



Southwest Engineers

Civil | Environmental | Land Development

OVERALL PRELIMINARY DRAINAGE REPORT

FOR

CITY OF LA VERNIA

Prepared For:

LA VERNIA MUNICIPAL DEVELOPMENT DISTRICT
207 W. CHIHUAHUA, SUITE 102
LA VERNIA, TEXAS 78121

Prepared By:

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APRIL 2022 – GG/PV
SWE Project #: 0200-032-22



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Overall Preliminary Drainage Report for the City of La Vernia

INTRODUCTION

Southwest Engineers, Inc. (SWE) has prepared this Overall Preliminary Drainage Report for the City of La Vernia in order to perform preliminary analyses of existing drainage ways, low-lying areas, and to identify problem areas that are either flooding or prone to flooding. By utilizing data provided by the City, data available through GIS & FEMA, and performing on-site investigations, SWE has identified five (5) problem areas that warrant attention. For each of the problem areas identified, SWE has provided recommendations and probable costs in order to alleviate current drainage issues.

In general, SWE recommends that Wilson County and SS WSC work with or notify La Vernia on future development in the 3 or 4 major watersheds that impact La Vernia to the south. Also, SWE recommends that the city require all development within its ETJ provide detention, especially if stormwater from the property flows into the city limits.

1. H-E-B

- a. Description: Within the frontage of the HEB located on Highway 87, there are 3 – 6' x 3' box culverts crossing Highway 87. During on-site investigations, it was observed that dirt and other debris has collected in these culverts, preventing them from flowing at full capacity. Flows from these culverts are then routed towards a concrete-lined channel which conveys flows around the store and parking lot, without providing detention. Downstream from the concrete-lined channel, stormwater continues through a section with brush and heavy vegetation before converging with another channel and passing through a culvert at FM 1346. Ponding was observed in the concrete-lined channel due to the brush obstructing the flow of stormwater downstream. It is our understanding that there are plans to expand the H-E-B building footprint and parking lot. There is existing 100-yr FEMA Floodplain both upstream and downstream of this location.
- b. Recommendation(s): Cleaning out the 3 – 6' x 3' culverts crossing Highway 87 will allow additional flow through the culvert and assist in reducing existing flooding conditions upstream. Brush should be cleared out downstream of the concrete-lined channel. Detention should be required for any improvements associated with the H-E-B expansion to prevent future flooding issues associated with additional impervious cover. Conversations should be had with City staff regarding the planned development to the south of Highway 87 (upstream from this location), which should be required to provide detention to prevent additional flooding issues. Based on preliminary analysis, it appears that the 3 – 6' x 3' box culverts may

be undersized. It is recommended that the City start a dialogue with the Texas Department of Transportation (TxDOT) about upgrading the culverts at this location.

While these improvements may assist in reducing existing flooding conditions, it is difficult to make recommendations when there is existing 100-yr FEMA Floodplain downstream. Please see the map in **Exhibit B** for reference.

- c. Probable Cost: \$16,400 (See **Exhibit C**)

2. CITY PARK/LA VERNIA ISD

- a. Description: There is a ± 300 -acre drainage area that is conveyed adjacent to La Vernia Primary & Intermediate Schools and through City Park. There are some existing drainage structures through this area, including 2 – 8' x 4' box culverts crossing FM 1346 S, 5 – 24" culverts crossing a private roadway by the school, and a low water crossing over San Antonio Rd. There is an existing water quality/detention pond on the La Vernia ISD property that has a 30" culvert outlet, but it has been observed that only a small amount of stormwater is detained by the pond.
- b. Recommendation(s): It is recommended that a 6'-wide concrete-bottom channel/sidewalk with earthen sides (graded 5:1) be constructed through this area to better define the flow path. It is also recommended that improvements be made to the outlet structure of the existing detention & water quality pond. The improved outlet structure should be able to control the outflow for lower intensity storms. Finally, the low water crossing at San Antonio Rd. should have gauge boards facing either direction if there are currently none. These recommendations complement the perforated piping and catch basin system that is being proposed to the east of the baseball fields. Please see the map in **Exhibit D** for reference.
- c. Probable Cost: \$430,900 (See **Exhibit E**)

3. HIGHWAY 87 CROSSING NEAR W. CHIHUAHUA

- a. Description: Downstream of Issue #2 (after the low water crossing at San Antonio Rd.), stormwater continues generally northeast through multiple properties, before crossing Highway 87 near W. Chihuahua. There are 3 – 6' x 3' box culverts crossing Highway 87 at this location. The length of the channel between the City Park and the Highway 87 crossing is ± 737 LF. During on-site investigations, there was brush and heavy vegetation observed through this channel which prevents the channel from flowing at full capacity. There was also scour/undermining observed at the upstream headwall at the Highway 87 crossing.

Downstream of the Highway 87 crossing, stormwater continues generally northeast through private property. However, there is a lack of a defined channel on the first property downstream of the crossing. A defined channel is apparent on the next property downstream. Most of the area that is related to this issue lies within the 100-yr FEMA Floodplain.

- b. Recommendation(s): It is recommended that the City acquire 25'-wide drainage easements between the low water crossing at San Antonio Rd. and the crossing at Highway 87 (about 737 LF), as well as around the property downstream of the Highway 87 crossing. These easements can be utilized to construct defined channels and clear brush that is obstructing the flow of stormwater. If a channel is constructed downstream of the Highway 87 crossing, fill will likely be required to fill in the existing channel (if any). It is also recommended that the scour/undermining at the headwall be fixed.

While these improvements may assist in reducing existing flooding conditions, it is difficult to make recommendations when there is existing 100-yr FEMA Floodplain downstream. Please refer to ***Exhibit F***.

- c. Probable Cost: \$147,700(See ***Exhibit G***)

4. WOODBRIDGE FARMS UNIT #2 DEVELOPMENT

- a. Description: Multiple sources have brought up flooding concerns within the Country Gardens subdivision. Directly upstream from flooding concerns is the Woodbridge Farms Unit #2 subdivision, which is in the process of being fully developed. Owners of neighboring properties have made complaints about more water coming onto their property since development began. During on-site investigations, observations included significant sediment within channels and pond areas, as well as erosion around headwall structures.
- b. Recommendation(s): Recommendations include for the developer to remove sediment from channels and culvert structures, and to repair erosion issues. A major sediment issue is caused by homebuilders not installing adequate erosion and sedimentation controls. This issue can be improved by creating or increasing requirements for erosion and sedimentation controls installed during the homebuilding phase. Complaints from neighbors about increased stormwater on their property could be related to the detention pond outlet structure not adequately detaining flows. Further study would need to be completed to determine the cause of any particular drainage issues. It is recommended that the developer of the Woodbridge Farms subdivision address these concerns.
- c. Probable Cost: It is recommended that costs be borne by the developer.

