85.98
0.5	3	0.00	30.28	60.59	86.36
0.5	3.5	0.00	30.96	61.28	86.68
0.5	4	0.00	31.55	61.87	86.96
0.5	4.5	0.00	32.05	62.38	87.20
0.5	5	0.00	32.49	62.83	87.41

Figure 5.1.10: Increased Flow Reduction Under Various Blockage Conditions (1 ft. Ditch Depth)

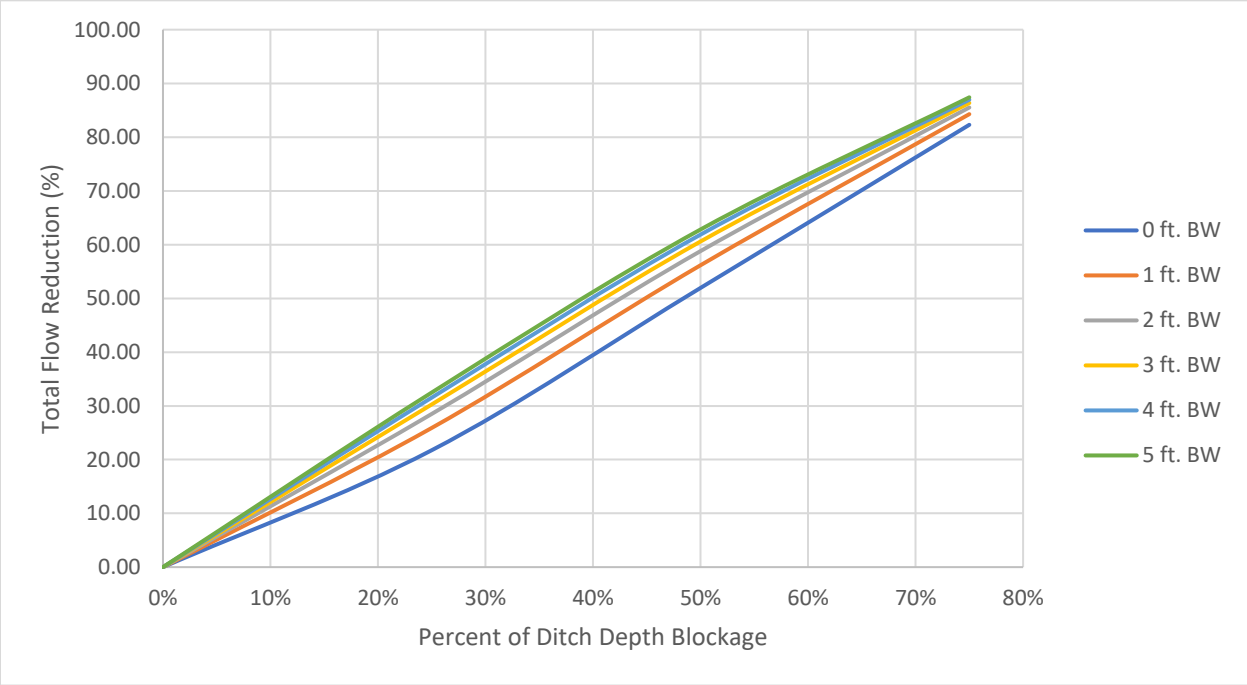


Table 5.1.11: Flow Reduction Under Various Blockage Conditions (1.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	23.38	53.61	83.08
0.5	1	0.00	24.74	54.99	83.73
0.5	1.5	0.00	25.90	56.17	84.28
0.5	2	0.00	26.90	57.17	84.76
0.5	2.5	0.00	27.76	58.04	85.16
0.5	3	0.00	28.51	58.80	85.52
0.5	3.5	0.00	29.17	59.47	85.83
0.5	4	0.00	29.76	60.06	86.11
0.5	4.5	0.00	30.28	60.59	86.36
0.5	5	0.00	30.74	61.06	86.58

Figure 5.1.11: Increased Flow Reduction Under Various Blockage Conditions (1.5 ft. Ditch Depth)

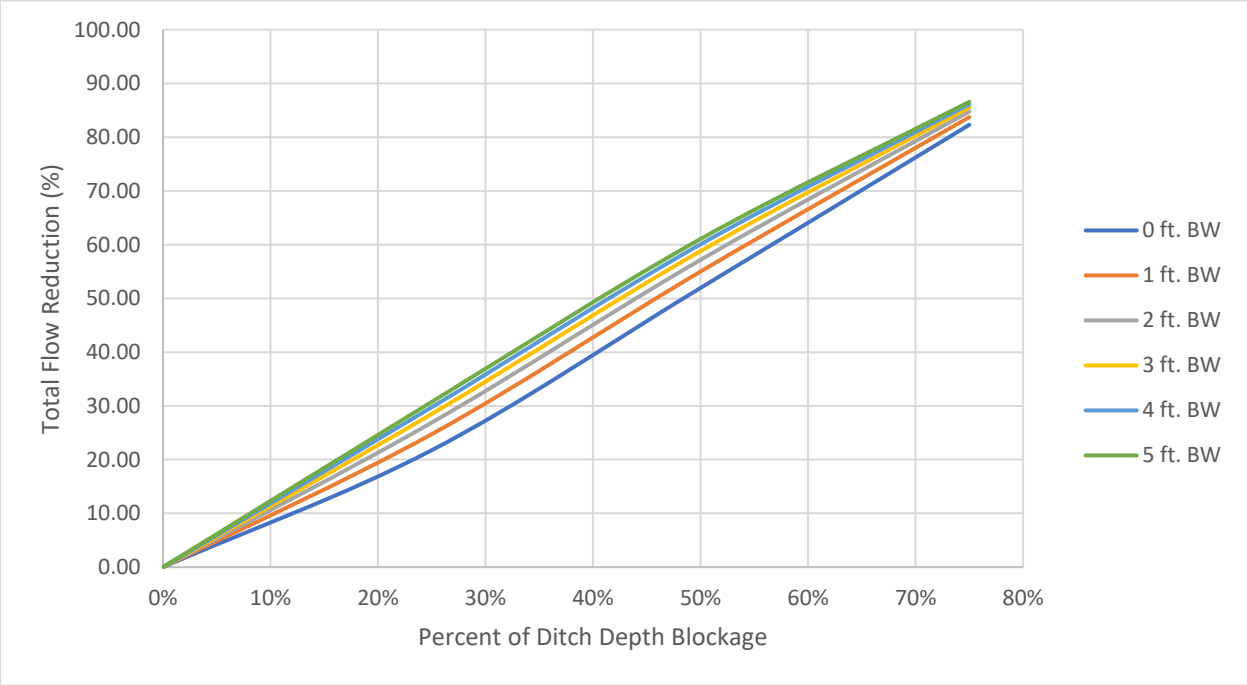


Table 5.1.12: Flow Reduction Under Various Blockage Conditions (2 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	23.00	53.22	82.90
0.5	1	0.00	24.09	54.33	83.42
0.5	1.5	0.00	25.05	55.31	83.88
0.5	2	0.00	25.90	56.17	84.28
0.5	2.5	0.00	26.66	56.94	84.64
0.5	3	0.00	27.34	57.62	84.97
0.5	3.5	0.00	27.95	58.24	85.26
0.5	4	0.00	28.51	58.80	85.52
0.5	4.5	0.00	29.01	59.31	85.76
0.5	5	0.00	29.47	59.78	85.98

Figure 5.1.12: Increased Flow Reduction Under Various Blockage Conditions (2 ft. Ditch Depth)

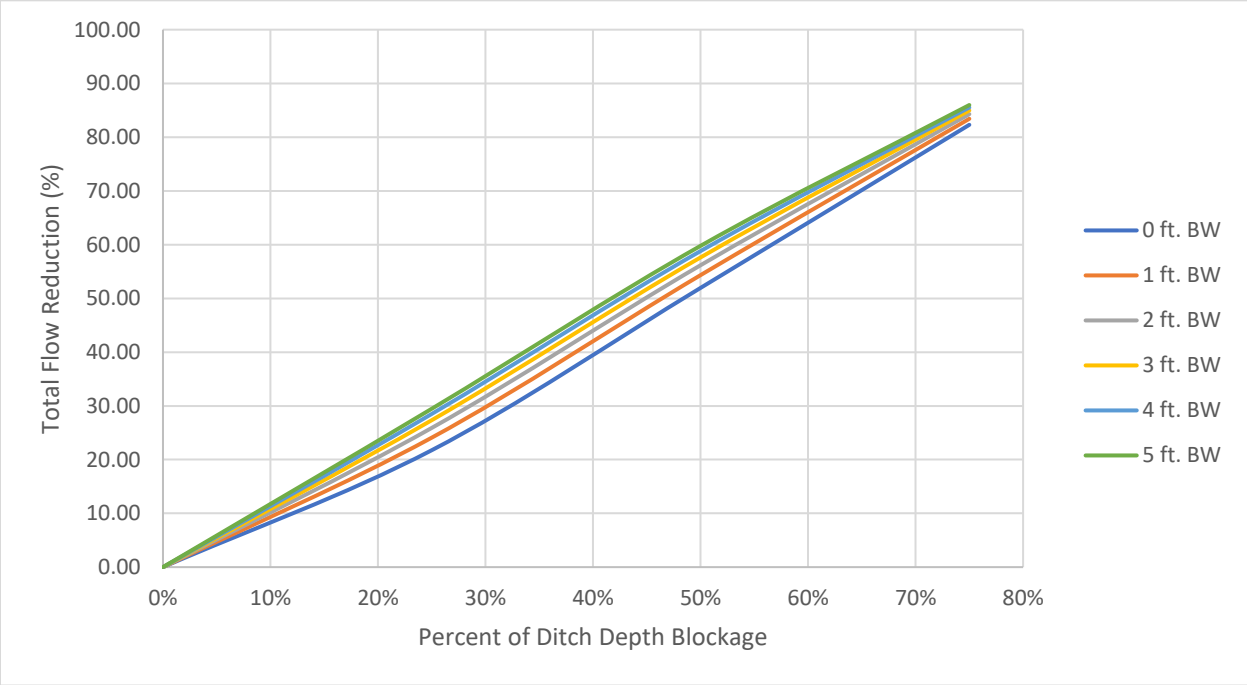


Table 5.1.13: Flow Reduction Under Various Blockage Conditions (2.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	22.77	52.98	82.78
0.5	1	0.00	23.67	53.91	83.22
0.5	1.5	0.00	24.49	54.74	83.61
0.5	2	0.00	25.23	55.49	83.96
0.5	2.5	0.00	25.90	56.17	84.28
0.5	3	0.00	26.52	56.79	84.57
0.5	3.5	0.00	27.08	57.36	84.84
0.5	4	0.00	27.59	57.88	85.09
0.5	4.5	0.00	28.07	58.36	85.31
0.5	5	0.00	28.51	58.80	85.52

