City of Isleton

Storm Drain Master Plan

November 2023

Prepared for:
City of Isleton

Prepared By:

Don Jones, PE

Dave Harden, PE

Ali Holladay, EIT

Jessica Ginnever, EIT

Christian Raganit

Bennett Engineering Services

1082 Sunrise Avenue, Suite 100
Roseville, CA 95661
916.783.4100

Table of Contents

List of Tables

List of Figures

Appendices

Abbreviations and Definitions

ACEP	Agriculture Conservation Easement Program
AMSL	Above Mean Sea Level
BEN|EN	Bennett Engineering Services
BGS	Below Ground Surface
BALMD	Brannan-Andrus Levee Maintenance District
City	City of Isleton
CIMIS	California Irrigation Management Information System
CIP	Capital Improvement Project
DI	Drainage Inlet
DPLA	Division of Planning and Local Assistance
DS	Downstream
DWR	California Department of Water Resources
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
HEC	Hydrologic Engineering Center
HGL	Hydraulic Grade Line
HMS	Hydrologic Modeling System
HP	Horsepower
Master Plan	Storm Drain Master Plan
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NRCS	National Resources Conservation Service
RAS	River Analysis System

RCN	Runoff Curve Number
RD	Reclamation District
SDMP	Storm Drain Master Plan
SOI	Sphere of Influence
TR-55	United States Department of Agriculture Natural Resource Conservation Service's Technical Release 55, Urban Hydrology for Small Watersheds
US	Upstream
USFW	United States Fish & Wildlife
USGS	United States Geological Survey
WW	Wastewater
WWTF	Wastewater Treatment Facility

1 Background

1.1 Introduction

The City is located in the southwestern corner of Sacramento County in the Delta, adjacent to the Sacramento River. The City owns and maintains a small storm drain collection system within the City limits. The storm drain collection system discharges to irrigation ditches which surround the City of Isleton and flow to a pump station. The pump station is owned and operated by Reclamation District 407.

1.2 Purpose and Scope

Bennett Engineering Services was contracted by the City of Isleton to create the City's first Storm Drain Master Plan. The purpose of this Master Plan is to guide future development within the City limits. The Master Plan identifies storm drain collection system deficiencies, develops a Capital Improvement Plan to address deficiencies, and plans infrastructure improvements that will serve both existing and future development. This master plan has been prepared to accompany the 2040 General Plan Update.

This SDMP document addresses and provides information with respect to the following:

- Watershed hydrology
- Infrastructure plan for new and retrofitted storm drainage facilities
- Improvement recommendations
- Funding alternatives

Evaluations of facility needs and upgrades performed as a part of the preparation of this document have been limited to "trunk" elements of the storm drain system which have been confirmed using record drawings and field investigations. This document is limited in its analysis due to the lack of system mapping and funding for field surveys of the City storm drain collection system.

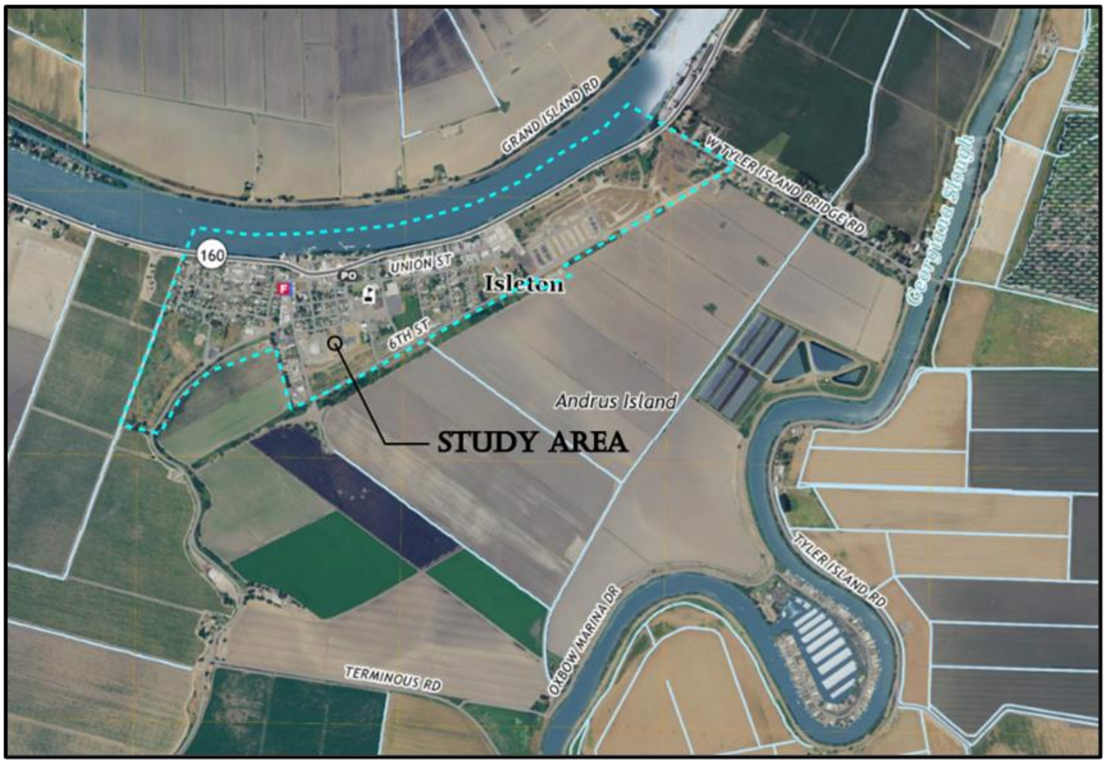
The SDMP has been prepared based on a review of existing information provided by the City, limited field investigations, and a desktop study utilizing Google maps and USGS topography.

This plan is meant to guide the City in their planning and approval of developments and should be a living document which is updated with developments and additional field investigations. This plan does not dictate how many developments should be allowed within the City of Isleton. New development projects will be required to provide site-specific, or project specific storm drain solutions that are consistent with the overall infrastructure approach presented in this SDMP or by the City. The

City may allow for a reasonable degree of flexibility to be incorporated into the specific design.

1.3 Study Area

The City limits are bound by West Tyler Island Bridge Road, 6th Street and the Sacramento River on Andrus Island. For the purpose of this report the study area will be the same as the City limits. The City's General Plan does not include the proposal of an SOI outside the City limits, see Figure 1 for the Study Area.



The location of the City and its facilities lie within the Delta on Andrus Island and is located north of Georgiana Slough. Basin Deposits underlie the City and consist of unconsolidated beds of clay with very low permeability (Ca DWR, 1973). A hydrogeological study completed by the consulting firm Wood in 2019, determined that the groundwater levels within the City limits are likely impacted by the tide in the Delta, nearby surface water and local agriculture. The City monitors groundwater levels near the WWTF, and depth to static groundwater varies from 2-9 feet BGS.

Elevations within City limits range from -2.4 feet to 15.6 feet AMSL. Much of the City is below AMSL with the exception of the levee and River Road. The study area generally slopes from 9 feet to -5 feet in elevation (NAVD88), the highest points in the City at 9 feet occur along the levee/Highway 160. Previous reports estimated that the City's average annual precipitation is 16.94 inches. Precipitation data from Staten Island weather station was used from CIMIS.

Land use within City limits consists of low to high density residential, industrial, mixed use, open space, and commercial land types. At the time of this report the land use element of the 2040 General Plan was being updated as shown in Figure 2.