5. **HIGHWAY 87 CROSSINGS & CR 342 CROSSING**

- a. Description: There are two culverts crossing Highway 87 on either side of Wiseman Lane. On the north side, there are 2 – 6' x 3' culverts; on the south side, there are 3 – 6' x 3' culverts. Upstream of the culverts on the northern side, there is a low-lying area that lacks a defined channel. Downstream of the culverts, stormwater is then conveyed towards the east onto private property (between Highway 87 and CR 342). Stormwater from the culverts on the northern side is conveyed east through what appears to be the resemblance of a channel. However, stormwater from the southern side flows east across a field with no defined channel. Flows from both sides eventually converge and are conveyed under CR 342 through a 12' x 5' culvert which is outside of the city limits. Most of the area concerned with this issue lies within the 100-yr FEMA Floodplain.
- b. Recommendation(s): It is recommended that the City acquire drainage easements in the area upstream of the Highway 87 crossings, as well as the area between the crossings at Highway 87 and the crossing at CR 342. Easement acquisition would allow for the construction of a defined channel through these sections. For the area upstream of the Highway 87 crossing, it is recommended that a 6'-wide concrete-bottom channel/sidewalk with earthen sides (graded 5:1) be constructed through this area to better define the flow path. Based on preliminary analyses using Atlas 14 rainfall data, it appears the culverts at both Highway 87 crossings may be undersized. It is recommended that the City start a dialogue with the Texas Department of Transportation (TxDOT) about upgrading the culverts at both of these locations.

In addition, the culvert at CR 342 is also undersized. Calculations show that peak flows at this location are equal to $\pm 1,600$ cfs for the 2-yr storm event, and $\pm 9,400$ cfs for the 100-yr storm event. A significant structure or bridge would be required to have the capacity to handle these flows. Further analysis and discussions with the county would be required before constructing improvements at this location; therefore, no cost estimate has been provided regarding this improvement.

While these improvements may assist in reducing existing flooding conditions, it is difficult to make recommendations when there is existing 100-yr FEMA Floodplain downstream. Please refer to ***Exhibit H***.

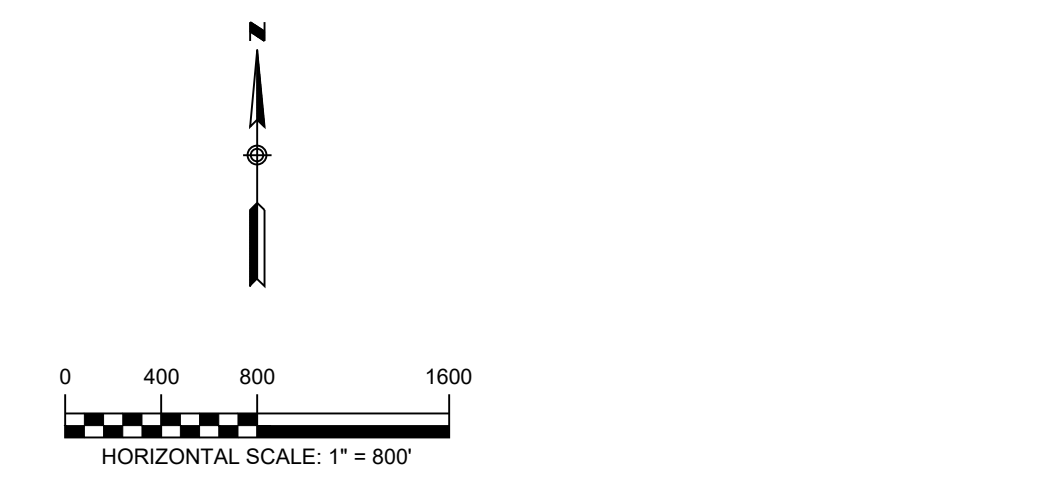
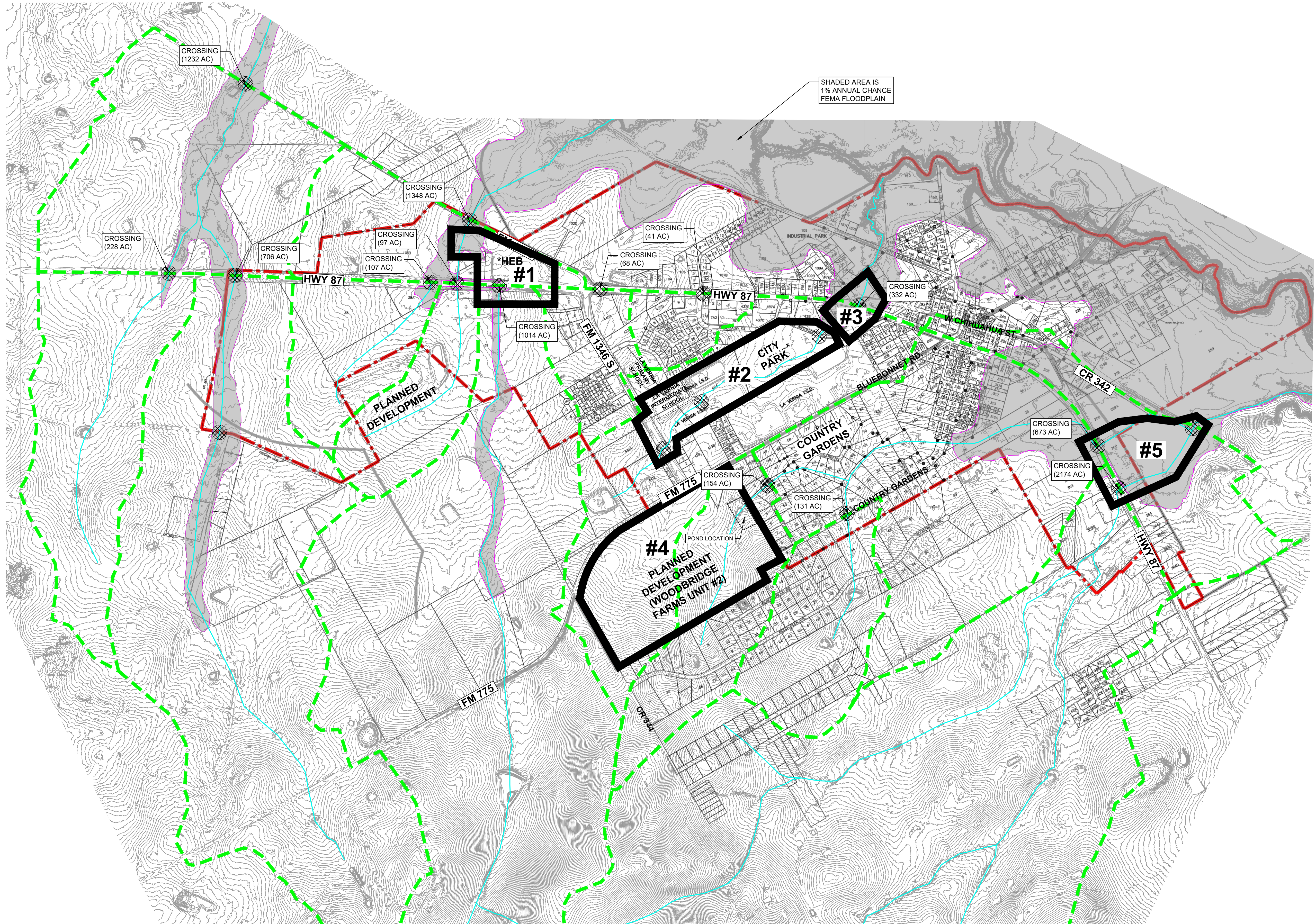
- c. Probable Cost: \$513,400 (See ***Exhibit I***)