Figure 5.1.13: Increased Flow Reduction Under Various Blockage Conditions (2.5 ft. Ditch Depth)

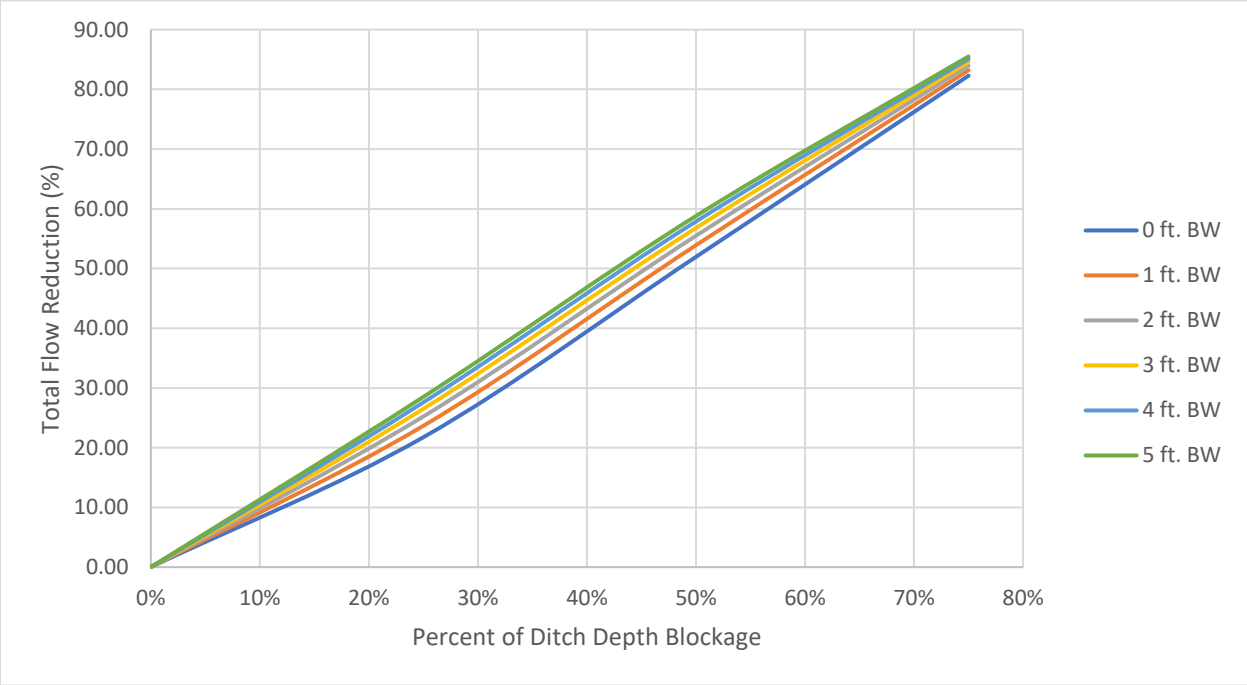


Table 5.1.14: Flow Reduction Under Various Blockage Conditions (3 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	22.61	52.82	82.71
0.5	1	0.00	23.38	53.61	83.08
0.5	1.5	0.00	24.09	54.33	83.42
0.5	2	0.00	24.74	54.99	83.73
0.5	2.5	0.00	25.35	55.60	84.02
0.5	3	0.00	25.90	56.17	84.28
0.5	3.5	0.00	26.42	56.69	84.53
0.5	4	0.00	26.90	57.17	84.76
0.5	4.5	0.00	27.34	57.62	84.97
0.5	5	0.00	27.76	58.04	85.16

Figure 5.1.14: Increased Flow Reduction Under Various Blockage Conditions (3 ft. Ditch Depth)

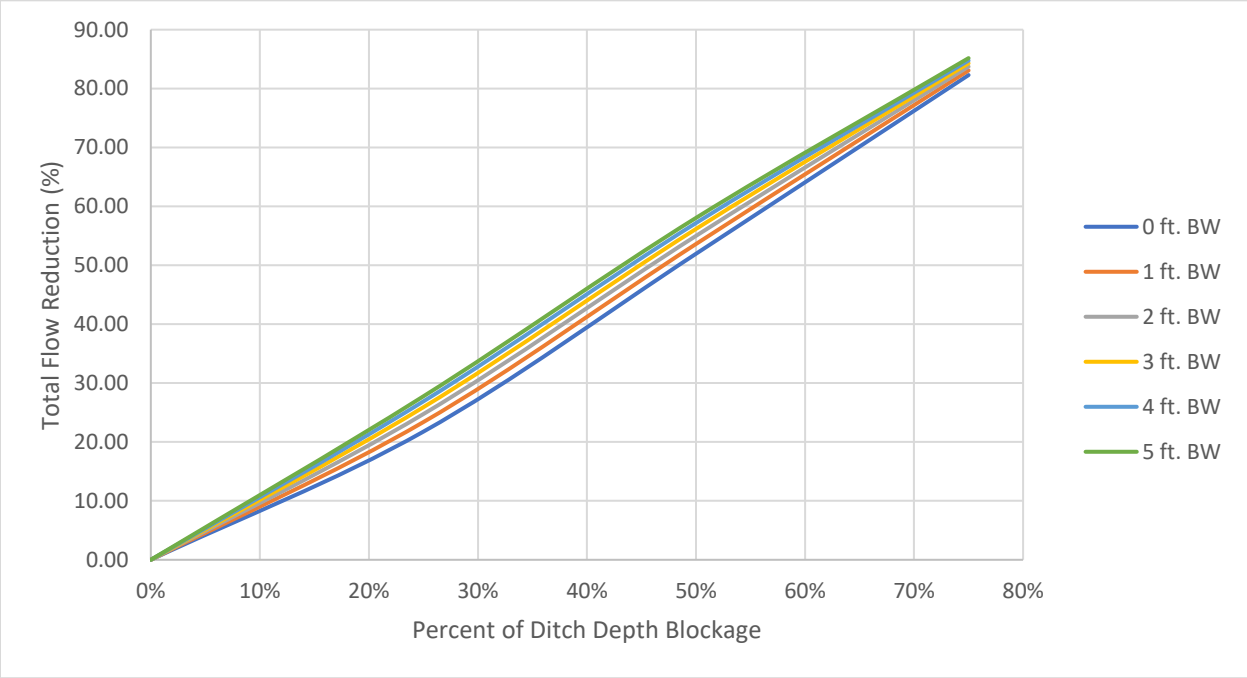


Table 5.1.15: Flow Reduction Under Various Blockage Conditions (3.5 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	22.49	52.70	82.65
0.5	1	0.00	23.17	53.39	82.97
0.5	1.5	0.00	23.80	54.03	83.28
0.5	2	0.00	24.38	54.62	83.56
0.5	2.5	0.00	24.92	55.17	83.81
0.5	3	0.00	25.43	55.69	84.06
0.5	3.5	0.00	25.90	56.17	84.28
0.5	4	0.00	26.35	56.62	84.49
0.5	4.5	0.00	26.76	57.04	84.69
0.5	5	0.00	27.15	57.44	84.88

Figure 5.1.15: Increased Flow Reduction Under Various Blockage Conditions (3.5 ft. Ditch Depth)

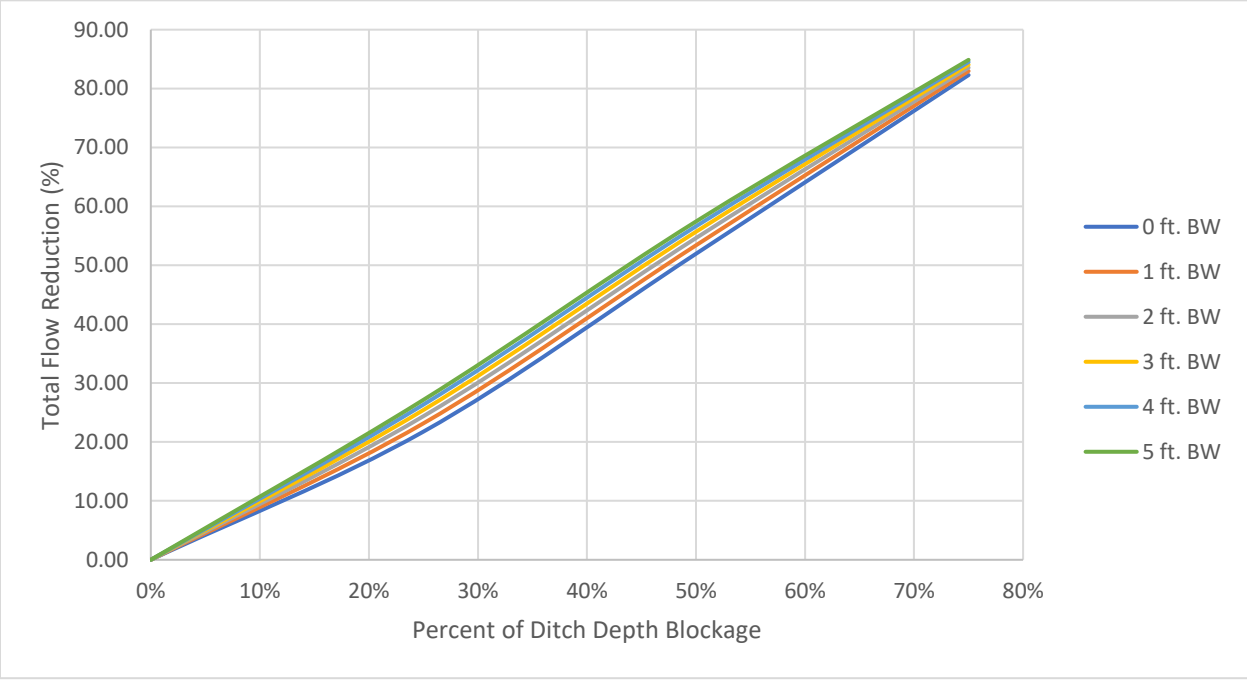
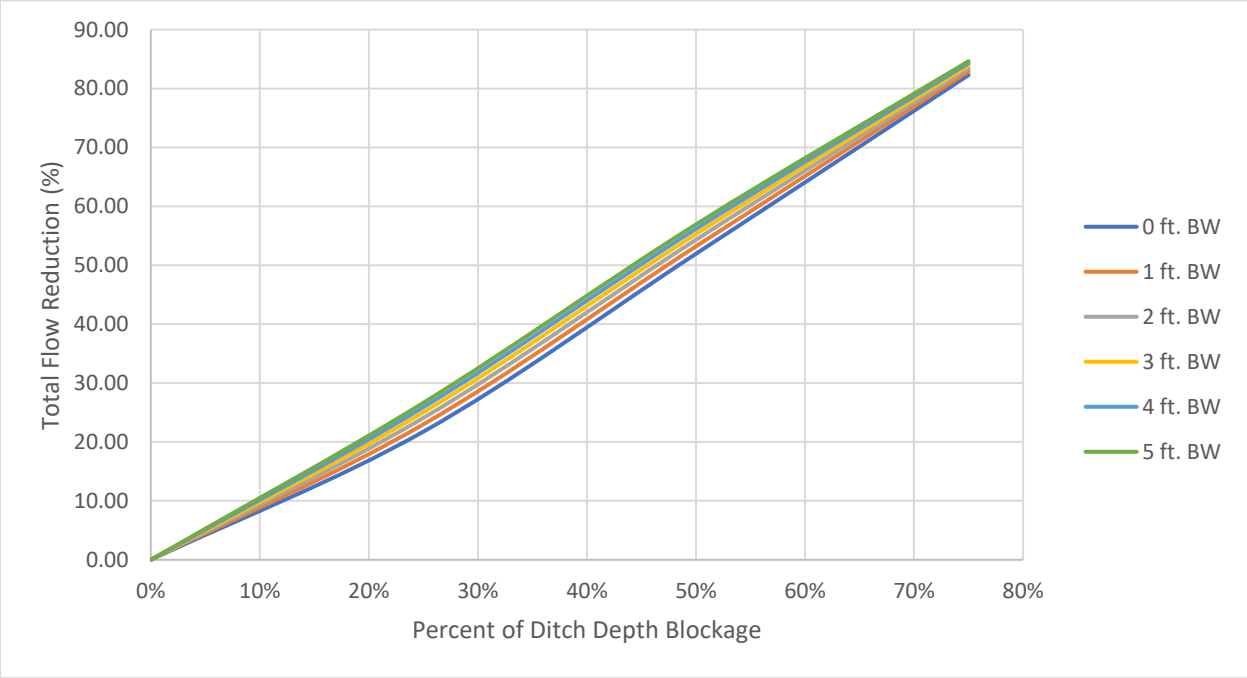