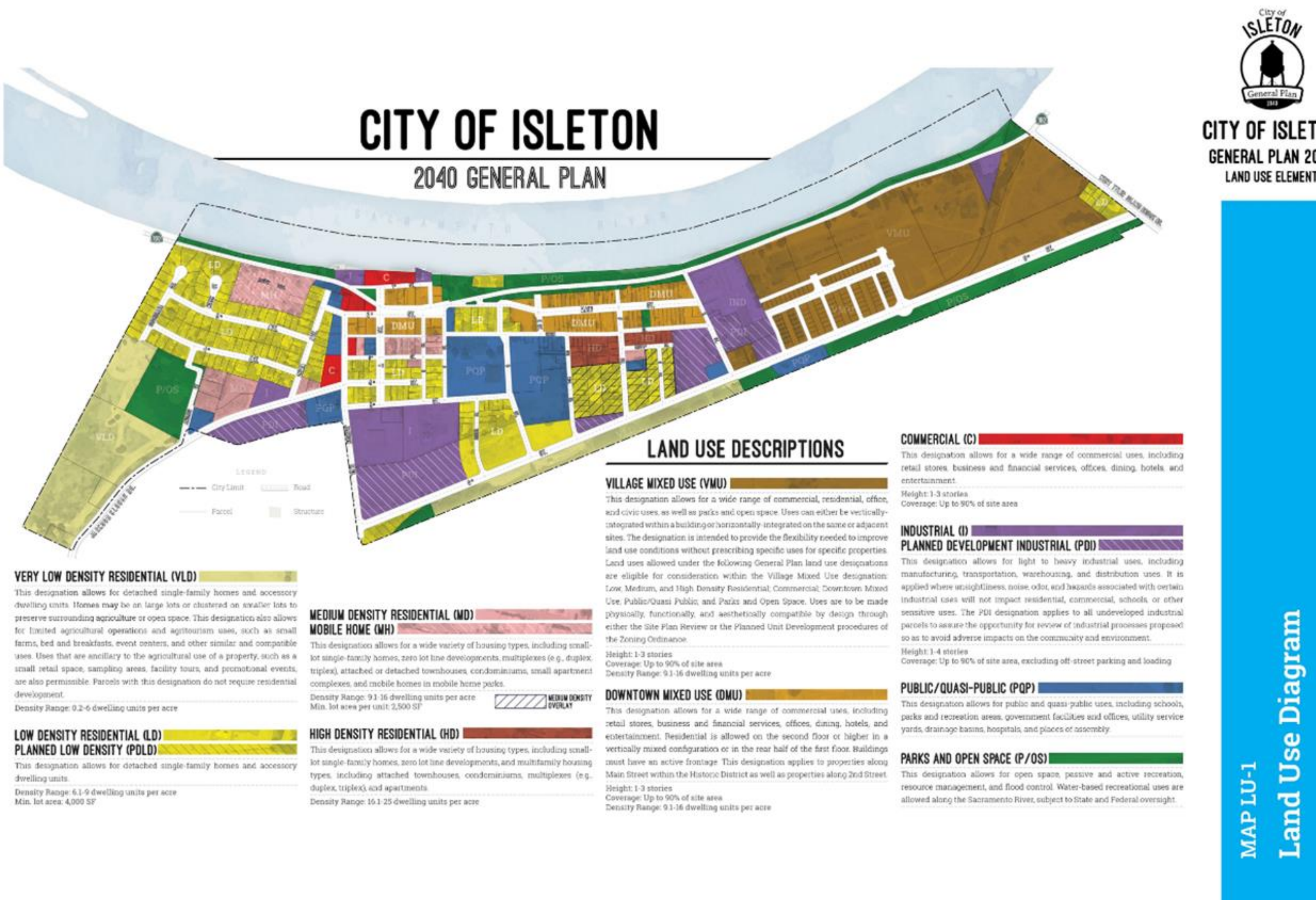


Figure 2 - 2040 General Plan Land Use

1.4 References

The following documents were referenced in the preparation of this master plan:

1. 2040 General Plan, July 2020, City of Isleton
2. Hydrologic Engineering Center River Analysis System (HEC-RAS) Version 4.10 Beta 4 User's Manual, United States Army Corp of Engineers Institute for Water Resources; Revised May 2021.
3. NOAA Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdsc/pfds/
4. NRCS Soil Survey web site (http://websoilsurvey.nrcs.usda.gov)
5. Rainfall Data based on point precipitation frequency analysis, NOAA Atlas 14; National Oceanic and Atmospheric Agency.
6. Sacramento County drainage design standards.
7. Soil Survey Sacramento County, California; United States Geological Survey, Natural Resources Conservation Service.
8. Topographic mapping of the study area with a contour interval of 1-foot based on the USGS Central Valley LiDAR; 2016.
9. Urban Hydrology for Small Watersheds, TR-55; Natural Resources Conservation Service; June 1986.

2 Existing Facilities Analysis

2.1 Condition Assessment

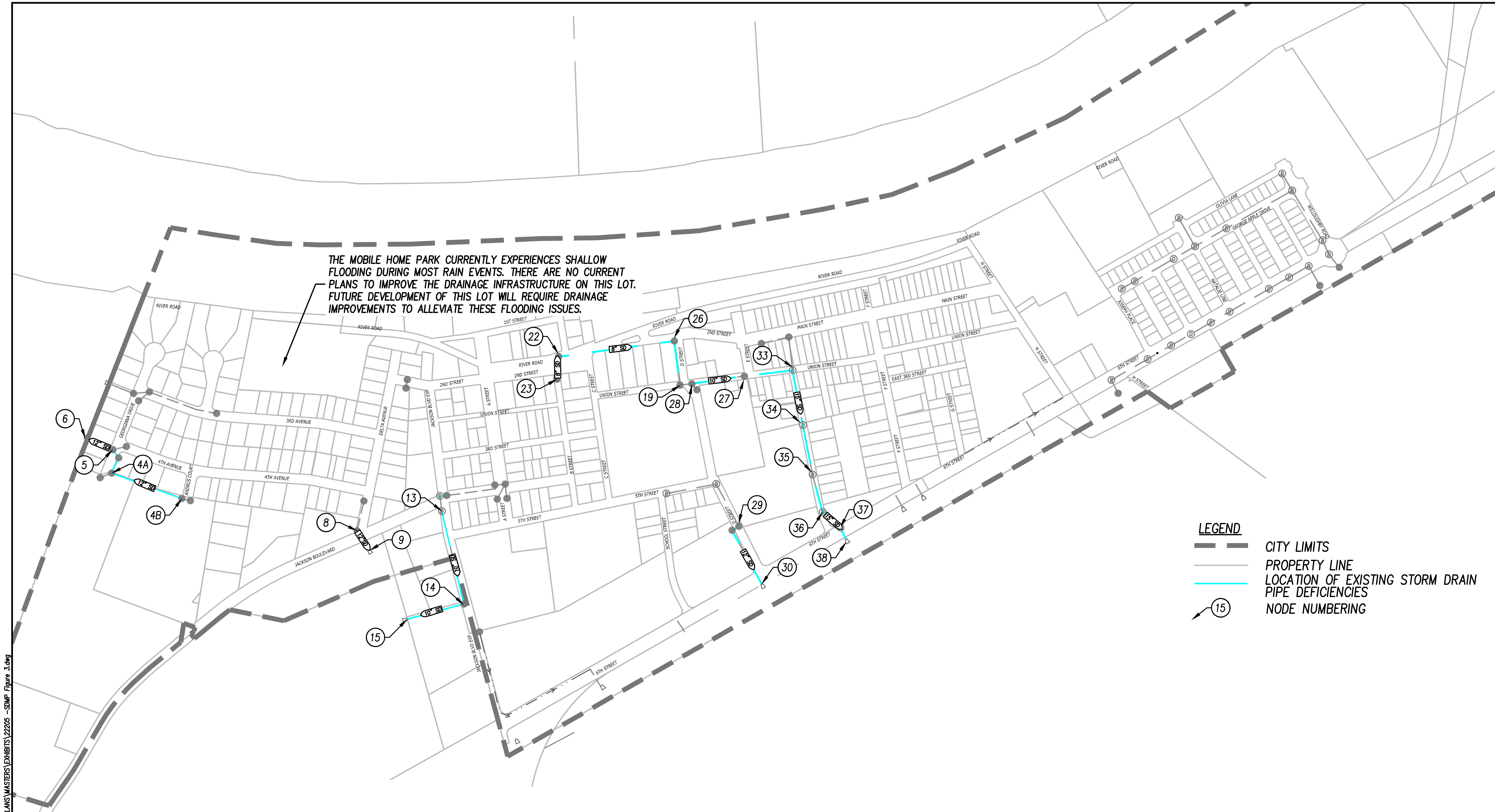
The condition assessment of selected storm drain facilities throughout the City of Isleton as part of this SDMP was limited due to budget constraints. BEN|EN conducted two field visits to map and identify existing drainage features. The field investigation results were used to produce a map of the existing storm drain system along with record drawings provided by the City. Refer to Appendix A for the Existing Storm Drain System Maps.

In general, the overall condition of the storm drain system was found to be poor. Roadside ditches are overgrown, culvert crossings are damaged with shallow cover, drain inlets were found filled with debris, and storm drainpipes are visibly cracked and broken.

The BEN|EN team reached out to staff at RD 407 to discuss existing problems that might exist. Andy Giannini, the Maintenance and Emergency Operations District Superintendent, indicated that the RD's primary responsibility was the pump station at Georgiana Slough which receives all the runoff from the City and lifts it into the slough. Mr. Giannini indicated that during the winter of 2022-2023 the pump station operated nearly constantly to keep up with the amount of runoff received during that time period. He could not relate any significant flooding that occurred during this time period. BEN|EN also reached out to City staff to discuss existing problems within the collection system. Not much is known about the storm drain system as there is no existing system map. The City believes that the Isleton Mobile Home and RV Park is lacking a sufficient collection system and may be discharging storm drain run off to the City's sewer system.