EXHIBIT A

OVERALL DRAINAGE AREA MAP

C:\CompanyData\GIS\Projects\0200-La Vernia City\0200-032-22 - Master Drainage Study\CAD\City of La Vernia Exhibit A - City Mapping - Layout1 - Exhibit.glt - Tue, Apr 05, 2022, 4:17pm, By: C1038, Owner



LEGEND	
	CITY LIMITS
	ISSUE AREA
	PROPERTY BOUNDARIES
	EXISTING 2-FT CONTOURS
	CHANNEL CENTERLINE
	DRAINAGE AREA BOUNDARY
	MAJOR CULVERT/CROSSING
	100-YR FEMA FLOODPLAIN

DRAINAGE AREAS CONTINUE
CUT-OFF FOR MAP READABILITY

Southwest Engineers

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EXHIBIT A - OVERALL DRAINAGE AREA MAP

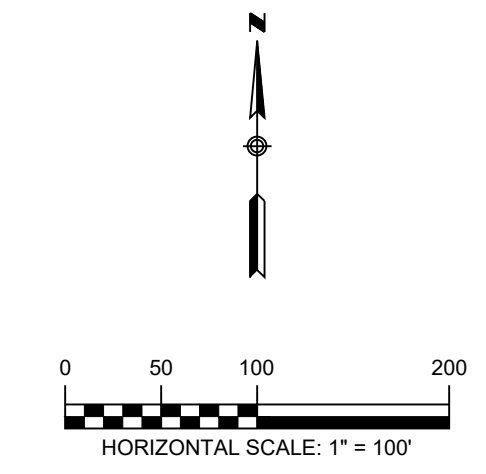
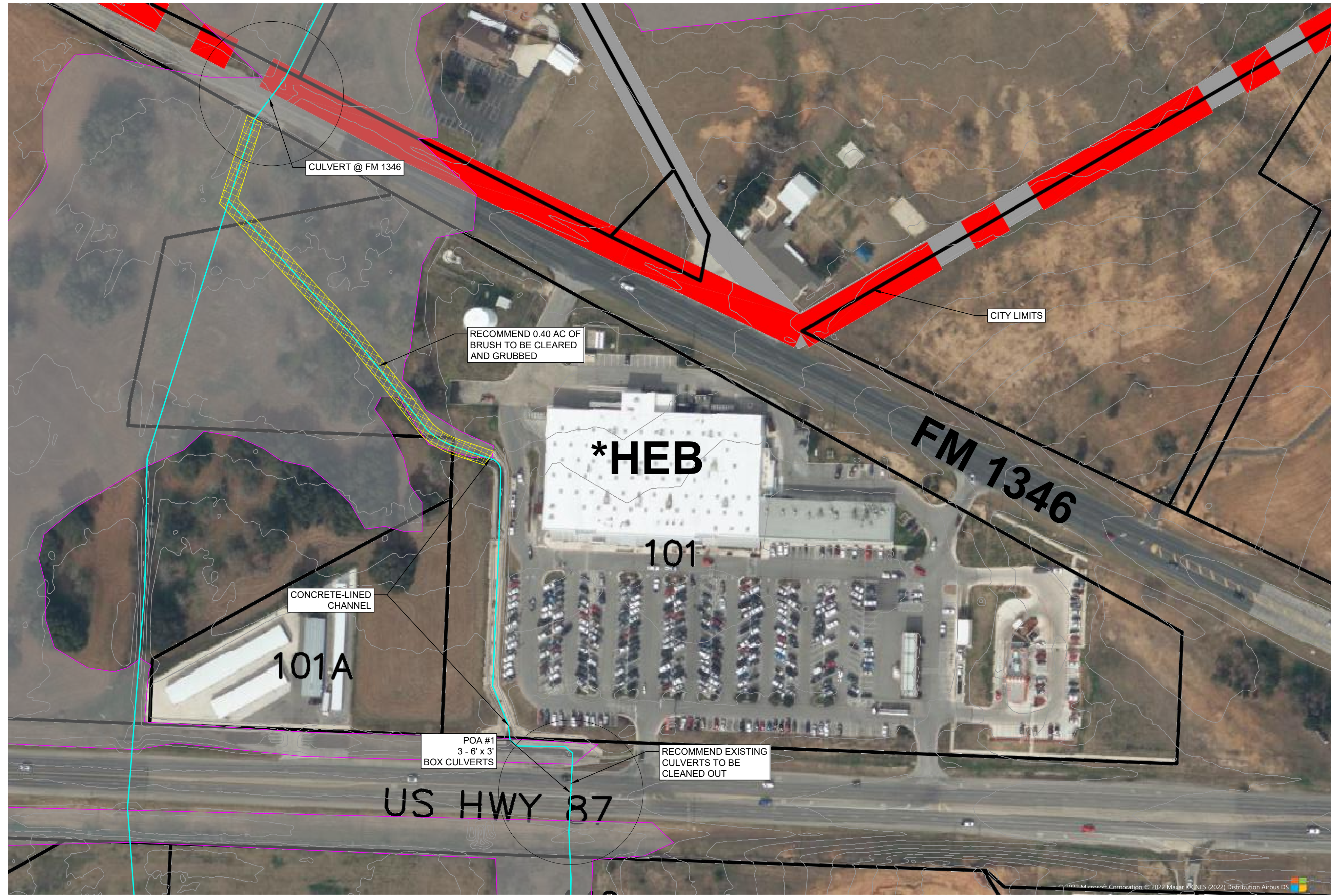
CITY OF LA VERNIA

WARNING	
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DATE:	04/05/2022
FILE:	EXHIBIT
DRAWN BY:	GG
PROJECT NO.:	0200-032-22



