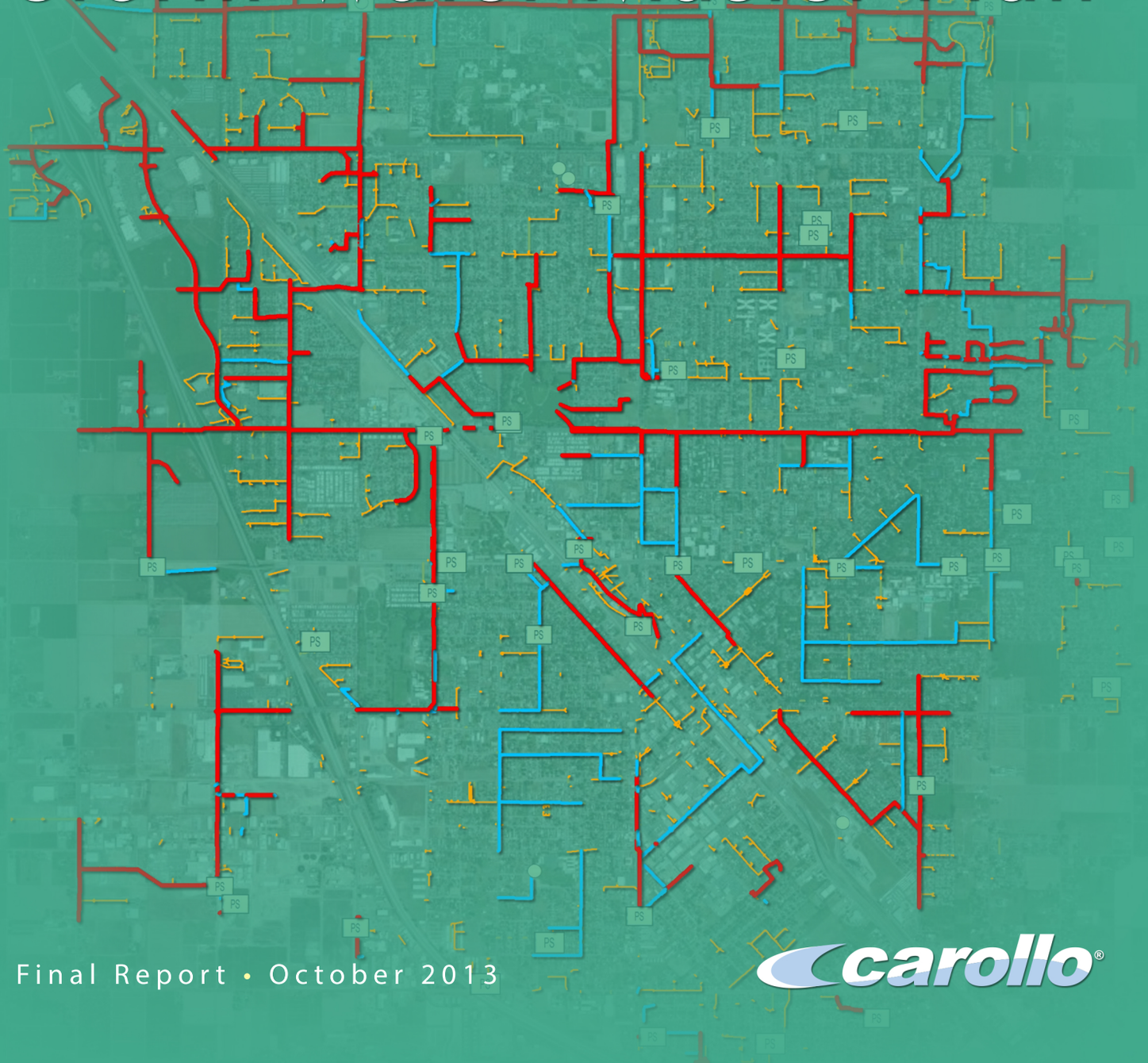
CITY OF TURLOCK INC. 1908

Storm Water Master Plan



Final Report • October 2013

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City of Turlock

STORM WATER MASTER PLAN

FINAL

October 2013

10/23/13

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Prepared by

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City of Turlock

STORM WATER MASTER PLAN

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LIST OF ABBREVIATIONS

°F	Degrees Fahrenheit
AACE	Association for the Advancement of Cost Engineering
ASCE	American Society of Civil Engineers
AF	Acre Feet
AFY	acre feet per year
BMP	best management practice
Carollo	Carollo Engineers, Inc.
CCTV	closed-circuit television
cfs	cubic feet per second
CIP	capital improvement project
City	City of Turlock
d/D	Flow Depth To Pipe Diameter Ratio
DCIA	directly connected impervious area
DDF	depth duration frequency
DEM	digital elevation model
DOF	California Department of Finance
ENR CCI	Engineering News Record Cost Construction Index
FEMA	Federal Emergency Management Agency
ft	feet
ft/s	feet per second
ft^2	Square Feet
GIS	geographic information system
gpd	Gallons Per Day
gpm	gallons per minute
GWI	Groundwater Infiltration

HGL	Hydraulic Grade Line
HP	Horsepower
in/hr	inches per hour
LAFCo	Local Agency Formation Commission
Master Plan	Stormwater Master Plan
MG	millions gallons
mgd	million gallons per day
msl	mean sea level
n	Manning's Friction Coefficient
n	Manning's Overland Flow Coefficient
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
ROW	right-of-way
R&R	rehabilitation and replacement
RTC	real time controls
SCS	Soil Conservation Service
SWMM	Storm Water Management Model
TMDL	Total Maximum Daily Limits
TRIP	Turlock Regional Industrial Park
TRWQCF	Turlock Regional Water Quality Control Facility
USDA	United States Department of Agriculture
US EPA	United States Environmental Protection Agency
USGS	United States Geological Service
UWMP	Urban Water Management Plan
WRCC	Western Regional Climate Center

EXECUTIVE SUMMARY

This executive summary presents a brief background of the City of Turlock (City) stormwater collection system, the need for this Master Plan, proposed improvements to mitigate existing system deficiencies, and proposed expansion projects. A summary of capital improvement project costs is included at the end of this summary.

ES.1 INTRODUCTION

The City is located in Stanislaus County on the eastern side of California's San Joaquin Valley, about 100 miles east of the San Francisco Bay Area and 90 miles south of Sacramento. State Highway 99 intersects the City along the north-south axis, providing regional transport to Stockton and Sacramento to the north and Fresno and Bakersfield to the south.

The City is bordered primarily by agricultural land, which helps establish it as a stand-alone community. In addition, agriculture is a major defining feature of the City's identity and comprises a large component of the City's economy. The City's downtown core, originally established around the railroad station, has since grown outward to include residential, commercial, and industrial developments. Turlock is attractive to food processors and distributors because of its location in the Central Valley and abundance of locally-grown products. The City was incorporated in 1908.

The City owns, maintains, and operates its own storm drainage system and associated facilities, including pipelines, pump stations, and detention/retention basins. The storm drainage system is designed to manage the runoff of rainwater and minimize the impact of significant rainfall.

ES.2 STUDY AREA

The City recently updated its General Plan. The City's General Plan study area consists of the City limits, the City's sphere of influence (SOI), and areas urban reserve (primarily used as agricultural land). The City's SOI is nearly conterminous with the City limits along its western edge, but varies along the eastern side of the City.

The General Plan update describes projected growth over the next 20 years as occurring as infill within current City limits, as well as limited new development outside City limits. City policy is that all infill growth areas within the current City limits must be at least 70 percent built-out before new development areas are allowed to annex. The General Plan includes three new distinct development areas. The land area remaining in the General Plan Planning Boundary is designated as Urban Reserve, or land that is not expected to develop within the planning horizon of the General Plan.

The study area boundary for this Master Plan coincides with the General Plan study area boundary (Figure ES.1). This area includes developed land within the City limits, infill areas within the existing City limits, and areas proposed for annexation and development within the study area boundary. The study area includes developed land within the City limits, infill areas within the existing City limits, and areas proposed for annexation and development that is outside the City limits and SOI. In addition, there are several County-owned islands within the City that are expected to be annexed and developed according to the development plan in the General Plan.

The City recently updated its General Plan to the planning horizon of 2030. The land use, zoning designations, and development assumptions used in this Master Plan are consistent with those provided in the General Plan.

ES.3 STORMWATER SERVICE AREA

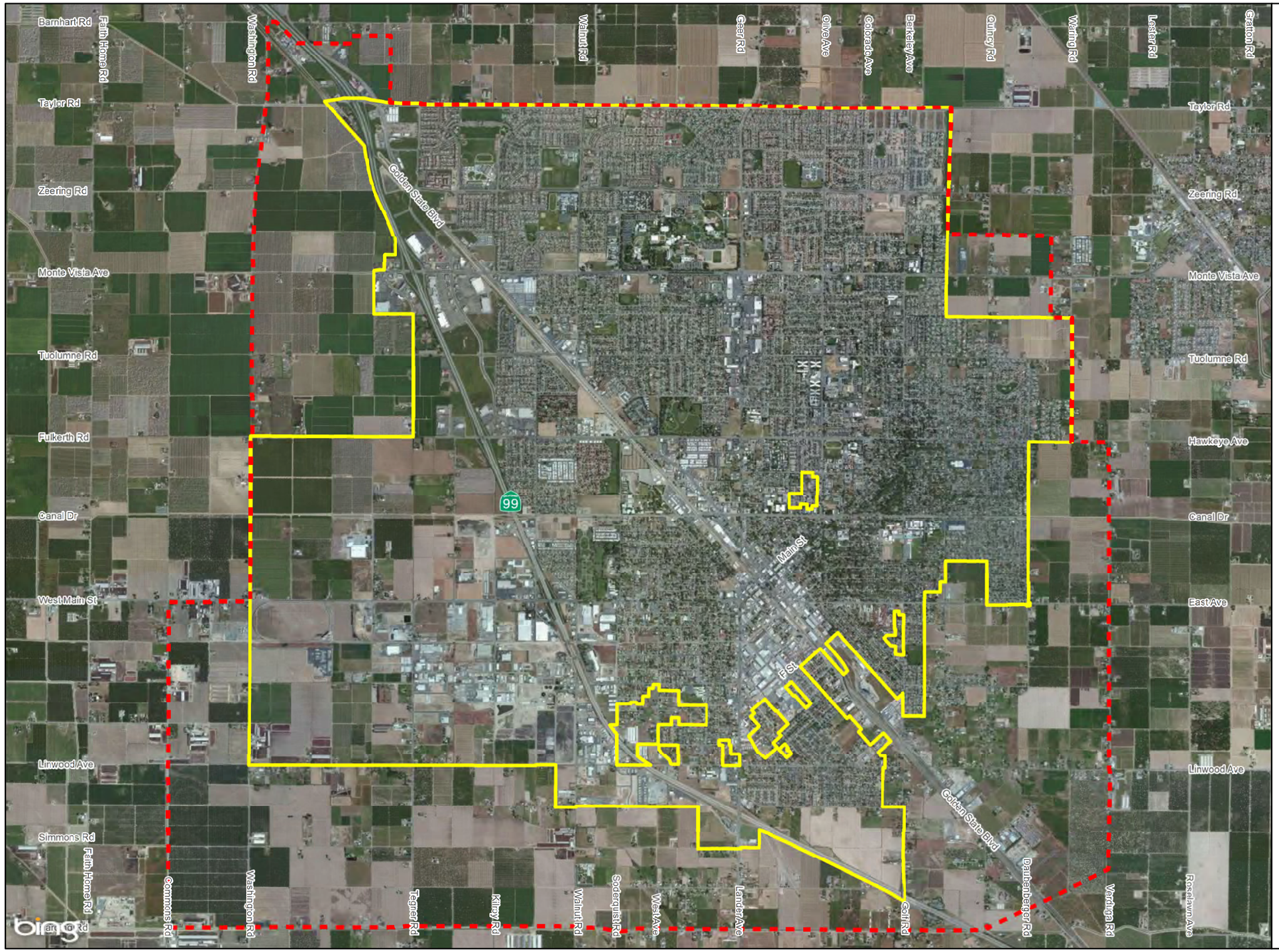
The City's collection system consists of pipelines, pump stations, and detention/retention basins that collect stormwater. The City's collection system is shown in Figure ES.2.

The City manages and maintains approximately 133 miles of gravity storm lines, 40 stormwater pump stations and associated force mains, and 45 detention/ retention basins. Collected runoff generally flows into detention/retention basins located throughout the City, and in some cases is ultimately pumped to local drainage channels for disposal after the storm event. For areas of central Turlock that are not served by detention/retention basins, stormwater is pumped directly into Turlock Irrigation District (TID) canals such as TID Lateral #4. The City maintains a discharge permit with TID that limits the amount of stormwater that can be discharged to the canal during a storm event.

ES.4 DRAINAGE SYSTEM

The stormwater system includes centralized drainage systems and independent community systems. Beginning with the adoption of the City's 1992 General Plan, the City's development and infrastructure planning efforts have become increasingly comprehensive. Based on the City's growth management strategy, the City has adopted a number of Specific Plans and Master Plans to guide growth in specified areas. Recently installed storm drainage infrastructure throughout the City were integrated with the needs of individual communities as well as regional planning efforts for stormwater management.

The City's 2030 General Plan update provides a summary of the Specific Plans and Master Plans for proposed development projects that are currently underway or that are proposed for the future. Based on the type of development (residential, industrial, commercial, etc.), the Plans propose appropriate methods of stormwater manage infrastructure (ponds, pump stations, or underground storage in pipes).