This assessment recommends that City pursue additional investigations of the existing system with special attention given to the Mobile Home and RV Park. An accurate system map will help in the preparation of a maintenance plan. The findings of the assessment will improve the overall understanding of the system and increase the accuracy of the modeling.

Based on the hydrologic and hydraulic analysis, storm drain pipes within the study area lack sufficient capacity, discussed in later sections. Pipes with insufficient capacity have been identified in Figure 3.



11/14/2023

BEN|EN

Y&C

SCALE: 1"=400'

FIGURE 3
EXISTING STORM DRAIN PIPE DEFICIENCIES

PROJECT No. 22205

Plot Date: November 16, 2023 – 7:34 am
File Name: P:\Pro\22205–Isleton–SDMP\03–PLANS\MASTERS\EXHIBITS\22205 –SDMP Figure 3.dwg

3 Hydrologic Analysis

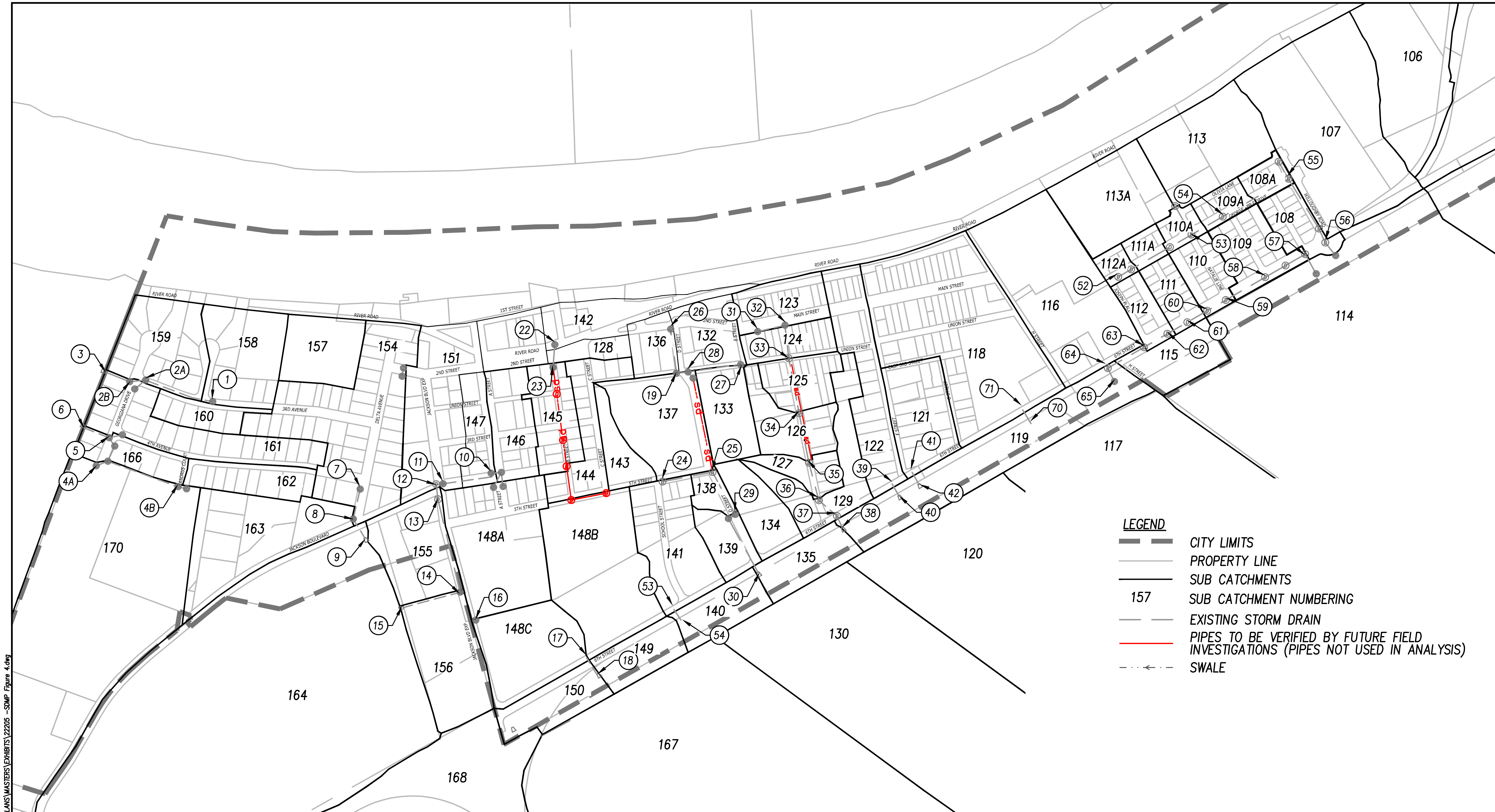
3.1 Existing Conditions

The City of Isleton currently has a limited number of underground storm drains. The conveyance of storm water runoff within the urbanized portions of the City is predominantly overland sheet flow. The storm water will drain to gutters or to the limited number of drainage inlets around the City. The drainage inlets and gutters collect run off and discharge to nearby roadside ditches or irrigation ditches. The roadside ditches are maintained by the City of Isleton, but the Irrigation Ditches are maintained by RD 407 which is a part of BALMD. BALMD oversees multiple reclamation districts including RD 407, which has jurisdiction over Andrus Island and City of Isleton. BALMD collects water on the island in the irrigation ditches which flow to a pump station on the island. The pump station discharges storm drain run off to the Georgiana Slough utilizing two 60 HP pumps.

Due to the City's average elevation being below sea level and the surrounding levees, localized flooding can be exacerbated by pumping limits. Currently, the island is drained through infiltration into the soil and pumping runoff into Georgiana Slough. BEN|EN was not provided with anecdotal information or documentation regarding flooding within the City.

3.2 Hydrologic Model Drainage Catchments

Catchment areas within the study area were delineated based on the following physical factors; topography, land use boundaries, street alignments and other physical boundaries, storm drain facilities and the proximity to suitable outfalls. A map of sub catchments and their identification number can be found in Figure 4. The sub catchment areas were used to produce the runoff hydrographs for evaluation of the existing storm drain infrastructure needs.



11/14/2023

BEN|EN

Y & C

SCALE: 1"=400'

FIGURE 4
SUB CATCHMENTS

PROJECT No. 22205

Plot Date: November 15, 2023 – 3:42 pm
File Name: P:\Proj\22205-Isleton-SDMP\03-PLANS\MASTERS\EXHIBITS\22205 -SDMP Figure 4.dwg

3.3 Hydrologic Model Methods

The United States Department of Agriculture Natural Resource Conservation Service's Technical Release 55 Urban Hydrology for Small Watersheds was used to determine runoff hydrographs for the study area. The Tabular Hydrograph Method (Chapter 5) was used in the analysis to determine runoff in the study area under existing and developed conditions for the 10 and 100-year, 24-hour duration storms. The regional rainfall time distribution used was Type 1 with an Antecedent Runoff Condition of average. Table 2-2b of TR-55, Runoff Curve Numbers for cultivated agriculture lands and developed (urban) areas were used.

Lag times were computed based on the topographic information from the USGS and TR-55 methods. Table 1, Hydrologic Inputs, shows the modeling inputs of the HEC-HMS models used in analyzing the existing conditions of the City watersheds.

The following inputs were used in the hydrologic modeling, see Table 1.