Table 5.1.16: Flow Reduction Under Various Blockage Conditions (4 ft. Ditch Depth)

Design Depth (ft)	Starting Bottom Width (ft)	0% Depth Blockage Flow Reduction (%)	25% Depth Blockage Flow Reduction (%)	50% Depth Blockage Flow Reduction (%)	75% Depth Blockage Flow Reduction (%)
0.5	0	0.00	21.76	51.95	82.30
0.5	0.5	0.00	22.40	52.61	82.61
0.5	1	0.00	23.00	53.22	82.90
0.5	1.5	0.00	23.57	53.80	83.17
0.5	2	0.00	24.09	54.33	83.42
0.5	2.5	0.00	24.59	54.83	83.65
0.5	3	0.00	25.05	55.31	83.88
0.5	3.5	0.00	25.49	55.75	84.09
0.5	4	0.00	25.90	56.17	84.28
0.5	4.5	0.00	26.29	56.56	84.47
0.5	5	0.00	26.66	56.94	84.64

Figure 5.1.16: Increased Flow Reduction Under Various Blockage Conditions (4 ft. Ditch Depth)



Attachment No. 6
Technical Memorandum No. 6 – Major Outfall Channels

CivilTech
Engineering, Inc.
Civil Engineering
Water Resources
Transportation
Structures
Economic Analysis
GIS
Land Development
Construction Services

Attachment 6

TO: Ken Gill, P.E., – City of Victoria

FROM: Mike McGovern, P.E., CFM – CivilTech Engineering Inc.

DATE: February 22, 2021

RE: Task G – Major Outfall Channels

CivilTech Engineering, Inc. (CivilTech) was contracted by the City of Victoria to prepare an update to the City of Victoria Storm Drainage Master Plan. Priority 5 (Task G) covers two major tasks:

- Field site visits, drone video footage, and preparation of a cost estimate to address the identified areas of erosion control/rip-rip failures.
- Determinization of the ultimate Right-of-Way (ROW) needs and the identification of channel sections with erosion control/rip-rap failures. The Ultimate ROW would provide information regarding areas adjacent to existing channels that the City would need to acquire in order to construct the ultimate channels that were outlined in the previous storm drainage master plan.

The previous storm drainage master plan was developed by PBS&J, updated in March 2007, titled *City of Victoria Storm Drainage Master Plan.* This document presents the methodology and results of both the erosion control/rip-rap failures assessment as well as Ultimate Right-of-Way (ROW) channel needs for various outfalls throughout the City of Victoria.

1. Major Outfall Channels

There are 14 major outfall channels within the City of Victoria, as listed below:

Jim Branch (JB)	Whispering Creek (WC)
Ben Jordan (BJ)	North Outfall (NO)
South Outfall (SO)	US 77 Outfall (US)
Second Street Outfall (SS)	Lone Tree Creek (LT)
West Outfall (WO)	Southern Pacific (SP)
Spring Creek (SC)	East Branch (EB)
Mockingbird Outfall (MO)	Marcado Creek (MC)

The locations of these channels can also be seen on **Exhibit 6.1.**

2. Field Investigation

The CivilTech and Urban Engineering team completed the field investigation using traditional method of field site visits and a non-traditional method of drone flights of each of the major outfall systems within the City. Photographs of erosion control/rip-rap failures were taken at locations across the City. The site visits also served to determine areas where channel maintenance was needed based on sedimentation build up within the channels. Documentation of the drone flight video footage, as well as site visit photographs is linked to the City of Victoria Master Drainage Study ArcGIS webpage developed by CivilTech as part of this study, https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f.

The field investigation and desktop review determined there is approximately 2,314,000 sqft. of concrete lined channels in the City and there are 113 sites where channel or sedimentation is a concern. This includes areas where rip-rap/concrete lining have failed or is undermined and locations where channel sedimentation has been identified throughout the City. These features are show on **Exhibits 6.2a – 6.8d.** and are also included on the City of Victoria Master Drainage Study ArcGIS webpage.

3. Preliminary Cost Estimate for Correction of Erosion Control/Rip-Rap Failures

A preliminary cost estimate was developed for the level of effort needed to address the identified erosion control issues and sediment deposits. The total cost was estimated to be $2,762,014. The unit costs for each element are outlined below and include a 25% contingency:

- Remove and replace concrete slope and channel pavement: $37.50/SF
- Repair earthen channel failures using stone rip rap: $50/SF
- Channel maintenance to remove sediment deposits: $4/SF

Table 6.1 presents a summary of the cost estimate per watershed.

Table 6.1: Cost for Correction of Erosion Control/Rip-Rap Failures

Watershed	Concrete Slope & Channel Pavement	Earthen Channel Stone Rip Rap	Sediment Removal in Channels	Cost
Jim Branch Outfall	$259,464	-	$258,836	$518,300
Lone Tree Creek	$133,945	$58,550	$251,132	$443,627
Mockingbird Outfall	-	-	-	$0
Marcado Creek	-	-	-	$0
North Outfall	$650,682	$487,259	$99,744	$1,237,685
Spring Creek	$750	$41,014	$102,084	$143,848
South Outfall	$8,4975	-	$22,596	$107,571
Second Street Outfall	-	-	-	$0
Whispering Creek	$15,563	$4,650	$99,068	$119,281
West Outfall	$116,766		$74,936	$191,702
Total Cost:	$1,262,145	$591,473	$908,396	**$2,762,014**

4. Ultimate ROW Needs

Of the 14 major outfall channels within the City, five outfall channels were not evaluated for ultimate ROW needs. The following outlines these five channels and the reason they were excluded from the analysis:

- Second Street Outfall – Identified as a storm sewer system (closed system); ROW geometries only created for open channels (PBS&J, 1999, p.105)
- Mockingbird Outfall – Identified as a storm sewer system (closed system); ROW geometries only created for open channels (PBS&J, 1999, p.105)
- Southern Pacific – No channel improvements identified in the PBS&J SDMP
- East Branch - No channel improvements identified in the PBS&J SDMP
- Spring Creek – Bridge improvements and detention basins identified, but no channel improvements identified in PBS&J SDMP

5. References

The following data sources were used as part of this analysis:

1. *City of Victoria Storm Drainage Master Plan*, dated June 1999 & resubmitted March 2007, prepared by PBS&J, Inc.
2. Light Detection and Ranging (LiDAR) data obtained from the Texas Natural Resources Information System (TNRIS) from the South Texas LiDAR dataset, dated 2018.

6. Results

The ultimate ROW needs, as identified in the previous PBS&J SDMP, were digitized in ArcGIS to aid in the identification of land adjacent to the channels that would need to be acquired in order to develop the ultimate channel section along each outfall channel. Results of the ultimate ROW needs for each channel can be seen spatially on the Master Drainage Plan Update ArcGIS Online Page at the following link –

https://enterprise.woolpert.com/portal/apps/webappviewer/index.html?id=f8cc0b417f5d4f59bb2c5b7df5272f2f

7. Preliminary Cost Estimate for Ultimate Channels

A preliminary cost estimate was developed to determine the cost to construct the ultimate channel sections for each of the streams, as outlined in the PBS&J SDMP. The costs have been adjusted to account for inflation (1999 to 2021) and do not include the cost for ROW acquisition. Where possible, 2021 TxDOT average low bid unit prices were used to aid in determining the 2021 cost. Additionally, the costs include a 15% contingency.

Table 6.2 presents a summary of the cost estimate per watershed.

Table 6.2: Preliminary Cost for Ultimate Channels

Watershed	Cost
Jim Branch Outfall	$12,062,503
Lone Tree Creek	$27,754,318
Mockingbird Outfall	$5,446,869
Marcado Creek	$13,427,747
North Outfall	$6,029,166

Watershed	Cost
Spring Creek	$0
South Outfall	$2,944,683
Second Street Outfall	$0
Whispering Creek	$2,806,923
West Outfall	$9,113,735
Total Cost:	**$79,585,944**

Exhibit 6.1

City of Victoria Streams

LEGEND

Open Channel

Studied Channel

N

0 2,500 5,000

Basemap:ESRI World Street Map

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THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