Legend

City Limits

General Plan Boundary

N

0 3,500 7,000 Feet

Figure ES.1
Master Plan Study Area
Stormwater Master Plan
City of Turlock

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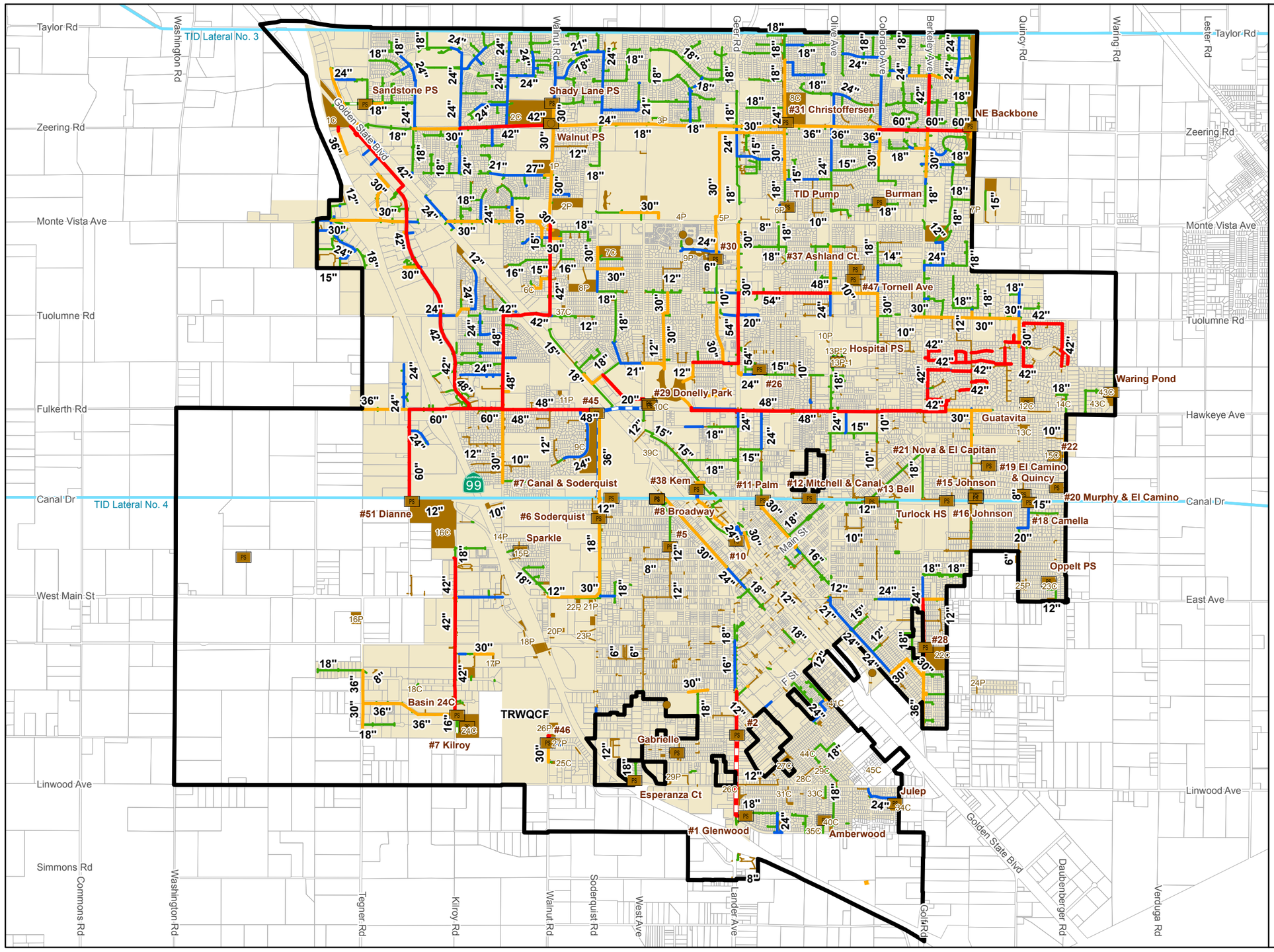

Figure ES.2
Existing Storm Drainage System
Stormwater Master Plan
City of Turlock

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The following sections describe some of the characteristics of the City's stormwater system and the stormwater management methods that are utilized in Turlock. Because of the variability of the City's infrastructure and the multitude of community systems, just a few examples of each method are provided.

ES.4.1 Drainage Areas

The City's stormwater system utilizes several large detention/retention basins as regional storage for runoff. The City has also installed several valves and diversion structures throughout the system that direct the flow to either major trunk pipelines or to storage ponds. The City's storm drainage system is unique because it contains several locations where flow is split and can be conveyed in multiple directions. This flexibility allows for maximum storage in the underground pipes when parts of the system begin to surcharge. While this approach effectively redistributes flow, it also makes it difficult to define distinct drainage basins in the Study Area. For some areas of the City's system, it is difficult to define where stormwater runoff will be directed because it could go to multiple locations. However, during large storm events, such as the 50-year design storm, much of the City's storm system surcharges and all of these connections (and overflows) are utilized.

ES.4.2 Detention/Retention Basins

Due to the City's relatively flat topography, detention/retention ponds are a critical tool in the management of stormwater. Many of the detention/retention ponds have pump stations that lift collected stormwater from the drainage system into the pond itself, which are usually at higher elevations than the conveyance system. The City has the ability to direct flow throughout the City, using valves and diversion structures, to detention/retention ponds where temporary capacity is available. Many of the detention/retention ponds in the City are less than 4 feet deep due to a high groundwater table throughout most of the Study Area. Consequently, the ability to direct flow from one part of the storm drainage system to another is a valuable tool.

ES.4.3 Storm Drainage System Pump Stations

The City owns and operates approximately 40 storm pump stations. The pump stations serve a variety of functions based on their location in the system. Many pump stations correspond with detention/retention basins, and pump stormwater from the pipeline drainage system into the storage basins. Additionally, several pump stations are located along Turlock Irrigation District (TID) Lateral No. 4, and pump collected stormwater from the drainage system into the canal for disposal.

ES.4.4 TID Lateral No. 4

While much of the new development in Turlock requires the utilization of onsite storage ponds to hold stormwater runoff, some of the older parts of town rely on other methods to discharge stormwater during a storm event (because storage ponds are not present).

These areas of the City discharge directly to the TID Lateral No. 4 canal, which runs east to west through the center of the City, along Canal Drive. Lateral No. 4 is an irrigation canal, and the raw water from the canal is used for agricultural purposes outside of the City. The City maintains an agreement with TID that allows discharge of a limited amount of stormwater to the Lateral No. 4 canal during a storm event. The agreement also allows for discharge of a limited amount of stormwater after a storm event, when the City needs to drain some of the detention/retention ponds to create more storage capacity in the system.

TID has expressed the desire to reduce the amount of stormwater runoff that is pumped into Lateral No. 4, primarily for the purposes of maintaining water quality and levels in the canal during and after a storm event. Accordingly, the direction of this Master Plan is to ultimately eliminate stormwater discharges to Lateral No. 4.

ES.4.5 Storm Drain Connections to the Sanitary Sewer System

Several areas of the City drain to stormwater inlets that are directly connected to the City's sanitary sewer collection system. Figure 4.2 indicates the areas that have been identified to contribute direct inflow to the sanitary sewer system. These general areas were identified by City operations staff, and were further delineated based on the results of the flow monitoring program performed for the City of Turlock 2013 Sanitary Sewer Master Plan (2013 Sewer Master Plan). For additional information about the direct stormwater inflow areas to the sanitary sewer system, please refer to the 2013 Sewer Master Plan.

ES.5 CAPACITY EVALUATION

Evaluation of the capacity of the City of Turlock's (City's) storm drainage system involved identifying areas in the system where street flooding exceeded the maximum planning criteria. Storm drains that lacked sufficient capacity to convey runoff generated from the design storm could produce backwater effects in the drainage system and potentially cause excessive flooding. This section discusses the possible locations of existing and future flooding caused by these deficiencies.

There are two options for how future management of the direct storm drain connections to the sanitary sewer system will be carried out. First, the City staff could leave the direct connections as they are currently, and make downstream modifications to the sanitary sewer collection system and Turlock Regional Water Quality Control Facility (TRWQCF) to have the capacity to convey and treat peak storm flows. Alternatively, City staff could remove the direct storm drain inlet connections to the sanitary sewer system and direct all of the stormwater inflow to the storm drainage system. Choosing this alternative would effectively segregate the stormwater drainage system and sewer collection systems. Removal of the stormwater inflow from the sanitary sewer system would reduce required capacity to hold peak sewer inflows, and would minimize stormwater impacts to the TRWQCF.

Based on the available alternatives, City staff chose to plan future improvement projects with the goal of segregating the two systems (i.e., removing the direct storm drain inlet connections from the sanitary sewer system). Therefore, future decisions regarding management of the stormwater in the City will assume that the existing areas that directly connect to the sewer collection system will ultimately flow to the stormwater drainage system.

Most areas of the existing storm drainage system have sufficient capacity to convey runoff generated during the 10-year design storm, though some locations exceed the criteria. It is in similar locations that the existing storm drain system lacks sufficient capacity to convey the 50-year design runoff while meeting the one-foot flooding criterion. Areas with existing deficiencies are dispersed throughout the City, but are generally limited to several locations where larger interceptors are required to convey flows collected from large tributary areas.

Build-out of the City's 2030 General Plan update will add residential, commercial, and industrial areas. In general, the City is planning three master plan development areas in the southeast area of the City, as well as the expansion of the Turlock Regional Industrial Park (TRIP) on the west side of the City.

ES.6 STORM DRAINAGE SYSTEM IMPROVEMENTS

The Storm drainage system was analyzed under existing and future build-out conditions. Findings from the analysis were used to develop system improvements.

As previously noted, the wastewater and stormwater systems are connected in the older downtown areas of the City. An important consideration is whether to eliminate storm drainage system connections to the sanitary sewer system. Improvements were identified for two different scenarios: (1) assuming that the direct storm drain connections to sewer would remain in place (existing situation), and (2) assuming that the storm drainage connections in downtown area would be segregated from the sewer system (storm inlets removed). The results of this analysis were presented to City staff at a planning meeting on February 7, 2013. The City concluded that the preferred approach was to segregate (i.e., remove) the storm drainage system connections from the sanitary sewer system. Accordingly, the proposed improvements and costs presented in this Master Plan assume the separation of the sewer and storm drainage systems.

Figure ES.3 and Figure ES.4 illustrate the proposed storm drainage system improvements required to correct existing deficiencies and to accommodate future growth. Table ES.1 shows details of each improvement, including the improvement figure number corresponding to Figure ES.3 and Figure ES.4. For future storm drains, the proposed diameter is shown along with the length of pipe. Figure ES.3, Figure ES.4 and Table ES.1 should be used together to locate the proposed improvement on the map and to gain details of the improvement (length, diameter, street location, etc.). Existing improvements