Table 1 - Hydrologic Modeling Inputs

Catchment Number	Area (acres)	Land Use	Hydrologic Soil Group	RCN	Lag Time (Minutes)
101	74.4	Agriculture	50% D, 50% A	66	60
102	45.4	Agriculture	20% C, 80% A	64	63
103	13.8	Mixed Use	C	80	21
104	45.7	Agriculture	60% C, 40% A	72	61
105	43.5	WW Treatment Plant	A	40	4
106	6.4	Mixed Use	C	80	30
107	9.5	Mixed Use	C	80	20
108	1.4	Mixed Use	C	80	11
109	2.0	Mixed Use	C	80	11
110	1.4	Mixed Use	C	80	13
111	1.1	Mixed Use	C	80	11
112	1.0	Mixed Use	C	80	10
113	4.2	Mixed Use	C	80	16
113A	3.6	Mixed Use	C	80	16
114	66.6	Agriculture	50% C, 50% A	70	74
115	1.9	Mixed Use	C	80	38

Catchment Number	Area (acres)	Land Use	Hydrologic Soil Group	RCN	Lag Time (Minutes)
116	7.3	Mixed Use	C	80	34
108A	0.7	Mixed Use	C	80	10
109A	0.8	Mixed Use	C	80	10
110A	0.6	Mixed Use	C	80	10
111A	0.5	Mixed Use	C	60	10
112A	0.5	Mixed Use	C	80	10
117	38.4	Agriculture	A	60	69
118	10.0	Mixed Use	C	80	23
119	6.0	Mixed Use	C	80	18
120	44.0	Agriculture	A	60	93
121	2.8	Mixed Use	C	80	33
122	3.4	Mixed Use	C	80	20
123	1.8	Mixed Use	C	80	13
124	1.3	Mixed Use	C	80	15
125	1.6	Mixed Use	C	80	26
126	2.0	Mixed Use	C	80	37
127	1.0	Mixed Use	C	80	32
128	1.0	Mixed Use	C	80	19
129	2.7	Mixed Use	C	80	19
130	41.9	Agriculture	A	60	112
131	67.5	Agriculture	A	60	55
132	1.4	Mixed Use	C	80	13
133	2.0	Mixed Use	C	80	28
134	1.8	Mixed Use	C	80	56
135	1.8	Mixed Use	C	80	24
136	1.6	Mixed Use	C	80	10
137	3.6	Mixed Use	C	80	28
138	0.6	Mixed Use	C	80	28
139	1.3	Mixed Use	C	80	47
140	1.7	Mixed Use	C	80	20
141	3.5	Mixed Use	C	80	26
142	3.4	Mixed Use	C	80	30
143	1.0	Mixed Use	C	80	37
144	3.6	Mixed Use	C	80	42
145	2.0	Mixed Use	C	80	17
146	2.1	Mixed Use	C	80	21
147	1.4	Mixed Use	C	80	14
148	13.1	Mixed Use	C	80	58
149	1.6	Mixed Use	C	80	18

Catchment Number	Area (acres)	Land Use	Hydrologic Soil Group	RCN	Lag Time (Minutes)
150	1.9	Mixed Use	C	80	16
151	4.4	Mixed Use	C	80	21
154	7.4	Mixed Use	C	80	21
155	3.9	Mixed Use	C	80	32
156	2.8	Mixed Use	C	80	52
157	2.2	Mixed Use	C	80	49
158	3.2	Mixed Use	C	80	16
159	3.3	Mixed Use	C	80	12
160	1.1	Mixed Use	C	80	27
161	3.7	Mixed Use	C	80	23
162	1.7	Mixed Use	C	80	55
163	4.9	Mixed Use	C	80	34
164	38.6	Mixed Use	C	80	76
166	1.4	Mixed Use	C	80	41
167	96.8	Agriculture	A	60	134
168	213.6	Agriculture	A	60	165
169	20.0	Agriculture	A	60	60
170	85.3	Mixed Use	30% C 70% A	66	74
171	24.5	Agriculture	A	60	70
172	3.2	Agriculture	A	60	27

The definitions used in this SDMP of existing, developed, and proposed conditions are as follows:

1) Existing Conditions: The condition that describes the land use as depicted in the 2040 General Plan. Some areas have no improvements currently; however, those areas were treated as “developed” in the hydrologic analysis.

2) Developed Conditions: The conditions anticipated with the City’s future land use designations as depicted in the 2040 General Plan.

3) Proposed Conditions: This scenario includes incorporating the proposed improvements to the conveyance system only. No changes in the hydrologic analysis were made for the proposed conditions. The hydraulic analysis was updated with Existing Conditions flows combined with the proposed improvements as discussed in Section 5, Capital Improvement Projects.

3.4 Hydrologic Model Results

The resulting peak flows for both the 10 and 100 year, 24-hour storm events are shown in Table 2.

Table 2 - Hydrologic Model Results

Hydrologic Node	Return Period 10-Year (cfs)	Return Period 100-Year (cfs)
101	3.7	16.5
102	1.6	8.3
103	5.6	13.0
104	4.8	15.2
105	0.0	0.5
106	2.1	4.9
107	4.5	10.3
108	0.7	1.6
109	1.0	2.4
110	0.6	1.5
111	0.7	1.6
112	0.7	1.6
113	2.1	6.4
114	5.1	17.5
115	0.6	1.3
116	2.2	5.0
117	0.8	4.6
118	3.9	9.0
119	2.5	5.7
120	0.9	4.6
121	0.8	1.9
122	1.3	3.0
123	1.0	2.2
124	0.6	1.4
125	0.5	1.1
126	0.6	1.3
127	0.4	0.9
128	0.5	1.2
130	0.9	4.0
131	1.5	9.0
132	0.6	1.5
133	0.7	1.5
134	1.0	2.4
135	0.7	1.6
136	1.1	2.4
137	1.3	3.0
138	0.2	0.5
139	0.3	0.8
140	0.8	1.8
141	1.1	2.6
142	1.1	2.4
143	0.4	0.9

Hydrologic Node	Return Period 10-Year (cfs)	Return Period 100-Year (cfs)
144	1.1	2.4
145	0.9	2.0
146	0.8	1.8
147	0.6	1.4
148	3.1	7.0
149	0.8	1.9
150	0.9	2.0
151	1.8	4.1
154	3.1	7.1
155	1.2	2.8
156	0.6	1.4
157	0.6	1.5
158	1.5	3.4
159	1.7	3.8
160	0.4	1.0
161	1.5	3.4
162	0.4	1.0
163	1.6	3.7
164	7.4	17.1
166	0.4	0.8
167	1.9	8.6
168	4.1	17.5
169	0.4	2.5
170	3.9	16.8
171	0.5	2.9
172	0.1	0.6
108A	0.4	0.8
109A	0.4	0.8
110A	0.4	0.8
111A	0.4	0.8
112A	0.4	0.8
Junction-1	48.8	170.5
Junction-10	18.0	3.2
Junction-11	18.6	5.5
Junction-12	19.2	7.9
Junction-13	19.8	10.3
Junction-14	0.6	7.7
Junction-15	2.7	12.7
Junction-16	3.4	7.7
Junction-17	1.8	4.2

Hydrologic Node	Return Period	
	10-Year (cfs)	100-Year (cfs)
Junction-18	3.4	7.7
Junction-19	5.0	11.8
Junction-2	15.6	44.1
Junction-20	12.7	29.8
Junction-21	3.4	8.0
Junction-22	13.5	37.1
Junction-23	20.9	54.3
Junction-24	1.5	3.6
Junction-25	1.9	4.4
Junction-26	2.2	5.2
Junction-27	3.0	7.0
Junction-28	6.7	15.5
Junction-29	1.5	3.5
Junction-3	17.1	75.7
Junction-30	2.3	5.3
Junction-31	1.7	3.9
Junction-32	6.3	14.6
Junction-33	6.5	15.0
Junction-34	22.8	58.6
Junction-35	3.0	7.1
Junction-36	3.4	7.9
Junction-37	29.1	73.6
Junction-38	29.8	75.2
Junction-39	3.7	8.7
Junction-4	15.8	64.6
Junction-40	1.3	3.1
Junction-41	3.1	7.1
Junction-42	4.1	9.6
Junction-43	5.7	13.4
108A	0.4	0.8
109A	0.4	0.8
110A	0.4	0.8
111A	0.4	0.8
112A	0.4	0.8
Junction-1	48.8	170.5
Junction-10	18.0	3.2
Junction-11	18.6	5.5
Junction-12	19.2	7.9

4 Hydraulic Analysis

4.1 Hydraulic Model Methods

The hydraulic analysis that was performed was based on the existing storm drain system but does not evaluate on site systems which are required to serve individual development projects.

No recorded stream flow data is available in any of the receiving channels in the area which could have been used to determine 10 and 100-year water surface elevations.

The 10-year, 24 hour peak flows with the resulting hydraulic grade line 0.5 ft below finished grade was used as the standard to determine the appropriate size if replacement was necessary.

This desktop study aimed to identify the majority of the existing drainage facilities within the Study Area. A system map of the existing storm drain collection system was created as part of this master planning effort. The map includes pipes which were identified through google maps and field investigations. Some drain inlets were located that were not shown on record drawings or other record documentation. If drain inlets were found to be within range of an identified system, they were connected when the elevations provided positive flow. Pipes highlighted for future investigations and areas not showing any storm drain lines should be further investigated to determine if they exist.

The capacity of the existing collection system was analyzed using a model developed for this SDMP. This model utilized simple spreadsheets to determine 10-year hydraulic grade lines for storm drain lines to determine if they could safely convey peak flows to outfalls south of the City, further discussed in Section 4.2 and 4.3.