EXHIBIT B

ISSUE #1 (H-E-B) - MAP



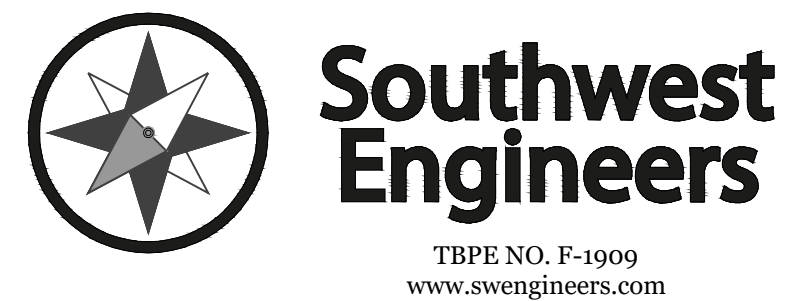
LEGEND	
	CITY LIMITS
	PROPERTY BOUNDARIES
	EXISTING 2-FT CONTOURS
	CHANNEL CENTERLINE
	CLEARING & GRUBBING AREA
	100-YR FEMA FLOODPLAIN
	POA POINT OF ANALYSIS

TIME OF CONCENTRATION

DRAINAGE AREA	SHEET FLOW			SHALLOW CONCENTRATED FLOW				CHANNEL FLOW (GUTTER)			
	SLOPE (FT/FT)	L (FT)	n	SLOPE (FT/FT)	L (FT)	Paved? Y or N	Tc Shallow (MIN.)	Vavg (FT/S)	L (FT)	Tc Shallow (MIN.)	Total Tc (MIN.)
POA #1 - HWY 87 XING	0.015	100	0.24	0.038	869	N	4.6	6.00	15903	44.18	63.0

HYDROLOGIC SUMMARY TABLE (SCS METHOD)	
Area Name	POA #1 HWY 87 CROSSING
Drainage Area (ac)	1014
CN #	68
% Imperv.	20
Tc (hrs)	1.050
Lag Time (hrs)	0.63
2 year Discharge (cfs)	615
10 year Discharge (cfs)	1541
25 year Discharge (cfs)	2258
100 year Discharge (cfs)	3540

* Part of the SCS Design Calculations shown are derived from existing conditions assumptions using available graphical computer programs (Google Earth, Google Maps, TNRS GIS Information) for what would be considered current developed conditions.
 ** All drainage calculations utilize Atlas 14 rainfall data



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EXHIBIT B - ISSUE #1 (H-E-B) - MAP

CITY OF LA VERNIA

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C:\CompanyData\Clients\0200-La Vernia City\0200-032-22 - Master Drainage Study\0303\City of La Vernia Exhibit B - HEB.dwg - Layout: "Exhibit #1" - Tue, Apr 05, 2022, 5:21pm, By: CIO38 - Grant G



EXHIBIT C

ISSUE #1 (H-E-B) – COST ESTIMATE



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City of La Vernia - Drainage Improvement Recommendations
La Vernia, TX
Issue #1 - H-E-B
Preliminary Cost Estimate
April 2022

Item #	Item	Quantity	Unit	Unit Cost	Cost
1	Clearing and Grubbing	0.40	ac	\$ 6,000	\$ 2,400
2	Clean Existing Culvert	3	ea	\$ 2,000	\$ 6,000
3	Revegetation	1,954	sy	\$ 3	\$ 5,862
OPINION OF PROBABLE CONSTRUCTION COST					\$ 14,262
CONTINGENCY (15%)					\$ 2,138
TOTAL OPINION OF PROBABLE COST					\$ 16,400

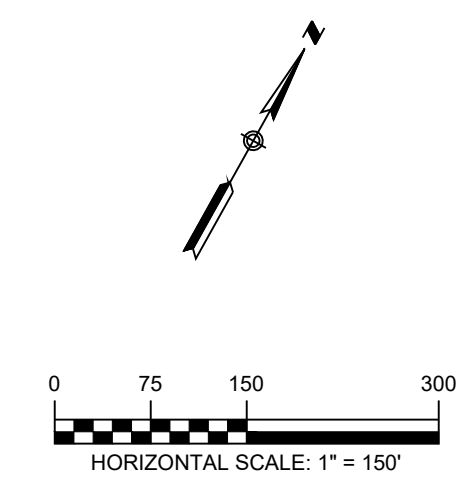
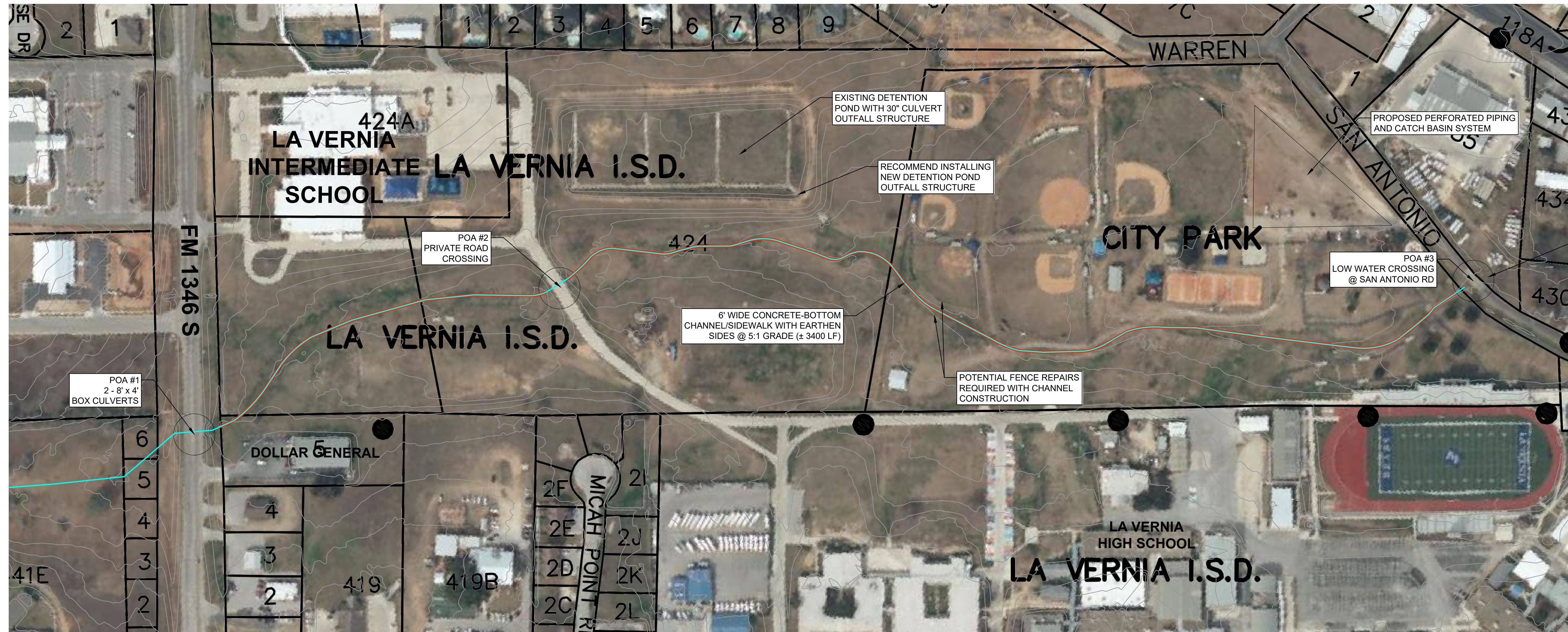
This opinion of probable construction cost represent best judgment as a design professional familiar with the Construction Industry and based on opinions and evaluations of current market rates for labor, materials and equipment. It is based on the understanding of the project at the time of its creation only. There is no warranty that any construction bid will not vary from this opinion.