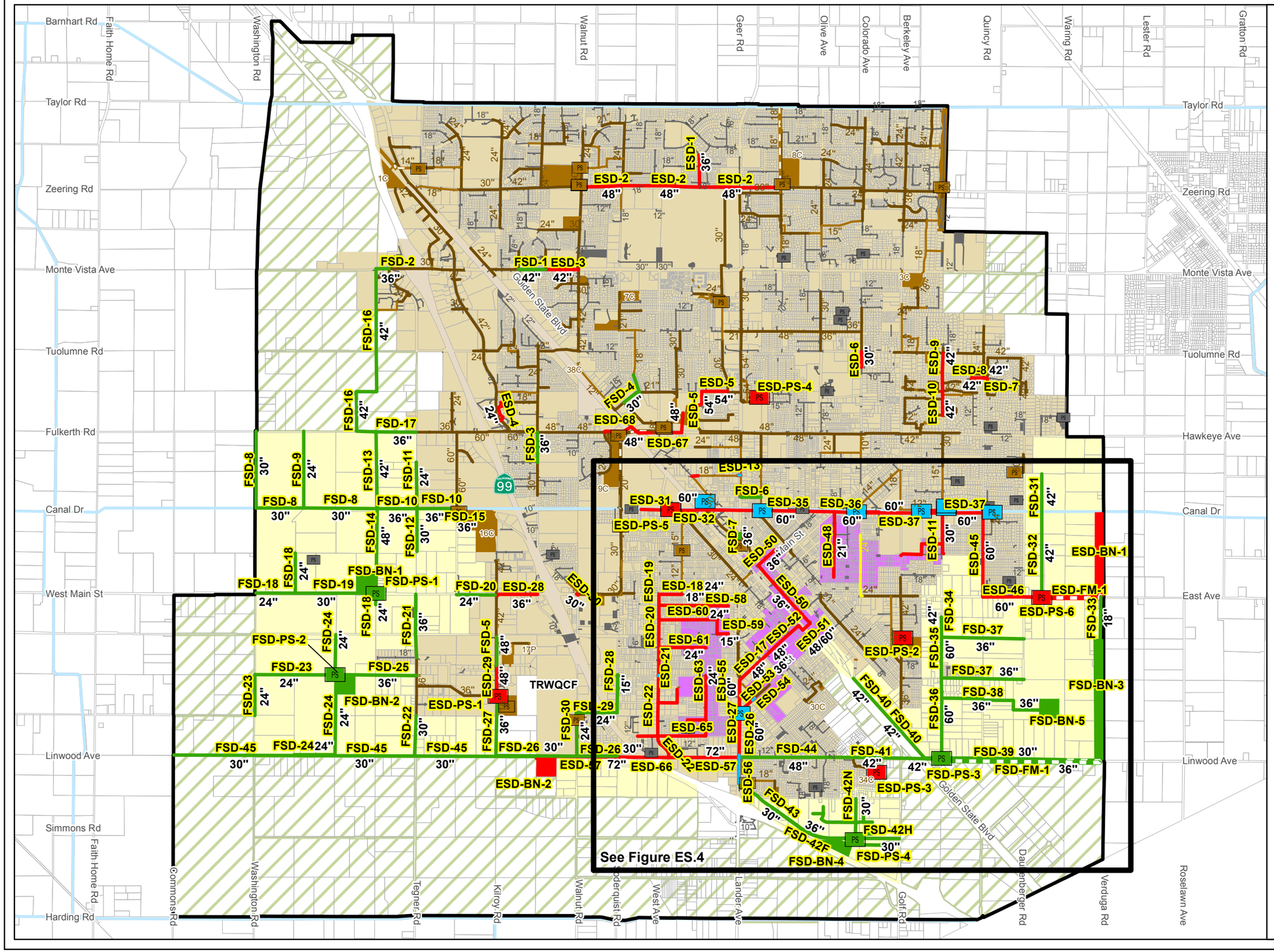

Figure ES.3
Proposed Improvements
Stormwater Master Plan
City of Turlock

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Table ES.1 Proposed Storm Drainage System Improvements
Storm Drainage System Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost				Capital Improvement Phasing				
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Phase 1 2013-2015	Phase 2 2016-2020	Phase 3 2021-2025	Phase 4 2026-2030	Phase 5 After 2030
Existing System Improvements													
Pipelines													
ESD-1	Pipe	Picadilly Lane	Midsummer Lane to Christoffersen Pkwy	A	24	36	Replace	1,060		Phase 2			
ESD-2	Pipe	Christoffersen Pkwy	Pump Station No. 31 Wet Well to Walnut Rd (Walnut Pump Station #1 Wet Well)	A	30	48	Replace	6,750		Phase 2			
ESD-3	Pipe	Monte Vista Dr	Four Seasons Dr to Walnut Rd	A	30	42	Replace	1,090			Phase 3		
ESD-4	Pipe	Countryside Dr	West side of Staples/Walmart Shopping Center, parallel to Countryside Dr	A	12/15	24	Replace	850				Phase 4	
ESD-5	Pipe	Pedras Road, Donnelly Park Drive	West of Geer Rd to South of De Pauw Dr	A	36/48	54	Replace	1,600		Phase 2			
ESD-6	Pipe	Colorado Ave	Waldorf Dr to Tuolumne Rd	A	18	30	Replace	520			Phase 3		
ESD-7	Pipe	Castleview Dr, Quincy Rd	Bristol Park Cl to Quincy Rd	A	12/24	42	Replace	200			Phase 3		
ESD-8	Pipe	Castleview Dr	Quincy Rd to west of Palace Ct	A	-	42	New	410			Phase 3		
ESD-9	Pipe	Johnson Rd	Tuolumne Rd to north of Castleview Dr	A	-	42	New	640			Phase 3		
ESD-10	Pipe	Johnson Rd	North of Castleview Dr to south of Jackson Ct	A	15	42	Replace	1,450			Phase 3		
ESD-12	Pipe	Canal Dr	Colorado Ave to west of Bell St	A	14	24	Replace	730				Phase 4	
ESD-13	Pipe	Almond Ave	Geer Rd and Almond Ave	A	18	-	Abandon	-				Phase 4	
ESD-14	Pipe	Almond Ave	Almond Ave and Golden State Blvd	A	-	18	New	210				Phase 4	
ESD-15	Pipe	Kern St	Canal Dr to Pump Station No. 38 Wet Well	A	12	36	Replace	330				Phase 4	
ESD-16	Pipe/Casing[1]	Canal Dr	Pipe & Casing under TID Canal #4, east of Front St	A	12	36/48	Replace	15				Phase 4	
ESD-18	Pipe	West Main St, West Ave South	Grant Ave to Columbia St	A	12	24	Replace	1,110		Phase 2			
ESD-23	Pipe	Montana Ave	East of Hwy 99 to West Ave South	A	-	15	New	660		Phase 2			
ESD-28	Pipe	West Main St	Walnut Rd to Kilroy Rd	A	24/30	36	Replace	1,350				Phase 4	
ESD-29	Pipe	Kilroy Rd	Parallel Pipe from Industrial Rowe to Spengler Way	A	-	48	New	1,000		Phase 2			
ESD-30	Pipe	West Main St	Corner of West Main St and Tully Rd, Add connection to existing storm drain	A	-	30	New	60		Phase 2			
ESD-31	Pipe	Canal Drive	East of Soderquist Rd to Lexington Ave	A	-	30	New	970				Phase 4	
ESD-32	Pipe	Canal Drive	Lexington to east of Front St	A	-	60	New	1,070				Phase 4	
ESD-33	Pipe/Casing[1]	Canal Drive	Boring under train tracks	A	-	60/84	New	90				Phase 4	
ESD-34	Pipe	Canal Drive	East of Front Street to Palm St	A	-	60	New	1,810				Phase 4	
ESD-35	Pipe	Canal Drive	Palm St to Rose St	A	-	60	New	2,380				Phase 4	
ESD-36	Pipe	Canal Drive	Rose St to Wallace St	A	-	60	New	2,890				Phase 4	
ESD-37	Pipe	Canal Drive	Wallace St to Quincy Rd	A	-	60	New	1,980				Phase 4	
ESD-38	Pipe	Canal Drive	Kern St and Canal Dr, provides connection to canal trunkline	A	-	36	New	30				Phase 4	
ESD-39	Pipe	Canal Drive	Canal and Palm, provides connection to canal trunkline	A	-	24	New	30				Phase 4	
ESD-40	Pipe	Canal Drive	Canal and Palm, provides connection to canal trunkline	A	-	30	New	20				Phase 4	
ESD-41	Pipe	Canal Drive	Canal and Sierra, provides connection to canal trunkline	A	-	24	New	40				Phase 4	
ESD-42	Pipe	Canal Drive	El Paseo Dr to Johnson Rd, provides connection to canal trunkline	A	-	24	New	830				Phase 4	
ESD-44	Pipe	Canal Drive	Camellia St to Quincy Rd	A	-	24	New	310				Phase 4	
ESD-45	Pipe	Quincy Rd	Canal Dr to East Ave	A	-	60	New	2,750				Phase 4	
ESD-46	Pipe	East Ave	Quincy Rd to Southeast 2 Area Pump Station (ESD-PS-6)	A	-	60	New	1,920				Phase 4	
ESD-49	Pipe	Johnson Rd	Marshall St to north of Zinfandel Ln	A	12	18	Replace	340				Phase 4	
ESD-67	Pipe	Hawkeye Ave	Donnely Park to connection at Fulkerth Rd and Joett Dr	A	-	48	New	3,045		Phase 2			
ESD-68	Pipe/Casing(1)	N Front St	Railroad Crossing at N Front St for Donnely Park Pipeline	A	-	48/60	New	295		Phase 2			
Pump Stations/Basins													
ESD-PS-1	Pump Station	Kilroy at WQC Pump Station	Spengler Way and Kilroy Road	-	22.3 cfs	120 cfs	Replace	-		Phase 2			
ESD-PS-2	Pump Station	Pump Station No. 28	Berkeley Ave, south of Daffodil Ln	-	8.9 cfs	37 cfs	Replace	-		Phase 2			
ESD-PS-3	Pump Station	Julep Pump Station	Warp Dr and Julep Way	-	0.9 cfs	4.3 cfs	Replace	-			Phase 3		
ESD-PS-4	Pump Station	Pump Station No. 26	Loyola Way and North Ave	-	3.1 cfs	6.5 cfs	Replace	-				Phase 4	
ESD-PS-5	Pump Station	Pump Station No. 8	Canal Dr and Lexington Ave	-	7.6 cfs	24.5 cfs	Replace	-				Phase 4	
ESD-PS-6	Pump Station	East Ave	East of Daubenberger Rd	-	-	160 cfs	New	-				Phase 4	
ESD-FM-1	Force Main	East Ave	Dual Force Mains to Northern East Linear Basin	B	-	42	New	3,740				Phase 4	
ESD-BN-1	Basin	Northern East Linear Basin	Northern East Linear Basin	-	-	55.8 ac-ft	New	-				Phase 4	
Projects to Remove Direct Connections to Sewer System													
ESD-11	Pipe	Johnson Rd	Marshall St to Canal Dr	A	8/12/15	30	Replace	1,120				Phase 4	
ESD-17	Pipe	D St	6th to Lander Ave	A	10/18	48	Replace	780		Phase 2			
ESD-19	Pipe	West South Ave	Columbia St to High St	A	12	36	Replace	490		Phase 2			
ESD-20	Pipe	West South Ave	High St to Vermont Ave	A	12	36	Replace	900		Phase 2			

Table ES.1 Proposed Storm Drainage System Improvements
Storm Drainage System Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost				Capital Improvement Phasing				
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Phase 1 2013-2015	Phase 2 2016-2020	Phase 3 2021-2025	Phase 4 2026-2030	Phase 5 After 2030
ESD-21	Pipe	West South Ave	Vermont Ave to South Ave	A	12	48	Replace	910		Phase 2			
ESD-22	Pipe	West Ave South	South Ave to Linwood Ave	A	-	48	New	2,820		Phase 2			
ESD-24	Pipe	South Ave	Corner of West Ave South, remove outfall to existing infrastructure	A	15	-	Abandon	-		Phase 2			
ESD-25	Pipe	Montana Ave	Gabriel St to West Ave South	A	-	30	New	670		Phase 2			
ESD-26	Pipe	Lander Ave	E St to Linwood Ave, Adjust inverts to match prposed Linwood trunkline	A	-	60	Replace	1,580	Phase 1				
ESD-27	Pipe	Lander Ave	At F St, influent pipe to Pump Station No. 2 Wet Well	A	42	-	Abandon	-		Phase 2			
ESD-43	Pipe	Canal Drive	Johnson Rd and Canal Dr, provides connection to canal trunkline	A	-	30	New	50				Phase 4	
ESD-47	Pipe	Marshall St	Berkeley Ave to Johnson Rd	A	-	30	New	1,720				Phase 4	
ESD-48	Pipe	Rose St	Merritt St to Canal Dr	A	-	21	New	2,150				Phase 4	
ESD-50	Pipe	Olive Ave, Golden State Blvd	Thor St to southeast of Minerva St	A	-	36	New	3,490		Phase 2			
ESD-51	Pipe/Casing[1]	Golden State Blvd, 1st Street	Pipe & Casing under Train Tracks, east of Golden State Blvd	A	-	48/60	New	130		Phase 2			
ESD-52	Pipe	D St	1st St to 6th St	A	-	48	New	2,060		Phase 2			
ESD-53	Pipe	F St	8th St to Lander Ave	A	-	36	New	680	Phase 1				
ESD-54	Pipe	F St	Southwest of 8th St, Remove connection to sewer	A	33	-	Abandon	-	Phase 1				
ESD-55	Pipe	Lander Ave	D St to E St	A	42	60	Replace	950		Phase 2			
ESD-56	Pipe	Lander Ave	Linwood Ave to Glenwood Ave	A	42	-	Abandon	-	Phase 1				
ESD-57	Pipe	Linwood Ave	Lander Ave to West Linwood Ave Basin	A	-	72	New	6,690	Phase 1				
ESD-58	Pipe	Columbia St	Locust St to West Ave South	A	-	18	New	2,280		Phase 2			
ESD-59	Pipe	Castor St, Laurel St	Locust St to High St	A	-	15	New	830		Phase 2			
ESD-60	Pipe	High St	Laurel St to West Ave South	A	-	24	New	1,910		Phase 2			
ESD-61	Pipe	Vermont Ave	Orange St to West Ave South	A	-	24	New	1,540		Phase 2			
ESD-62	Pipe	Martinez St, Williams Ave	Parnell Ave to West Ave South	A	-	15	New	1,070		Phase 2			
ESD-63	Pipe	Orange St	South Ave to Montana Ave	A	-	24	New	1,980		Phase 2			
ESD-64	Pipe	Lewis St	Maple St to Orange St	A	-	15	New	600		Phase 2			
ESD-65	Pipe	Montana Ave	Orange St to west of Gabriel St	A	-	30	New	900		Phase 2			
ESD-66	Pipe/Casing[1]	Linwood Ave, under Highway 99	Boring under Highway 99, under Linwood Ave	A	-	72/84	New	240	Phase 1				
ESD-BN-2	Basin	Linwood Ave	West Linwood Ave Basin	-	-	123 ac-ft	New	-	Phase 1				
Buildout System Improvements													
Pipelines													
FSD-1	Pipe	Monte Vista Dr	Summer Creek Dr to Four Seasons Dr	A	30	42	Replace	890			Phase 3		
FSD-2	Pipe	Monte Vista Dr	West of Tegner Rd to Tegner Rd	A	24	36	Replace	426					Phase 5
FSD-3	Pipe	Tully Rd	Branding Iron Dr to Fulkerth Rd	A	30	36	Replace	980				Phase 4	
FSD-4	Pipe	Oxford Ave, Pedras Rd	Jacquelinelee Dr to Northeast of Divanian Dr	A	18/21	30	Replace	1,220				Phase 4	
FSD-5	Pipe	Kilroy Rd	Parallel Pipe from Castor St to Industrial Rowe	A	-	48	New	940		Phase 2			
FSD-6	Pipe	Syracuse Ave	Palm St to Geer Rd	A	8	18	Replace	660			Phase 3		
FSD-7	Pipe	Golden State Blvd	Monroe Ave to Geer Rd	A	24	36	Replace	200			Phase 3		
FSD-8	Pipe	Washington Rd, Canal Dr	Fulkerth Rd to Fransil Ln	B	-	30	New	6,490					Phase 5
FSD-9	Pipe	Unnamed Rd	Fulkerth Rd to Canal Dr	B	-	24	New	2,530					Phase 5
FSD-10	Pipe	Canal Dr	Dianne Dr to Fransil Ln	B	-	36	New	2,560					Phase 5
FSD-11	Pipe	Tegner Rd	South of Fulkerth Rd to Canal Dr	B	-	24	New	1,540					Phase 5
FSD-12	Pipe	Tegner Rd	North of West Main St to Canal Dr	B	-	30	New	1,400					Phase 5
FSD-13	Pipe	Fransil Ln	Fulkerth Rd to Canal Dr	B	-	42	New	2,510					Phase 5
FSD-14	Pipe	Fransil Ln	Canal Dr to West Main St, to FSD-PS-2 Wet Well	B	-	48	New	2,760					Phase 5
FSD-15	Pipe	Dianne Dr	Overflow Pipe from Dianne Pump Station (No. 51) to FSD-11	B	-	36	New	70					Phase 5
FSD-16	Pipe	Unnamed Roads, Agricultural Land	Monte Vista Ave to Fulkerth Rd	B	-	42	New	6,620					Phase 5
FSD-17	Pipe	Fulkerth Rd	Tegner Rd to Fransil Ln, Overflow pipe from Fulkerth Rd storm drains	B	-	36	New	1,310					Phase 5
FSD-18	Pipe	West Main St, Clinton Rd, Fransil Ln	Near intersection of West Main St and Clinton Rd, and along Fransil Ln	B	-	24	New	2,980					Phase 5
FSD-19	Pipe	West Main St	Clinton Rd to Fransil Ln	B	-	30	New	2,640					Phase 5
FSD-20	Pipe	West Main St	Dianne Dr to Kilroy Rd	B	-	24	New	1,270					Phase 5
FSD-21	Pipe	Tegner Rd	West Main St to Liberty Square Pkwy	B	-	36	New	2,070					Phase 5
FSD-22	Pipe	Tegner Rd	Linwood Ave to south of Humphrey Ct	B	-	30	New	1,300					Phase 5
FSD-23	Pipe	Washington Rd, Ruble Rd	Clayton Rd to FSD-PS-2 Wet Well	B	-	24	New	3,920					Phase 5
FSD-24	Pipe	Linwood Ave, Unnamed Rd	Linwood Ave and along Unnamed Rd, to FSD-PS-2 Wet Well	B	-	24	New	5,290					Phase 5
FSD-25	Pipe	Ruble Rd	Tegner Rd to Unnamed Rd	B	-	36	New	2,670					Phase 5
FSD-26	Pipe	Linwood Ave	Glenwood Ave to Kilroy Rd	A	-	30	New	3,990					Phase 5
FSD-27	Pipe	Kilroy Rd	Linwood Ave to Spengler Way	A	-	36	New	1,950					Phase 5