4.2 Hydraulic Model Inputs & Results

The existing system as laid out in Appendix A, was inputted into the simplified model, including the pipes, manholes and other drainage features.

Manning's equation for open channel flow was used to determine head loss in pipes with an assumed "N" value of 0.015. Table 3 compares the computed, hydraulic grade line elevations in relation to the top of grate or manhole elevations for the existing system with no improvements.

Most of the existing systems would surcharge during extreme runoff events so, the hydraulic analysis represents pressurized flow. This occurs when a closed conduit becomes full, such that flows can exceed the full normal flow value. Flooding occurs when the water depth at a node exceeds the maximum available depth, and the excess flow is either lost from the system or can pond atop the node and re-enter the drainage system. The 10 -year, 24- hour duration discharge hydrographs developed in HEC-HMS were input into the hydraulic model to determine deficiencies in the existing system.

Parts of the existing underground drainage system in the City do not have capacity to convey 10-year flows without overtopping the underground system and flooding existing streets and properties. Pipes without sufficient capacity in the existing system can be found in Table 3 with negative freeboard values. The entire system would be surcharged in a 10-year event, meaning water surface elevations would be above the top of pipe during a 10-year event. Table 3 shows the maximum water surface elevations at each node of the system during a 10-year event. Hydraulic Modeling for a 100-year flow event was not conducted, by inspection the entire system would be surcharged in a 100-year event.

A hydraulic analysis was conducted for the system but with the proposed conditions. Table 4 shows the hydraulic grade line for a 10-year event with proposed pipes to alleviate the high hydraulic grade line deficiencies in each system. Hydraulic modeling for a 100-year flow event was not conducted for the proposed conditions. It is recommended that a hydraulic model for the 100-year flow event be conducted once more information is available regarding the existing system.

Table 3- Existing Storm Drain System Hydraulic Capacity Analysis

Hydraulic Node		Hydrologic Node	Q	Pipe Size	Manning's Roughness	Velocity	Friction Slope	DS HGL	Pipe Length	US HGL	Freeboard
DS	US		cfs	inches		fps		ft	ft	ft	(ft)
System 1 Georgiana Drive Outfall											
3	2B	J-16	3.4	15	0.015	2.8	0.0037	0.0	112	0.4	2.4
2B	2A	J-18	3.4	10	0.015	6.2	0.0321	0.4	72	2.7	0.2
2A	1	J-17	1.8	12	0.015	2.3	0.0034	2.7	317	3.8	0.3
6	5	J-19	5.0	12	0.015	6.4	0.0262	1.0	115	4.0	-3.1
5	4A	J-44	0.8	12	0.015	1.0	0.0007	4.0	70	4.1	-3.3
4A	4B	162	0.4	12	0.015	0.5	0.0002	4.1	320	4.1	-3.1
System 2 - Delta Ave Outfall											
9	8	J-21	3.4	12	0.015	4.3	0.0121	-1.0	96	0.2	3.7
8	7	J-21	3.4	12	0.015	4.3	0.0121	0.2	98	1.4	1.6
System 3 - School Street Outfall #1											
15	14	J-42	4.5	10	0.015	8.3	0.0562	-2.0	255	12.3	-14.2
14	13	J-41	3.1	10	0.015	5.7	0.0267	12.3	415	23.4	-21.5
13	12	J-41	3.1	10	0.015	5.7	0.0267	23.4	66	25.2	-23.0
12	11	J-40	1.3	10	0.015	2.4	0.0047	25.2	35	25.3	-22.6
11	10	J-40	1.3	10	0.015	2.4	0.0047	25.3	214	26.3	-23.6
System 4 - School Street Outfall #2											
18	17	J-39	3.1	18	0.015	1.8	0.0012	-3.0	85	-2.9	0.0
17	16	J-40	3.1	21	0.045	1.3	0.0046	-2.9	810	0.8	1.9
System 5 - D Street Outfall											
30	29	J-28	3.0	12	0.015	3.8	0.0094	-4.0	302	-1.1	-0.9
29	25	J-32	0.7	12	0.015	0.9	0.0005	-1.1	209	-1.0	-1.0
25	24	J-36	0.7	12	0.015	0.9	0.0005	-1.0	221	-0.9	-1.1
System 6 - Gas Well Road Outfall											
38	37	J-27	9.2	15	0.015	7.5	0.0270	-3.6	56	-2.1	-1.9
37	36	J-30	8.7	15	0.015	7.1	0.0242	-2.1	103	0.4	-3.6
36	35	J-26	8.4	15	0.015	6.8	0.0225	0.4	169	4.2	-6.5
35	34	J-25	4.7	15	0.015	3.8	0.0071	4.2	218	5.7	-6.9
34	33	J-24	4.3	15	0.015	3.5	0.0059	5.7	248	7.2	-5.0
33	27	J-51	2.8	10	0.015	5.1	0.0218	7.2	211	11.8	-8.0
27	28	J-52	2.2	10	0.015	4.0	0.0134	11.8	230	14.9	-10.1
28	19	J-52	2.2	10	0.015	4.0	0.0134	14.9	50	15.6	-10.7
19	26	J-52	2.2	8	0.015	6.3	0.0442	15.6	50	17.8	-12.9
26	22	J-31	1.5	8	0.015	4.3	0.0205	17.8	507	28.2	-20.5

Hydraulic Node		Hydrologic Node	Q	Pipe Size	Manning's Roughness	Velocity	Friction Slope	DS HGL	Pipe Length	US HGL	Freeboard
DS	US		cfs	inches		fps		ft	ft	ft	(ft)
22	23	J-29	1.5	8	0.015	4.3	0.0205	28.2	193	32.1	-24.9
33	32	123	1.0	12	0.015	1.3	0.0010	32.1	146	32.3	-26.3
32	31	123	1.0	8	0.015	2.9	0.0091	32.3	122	33.4	-27.4
System 7 - WW Pump Station Outfall											
65	64	J-15	21.5	30	0.015	4.4	0.0037	-4.0	87	-3.7	0.8
64	63	J-13	19.8	30	0.015	4.0	0.0031	-3.7	74	-3.5	1.0
63	62	J-12	19.2	30	0.015	3.9	0.0029	-3.5	109	-3.1	0.6
62	61	J-11	18.6	30	0.015	3.8	0.0027	-3.1	130	-2.8	0.9
61	60	J-10	18.0	30	0.015	3.5	0.0023	-2.8	96	-2.6	1.0
60	59	J-9	17.1	30	0.015	3.5	0.0023	-2.6	135	-2.2	0.4
59	58	J-8	17.1	30	0.015	3.5	0.0023	-2.2	206	-1.8	-0.9
58	57	J-9	16.7	30	0.015	3.4	0.0022	-1.8	167	-1.4	-1.7
57	56	J-8	16.7	30	0.015	3.4	0.0022	-1.4	102	-1.2	0.1
56	55	J-48	9.6	30	0.015	2.0	0.0007	-1.2	320	-0.9	2.1
55	54	J-47	3.1	30	0.015	0.6	0.0001	-0.9	330	-0.9	0.9
54	53	141	2.7	30	0.015	0.6	0.0001	-0.9	158	-0.9	2.9
53	52	J-45	0.7	18	0.015	0.4	0.0001	-0.9	365	-0.9	3.9

Note: Those hydraulic components highlighted in pink do not have capacity for the 10-year storm. Upstream pipes have the largest negative freeboard due to storm water backing up within the storm drain system. This does not necessarily mean that the pipe itself lacks capacity but the overall system does.