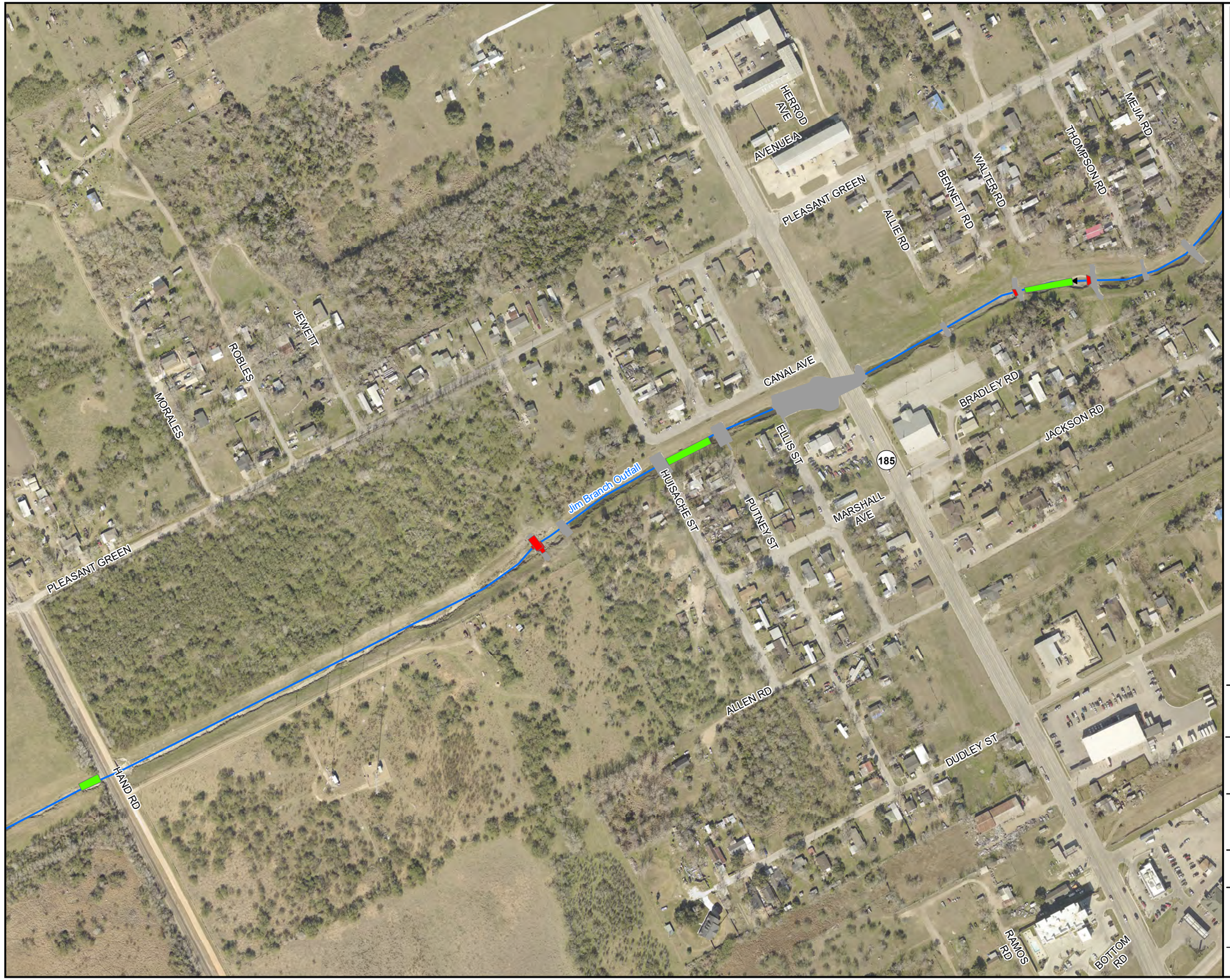
City of Victoria
Streams

September 2021	Project No. 400022	Exhibit No. 6.1

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\COV Streams.mxd

Exhibit 6.2a – 6.8d

Erosion Control and Rip Rap Features



LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 150 300

Aerial Source: City of Victoria 2020

N

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City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
Jim Branch Outfall

September 2021	Project No. 400022	Exhibit No. 6.2a

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Jim Branch.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 150 300

N

Aerial Source: City of Victoria 2020

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City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures Jim Branch Outfall

September 2021	Project No. 400022	Exhibit No. 6.2b

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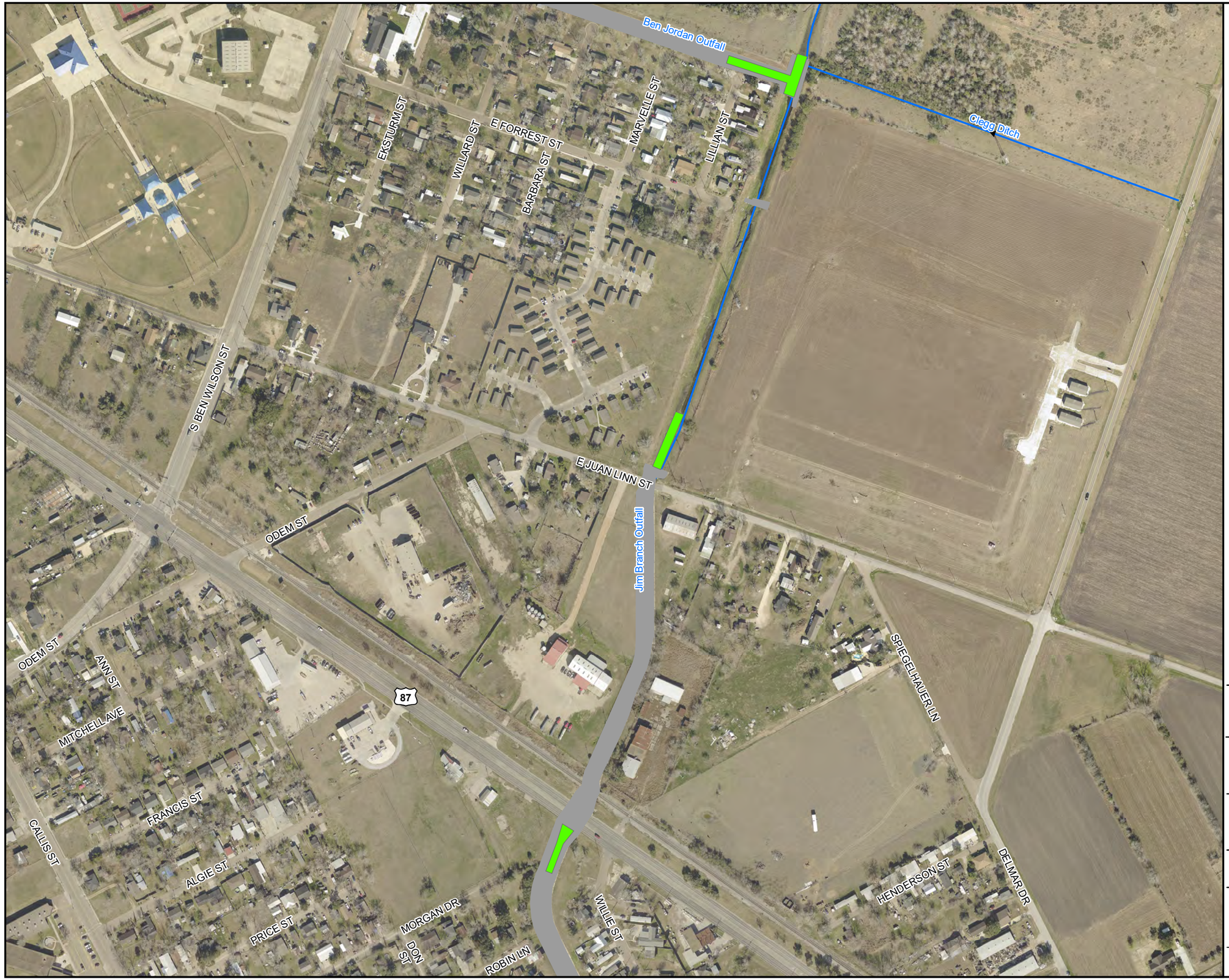

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 150 300

Aerial Source: City of Victoria 2020

N

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City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
Jim Branch Outfall

September 2021	Project No. 400022	Exhibit No. 6.2c

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Jim Branch3.mxd

LEGEND

- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit
- Open Channel
- Concrete Lined Section

N

0 100 200

Aerial Source: City of Victoria 2020

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Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures Jim Branch Outfall

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LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 150 300

N

Aerial Source: City of Victoria 2020

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Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures Lone Tree Creek

September 2021	Project No. 400022	Exhibit No. 6.3a

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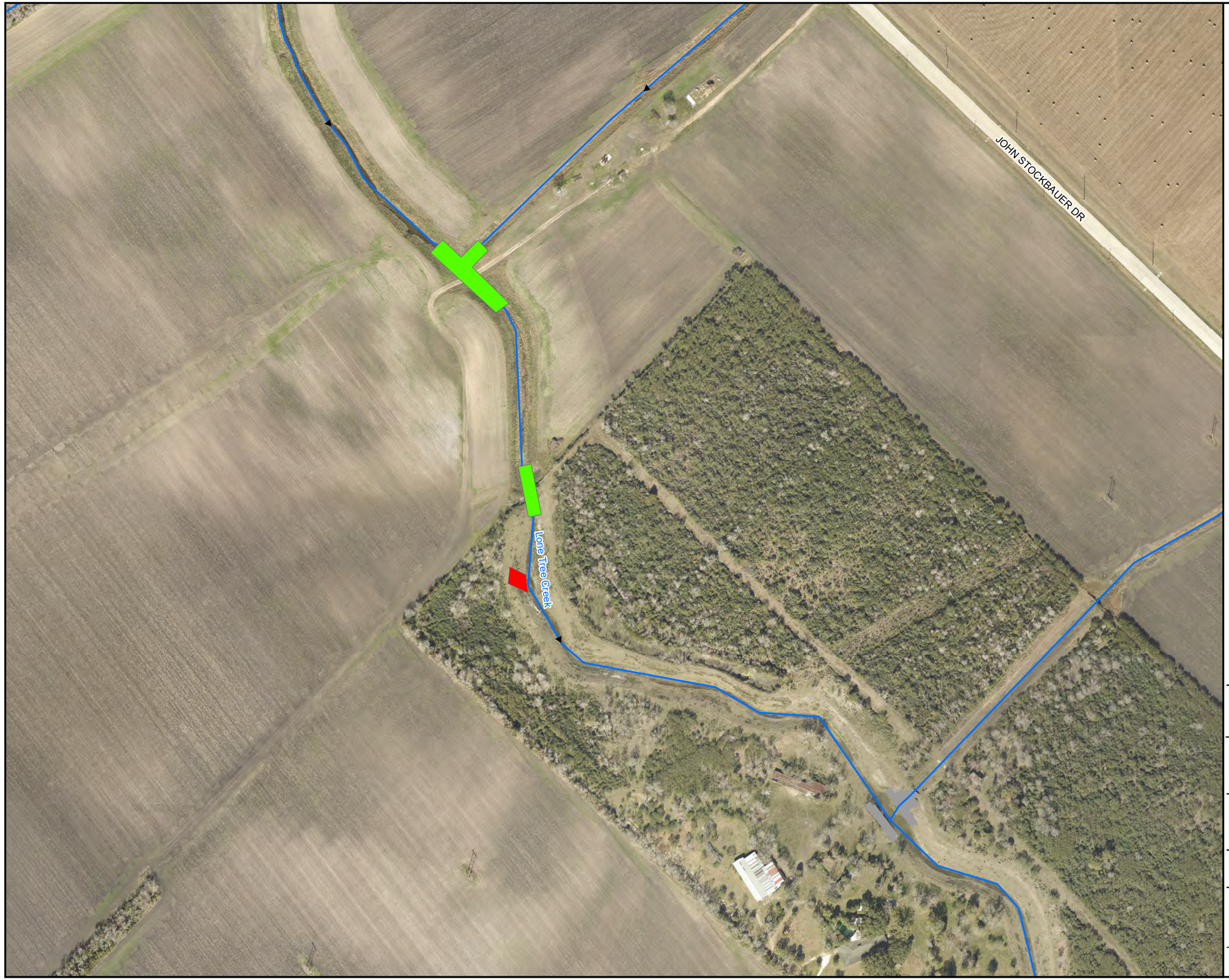