STATE OF TEXAS
PAUL J. VIKTORIN
66879
LICENSED PROFESSIONAL ENGINEER
4/6/22



EXHIBIT D

ISSUE #2 (CITY PARK/LA VERNIA ISD) - MAP



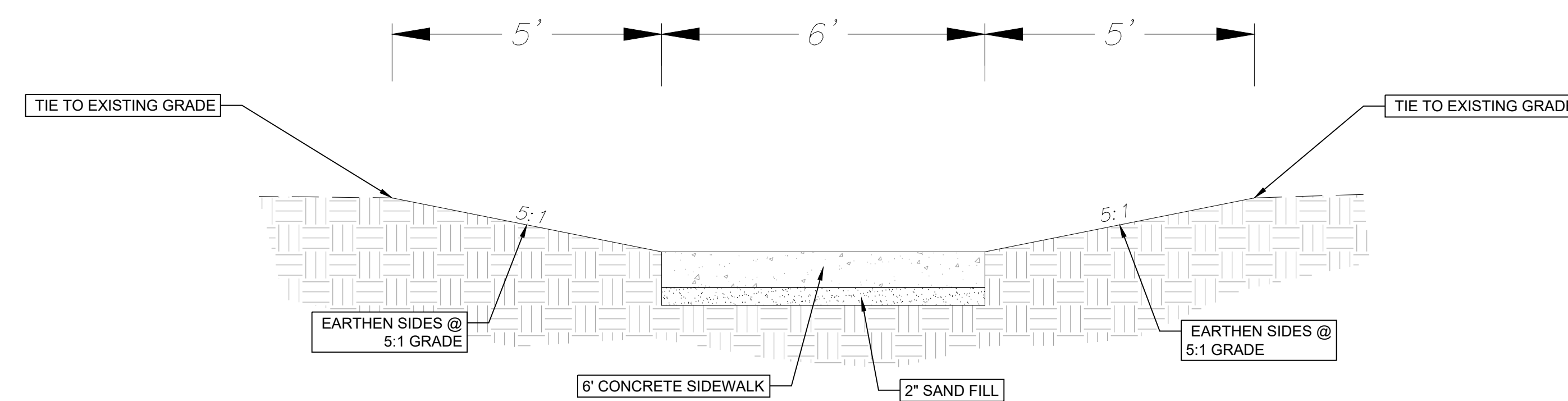
SEE ISSUE #3 FOR CONTINUATION

LEGEND	
	CITY LIMITS
	PROPERTY BOUNDARIES
	EXISTING 2-FT CONTOURS
	CHANNEL CENTERLINE
	PROPOSED CHANNEL BOTTOM/SIDEWALK
	POA POINT OF ANALYSIS

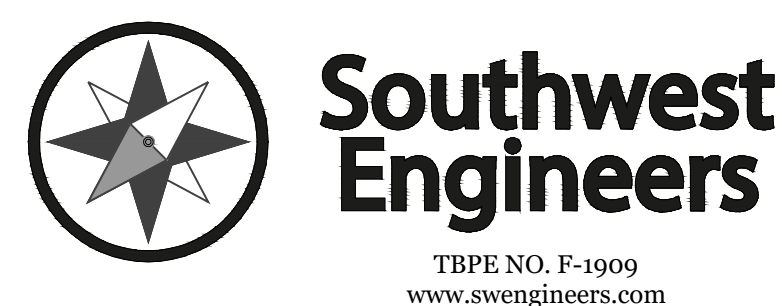
DRAINAGE AREA	SHEET FLOW			SHALLOW CONCENTRATED FLOW				CHANNEL FLOW (GUTTER)			
	SLOPE (FT/FT)	L (FT)	n	SLOPE (FT/FT)	L (FT)	Paved? Y or N	Tc Shallow (MIN.)	Vavg (FT/S)	L	Tc Shallow (MIN.)	Total Tc (MIN.)
POA #1 - FM 1346 XING	0.025	100	0.24	0.025	1453	N	9.5	5.00	1920	6.40	27.5
POA #2 - PRIVATE RD XING	0.025	100	0.24	0.025	1453	N	9.5	5.00	2922	9.74	30.8
POA #3 - LOW WATER XING	0.025	100	0.24	0.025	1453	N	9.5	5.00	5318	17.73	38.8

HYDROLOGIC SUMMARY TABLE (SCS METHOD)			
Area Name	POA #1 FM 1346 CROSSING	POA #2 PRIVATE RD CROSSING	POA #3 LOW WATER CROSSING (@ SAN ANTONIO RD)
Drainage Area (ac)	154	176	287
CN #	70	70	70
% Imperv.	30	30	30
Tc (hrs)	0.458	0.514	0.647
Lag Time (hrs)	0.27	0.31	0.39
2 year Discharge (cfs)	174	188	266
10 year Discharge (cfs)	408	436	624
25 year Discharge (cfs)	582	624	897
100 year Discharge (cfs)	883	953	1375

* Part of the SCS Design Calculations shown are derived from existing conditions assumptions using available graphical computer programs (Google Earth, Google Maps, TNRS GIS Information) for what would be considered current developed conditions.
 ** All drainage calculations utilize Atlas 14 rainfall data.



CONCRETE-BOTTOM CHANNEL/SIDEWALK DETAIL
N.T.S



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EXHIBIT D - ISSUE #2 (CITY PARK/LA VERNIA ISD) MAP

CITY OF LA VERNIA

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 PROJECT NO.: 0200-032-22

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EXHIBIT E

ISSUE #2 (CITY PARK/LA VERNIA ISD) – COST ESTIMATE

City of La Vernia - Drainage Improvement Recommendations
 La Vernia, TX
 Issue #2 - City Park/La Vernia ISD
 Preliminary Cost Estimate
 April 2022

Item #	Item	Quantity	Unit	Unit Cost	Cost
1	Clearing and Grubbing	1.25	ac	\$ 6,000	\$ 7,500
2	Earthwork for Channel	3,400	lf	\$ 20	\$ 68,000
3	6' Concrete Channel Bottom/Sidewalk	20,400	sf	\$ 10	\$ 204,000
4	Embankment/Fill	630	cy	\$ 12	\$ 7,560
5	Upgrade Existing Pond Outfall Structure	1	ea	\$ 50,000	\$ 50,000
6	Fence Repair	1	ls	\$ 2,000	\$ 2,000
7	Revegetation	1,889	sy	\$ 3	\$ 5,667

OPINION OF PROBABLE CONSTRUCTION COST \$ 344,727
ENGINEERING & CONTINGENCY (25%) \$ 86,173
TOTAL OPINION OF PROBABLE COST \$ 430,900

This opinion of probable construction cost represent best judgment as a design professional familiar with the Construction Industry and based on opinions and evaluations of current market rates for labor, materials and equipment. It is based on the understanding of the project at the time of its creation only. There is no warranty that any construction bid will not vary from this opinion.