Table 4 - Proposed System Hydraulic Analysis

Hydraulic Node		Hydrologic Node	Q	Pipe Size	Manning's Roughness	Velocity	DS HGL	Pipe Length	US HGL	Freeboard
DS	US		cfs	ft		fps	ft	ft	ft	ft
System 1 Georgiana Drive Outfall										
3	2B	J-16	3.4	1.3	0.015	2.8	0.0	112	0.4	2.4
2B	2A	J-18	3.4	0.8	0.015	6.2	0.4	72	2.7	0.2
2A	1	J-17	1.8	1.0	0.015	2.3	2.7	317	3.8	0.3
6	5	J-19	5.0	1.0	0.015	6.4	-2.3	115	0.7	0.2
5	4A	J-44	0.8	1.0	0.015	1.0	0.7	70	0.8	0.0
4A	4B	162	0.4	1.0	0.015	0.5	0.8	320	0.8	0.2
System 2 - Delta Ave Outfall										
9	8	J-21	3.4	1.0	0.015	4.3	-1.0	96	0.2	3.7
8	7	J-21	3.4	1.0	0.015	4.3	0.2	98	1.4	1.6
System 3 - School Street Outfall #1										
15	14	J-42	0.5	1.5	0.015	0.3	-2.2	255	-2.2	0.3
14	13	J-41	3.1	1.5	0.015	1.8	-2.2	415	-1.7	3.6
13	12	J-41	3.1	0.8	0.015	5.7	-1.7	66	0.0	2.2
12	11	J-40	1.3	0.8	0.015	2.4	0.0	35	0.2	2.5
11	10	J-40	1.3	0.8	0.015	2.4	0.2	214	1.2	1.5
System 4 - School Street Outfall #2										
18	17	J-39	3.1	1.5	0.015	1.8	-3.0	85	-2.9	0.0
17	16	J-40	3.1	1.8	0.045	1.3	-2.9	810	0.8	1.9
System 5 - D Street Outfall										
30	29	J-28	3.0	1.5	0.015	1.7	-4.0	302	-3.7	1.7
29	25	J-32	0.7	1.0	0.015	0.9	-3.7	209	-3.6	1.6
25	24	J-36	0.7	1.0	0.015	0.9	-3.6	221	-3.5	1.5
System 6 - Gas Well Road Outfall										
38	37	J-27	9.2	2.0	0.015	2.9	-4.5	56	-4.4	0.4
37	36	J-30	8.7	2.0	0.015	2.8	-4.4	103	-4.2	1.0
36	35	J-26	8.4	1.5	0.015	4.8	-4.2	169	-2.7	0.4
35	34	J-25	4.7	1.5	0.015	2.7	-2.7	218	-2.2	1.0
34	33	J-24	4.3	1.5	0.015	2.4	-2.2	248	-1.6	3.8
33	27	J-51	2.8	1.3	0.015	2.3	-1.6	211	-1.1	4.9
27	28	J-52	2.2	1.0	0.015	2.8	-1.1	230	0.1	4.7
28	19	J-52	2.2	1.0	0.015	2.8	0.1	50	0.4	4.5
19	26	J-52	2.2	1.0	0.015	2.8	0.4	50	0.6	4.3
26	22	J-31	1.5	1.0	0.015	1.9	0.6	507	1.8	5.9

Hydraulic Node		Hydrologic Node	Q	Pipe Size	Manning's Roughness	Velocity	DS HGL	Pipe Length	US HGL	Freeboard
DS	US		cfs	ft		fps	ft	ft	ft	ft
22	23	J-29	1.5	1.0	0.015	1.9	1.8	193	2.3	4.9
33	32	123	1.0	1.0	0.015	1.3	2.3	146	2.4	3.6
32	31	123	1.0	0.7	0.015	2.9	2.4	122	3.5	2.5
System 7 - WW Pump Station Outfall										
65	64	J-15	21.5	2.5	0.015	4.4	-4.0	87	-3.7	0.8
64	63	J-13	19.8	2.5	0.015	4.0	-3.7	74	-3.5	1.0
63	62	J-12	19.2	2.5	0.015	3.9	-3.5	109	-3.1	0.6
62	61	J-11	18.6	2.5	0.015	3.8	-3.1	130	-2.8	0.9
61	60	J-10	18.0	2.5	0.015	3.5	-2.8	96	-2.6	1.0
60	59	J-9	17.1	2.5	0.015	3.4	-2.6	135	-2.3	0.5
59	58	J-8	16.7	2.5	0.015	3.4	-2.3	206	-1.8	-0.9
58	57	J-9	16.7	2.5	0.015	3.4	-1.8	167	-1.4	-1.7
57	56	J-8	16.7	2.5	0.015	3.4	-1.4	102	-1.2	0.1
56	55	J-48	9.6	2.5	0.015	2.0	-1.2	320	-1.0	2.2
55	54	J-47	3.1	2.5	0.015	0.6	-1.0	330	-0.9	0.9
54	53	141	2.7	2.5	0.015	0.6	-0.9	158	-0.9	2.9
53	52	J-45	0.7	1.5	0.015	0.4	-0.9	365	-0.9	3.9

Note: Those hydraulic components highlighted in pink do not have capacity for the 10-year storm. Improvements for nodes 58 and 59 were not included in the proposed conditions in the model. The pipes connected to these nodes are larger pipes, and were just freshly paved over, in addition if these nodes were to flood there is an overland flow path for the water to drain which does not pose a threat to other infrastructure.

5 Capital Improvement Projects

This chapter presents the recommended CIP for the City's storm drain system and a summary of the capital costs. This chapter is organized to assist the City in making financial decisions, and to plan the drainage system improvements through build-out of the 2040 General Plan. The following projects are ranked in order of priority to reduce localized flooding. In addition, it should be noted that priorities may change due to proposed infrastructure improvement projects.

Most of the projects listed below are related to upsizing the downstream outfall or ditch receiving storm drain water. The City should coordinate with RD407 for the implementation, design and construction of these projects. See Figure 5 for the locations of the proposed projects discussed in this section.

5.1 Project 1- System Investigations and Maintenance Plan

It is recommended that the City of Isleton conducts additional field investigations to determine the limits of their storm drain system. The investigation should include locating all outfalls of the system and documenting how each DI within the City is connected to the outfalls. Special attention shall be given to DIs that are not near other storm drain systems to verify that they are not illicitly connected to the sanitary sewer system, as well as the Isleton Mobile Home and RV Park. Additionally, the City should map the system and provide surveyed invert elevations.

The opinion of probable cost for the system investigations is $75,000. This cost is based on a previous cost for survey of the sanitary sewer system in the City of Isleton.

5.2 Project 2 - Gas Well Road Outfall (System 6)

Project 2 starts at node 23 on River Road, flows south along D Street to node 19, then west along Union Street to node 33 and then south along Gas Well Rd terminating at node 38.

This project includes upsizing existing storm drain pipes to increase capacity from hydraulic node 38 to 23 as shown on Figure 5. The project includes installation of approximately 1,100 LF of 12" pipe from node 23 to node 27, 215 LF of 15" pipe from node 27 to 33, 640 LF of 18" pipe from 33 to 36, 160 LF of 24" pipe from node 36 to 38, 6 storm drain manholes and 12 catch basins or Dis.

The opinion of probable construction cost is $1,631,203, see Table 5 for a breakdown of costs. Caltrans Contract Cost Data was used to estimate unit costs as well as recent bid results.

Table 5- Project 2 Gas Well Road Cost Estimate

Item #	Description	Unit	Qty	Unit Cost	Total
1	12-inch RCP Storm Drain Pipe	LF	1100	$350	$385,000
2	15-inch RCP Storm Drain Pipe	LF	215	$375	$80,625
3	18-inch RCP Storm Drain Pipe	LF	640	$400	$256,000
4	24-inch RCP Storm Drain Pipe	LF	160	$425	$68,000
5	48-inch SD Manhole	EA	6	$11,000	$66,000
6	Catch Basin	EA	12	$7,500	$90,000
	Engineering and Design		15%		$141,844
	Construction Management		20%		$217,494
	Subtotal:				$1,304,963
	Contingency	%	25%		$326,241
				Total:	**$1,631,203**

5.3 Project 3 – School Street Outfall 1 (System 3)

Project 3 starts at node 13 on Jackson Blvd heads south and then east terminating into node 15 running between private properties.

This project includes upsizing existing storm drain pipes to increase capacity from hydraulic node 15 to 13 as shown on Figure 5. The project includes installation of approximately 670 LF of 18” pipe from node 15 to 13, 4 storm drain manholes and 8 catch basins or DIs.

The opinion of probable construction cost is $743,475, see Table 6 for a breakdown of costs. Caltrans Contract Cost Data was used to estimate unit costs as well as recent bid results.

Table 6 - Project 3 School Street Outfall Cost Estimate

Item #	Description	Unit	Qty	Unit Cost	Total
1	18-inch RCP Storm Drain Pipe	LF	670	$500	$335,000
2	48-inch SD Manhole	EA	4	$11,000	$44,000
3	Catch Basin	EA	8	$6,500	$52,000
	Engineering and Design		15%		$64,650
	Construction Management		20%		$99,130
	Subtotal:				$594,780
	Contingency	%	25%		$148,695
				Total:	$743,475

5.4 Project 4 – Georgiana Drive Outfall (System 2)

Project 4 starts at node 4B on Andrus Court heads west toward Georgiana Drive and then west terminating into node 6.

This project could be achieved by either upsizing the existing storm drain pipes to increase capacity from hydraulic node 4B to 6 as shown on Figure 5 or widen the irrigation ditch which node 6 discharges to. The channel would need to be widened enough to lower the downstream water elevation by 3.3 feet. It is unlikely that the downstream elevation can be lowered by that much, so a combination of channel widening and upsizing of pipes is proposed.