Table ES.1 Proposed Storm Drainage System Improvements
Storm Drainage System Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost				Capital Improvement Phasing				
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Phase 1 2013-2015	Phase 2 2016-2020	Phase 3 2021-2025	Phase 4 2026-2030	Phase 5 After 2030
FSD-28	Pipe	Soderquist Rd	South Ave to Jordan Ave	A	-	15	New	2,500					Phase 5
FSD-29	Pipe/Casing[1]	Highway 99	West of Soderquist Rd to the east side of Highway 99, north of Venture Ln	A	-	24/42	New	200					Phase 5
FSD-30	Pipe	North of Venture Ln, Walnut Rd	Soderquist Rd to Walnut Rd, Linwood Ave to Venture Ln	A	-	24	New	2,820					Phase 5
FSD-31	Pipe	Unnamed Dr	South of Hawkeye Ave to north of Canal Dr	B	-	42	New	1,980				Phase 4	
FSD-32	Pipe	Unnamed Dr	South of Canal Dr to East Ave	B	-	42	New	2,080				Phase 4	
FSD-33	Pipe	West of Verduga Rd	Connection pipeline from Northern to Southern East Linear Basin	B	-	18	New	1,420				Phase 4	
FSD-34	Pipe	Johnson Rd	South of East Ave to Unnamed Rd	B	-	42	New	620			Phase 3		
FSD-35	Pipe	Johnson Rd	Unnamed Rd to Brier Rd	B	-	60	New	1,340			Phase 3		
FSD-36	Pipe	Johnson Rd	Brier Rd to Linwood Ave	B	-	60	New	2,620			Phase 3		
FSD-37	Pipe	Unnamed Rd, Brier Rd	Daubenberger Rd to Johnson Rd	B	-	36	New	5,410			Phase 3		
FSD-38	Pipe	South of Brier Rd	FSD-BN-5 (Future Basin) to Johnson Rd	B	-	36	New	3,580			Phase 3		
FSD-39	Pipe	Linwood Ave	West of Verduga Rd to Johnson Rd	B	-	30	New	4,030			Phase 3		
FSD-40	Pipe	Paulson Rd	Center St to Linwood Ave at Future Pump Station (FSD-PS-3) Wet Well	B	-	42	New	4,050			Phase 3		
FSD-41	Pipe	Linwood Ave	Johnson Rd to 5th St	B	-	42	New	2,830			Phase 3		
FSD-42A	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	60	New	220		Phase 2			
FSD-42B	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	2,230		Phase 2			
FSD-42C	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	670		Phase 2			
FSD-42D	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	440		Phase 2			
FSD-42E	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	720		Phase 2			
FSD-42F	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	2,310		Phase 2			
FSD-42G	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	150		Phase 2			
FSD-42H	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	1,440		Phase 2			
FSD-42I	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	560		Phase 2			
FSD-42J	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	380		Phase 2			
FSD-42K	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	490		Phase 2			
FSD-42L	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	670		Phase 2			
FSD-42M	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	770		Phase 2			
FSD-42N	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	510		Phase 2			
FSD-42O	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	280		Phase 2			
FSD-42P	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	800		Phase 2			
FSD-42Q	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	260		Phase 2			
FSD-43	Pipe	Lander Ave	Southeast 1 Area (FSD-PS-4) to Lander Ave	B	-	30	New	4,270		Phase 2			
FSD-44	Pipe	Linwood Ave	5th St to Lander Ave	A	-	48	New	3,770		Phase 2			
FSD-45	Pipe	Linwood Ave	West Linwood Ave Basin to Harding Drain Outfall	B	-	30	New	23,760			Phase 3		
Pump Stations/Basins													
FSD-PS-1	Pump Station	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Pump Station	-	-	60 cfs	New	-					Phase 5
FSD-PS-2	Pump Station	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Pump Station	-	-	48.5 cfs	New	-					Phase 5
FSD-PS-3	Pump Station	Linwood Ave	At Johnson Rd	-	-	136 cfs	New	-			Phase 3		
FSD-FM-1	Force Main	Linwood Ave	Johnson Rd to Verduga Rd (Dual Force Mains)	B	-	36	New	10,320			Phase 3		
FSD-PS-4	Pump Station	Unnamed Rd	Southeast 1 Area Future Pump station	-	-	47 cfs	New	-		Phase 2			
FSD-BN-1	Basin	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Retention Basin	-	-	40 ac-ft	New	-					Phase 5
	Land Acquisition	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Retention Basin	-	-	10 acres	New	-					Phase 5
FSD-BN-2	Basin	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Detention Basin	-	-	40 ac-ft	New	-					Phase 5
	Land Acquisition	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Detention Basin	-	-	10 acres	New	-					Phase 5
FSD-BN-3	Basin	Southern East Linear Basin	Southern East Linear Basin	-	-	81 ac-ft	New	-			Phase 3		
	Land Acquisition	Southern East Linear Basin	Southern East Linear Basin	-	-	20.25 acres	New	-			Phase 3		
FSD-BN-4	Basin	Highway 99 Basin	Southeast 1 Area, Highway 99 new basin	-	-	24.6 ac-ft	New	-		Phase 2			
	Land Acquisition	Highway 99 Basin	Southeast 1 Area, Highway 99 new basin	-	-	6.2 acres	New	-		Phase 2			
FSD-BN-5	Basin	Unnamed Rd	Southeast of Daubenberger Rd and Brier Rd	-	-	40 ac-ft	New	-			Phase 3		
	Land Acquisition	Unnamed Rd	Southeast of Daubenberger Rd and Brier Rd	-	-	10 acres	New	-			Phase 3		

Notes:
1. Proposed casings size and carrier pipe size.
2. Pump station capacities refer to the total capacity unless noted otherwise.

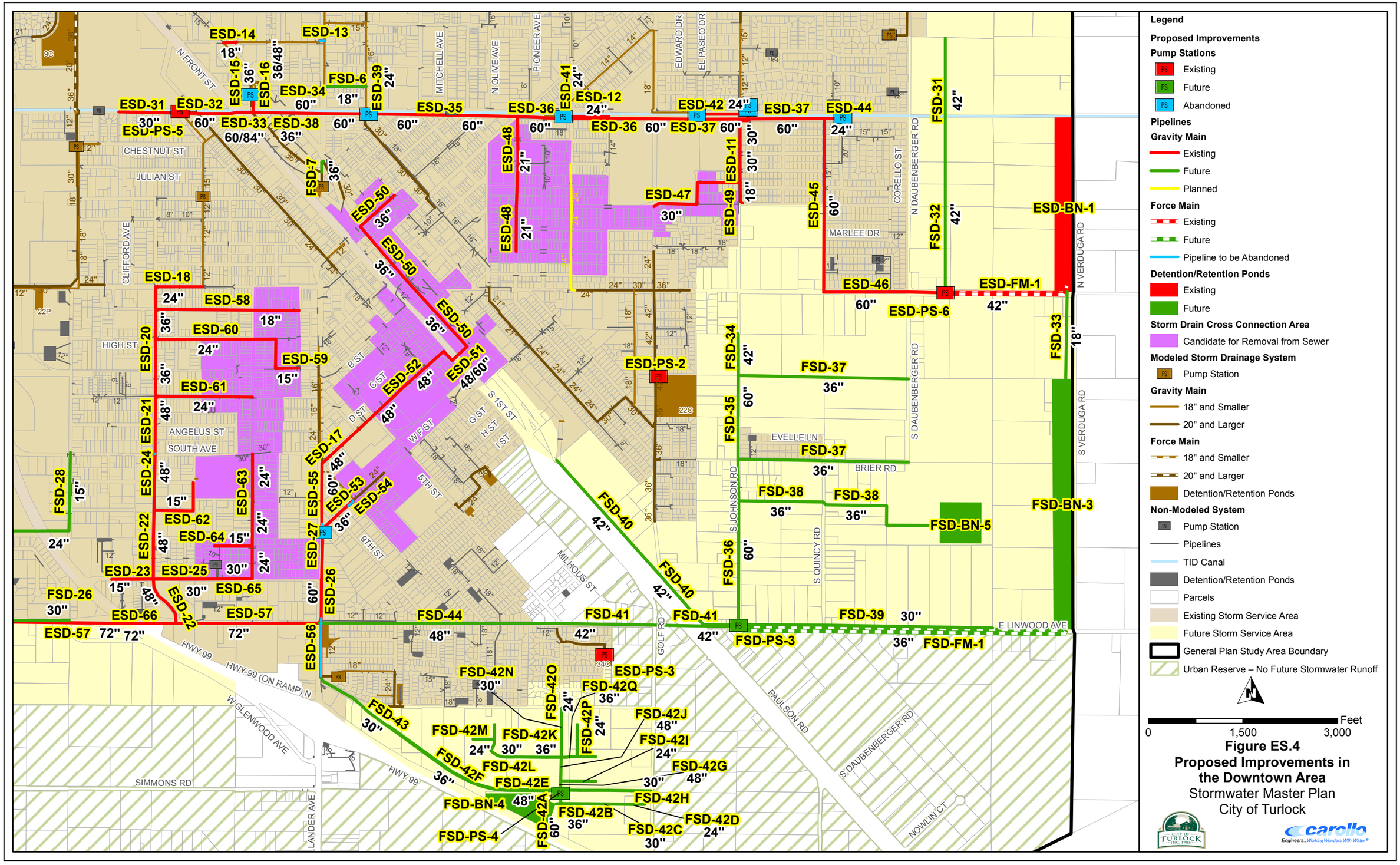


Figure ES.4
Proposed Improvements in the Downtown Area
Stormwater Master Plan
City of Turlock

are labeled “ESD” for “Existing Storm Drain” improvement; future improvements are labeled “FSD” for “Future Storm Drain” improvement.

ES.6.1 Differentiating between Improvements for Existing Users and Future Users

An existing storm drain, pump station, or basin may have sufficient capacity to convey current peak runoff, but as growth continues and more users are added to the system, the increased runoff results in capacity deficiencies. These projects, as well as new storm drainage system facilities to extend service to future growth areas, are considered future improvements and allocated to future users.

In some cases a project is needed to correct an existing capacity deficiency but it is sized to accommodate additional runoff from future development. In these cases, the hydraulic modeling results were used to determine the cost breakdown between existing and future users.

ES.6.2 Project Prioritization

When fully implemented, the capital projects will facilitate the collection, conveyance, storage, and discharge of peak storm flows to limit street flooding to the maximum allowed. Prioritizing the required capital improvements for the City’s storm drainage system is an important aspect of the Master Plan. The improvement projects were prioritized on a short-term and long-term basis to mitigate existing deficiencies and meet the needs of proposed development.

The projects are grouped into the following phases based on project priorities and future growth:

- Phase 1: Years 2013 through 2015
- Phase 2: Years 2016 through 2020
- Phase 3: Years 2021 through 2025
- Phase 4: Years 2026 through 2030
- Phase 5: After 2030

The projects were phased based on the best available information for how the City will develop moving forward. The actual implementation of the improvements serving future users ultimately depends on growth. The priorities presented below are estimates, and changes in the City’s planning assumptions or growth projections could increase or decrease the priority of each improvement.

- **Phase 1 Projects (2013-2015).** The highest priority projects are the main backbone features of the storm drainage system improvement projects needed to remove storm drainage system connections to the sewer system. These include a new storm basin

(ESD-BN-2) and other major storm drain pipelines to the basin (ESD-26, ESD-53, ESD-57, and ESD-66). These improvements are indentified on Figure 5.2 and Table 5.1. However, costs associated with these projects are included in the Sewer System CIP.

- **Phase 2 Projects (2016-2020).** The second phase targets the majority of the remaining improvement projects to remove storm drain connections from the sewer system. These include:
  - ESD-17
  - ESD-19 to ESD-22
  - ESD-24 and ESD-25
  - ESD-50 to ESD-52
  - ESD-55
  - ESD-58 to ESD-65

  Other high priority projects to address storm drainage system deficiencies targeted for implementation phase 2 include:
  - ESD-1 and ESD-2
  - ESD-5
  - ESD-18, ESD-23
  - ESD-29 and ESD-30
  - Kilroy at WQCF Pump Station (ESD-PS-1)
  - Pump Station 28 (ESD-PS-2)

  Phase 2 also targets additional growth related improvements which could potentially be required in the relatively near term. These projects include:
  - FSD-5
  - FSD-42 to FSD-44
  - Future Pump Station in Southeast Area 1 (FSD-PS-4)
  - Future Basin in Southeast Area 1 (FSD-BN-4)
- **Phase 3, 4, and 5 Projects (2021-2025, 2026-2030, and After 2030)**. Lower priority projects to address existing storm drainage system deficiencies are targeted for implementation in phases 3 and 4. In addition, the remaining storm drainage system projects that remove storm drain connections to the sewer system (ESD-11, ESD-43, ESD-47, and ESD-48) are targeted for phase 4.