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 150 300

N

Aerial Source: City of Victoria 2020

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Erosion Control and Rip Rap Failures
Lone Tree Creek

September 2021	Project No. 400022	Exhibit No. 6.3b

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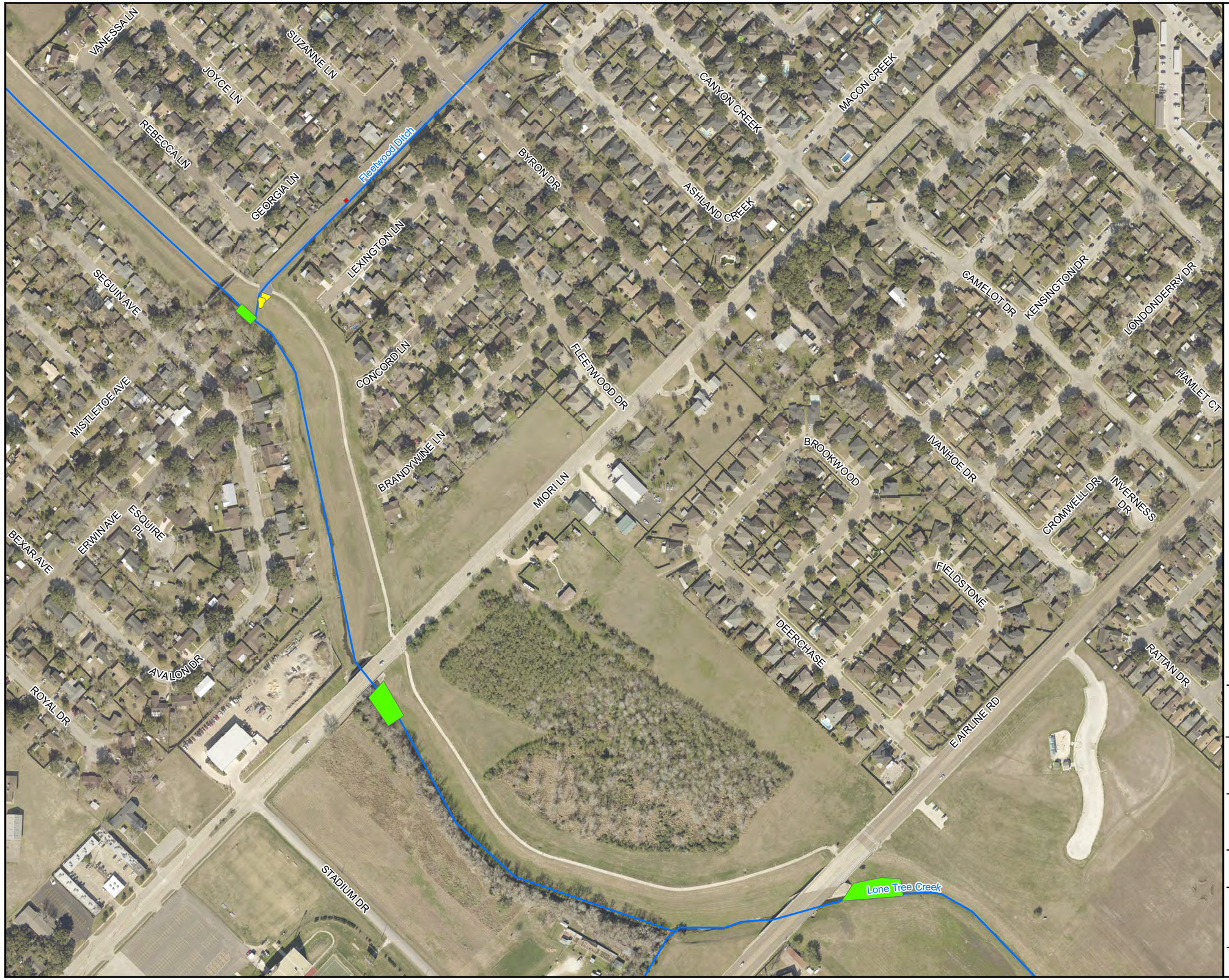

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 150 300

Aerial Source: City of Victoria 2020

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Erosion Control and Rip Rap Failures Lone Tree Creek

September 2021	Project No. 400022	Exhibit No. 6.3c

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Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Lone Tree Creek 3.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 50 100

Aerial Source: City of Victoria 2020

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Erosion Control and Rip Rap Failures
Lone Tree Creek

September 2021	Project No. 400022	Exhibit No. 6.3d

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Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Lone Tree Creek 4.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 25 50

N

Aerial Source: City of Victoria 2020

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Erosion Control and Rip Rap Failures
Lone Tree Creek

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LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 25 50

Aerial Source: City of Victoria 2020

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Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
North Outfall

September 2021	Project No. 400022	Exhibit No. 6.4a

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Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\North Outfall 1.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 25 50

Aerial Source: City of Victoria 2020

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Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
North Outfall

September 2021	Project No. 400022	Exhibit No. 6.4b

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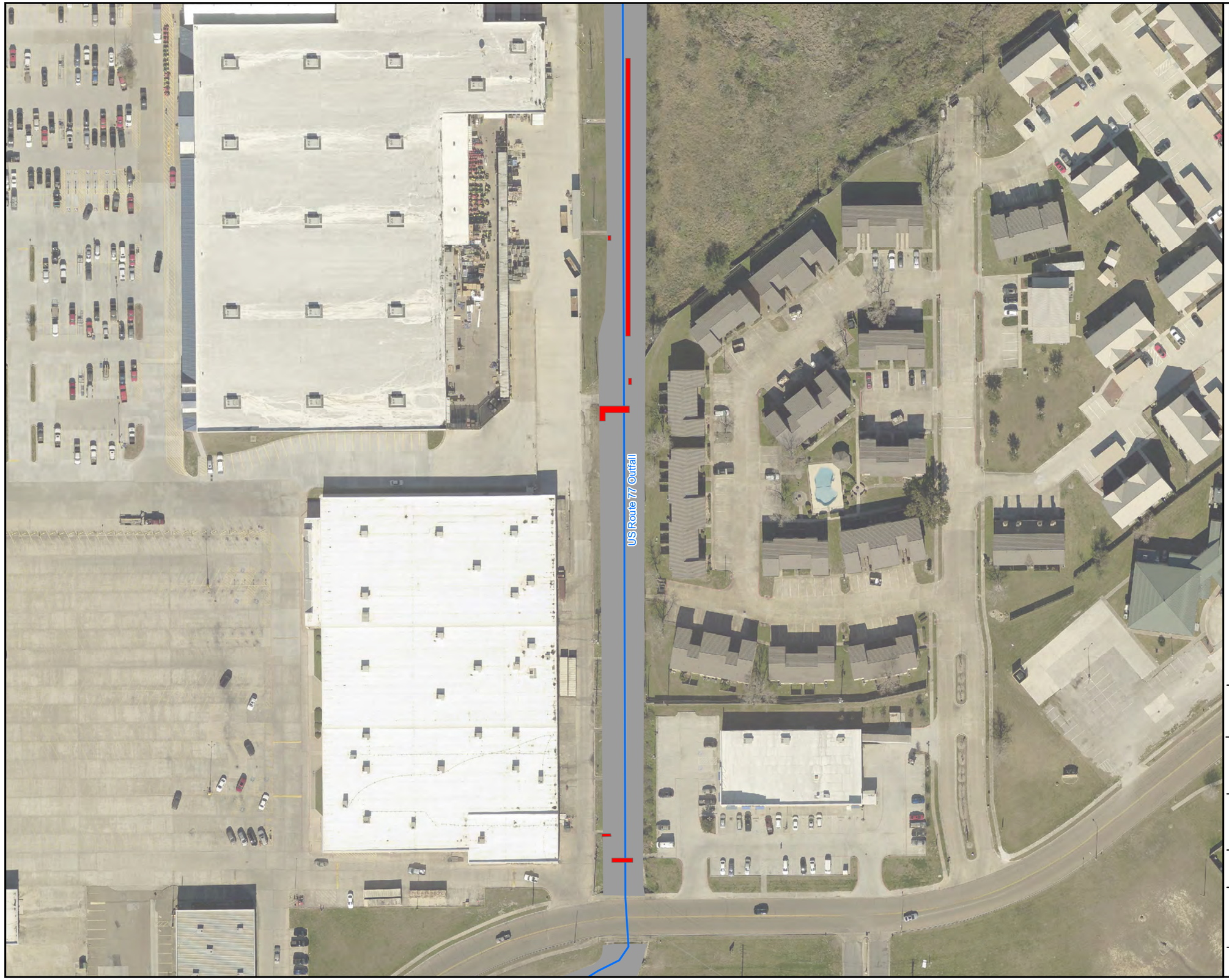

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 50 100

Aerial Source: City of Victoria 2020

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Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures North Outfall

September 2021	Project No. 400022	Exhibit No. 6.4c

User Name: ccotsakis
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LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 50 100

Aerial Source: City of Victoria 2020

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Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures North Outfall

September 2021	Project No. 400022	Exhibit No. 6.4d

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\North Outfall 4.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 50 100

N

Aerial Source: City of Victoria 2020

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City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures North Outfall