The project includes installation of approximately 825 LF of 18" pipe from node 4B to 6, installation of an upgraded outfall structure, two manholes and widening of the channel for approximately 150 feet.

The opinion of probable construction cost is $654,328, see Table 7 for a breakdown of costs. Caltrans Contract Cost Data was used to estimate unit costs as well as recent bid results.

Table 7 - Project 4 Georgiana Drive Cost Estimate

Item #	Description	Unit	Qty	Unit Cost	Total
1	Channel Widening	LF	125	$250	$31,250
2	Outfall Structure	EA	1	$7,500	$7,500
3	18-inch RCP Storm Drain Pipe	LF	825	$400	$330,000
	48-inch SD Manhole	EA	2	$9,500	$19,000
	Engineering and Design		15%		$58,163
	Construction Management		20%		$77,550
	Subtotal:				$523,463
	Contingency	%	25%		$130,866
				Total:	$654,328

5.5 Project 5 – D Street Outfall (System 5)

Project 5 starts at node 29 on D Street and flows south to node 30.

This project includes upsizing existing storm drain pipes to increase capacity from hydraulic node 29 to 30 as shown on Figure 5. The project includes installation of approximately 300 LF of 18" pipe, 2 storm drain manholes and 4 catch basins or DIs.

The opinion of probable construction cost is $296,700, see Table 8 for a breakdown of costs. Caltrans Contract Cost Data was used to estimate unit costs as well as recent bid results.

Table 8 - Project 5 D Street Outfall Cost Estimate

Item #	Description	Unit	Qty	Unit Cost	Total
1	18-inch RCP Storm Drain Pipe	LF	300	$400	$120,000
2	48-inch SD Manhole	EA	2	$11,000	$22,000
3	Catch Basin	EA	4	$6,500	$30,000
	Engineering and Design		15%		$25,800
	Construction Management		20%		$39,560
	Subtotal:				$237,360
	Contingency	%	25%		$59,340
				Total:	$296,700

5.6 Project 6- Delta Ave Outfall (System 2)

Project 6 starts at node 8 on Delta Ave and flows south until the storm run off is discharged to an irrigation ditch at node 9.

This project includes replacing approximately 100 LF of 12” storm drain pipe, one storm drain manhole and installing an upgraded outfall structure, as shown on Figure 5. The existing pipe was visible during field investigations as it daylighted into the ditch, cracks and a broken top were found.

The opinion of probable construction cost is $92,288, see Table 9 for a breakdown of costs. Caltrans Contract Cost Data was used to estimate unit costs as well as recent bid results.

Table 9 - Project 9 Delta Outfall Cost Estimate

Item #	Description	Unit	Qty	Unit Cost	Total
1	12-inch RCP Storm Drain Pipe	LF	100	$350	$35,000
2	48-inch SD Manhole	EA	1	$11,000	$22,000
3	Outfall Structure	EA	1	$7,500	$7,500
	Engineering and Design		15%		$8,025
	Construction Management		20%		$12,305
	Subtotal:				$73,830
	Contingency	%	25%		$18,458
				Total:	$92,288

5.7 Project 7 - Roadway Projects

As the City plans additional roadway projects attention should be directed to low lying areas on the roads, to provide positive drainage to DIs or to existing roadside ditches.

A cost estimate was not provided as the scope of work is dependent on the roadway project.

11/14/2023

BEN | EN

Y & C

SCALE: 1"=400'

FIGURE 5
PROPOSED IMPROVEMENTS TO EXISTING SYSTEM

PROJECT No. 22205

Plot Date: November 15, 2023 – 3:52 pm
File Name: P:\Pro\22205-Isleton-SDMP\03-PLANS\MASTERS\EXHIBITS\22205 -SDMP Figure 5.dwg

6 Funding Alternatives

The City collects development impact fees for the maintenance and operation of the City-owned storm drain facilities as set forth in the City of Isleton Impact Fee Study from 2021. The drainage fee is set at $1,563 per residential unit.

To fund the capital improvement projects that are outside of the drainage budget, there are state and federal grants or loans that the City can pursue.

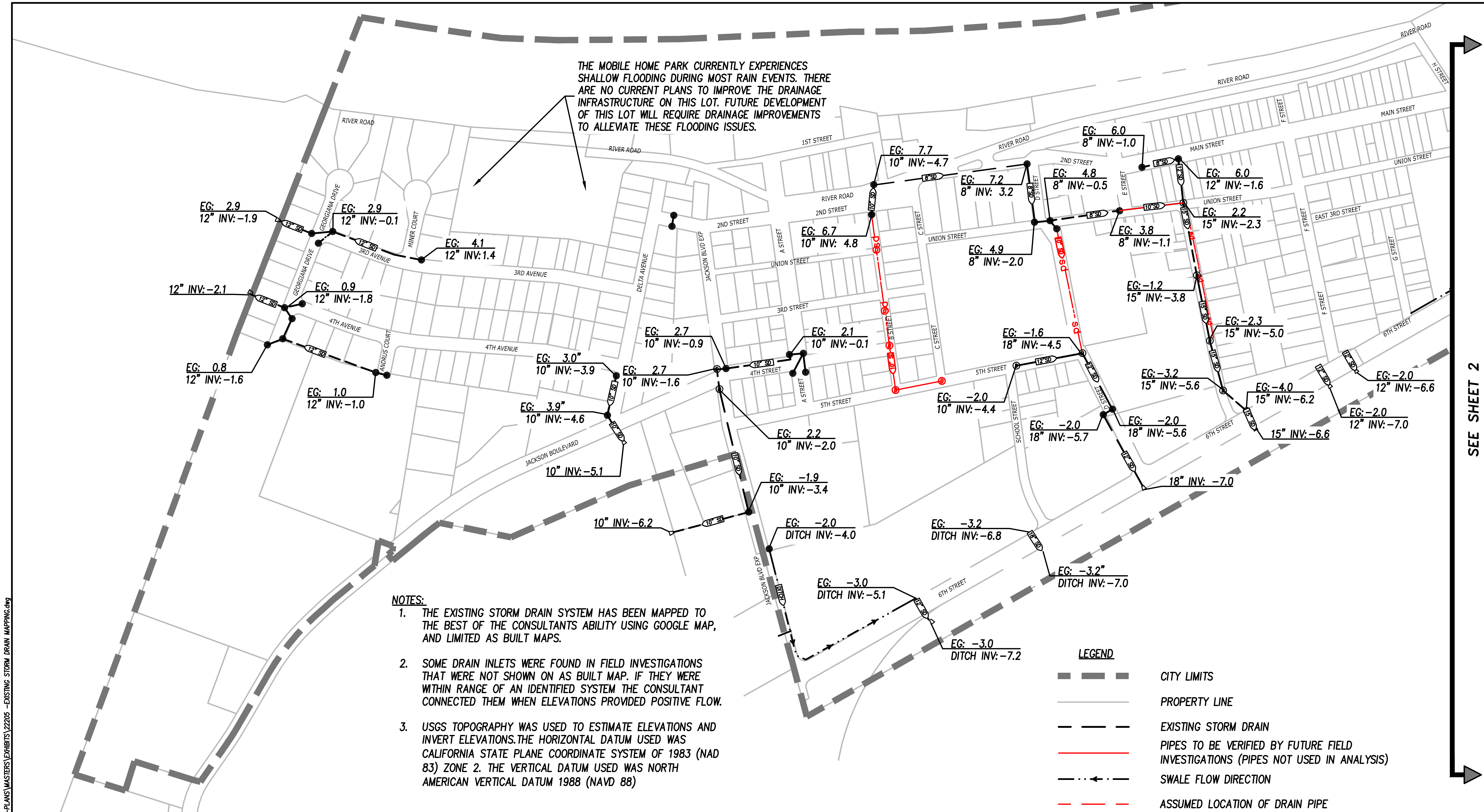
Table 10 - Funding Alternatives

Funding Category	Agency	Program	Description	Website
Land Acquisition	US Natural Resources Conservation Service	Agriculture Conservation Easement Program	The (ACEP) provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits.	https://www.nrcs.usda.gov/wps/portal/nrcs/main/ca/programs/easements/acep/
	US Fish and Wildlife Service	Cooperative Endangered Species Conservation Fund Grants	USFW works with others to find ways to invigorate and modernize the implementation of the ESA.	https://www.fws.gov/program/endangered-species
	Bureau of Reclamation	3406(d) Refuge Water Supply	As part of the Central Valley Refuges And Wildlife Habitat Areas", program, Reclamation negotiates for long-term water supply contracts with the California Department of Fish and Game, Grasslands Water District.	https://www.usbr.gov/mp//cvpia/3406d/index.html