  For the purposes of prioritizing future system improvements, the Phase 3 through 5 growth projects are viewed as longer-term projects driven by development at the outer edges of the planning area.

ES.7 CAPITAL IMPROVEMENT PLAN

The capacity upgrades set the foundation for the City's stormwater system capital improvement plan (CIP). The CIP cost estimates are opinions developed from bid tabulations, cost curves, and information obtained from previous studies.

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as preliminary alignment generation, investigation of alternative routings, and detailed utility and topography surveys.

The Association for the Advancement of Cost Engineering (AACE) defines an Order of Magnitude Estimate, deemed appropriate for master plan studies, as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within plus 50 percent to minus 30 percent. This section presents the assumptions used in developing order of magnitude cost estimates for recommended facilities.

The CIPs are prioritized based on their urgency to mitigate existing deficiencies and for servicing anticipated growth. It is recommended that improvements to mitigate existing deficiencies be assigned the highest priority. Expansion of the system to accommodate growth should be implemented as the City grows.

The implementation phases are in 5-year increments, except for the first phase, which runs from 2013 through 2015. A summary by phase is provided in Table ES.2. The total capital cost of the City's CIP for the stormwater improvements is $125.8 million.

Table ES.2 Capital Cost Summary Stormwater Master Plan City of Turlock

	Project Phasing					
User Type	**Phase 1 2013-15 ($, mill.)**	**Phase 2 2016-20 ($, mill.)**	**Phase 3 2021-25 ($, mill.)**	**Phase 4 2026-30 ($, mill.)**	**Phase 5 Post 2030 ($, mill.)**	**Total ($, mill.)**
Storm Drainage System[(2)]						
Exiting Users	0.0	11.6	11.7	23.7	13.3	60.3
Future Users	0.0	12.6	29.1	6.0	17.8	65.5
Total	**0.0**	**24.3**	**40.7**	**29.7**	**31.1**	**125.8**

Notes:
(1) Costs are based on the Engineering News Record Construction Cost Index of 821 (1967 base year, San Francisco, March 2013).
(2) Costs for storm drainage projects to remove storm drain cross connections from the sewer system are included in the sewer system CIP.

Chapter 1

BACKGROUND

This chapter presents the background for the Stormwater Master Plan (Master Plan) and the objectives of the study. A list of abbreviations is also provided.

1.1 STUDY AREA SETTINGS

The City of Turlock (City) is located in Stanislaus County (County) on the eastern side of California's San Joaquin Valley, about 100 miles east of the San Francisco Bay Area and 90 miles south of Sacramento. Figure 1.1 provides a regional location map of the City. State Highway 99 intersects the City along the north-south axis, providing regional transport to Stockton and Sacramento to the north and Fresno and Bakersfield to the south.

The City is bordered primarily by agricultural land, which helps establish it as a stand-alone community. In addition, agriculture is a major defining feature of the City's identity and comprises a large component of the City's economy. The City's downtown core was originally established around the railroad station, and has since grown outward to include residential, commercial, and industrial developments. Turlock is attractive to food processors and distributors because of its location in the Central Valley and abundance of locally grown products. The City was incorporated in 1908.

The City owns, maintains, and operates its own storm drainage system and associated facilities, including pipelines, pump stations, and detention/retention basins. The storm drainage system is designed to manage the runoff of rainwater and minimize the impact of significant rainfall.

1.2 STORM WATER SERVICE AREA

Figure 1.2 illustrates the City's current stormwater service area. The City storm drainage system serves customers within the existing City limits, excluding County islands and some industrial facilities that retain stormwater onsite but there are also some locations where the storm service area extends outside the city limits. The City manages and maintains approximately 133 miles of gravity storm lines, 40 stormwater pump stations and associated force mains, and 45 detention/ retention basins. Collected runoff generally flows into detention/retention basins located throughout the City, and in some cases is ultimately pumped to local drainage channels for disposal after the storm event. For areas of central Turlock that are not served by detention/retention basins, stormwater is pumped directly into Turlock Irrigation District (TID) canals such as TID Lateral #4. The City maintains a discharge permit with TID that limits the amount of stormwater that can be discharged to the canal during a storm event.

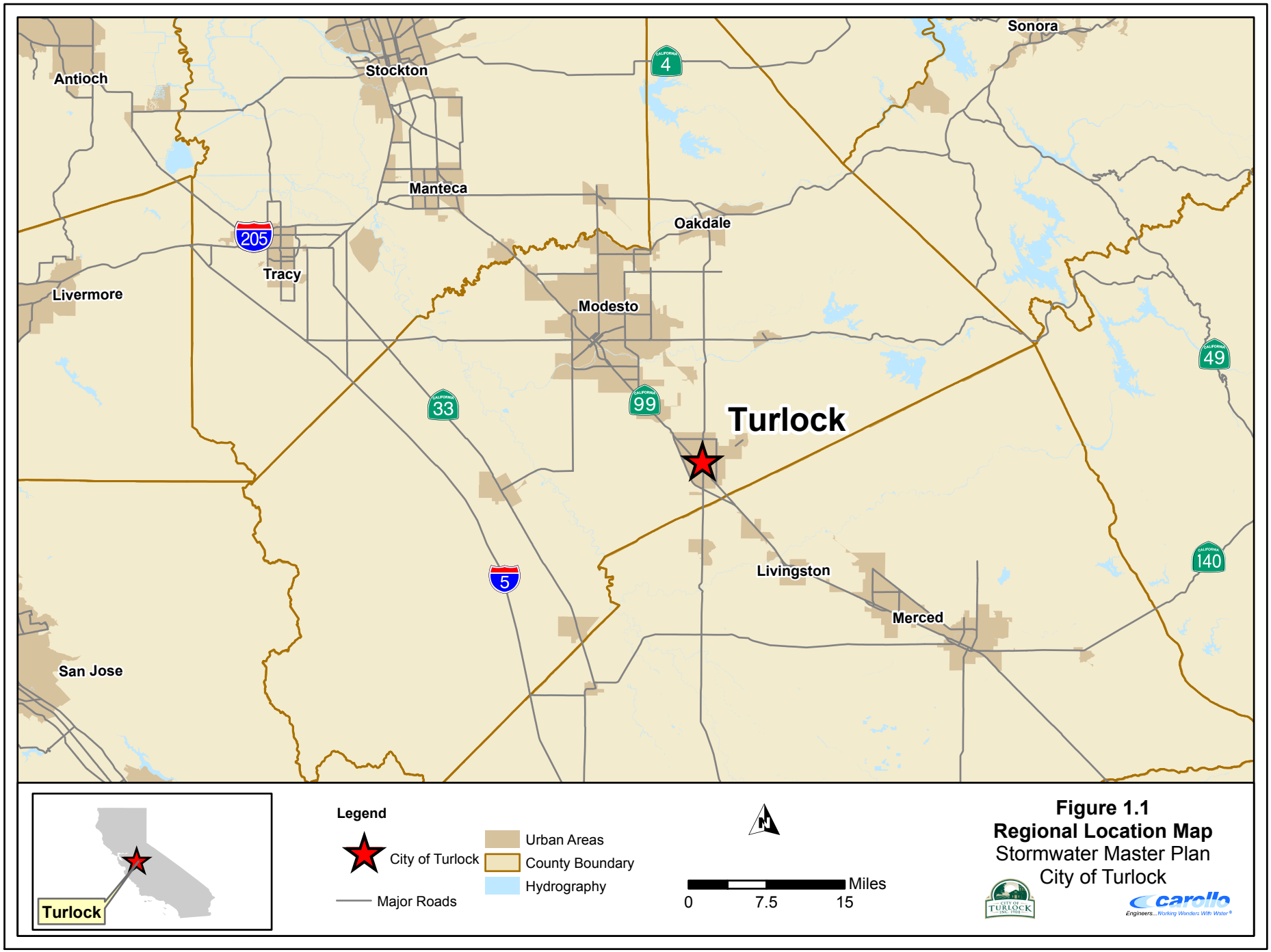
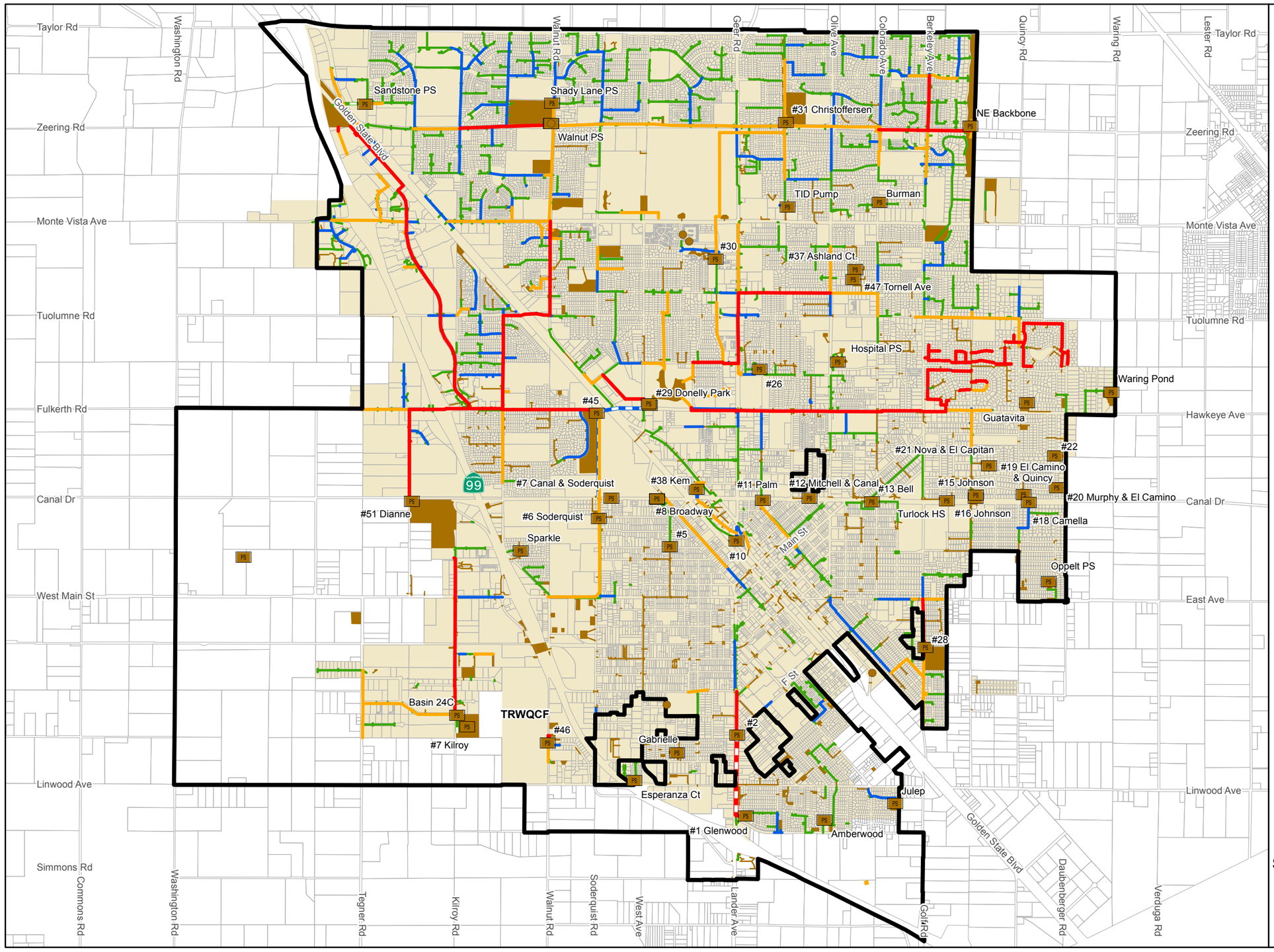


Figure 1.1
Regional Location Map
Stormwater Master Plan
City of Turlock



Legend

Existing Storm Drainage System

- Pump Station
- Downwell

Pipelines

Gravity Mains

- 12" and Smaller
- 14" - 18"
- 20" - 27"
- 30" - 36"
- 42" and Larger

Force Mains

- 12" and Smaller
- 14" - 18"
- 20" - 27"
- 30" - 36"
- 42" and Larger

- Detention/Retention Ponds
- Existing Storm Service Area
- City Limits
- Parcels

N

0 3,000 6,000 Feet

Figure 1.2
Storm Drainage System Service Area
Stormwater Master Plan
City of Turlock

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The City recently updated its General Plan for a planning horizon of 2030. The land use, zoning designations, and development assumptions used in this Master Plan are consistent with those provided in the General Plan. The improvement projects recommended in this Master Plan are meant to serve existing and future customers as development extends to the General Plan Study Area Boundary. Should future planning conditions change from the assumptions stated in this Master Plan, such as accelerated growth or more intense developments, revisions and adjustments to the Master Plan recommendations would be necessary.

1.3 SCOPE AND AUTHORIZATION

The purpose of the Stormwater Master Plan is to identify capacity deficiencies in the stormwater system, develop feasible alternatives to correct these deficiencies, and plan infrastructure that will serve future development. On September 30, 2011, the City approved a professional service agreement with Carollo Engineers, Inc. (Carollo), which included the following main tasks:

- Collect and review data,
- Conduct drainage system condition assessment,
- Create hydraulic model,
- Evaluate capacity of storm drainage system and related facilities,
- Develop a phased capital improvement program, and
- Master Plan preparation.

1.4 REPORT ORGANIZATION

The Master Plan contains six chapters, followed by appendices that provide supporting documentation for the information presented in the report.

Chapter 1 - Background. This chapter presents the need for this Master Plan and the objectives of the study. A list of reference material is provided to assist the reader in understanding the information presented.

Chapter 2 - Study Area Description. This chapter presents a description of the study area, defines the land use classifications, and summarizes the historical population trends.