September 2021	Project No. 400022	Exhibit No. 6.4e

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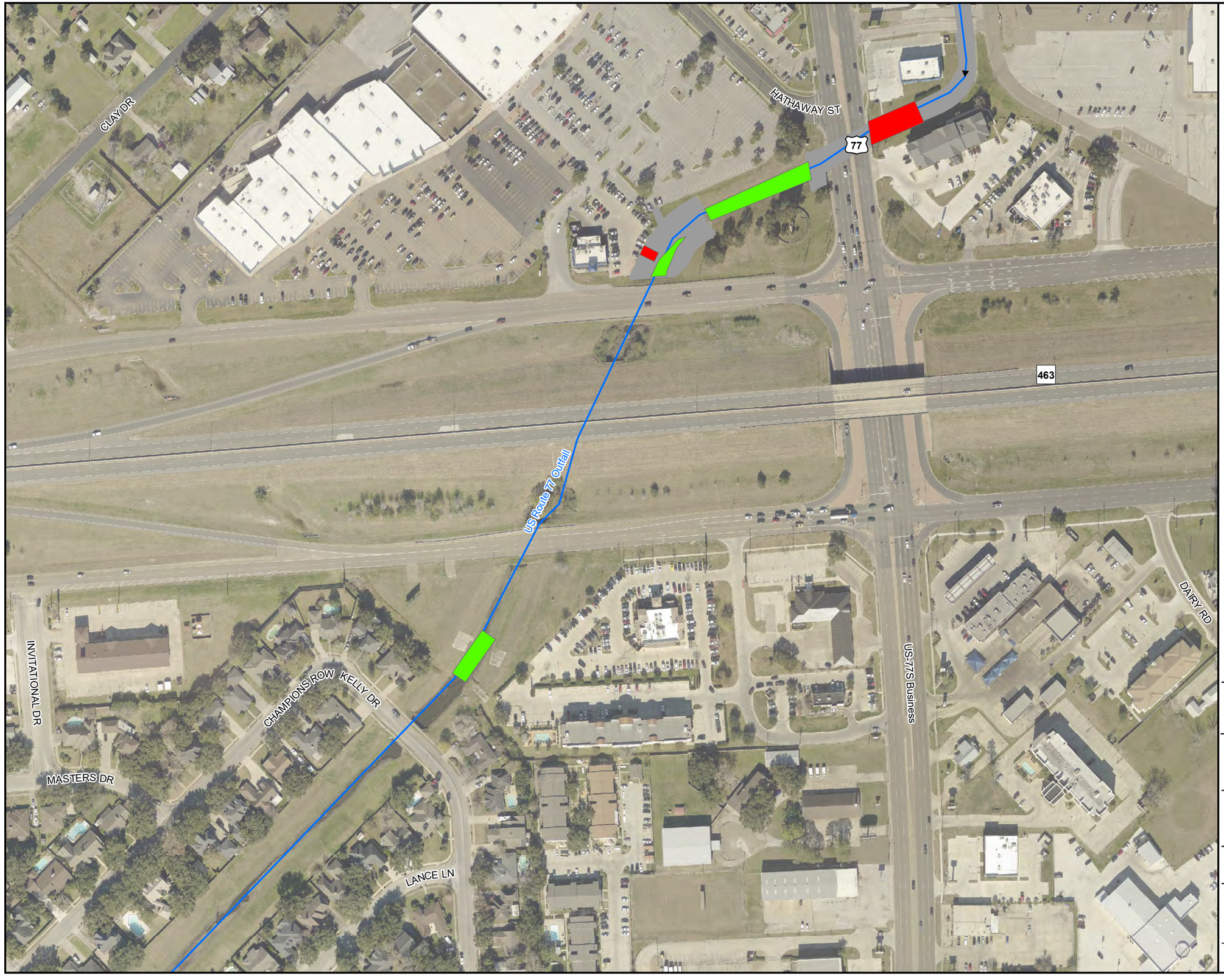

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 50 100

N

Aerial Source: City of Victoria 2020

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THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures North Outfall

September 2021	Project No. 400022	Exhibit No. 6.4f

User Name: ccotsakis
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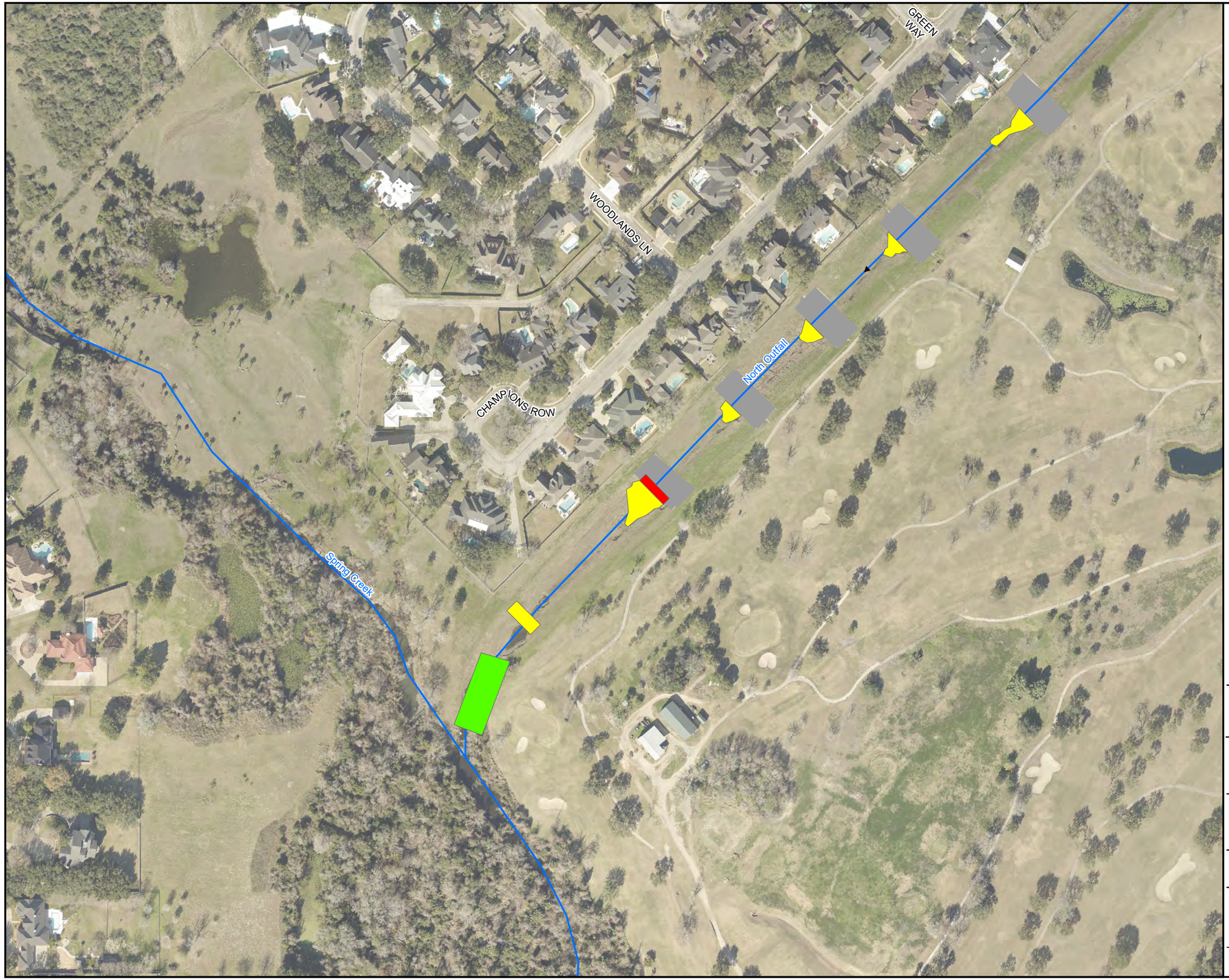

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 50 100

Aerial Source: City of Victoria 2020

CivilTech Engineering, Inc.
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THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
North Outfall

September 2021	Project No. 400022	Exhibit No. 6.4g

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\North Outfall 7.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 50 100

Aerial Source: City of Victoria 2020

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THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
Spring Creek

September 2021	Project No. 400022	Exhibit No. 6.5a

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Spring Creek 1.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 25 50

Aerial Source: City of Victoria 2020

CivilTech Engineering, Inc.
11821 Telge Rd
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THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
Spring Creek

September 2021	Project No. 400022	Exhibit No. 6.5b

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Spring Creek 2.mxd

LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 25 50

Aerial Source: City of Victoria 2020

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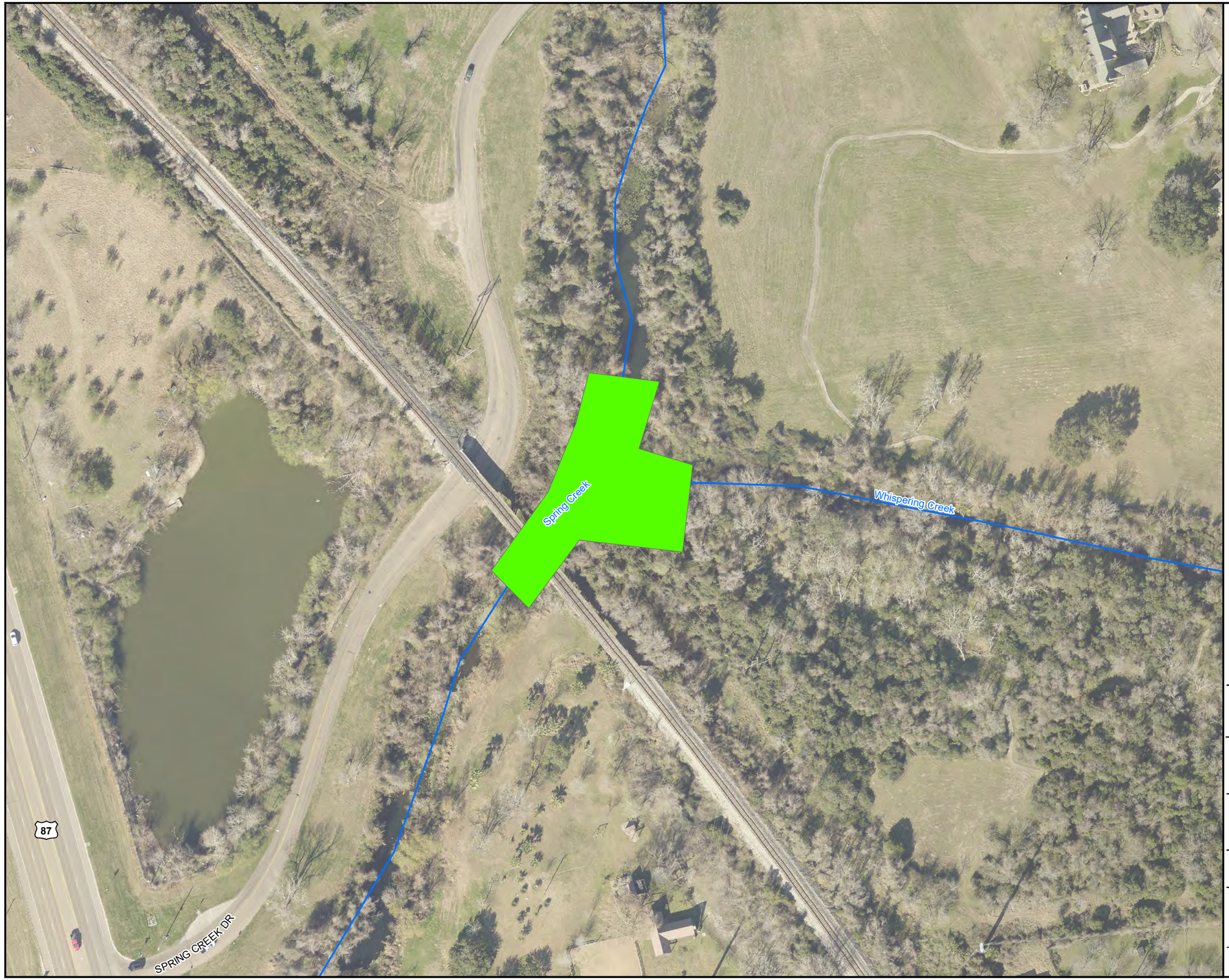
THE CITY OF VICTORIA TEXAS