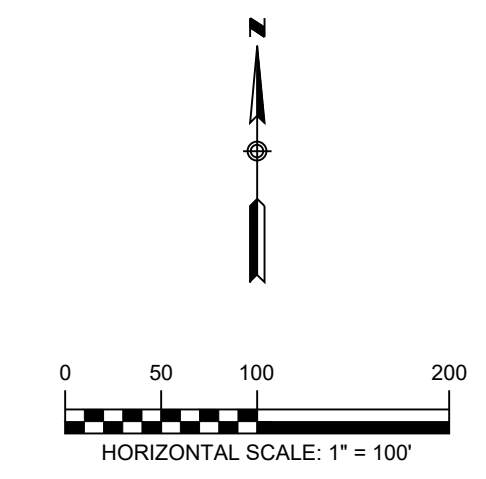
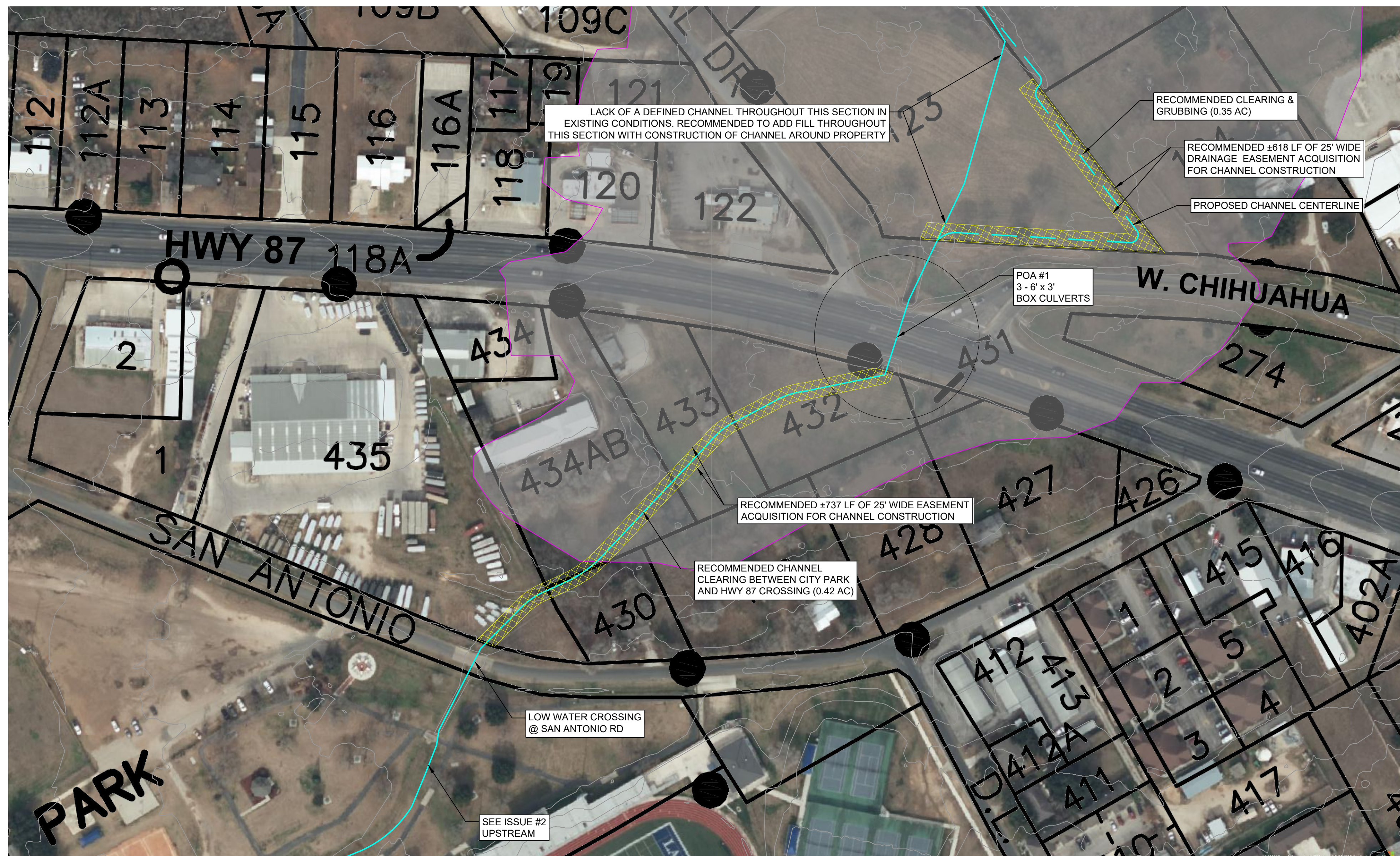


STATE OF TEXAS
 PAUL J. VIKTORIN
 66879
 LICENSED PROFESSIONAL ENGINEER
 4/6/22



EXHIBIT F

ISSUE #3 (HIGHWAY 87 CROSSING NEAR W. CHIHUAHUA) - MAP



LEGEND	
	CITY LIMITS
	PROPERTY BOUNDARIES
	EXISTING 2-FT CONTOURS
	EXISTING CHANNEL CENTERLINE
	PROPOSED CHANNEL CENTERLINE
	EASEMENT / CLEARING & GRUBBING AREA
	100-YR FEMA FLOODPLAIN
	POA POINT OF ANALYSIS

TIME OF CONCENTRATION

DRAINAGE AREA	SHEET FLOW				SHALLOW CONCENTRATED FLOW				CHANNEL FLOW (GUTTER)			
	SLOPE (FT/FT)	L (FT)	n	Tc sheet (MIN.)	SLOPE (FT/FT)	L (FT)	Paved? Y or N	Tc Shallow (MIN.)	Vavg (FT/S)	L (FT)	Tc Shallow (MIN.)	Total Tc (MIN.)
POA #1 - HWY 87 XING	0.025	100	0.24	11.6	0.025	1453	N	9.5	5.00	6136	20.45	41.5

HYDROLOGIC SUMMARY TABLE (SCS METHOD)

Area Name	POA #1 HWY 87 CROSSING
Drainage Area (ac)	332
CN #	70
% Imperv.	30
Tc (hrs)	0.691
Lag Time (hrs)	0.41
2 year Discharge (cfs)	296
10 year Discharge (cfs)	694
25 year Discharge (cfs)	998
100 year Discharge (cfs)	1529

* Part of the SCS Design Calculations shown are derived from existing conditions assumptions using available graphical computer programs (Google Earth, Google Maps, TNRS GIS Information) for what would be considered current developed conditions.
 ** All drainage calculations utilize Atlas 14 rainfall data.