Chapter 3 - Planning Criteria. This chapter presents the planning criteria for evaluating the storm drainage system. The planning criteria address the storm drainage system capacity, maximum surcharge and flood depths, and storm runoff coefficients.

Chapter 4 - Stormwater System Facilities and Hydraulic Model. This chapter presents an overview of the City's storm drainage facilities. This chapter also describes the

development of the City's storm drainage hydrologic and hydraulic models. These models were used for identifying existing system deficiencies and for recommending improvements.

Chapter 5 - Capacity Evaluation and Proposed Improvements. This chapter discusses the capacity evaluation of the storm drainage system and the proposed improvements needed to mitigate existing capacity deficiencies and serve future users.

Chapter 6 - Capital Improvement Projects. This chapter presents the recommended Capital Improvement Program (CIP) for the City's stormwater drainage system. The CIP includes a description of the capital improvement projects, a summary of the capital costs, and assessment of the costs that the City will need to recover from existing rate payers and future development. This chapter is organized to assist the City in making finance decisions.

1.5 ACKNOWLEDGMENTS

Carollo wishes to acknowledge and thank Mike Pitcock, Director of Development Services/City Engineer; Dan Madden, Municipal Services Director; Anthony Orosco, Senior Civil Engineer; Rich Fulz, City Land Surveyor/Development Services Supervisor, and Larry Gilley, Utilities Manager. Their cooperation and courtesy in obtaining a variety of necessary information were valuable components in completing and producing this report.

1.6 REFERENCE MATERIAL

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

- City of Turlock General Plan, Public Review Draft, October 2011, Dyett & Bhatia
- City of Turlock Standard Specifications and Drawings, March 2008, City of Turlock Development Services, Engineering Division
- City of Turlock General Plan, Existing Conditions Report, March 2009, Dyett & Bhatia
- Stanislaus County Standards and Specifications, 2007 Edition, Stanislaus County Department of Public Works
- Soil Survey of Stanislaus County, California, Western Part, United States Department of Agriculture Natural Resources Conservation Service
- Infrastructure Planning for City of Turlock General Plan Update, November 2012, West Yost Associates

Chapter 2

STUDY AREA DESCRIPTION

This chapter presents a description of the study area, defines the land use classifications, and summarizes the historical population trends.

2.1 STUDY AREA

The City of Turlock (City) updated its General Plan in 2011. The City's General Plan study area consists of the City limits, the City's sphere of influence (SOI), and areas urban reserve (primarily used as agricultural land). The City's SOI is nearly conterminous with the City limits along its western edge, but varies along the eastern side of the City.

The General Plan update describes projected growth over the next 20 years as occurring as infill within current City limits, as well as limited new development outside City limits. City policy is that all infill growth areas within the current City limits must be at least 70-percent built out before new development areas are allowed to annex. The General Plan includes three new distinct development areas. The land area remaining in the General Plan Planning Boundary is designated as Urban Reserve, or land that is not expected to develop within the planning horizon of the General Plan.

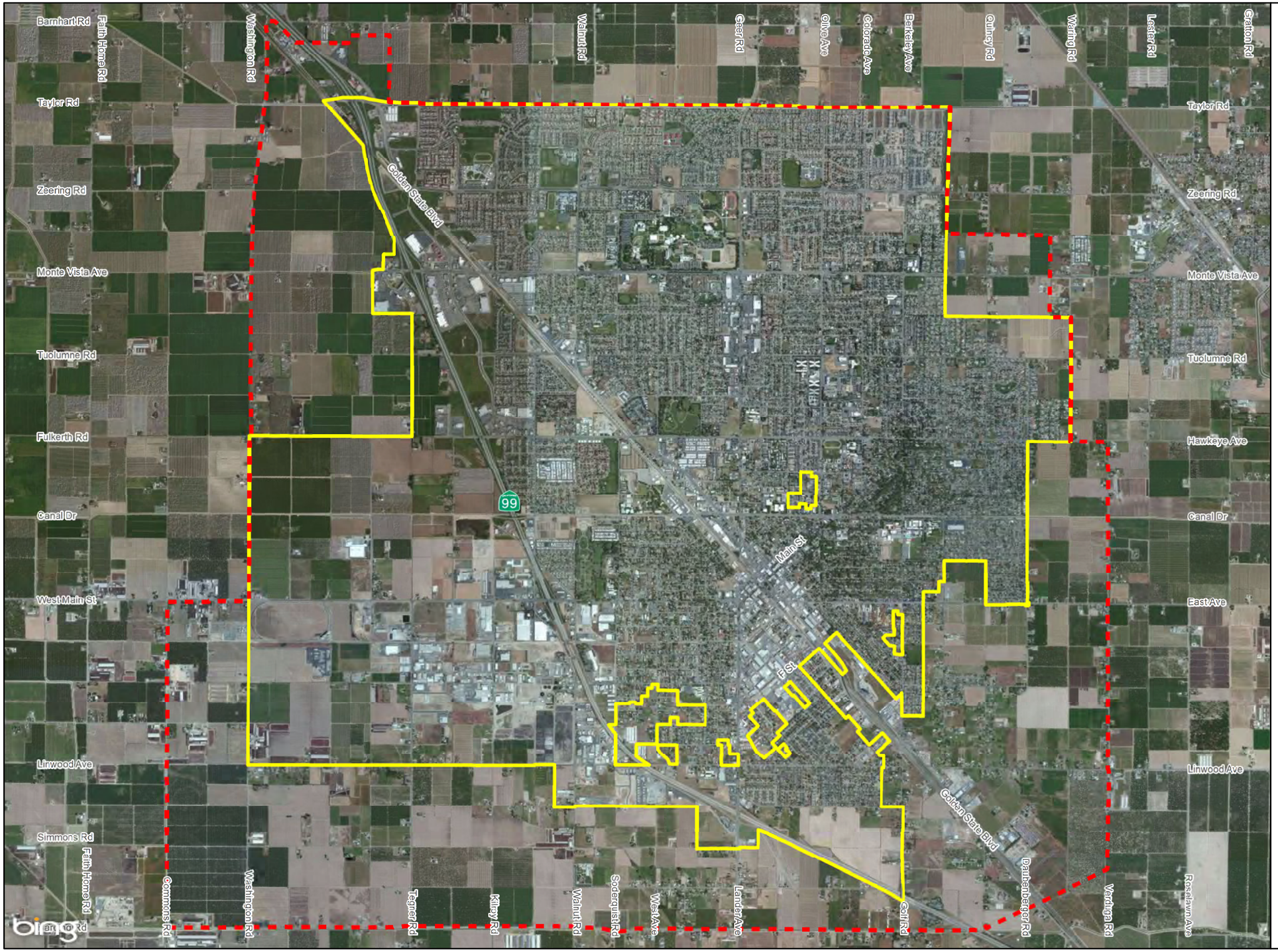
The study area boundary (Figure 2.1) for this master plan coincides with the General Plan study area boundary. This area includes developed land within the City limits, infill areas within the existing City limits, and areas proposed for annexation and development within the study area boundary. The study area includes developed land within the City limits, infill areas within the existing City limits, and areas proposed for annexation and development that is outside the City limits and SOI. In addition, there are several County-owned islands within the City that are expected to be annexed and developed according to the development plan in the General Plan.

2.2 PLANNING PERIOD

The study area includes the existing City limits and development within the General Plan Study Area boundary that could occur through the year 2030 and beyond. Build-out of the majority of the City is projected to occur by year 2030, whereas full build-out of the Turlock Regional Industrial Park (TRIP) is expected to occur some time after 2030. Existing and projected populations and land uses within the Study Area are discussed in this chapter.

2.3 CLIMATE

The City is characterized by an "inland Mediterranean" type climate; summers are hot and dry and winters are cool and moist. Approximately 88 percent of the annual rainfall occurs



Legend

City Limits

General Plan Boundary

N

0 3,500 7,000 Feet

Figure 2.1
Master Plan Study Area
Stormwater Master Plan
City of Turlock

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between November and April, with an average annual rainfall of 11.4 inches[1]. In winter months, fog conditions often persist and can last for several days, but the season is generally short.

2.4 SOIL AND TOPOGRAPHY

The City is located in the heart of California's Central Valley. The City is predominantly flat and slopes to the southwest. The City ranges in elevation from about 116 feet above mean sea level (msl) on the eastside of the City, to 93 feet above msl on the west side of the City. Figure 2.2 shows the topography of the study area.

According to data provided by the United States Department of Agriculture's (USDA) Natural Resource Conservation Service (NRCS), the Study Area has 12 main soil types, which are listed in Table 2.1 and shown on Figure 2.3. Soils that accounted for less than one percent were combined in the "Other" category.

2.5 LAND USE

Land use information is an integral component in determining the amount of stormwater runoff generated within a City. The type of land use in an area will affect the pervious surface area, and therefore the volume and characteristics of the stormwater generation. Aerial photography and satellite imagery were used to determine runoff for existing development conditions. The existing pervious surface areas throughout the City is described in Chapter 4.

Land use assumptions used in this study are consistent with those for existing and proposed development published in the 2030 General Plan.

The following land use descriptions are paraphrased from the City's General Plan. Pages from the General Plan are included in Appendix A for reference.

Residential. Areas designated as residential permit housing, childcare facilities, places of religious assembly, retail grocery stores not exceeding 2,500 square feet, and residential care facilities consistent with Federal and State Laws. Residential densities are per gross acre of developable land. Average densities are equivalent to the average densities assumed in the General Plan for calculation purposes.

- Very Low Density (VLDR) allows 0.2 to 3.0 units per gross acre, and assumes 3.0 persons per unit. An average density of 1.6 units per gross acre is assumed.
- Low Density (LDR) allows 3.0 to 7.0 units per gross acre, and assumes 3.2 persons per unit. An average density of 5.0 units per gross acre is assumed.

[1] Source: Historical data from Western Regional Climate Center, Modesto, CA (Station: Cty-Co H Sham FD APT [KMOD])

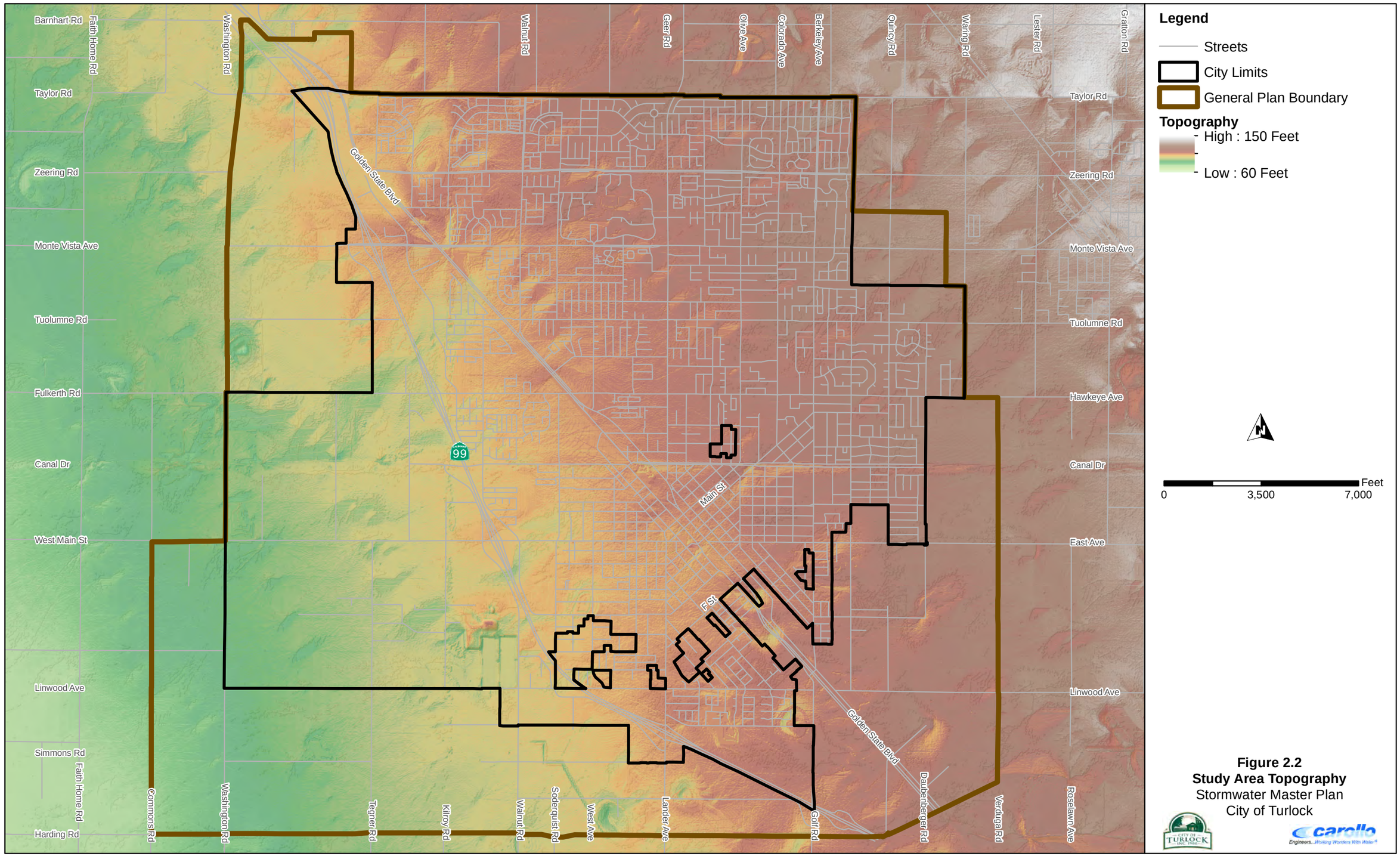

Figure 2.2
Study Area Topography
Stormwater Master Plan
City of Turlock

Table 2.1 Soil Types and Distribution within the Project Area
Stormwater Master Plan
City of Turlock

Soil Type	Percent of Study Area
Delhi loamy sand, silty substratum, 0 to 3 percent slopes	1.8
Delhi loamy sand, 0 to 3 percent slopes	15.7
Delhi sand, 0 to 3 percent slopes	1.8
Dinuba fine sandy loam, 0 to 1 percent slopes	5.2
Dinuba sandy loam, 0 to 1 percent slopes	26.9
Dinuba sandy loam, deep, 0 to 1 percent slopes	3.4
Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes	3.2
Hanford sandy loam, 0 to 3 percent slopes	5.7
Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes	2.9
Hilmar loamy sand, 0 to 1 percent	25.1
Hilmar sand, 0 to 3 percent slopes	1.1
Tujunga loamy sand, 0 to 3 percent slopes	4.0
Other	3.3
Total	**100.0**

Source: United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS)

- Low-Medium Density (LDR-MDR) allows 5.0 to 10.0 units per gross acre, and assumes 3.0 persons per unit. An average density of 7.5 units per gross acre is assumed.
- Medium Density (MDR) allows 7.0 to 15.0 units per gross acre, and assumes 2.7 persons per unit. An average density of 11.0 units per gross acre is assumed.
- High Density (HDR) allows 15.0 to 40.0 units per gross acre, and assumes 2.4 persons per unit. An average assumed density is not listed in the General Plan for this classification, but 27 units per gross acre is assumed for this Master Plan.