City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
Spring Creek

September 2021	Project No. 400022	Exhibit No. 6.5c

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Spring Creek 3.mxd



LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 50 100

Aerial Source: City of Victoria 2020

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City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures Spring Creek

September 2021	Project No. 400022	Exhibit No. 6.5d

User Name: ccotsakis
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LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 50 100

N

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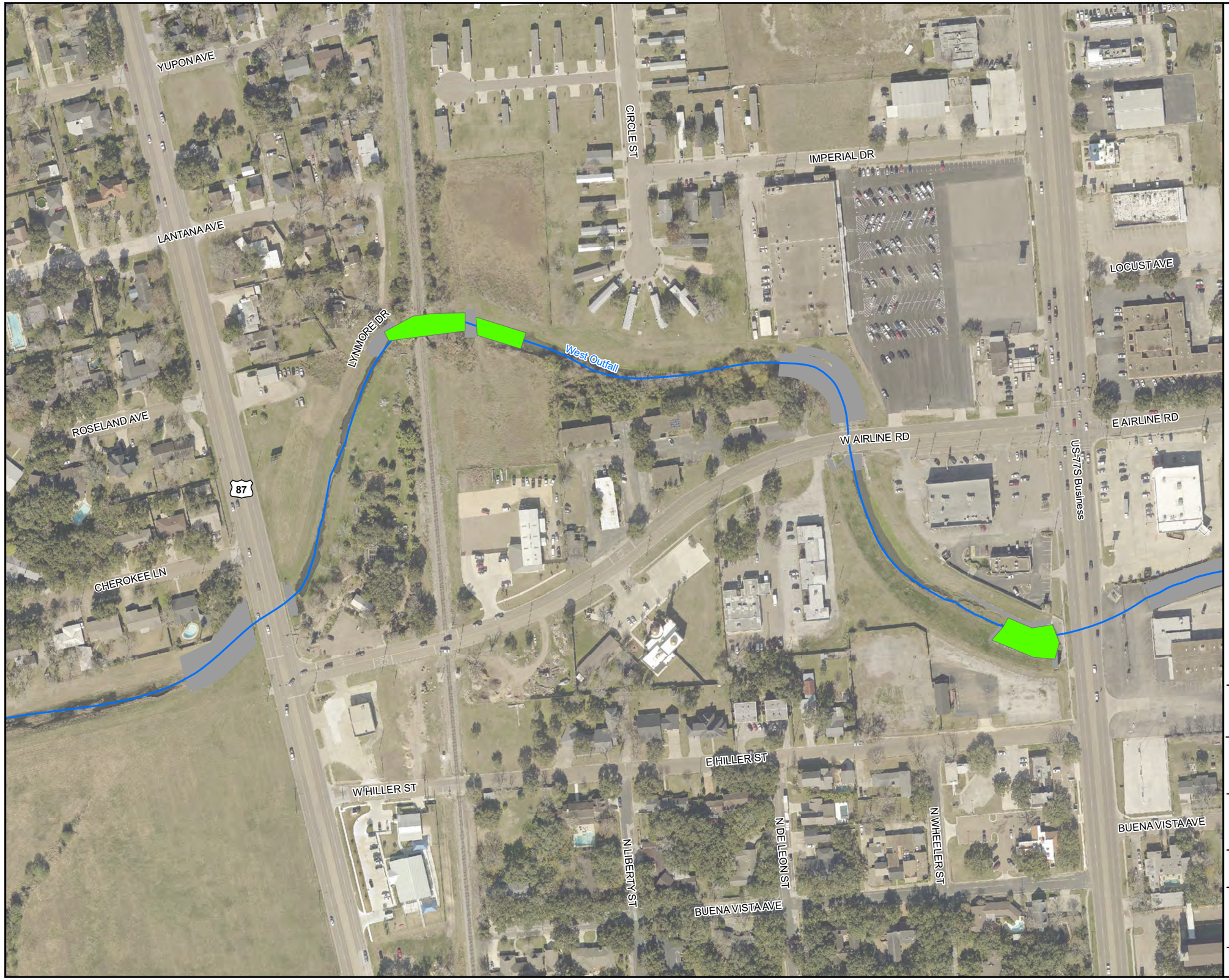
City of Victoria
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures
West Outfall

September 2021	Project No. 400022	Exhibit No. 6.6a

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\West Outfall 1.mxd



LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 100 200

N

Aerial Source: City of Victoria 2020

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Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures West Outfall

September 2021	Project No. 400022	Exhibit No. 6.6b

User Name: ccotsakis
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LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 100 200

N

Aerial Source: City of Victoria 2020

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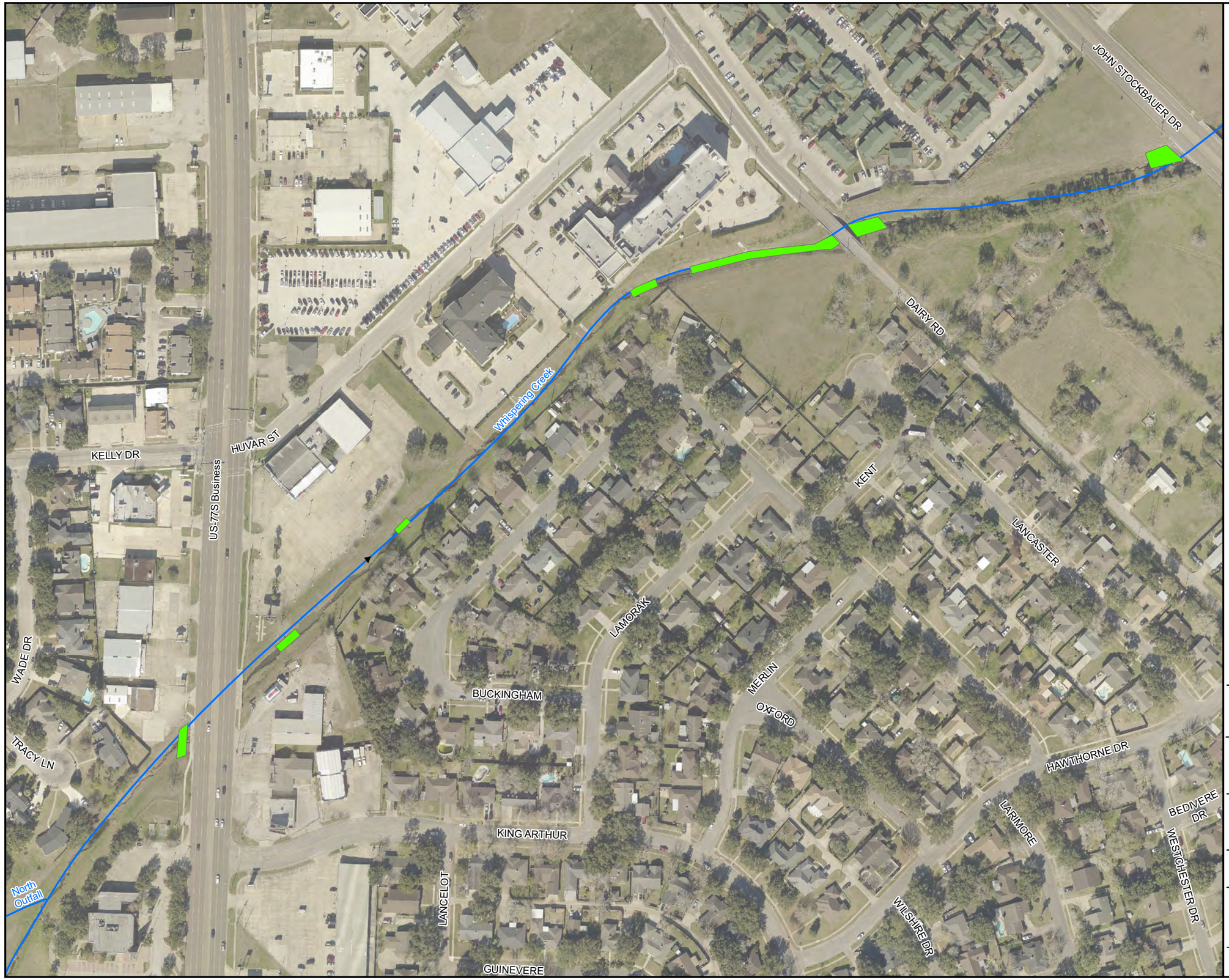
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures South Outfall

September 2021	Project No. 400022	Exhibit No. 6.7a

User Name: cootsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\South Outfall 1.mxd



LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 100 200

N

Aerial Source: City of Victoria 2020

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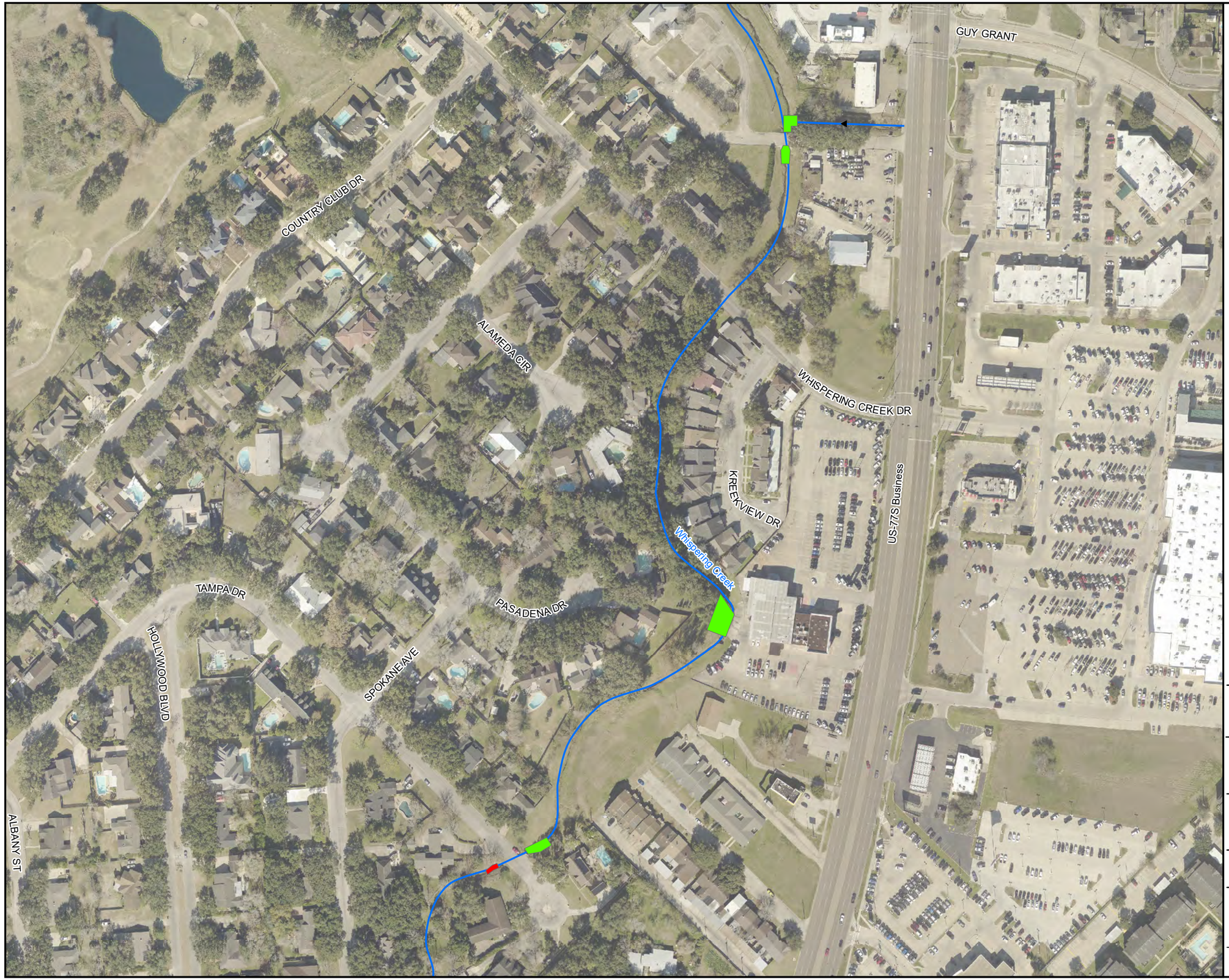
Storm Drainage Master Plan Update