	State of California (Various)	Habitat Conservation Fund	Eligible projects include: nature interpretation programs to bring urban residents into park and wildlife areas, protection of various plant and animal species, and acquisition and development of wildlife corridors and trails.	https://www.parks.ca.gov/?page_id=21361#:~:text=The%20Habitat%20Conservation%20Fund%20allocates,program%20requires%20a%2050%25%20match
	FEMA	Project Impact Grant Programs	Provides funding for eligible mitigation measures which reduce losses during a disaster. This includes sustainable actions that reduces or eliminates long-term risk to people and property from future disasters	https://www.fema.gov/grants/mitigation
	California DWR	DPLA Grant and Loan Program	DWR programs that support integrated water management activities addressing environmental stewardship, water supply reliability, public safety, and economic stability.	https://water.ca.gov/work-with-us/grants-and-loans
Flood Hazard Mitigation	FEMA	Flood Mitigation Assistance	Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program.	https://www.fema.gov/grants/mitigation/floods

	USGS	Stream Gaging Program	Under this program, the USGS provides up to 50 percent of the funds, and the State or local agency provides the remainder for the installation of stream gages.	https://pubs.usgs.gov/circ/circ1123/overview.html

Appendix A: Existing Storm Drain Map



NOTES:

1. THE EXISTING STORM DRAIN SYSTEM HAS BEEN MAPPED TO THE BEST OF THE CONSULTANTS ABILITY USING GOOGLE MAP, AND LIMITED AS BUILT MAPS.
2. SOME DRAIN INLETS WERE FOUND IN FIELD INVESTIGATIONS THAT WERE NOT SHOWN ON AS BUILT MAP. IF THEY WERE WITHIN RANGE OF AN IDENTIFIED SYSTEM THE CONSULTANT CONNECTED THEM WHEN ELEVATIONS PROVIDED POSITIVE FLOW.
3. USGS TOPOGRAPHY WAS USED TO ESTIMATE ELEVATIONS AND INVERT ELEVATIONS. THE HORIZONTAL DATUM USED WAS CALIFORNIA STATE PLANE COORDINATE SYSTEM OF 1983 (NAD 83) ZONE 2. THE VERTICAL DATUM USED WAS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88)

LEGEND

- CITY LIMITS
- PROPERTY LINE
- EXISTING STORM DRAIN
- PIPES TO BE VERIFIED BY FUTURE FIELD INVESTIGATIONS (PIPES NOT USED IN ANALYSIS)
- SWALE FLOW DIRECTION
- ASSUMED LOCATION OF DRAIN PIPE

11/15/2023

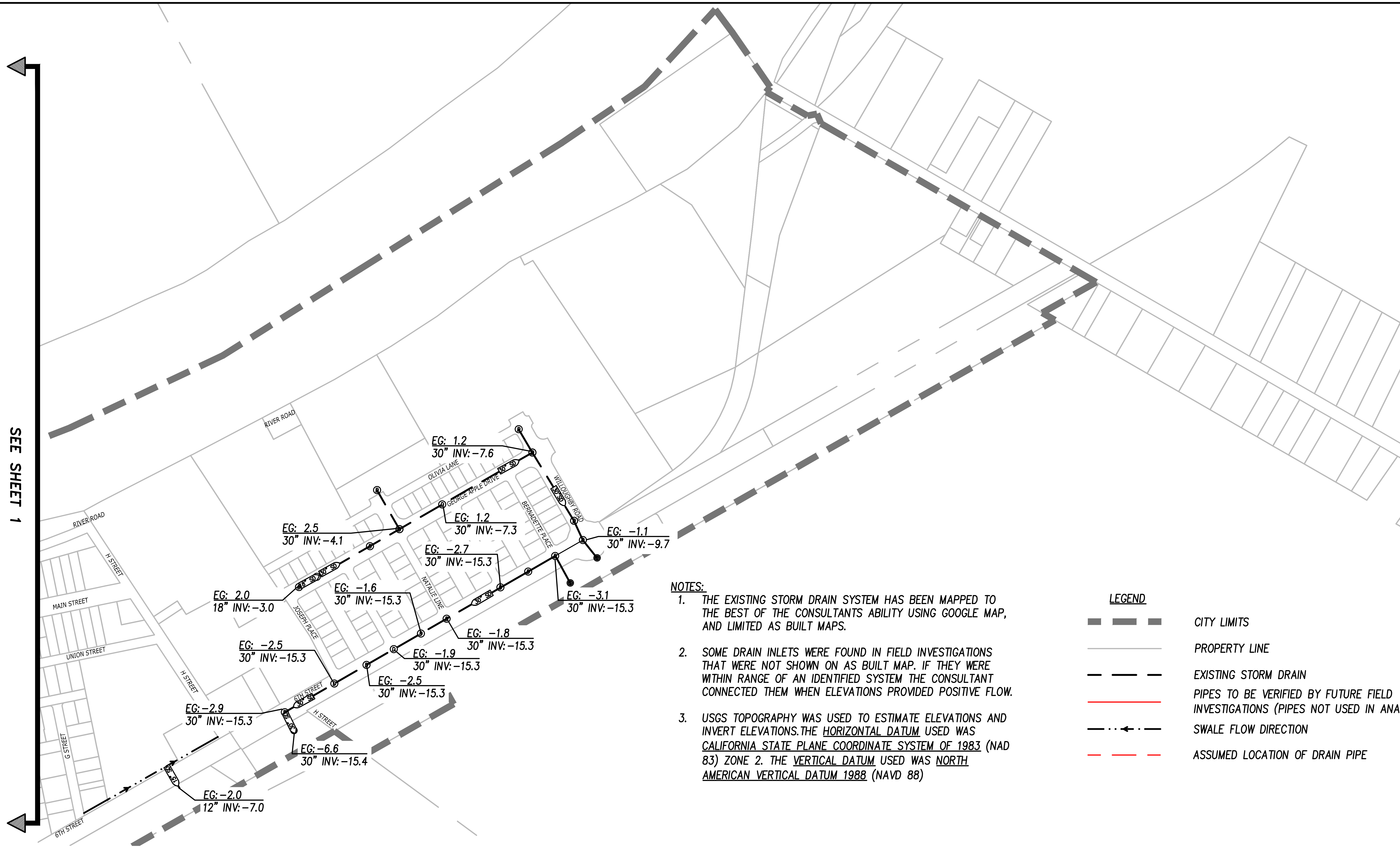
BEN|EN

SCALE: 1"=300'

CITY OF ISLETON
EXISTING STORM DRAIN MAPPING

PROJECT No. 22205

Plot Date: November 16, 2023 - 7:44 am
File Name: P:\Proj\22205-Isleton-SDMP\03-PLANS\MASTERS\EXHIBITS\22205 -EXISTING STORM DRAIN MAPPING.dwg



NOTES:

1. THE EXISTING STORM DRAIN SYSTEM HAS BEEN MAPPED TO THE BEST OF THE CONSULTANTS ABILITY USING GOOGLE MAP, AND LIMITED AS BUILT MAPS.
2. SOME DRAIN INLETS WERE FOUND IN FIELD INVESTIGATIONS THAT WERE NOT SHOWN ON AS BUILT MAP. IF THEY WERE WITHIN RANGE OF AN IDENTIFIED SYSTEM THE CONSULTANT CONNECTED THEM WHEN ELEVATIONS PROVIDED POSITIVE FLOW.
3. USGS TOPOGRAPHY WAS USED TO ESTIMATE ELEVATIONS AND INVERT ELEVATIONS. THE HORIZONTAL DATUM USED WAS CALIFORNIA STATE PLANE COORDINATE SYSTEM OF 1983 (NAD 83) ZONE 2. THE VERTICAL DATUM USED WAS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88)

LEGEND

- CITY LIMITS
- PROPERTY LINE
- EXISTING STORM DRAIN
- PIPES TO BE VERIFIED BY FUTURE FIELD INVESTIGATIONS (PIPES NOT USED IN ANALYSIS)
- SWALE FLOW DIRECTION
- ASSUMED LOCATION OF DRAIN PIPE

11/15/2023

BEN|EN

Y & C

SCALE: 1"=300'

CITY OF ISLETON
EXISTING STORM DRAIN MAPPING

PROJECT No. 22205

Plot Date: November 16, 2023 - 7:43 am
File Name: P:\Proj\22205-Isleton-SDMP\03-PLANS\MASTERS\EXHIBITS\22205 -EXISTING STORM DRAIN MAPPING.dwg