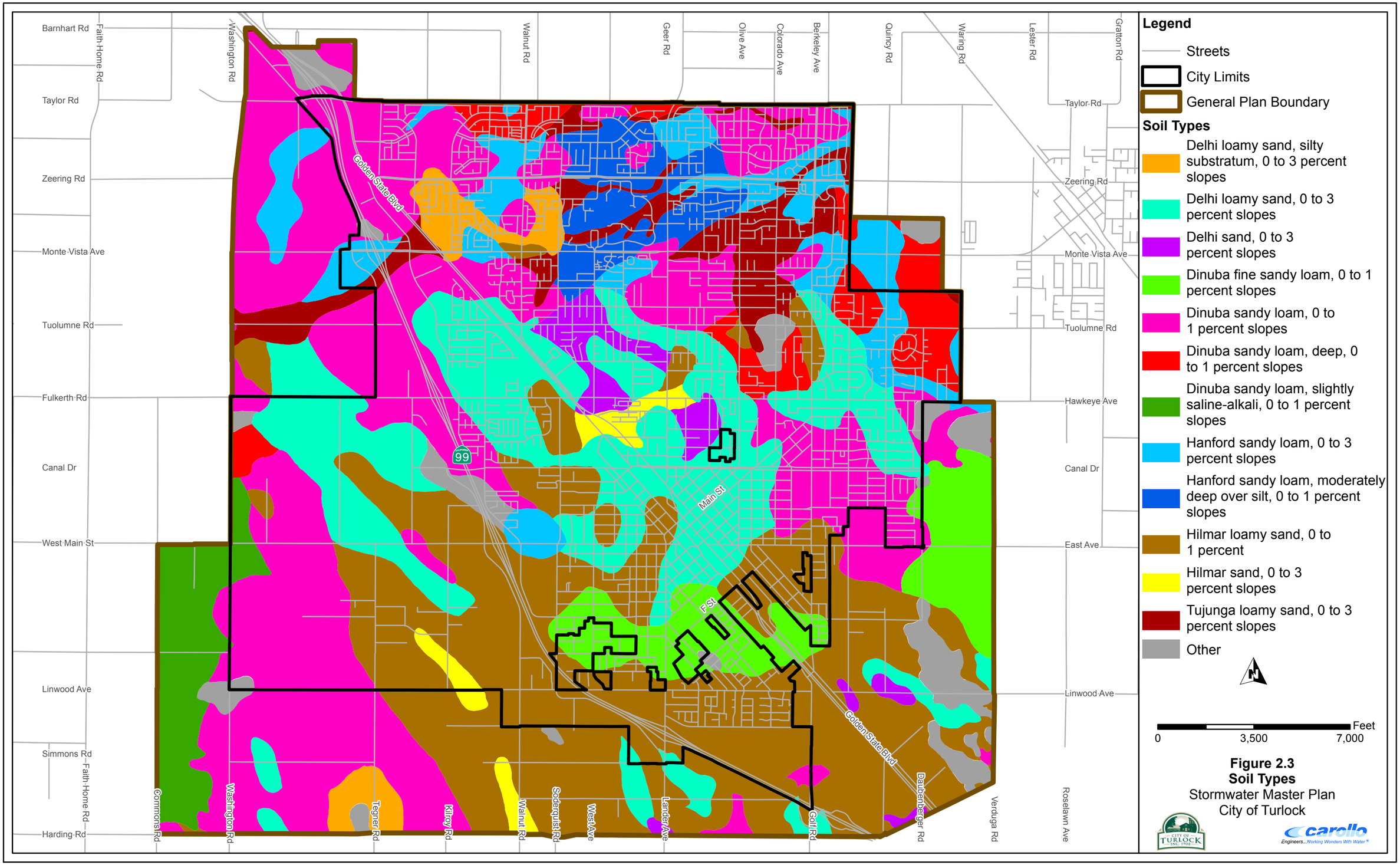

Figure 2.3
Soil Types
Stormwater Master Plan
City of Turlock

Commercial and Mixed Use. Commercial land use classifications vary widely and constitute distinct purposes. Mixed use designations generally consist of a combination of commercial and residential and/or office uses.

- Downtown Mixed Use (DT) applies to Turlock's traditional Downtown area and indicates the area where the Downtown Overlay zoning districts apply. This classification includes apparel stores, restaurants, specialty shops, entertainment uses, bookstores, travel agencies, hotels/motels, and other similar uses. It also includes financial institutions, medical and professional offices, and other general office space. Nonresidential development in this classification should not exceed a FAR of 3.0.
- Office (O) includes business and professional offices, with a maximum FAR of 0.35.
- Community Commercial (CC) encompasses retail and personal service users, including retail stores, food and drug stores, apparel stores, specialty shops, home furnishings, durable goods, offices, restaurants, and other similar uses. This designation should not exceed 0.25 FAR.
- Regional Commercial (RC) includes large-scale shopping centers, factory outlets, discount stores, and other commercial uses. Development in this designation should not exceed 0.35 FAR, except for hotels/motels, which may have up to 2.0 FAR.
- Highway Commercial (HWC) provides for uses designated to serve motorists traveling along major highways, and include service stations, hotels/motels, restaurants, auto sales, and other automobile-dependent uses. This designation may not exceed 0.35 FAR.
- Heavy Commercial (HC) includes heavy, wholesale, and service commercial uses that do not require highly visible locations, or where noise levels or other conditions may limit the suitability for other retail uses. May not exceed 0.35 FAR.
- Multiple Use Designations occur when several land use designations are combined. Land uses with multiple designations are permitted to develop at the highest density or FAR allowed by the associated designations.

Industrial. This designation provides for large and small scale industrial, manufacturing, distributing, and heavy commercial uses.

- Industrial (I) designation includes land uses such as food processing, fabricating, motor vehicle service and repair, truck yards and terminals, warehousing and storage uses, wholesale uses, construction supplies, building material facilities, offices, and other similar uses. Development in this designation may not exceed 0.6 FAR.
- Business Park (BP) provides for office centers, research and development facilities, medical and professional office, institutional uses, limited light industrial uses,

warehousing and distributing, “back office” uses, and other similar applications. Development may not exceed 0.35 FAR.

Public/Institutional (PUB). This classification applies to the City’s major public and private institutional uses, including public safety facilities, public schools, California State University Stanislaus, State fairgrounds, and other prominent public uses and facilities. Stormwater detention basins are also designated as public uses on the land use diagram.

Parks (P). This designation applies to existing and planned public parks and open space, including specialized public recreation facilities.

Urban Reserve (UR). This classification is established for identifying land that is reserved for future unspecified urban uses. Agricultural uses are permitted on property that is classified UR, though they may eventually be replace by permanent urban development. Public and recreational facilities may also be located on land classified as UR.

2.5.1 Service Area Land Use

Existing and future land uses affect the amount of runoff generated. Table 2.2 includes the existing land use totals for the 2012 stormwater service area, including the breakdown between developed and vacant land. Figure 2.4 shows the City’s existing land uses.

Table 2.2 Existing Service Area Land Use
Stormwater Master Plan
City of Turlock

Land Use Category	Existing Service Area (acres)
Residential	
Agricultural	263
Residential Ranchette	32
Low & Medium Residential	3,334
High Density Residential	229
Commercial/Industrial	
Commercial	650
Office	118
Industrial	579
Other	

Table 2.2 Existing Service Area Land Use Stormwater Master Plan City of Turlock	
Land Use Category	**Existing Service Area (acres)**
Mixed Use	69
Public/Semi-Public/Community Facility	684
Parks & Open Space	192
Vacant	679
Streets/ROW	1,976
Total	**8,805**

Table 2.3 includes the 2030 General Plan land use totals for build-out of the General Plan boundary. Figure 2.5 shows the build-out service area land use.

2.5.1.1 Existing Service Area Land Use

The City provides stormwater service to residents, businesses, and other institutions within its service area, which is approximately 10,757 acres (includes developed and undeveloped land) or 16.8 square miles. The largest land use category is residential (agricultural, residential ranchette, low and medium density, and high density), which accounts for approximately 49 percent of the total current service area acreage. Commercial land uses (commercial, office) make up approximately 7 percent of the total. Industrial designations comprise 8 percent of the service area. Other land uses, such as mixed use, public, parks and open space, and vacant land account for the remaining 36 percent of the total service area.

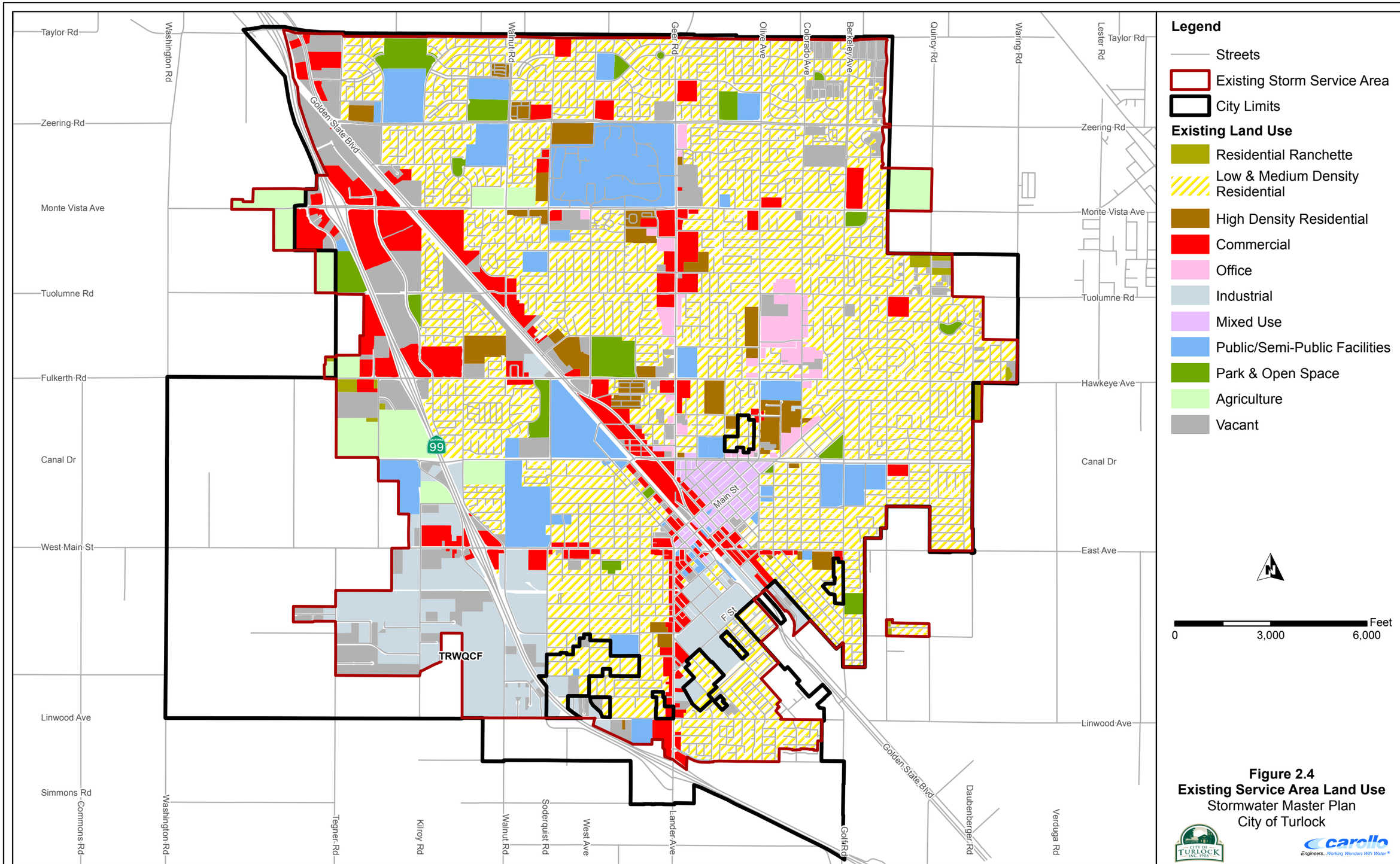

Figure 2.4
Existing Service Area Land Use
Stormwater Master Plan
City of Turlock

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Table 2.3 Build-Out Service Area Land Use Sewer System Master Plan City of Turlock	
Land Use Category	**Build-Out Service Area (acres)**
Residential	
Urban Reserve	4,570
Very Low Density	289
Low Density	2,916
Low-Medium Density	408
Medium Density	872
Medium Density/Office	6
High Density	345
High Density/Office	15
Subtotal	**9,421**
Commercial/Industrial	
Business Park	272
Community Commercial	509
Community Commercial/Office	15
Community Commercial/Office/High Density Residential	9
Heavy Commercial	367
Highway Commercial	194
Neighborhood Commercial	164
Downtown	255
Office	22
Neighborhood Center	1,854
Industrial	272
Subtotal	**3,933**
Other	
Public	934
Park	361
Detention Basin	89
Streets/ROW	2,432
Subtotal	**3,816**
Total	**17,170**

2.5.1.2 Future Service Area Land Use

At build-out of the General Plan boundary, the City will encompass approximately 16,895 acres (26.4 square miles). Build-out is defined as complete development of the General Plan Boundary. At build-out, the largest land use category is residential (very low density, low density, low-medium density, medium density, medium density/office, high density, and urban reserve), which accounts for approximately 56 percent of the total General Plan acreage. Commercial land uses (business park, community commercial, community commercial/office, heavy commercial, highway commercial, neighborhood commercial, downtown, and office) make up approximately 11 percent of the total. Industrial designations comprise 11 percent of the service area. Other land uses, such as public, parks, and detention basins account for the remaining 22 percent of the total service area.