Erosion Control and Rip Rap Failures Whispering Creek

September 2021	Project No. 400022	Exhibit No. 6.8a

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\South Outfall 1.mxd



LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

N

0 100 200

Aerial Source: City of Victoria 2020

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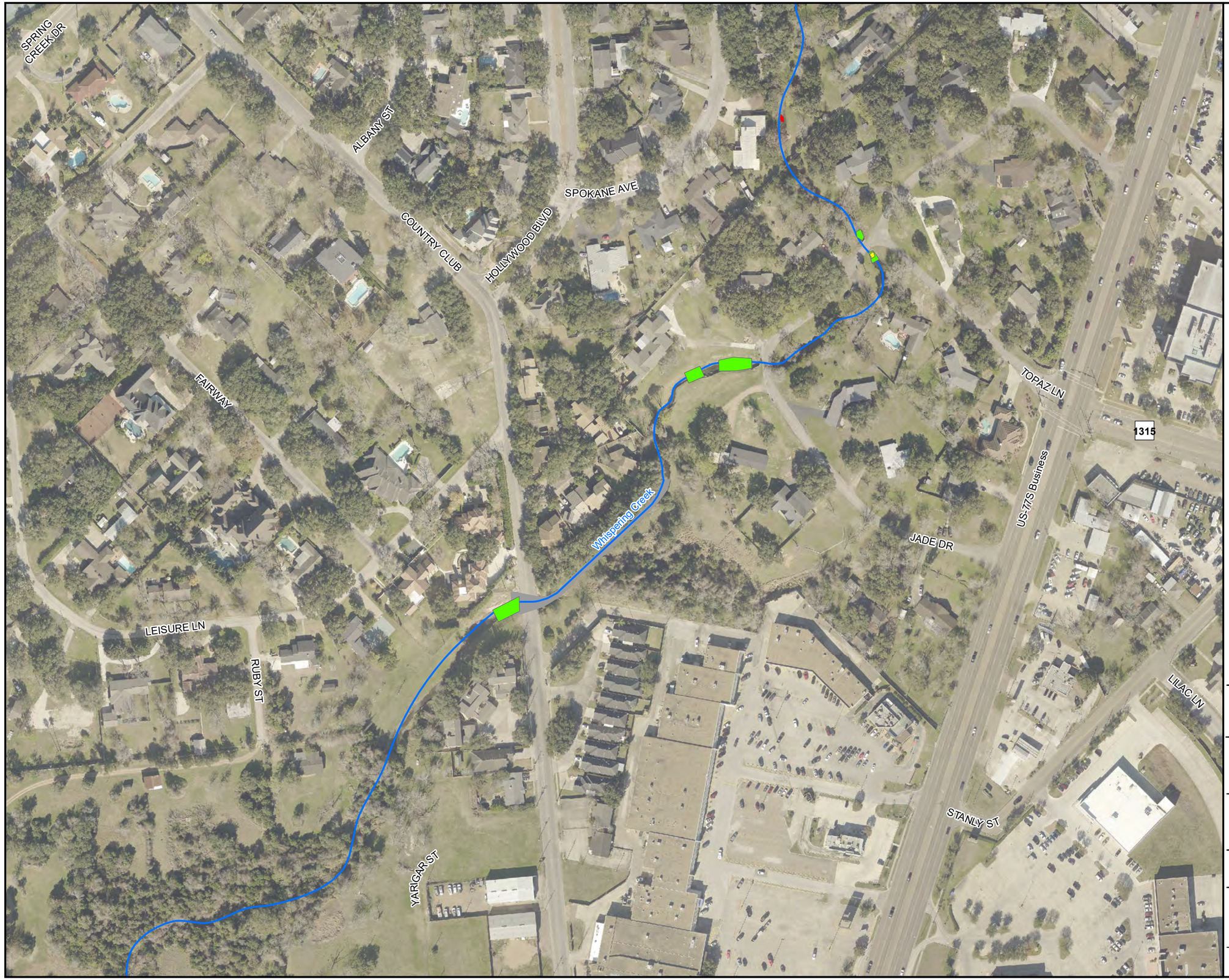
Erosion Control and Rip Rap Failures Whispering Creek

September 2021	Project No. 400022	Exhibit No. 6.8b

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Whispering Creek 2.mxd



LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 100 200

N

Aerial Source: City of Victoria 2020

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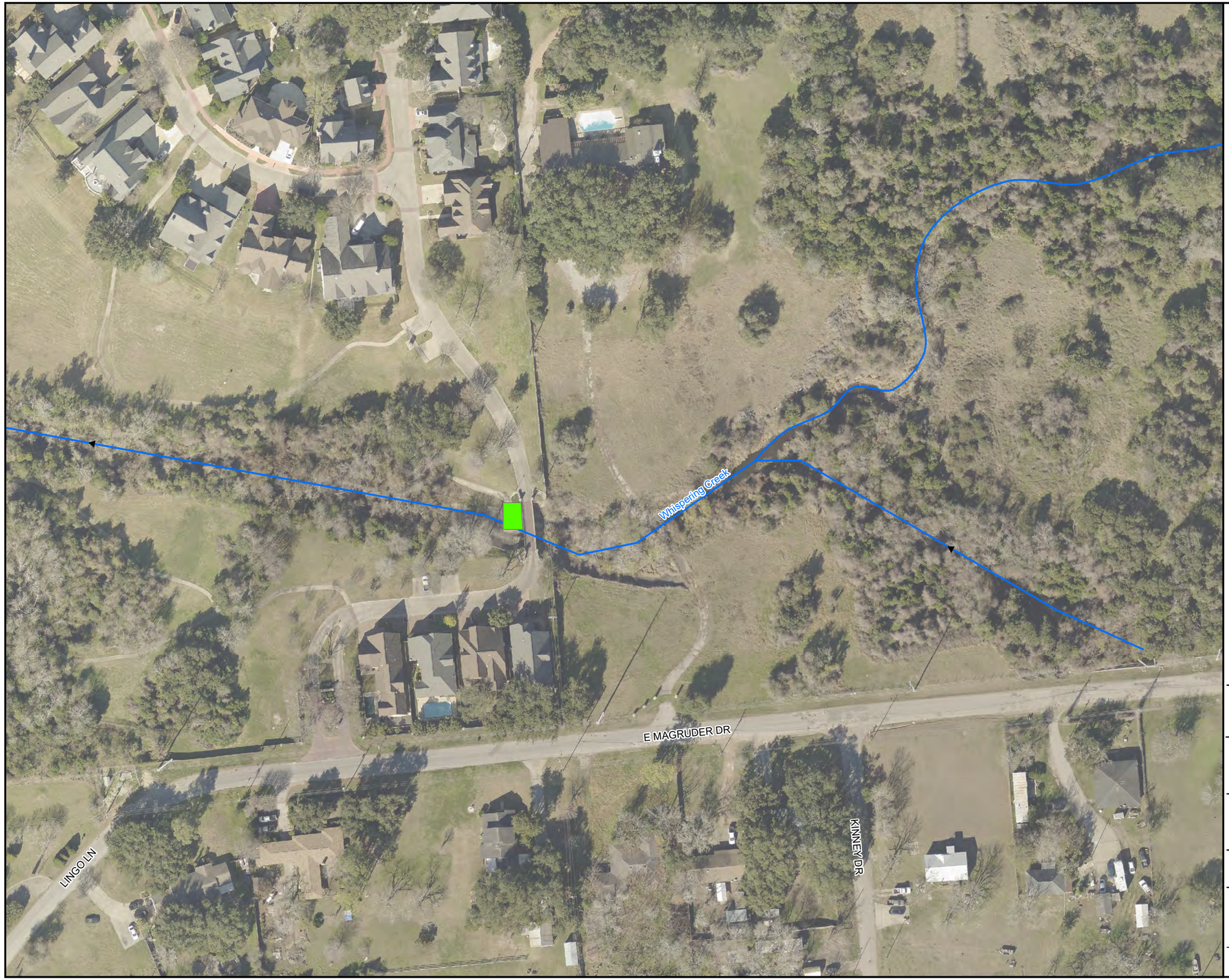
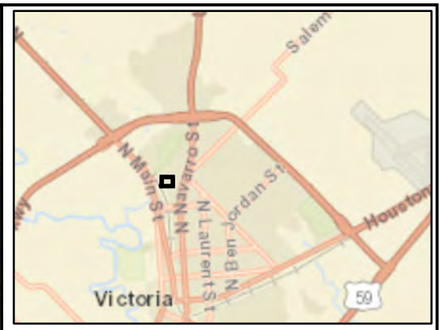
Erosion Control and Rip Rap Failures Whispering Creek

September 2021	Project No. 400022	Exhibit No. 6.8c

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Whispering Creek 3.mxd





LEGEND

- Open Channel
- Concrete Lined Section
- Concrete Lined Channel Failure
- Earthen Channel Failure
- Sediment Deposit

0 50 100

N

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Erosion Control and Rip Rap Failures
Whispering Creek

September 2021	Project No. 400022	Exhibit No. 6.8d

User Name: ccotsakis
Document Path: O:\2020\400022\GIS\Exhibits\Erosion Control Maps\Whispering Creek 4.mxd