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EXHIBIT F - ISSUE #3 (HWY 87 CROSSING NEAR W. CHIHUAHUA) - MAP

CITY OF LA VERNIA

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EXHIBIT G

ISSUE #3 (HIGHWAY 87 CROSSING NEAR W. CHIHUAHUA) – COST ESTIMATE



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City of La Vernia - Drainage Improvement Recommendations
La Vernia, TX
Issue #3 - Highway 87 Crossing near W. Chihuahua
Preliminary Cost Estimate
April 2022

Item #	Item	Quantity	Unit	Unit Cost	Cost
1	Clearing and Grubbing	0.77	ac	\$ 6,000	\$ 4,620
2	Easement Acquisition	1,355	lf	\$ 20	\$ 27,100
3	Earthwork for Channel	1,355	lf	\$ 20	\$ 27,100
4	Clean Existing Culvert	3	ea	\$ 2,000	\$ 6,000
5	Embankment/Fill	598	cy	\$ 12	\$ 7,176
6	Repair Existing Headwall Scour/Undermining	1	ls	\$ 35,000	\$ 35,000
7	Revegetation	3,727	sy	\$ 3	\$ 11,181

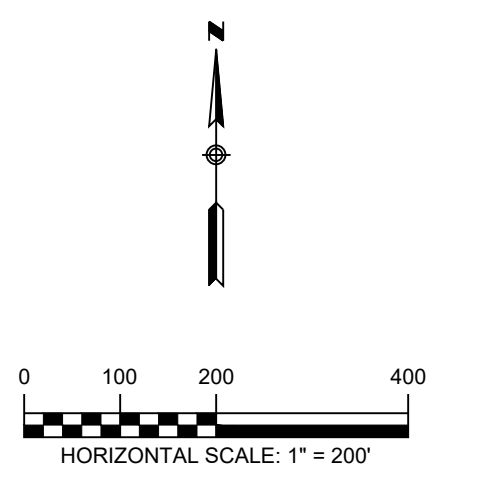
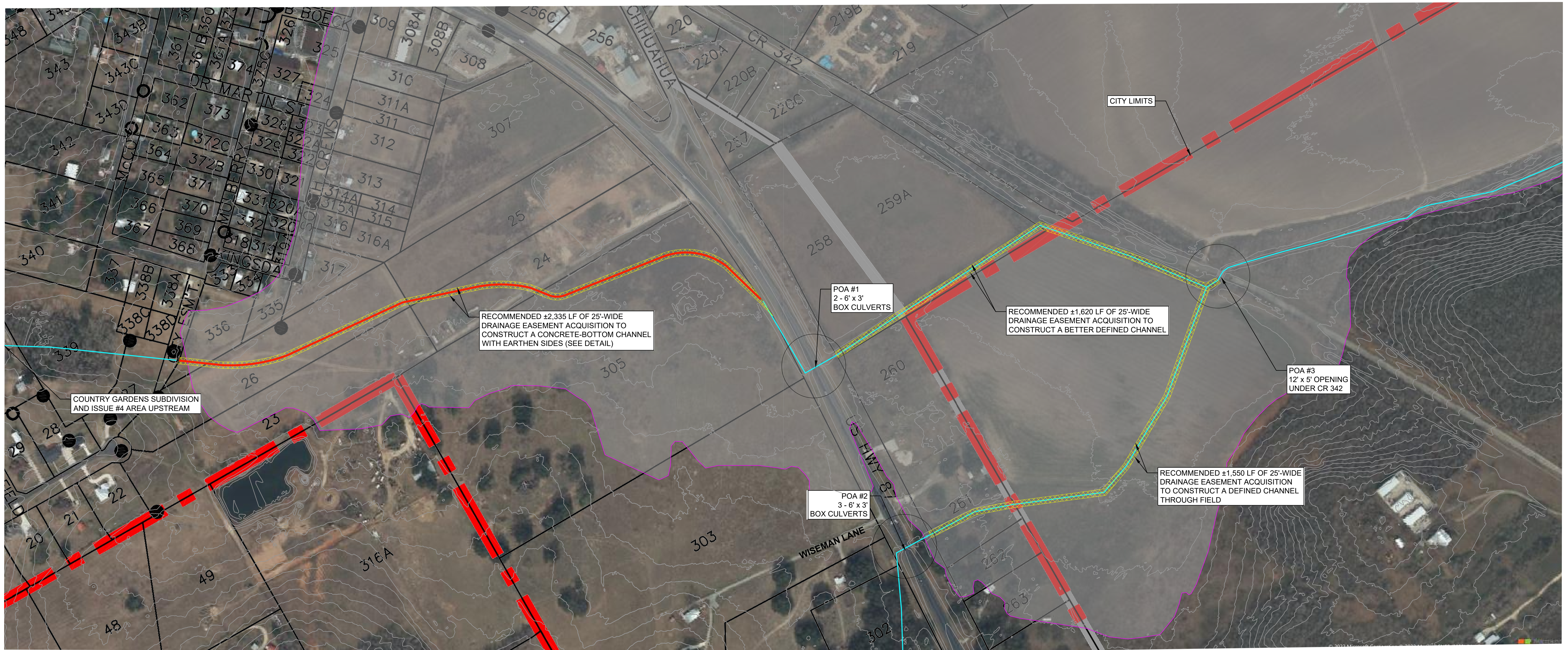
OPINION OF PROBABLE CONSTRUCTION COST \$ 118,177
ENGINEERING & CONTINGENCY (25%) \$ 29,523
TOTAL OPINION OF PROBABLE COST \$ 147,700

This opinion of probable construction cost represent best judgment as a design professional familiar with the Construction Industry and based on opinions and evaluations of current market rates for labor, materials and equipment. It is based on the understanding of the project at the time of its creation only. There is no warranty that any construction bid will not vary from this opinion.



EXHIBIT H

ISSUE #5 (HIGHWAY 87 & CR 342 CROSSINGS) - MAP



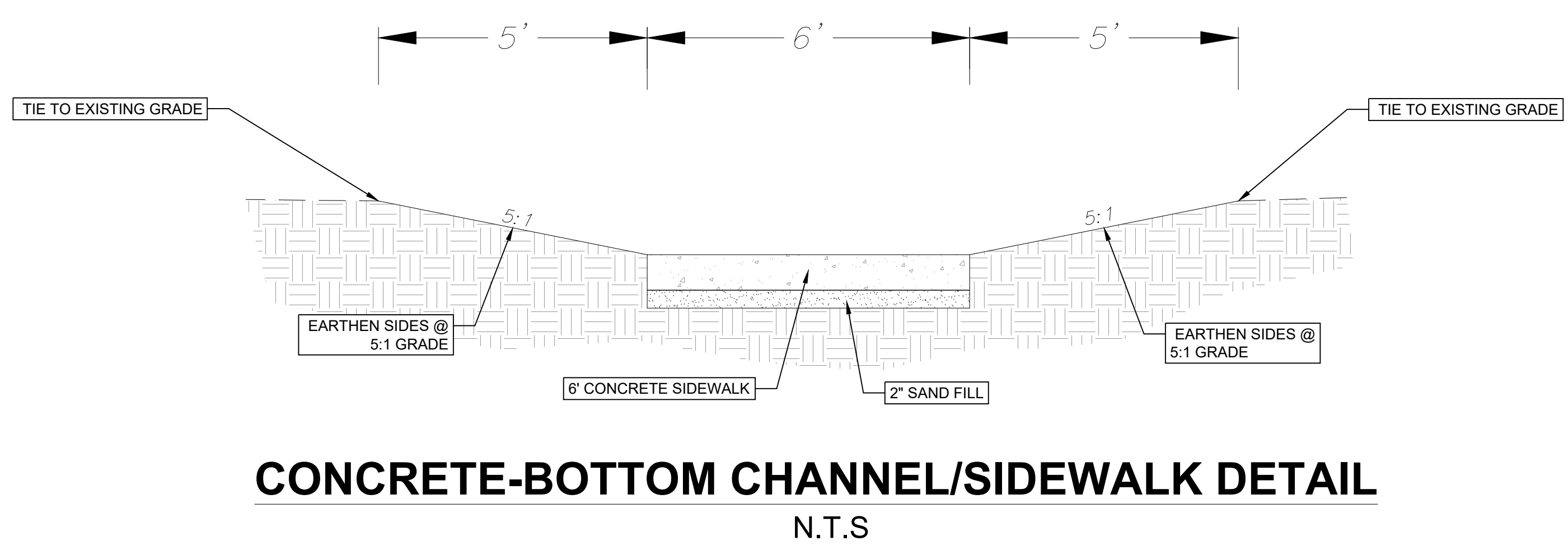
TIME OF CONCENTRATION

DRAINAGE AREA	SHEET FLOW				SHALLOW CONCENTRATED FLOW				CHANNEL FLOW (GUTTER)			
	SLOPE (FT/FT)	L (FT)	n	Tc sheet (MIN.)	SLOPE (FT/FT)	L (FT)	Paved? Y or N	Tc Shallow (MIN.)	Vavg (FT/S)	L (FT)	Tc Shallow (MIN.)	Total Tc (MIN.)
POA #1 - HWY 87 N XING	0.055	100	0.24	8.5	0.054	817	N	3.6	6.00	8721	24.23	36.3
POA #2 - HWY 87 S XING	0.040	100	0.24	9.6	0.040	2747	N	14.2	6.00	17032	47.31	71.1
POA #3 - CR 342 XING	0.040	100	0.24	9.6	0.040	2747	N	14.2	6.00	18591	51.64	75.4

HYDROLOGIC SUMMARY TABLE (SCS METHOD)

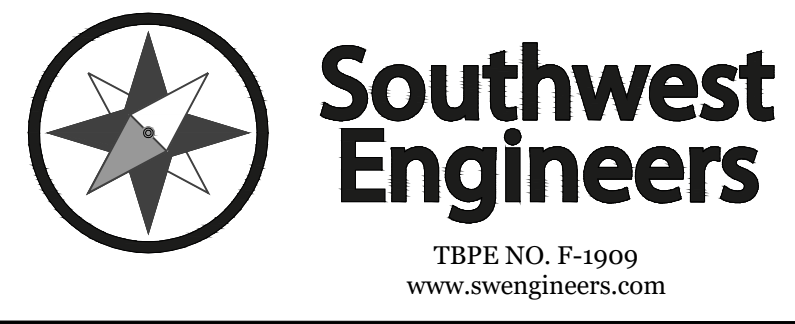
Area Name	POA #1 HWY 87 N CROSSING	POA #2 HWY 87 S CROSSING	POA #3 CR 342 CROSSING
Drainage Area (ac)	673	2174	3010
CN #	69	68	68
% Imperv.	25	20	20
Tc (hrs)	0.604	1.185	1.257
Lag Time (hrs)	0.36	0.71	0.75
2 year Discharge (cfs)	613	1211	1619
10 year Discharge (cfs)	1484	3054	4065
25 year Discharge (cfs)	2142	4492	5971
100 year Discharge (cfs)	3296	7080	9413

* Part of the SCS Design Calculations shown are derived from existing conditions assumptions using available graphical computer programs (Google Earth, Google Maps, TNIRIS GIS Information) for what would be considered current developed conditions.
 ** All drainage calculations utilize Atlas 14 rainfall data



LEGEND

- - - CITY LIMITS
- PROPERTY BOUNDARIES
- EXISTING 2-FT CONTOURS
- EXISTING CHANNEL CENTERLINE
- EASEMENT / CLEARING & GRUBBING AREA
- PROPOSED CHANNEL BOTTOM/SIDEWALK
- 100-YR FEMA FLOODPLAIN
- POA POINT OF ANALYSIS



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EXHIBIT H - ISSUE #5 (HWY 87 & CR 342 CROSSINGS) - MAP

CITY OF LA VERNIA, TEXAS

WARNING
 IF THIS BAR DOES NOT MEASURE 1",
 THE DRAWING IS NOT TO SCALE

DATE: 04/06/2022
 FILE: EXHIBIT
 DRAWN BY: GG
 PROJECT NO.: 0200-032-22



EXHIBIT I

ISSUE #5 (HIGHWAY 87 & CR 342 CROSSINGS) – COST ESTIMATE



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City of La Vernia - Drainage Improvement Recommendations
La Vernia, TX
Issue #5 - Highway 87 and CR 342 Crossings
Preliminary Cost Estimate
April 2022

Item #	Item	Quantity	Unit	Unit Cost	Cost
1	Clearing and Grubbing	3.16	ac	\$ 6,000	\$ 18,960
2	Easement Acquisition	5,505	lf	\$ 20	\$ 110,100
3	Earthwork for Channel	5,505	lf	\$ 20	\$ 110,100
4	6' Concrete Channel Bottom/Sidewalk	14,009	sf	\$ 10	\$ 140,090
5	Embankment/Fill	432	cy	\$ 12	\$ 5,184
6	Revegetation	8,760	sy	\$ 3	\$ 26,280
				OPINION OF PROBABLE CONSTRUCTION COST	\$ 410,714
				ENGINEERING & CONTINGENCY (25%)	\$ 102,686
				TOTAL OPINION OF PROBABLE COST	\$ 513,400

This opinion of probable construction cost represent best judgment as a design professional familiar with the Construction Industry and based on opinions and evaluations of current market rates for labor, materials and equipment. It is based on the understanding of the project at the time of its creation only. There is no warranty that any construction bid will not vary from this opinion.



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