2.6 HISTORICAL AND PROJECTED POPULATION

The City has historically been an agricultural-based community that has placed heavy emphasis on a growth management strategy that preserves a distinct "edge" of urban development. As such, the City is surrounded by agricultural fields and supports food processing facilities and related agricultural services.

According to data collected from the California Department of Finance (DOF), the City's 2010 population was approximately 68,279. This corresponds to an increase of 23 percent from the City's 55,359 population in the year 2000[2], and an average annual population growth of 2.1 percent since 2000. Since 1990, the City's population has grown from 42,224, an increase of 26,055 people, or a total growth of nearly 62 percent.

The City's 2030 General Plan Update includes population projections for Turlock. Table 2.4 provides a summary of the City's projected population. Figure2.6 illustrates the City's historical population based on DOF estimates, and the population projections provided in the 2030 General Plan Update. Intermediate projections (for the years 2015, 2020, and 2025) were calculated by assuming steady growth through the 2030 planning period. The population forecast results in an annual growth rate of approximately 2.2 percent per year.

Table 2.4 Historical and Projected Population
Sewer System Master Plan
City of Turlock

Projected Years	2010	2015	2020	2025	2030
Population	68,300	75,900	84,500	94,000	104,500

Notes:
(1) Source of 2010 population data: California Department of Finance.
(2) Population projections for year 2030 were taken from the City's 2030 Draft General Plan Update. Population projections for years 2015, 2020, and 2025 are based on a constant growth rate to achieve the 2030 forecasts.

[2] Source: California Department of Finance

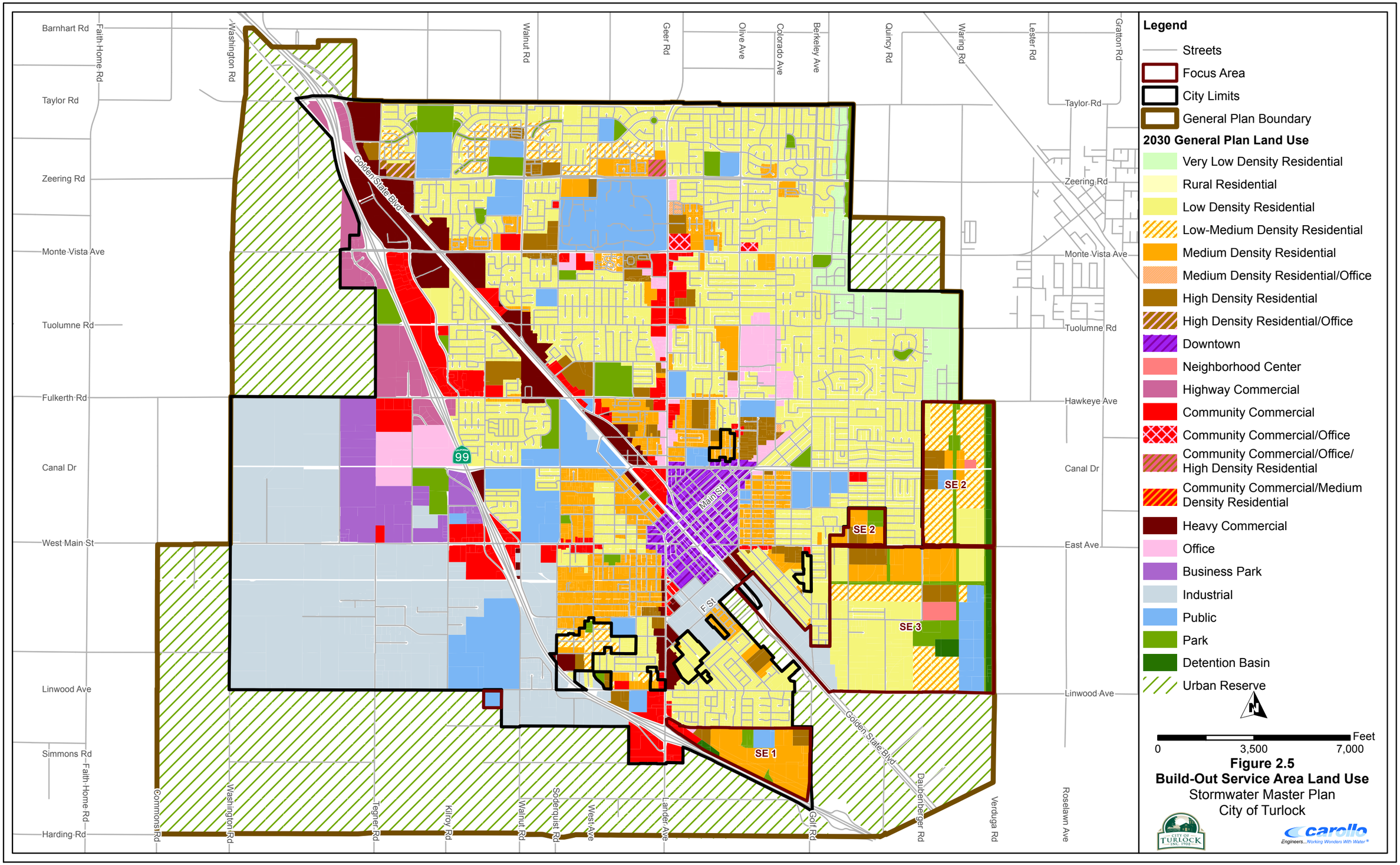

Figure 2.5
Build-Out Service Area Land Use
Stormwater Master Plan
City of Turlock

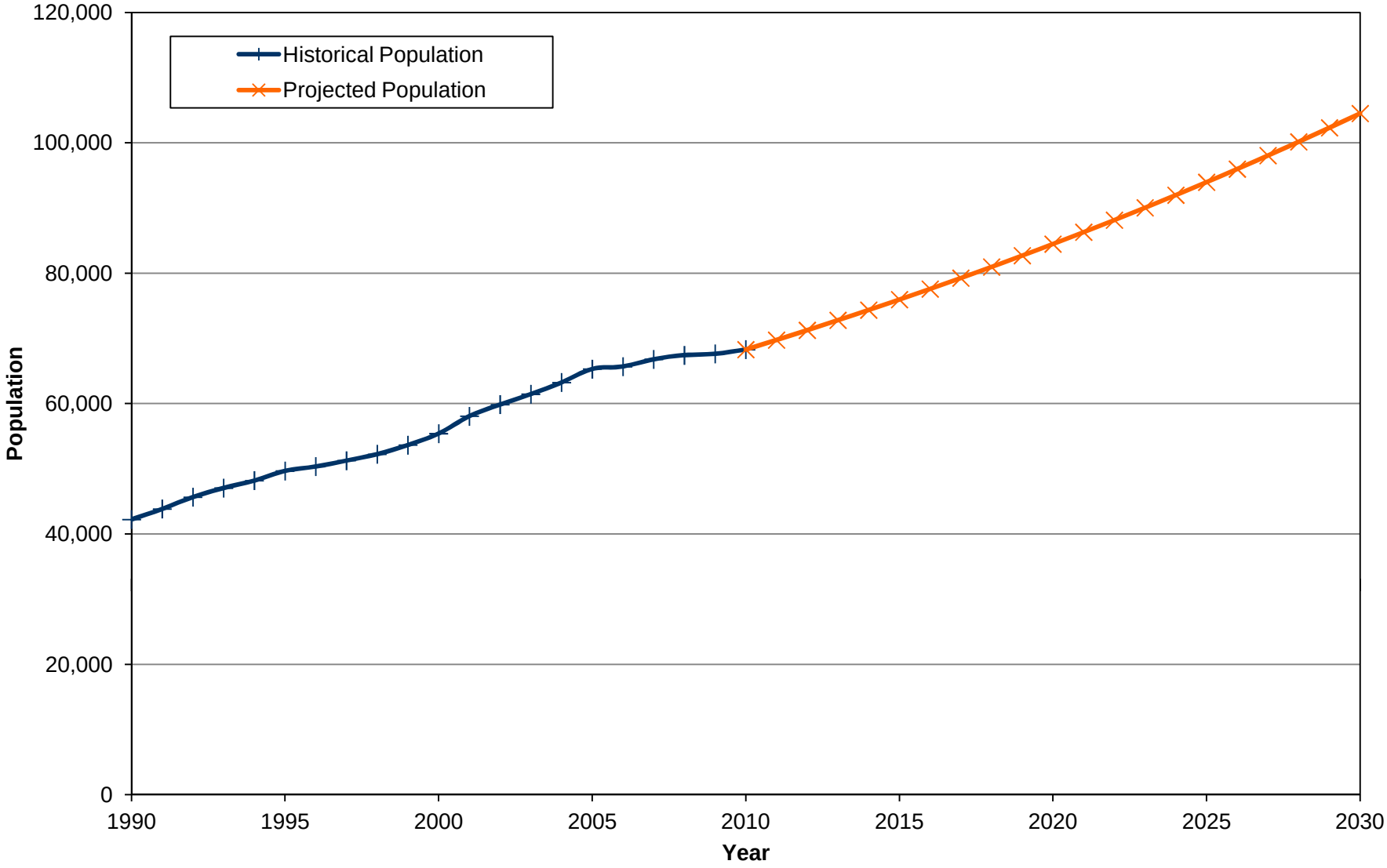

Figure 2.6
Historical and Projected Population
Stormwater Master Plan
City of Turlock

Chapter 3

PLANNING CRITERIA AND ASSUMPTIONS

The capacity of the City of Turlock's (City) stormwater drainage system was evaluated based on the planning criteria defined in this chapter. The criteria include standards from the City's Improvement Standards and Specifications (Improvement Standards), Stanislaus County (County) Improvement Standards and Specifications (2007), and other planning criteria developed by Carollo based on engineering judgment and past experience. Precipitation characteristics, design storm duration and frequency, and impervious versus pervious surface areas were reviewed to perform the hydrologic analysis on the system. The planning criteria address both hydraulic and hydrologic criteria related to the storm drainage system, and include criteria for system capacity, roughness, and overland flow coefficients, and pump station capacity.

3.1 PHASE II SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEM GENERAL PERMIT

As of June 2013 the State Water Resources Control Board (State Water Board), has adopted a new Phase II Small Municipal Separate Storm Sewer System (2013 Small MS4) General Permit. The 2013 Small MS4 permit contains several significant changes that the City will need to consider related to the management of their storm water system. The 2013 Small MS4 regulates municipalities with populations of less than 100,000 persons.

The 2013 Small MS4 permit specifies actions necessary to reduce the discharge of pollutants in storm water to the Maximum Extent Practicable (MEP). This level of specificity was included in order to cleary define the Water Boards expectations for control of storm water runoff. The 2013 Small MS4 also eliminates the need for municipalities to prepare a Storm Water Management Plan (SWMP).

While this Storm Drain Master Plan is focused on hydraulic capacity, the operation and management of the City's storm drain system will be impacted by the 2013 Small MS4, and thus it is important to include references to the changes associated with the new regulation. A summary of the changes to the 2013 Small MS4 include:

- **Implementation of Low Impact Development (LID) Principles** – Requires incorporation of the principles of LID including storm water recovery and use for most types of new and re-development. The City will need to incorporate LID practices and requirements into development requirements and planning guidelines.
- **Designation of Areas of Special Biological Significance (ASBS)** – Incorporates the Special Protection for discharges of Storm Water to ASBS that were recently adopted by the State Water Board. These Special Protections will ensure that natural water quality on ASBS will be maintained.

- **Special Management Measures** – Includes specific management measures and describes the associated tasks and implementation levels that municipalities must meet.
- **Program Management** – Requires that the storm water program is actively managed and a specific point person be responsible for permit administration and compliance.
- **Storm Water Multi-Application Reporting and Tracking System (SMARTS)** – Requires that Notices of intent and Annual Reports be submitted electronically using the SMARTS system, an online database maintained by the State Water Board.
- **Water Quality Monitoring** – Prioritizes monitoring for ASBS, total maximum daily limits (TMDLs) and listed water bodies. Permittees having a population of 50,000 or more are required to choose from a number of monitoring options. While regional collaboration among jurisdictions is encouraged, the permit provides options for conducting the monitoring program.
- **Program Effectiveness Assessments** – Requires Permittees to assess their programs to ensure that efforts to control pollutants and debris are effective. The 2013 Small MS4 programs should be able to demonstrate the link between activities and water quality improvements.

3.2 HYDRAULIC CRITERIA

The capacity of the City's stormwater drainage system was evaluated based on the analysis and design criteria defined in this section. While the City's Improvement Standards specify some information regarding hydraulic criteria, the County's Improvement Standards stipulate policies for design, flow, construction, testing, inspection, calculations, and documentation standards for the storm drainage system. The City and County standards were used as the basis for the criteria specified in this chapter. Where City or County standards did not cover specific areas in this master plan report, criteria and assumptions were developed based on Carollo's storm drain planning experience.

3.2.1 Gravity Pipes

Conveyance facilities in the City consist mainly of enclosed gravity storm drainage pipelines. The capacity of the storm pipelines were evaluated using the computer hydraulic model created as a part of this Master Plan, which is based on the continuity equation and Manning's equation for steady-state flow, as follows:

Continuity Equation: $Q = V A$

Where: Q = peak flow, cfs

V = velocity, ft/s

A = cross-sectional area of pipe, ft^2

Manning Equation: $V = (1.486\ R^{2/3}\ S^{1/2})/n$

Where: V = velocity, ft/s

n = Manning's coefficient of friction

R = hydraulic radius (area divided by wetted perimeter), ft

S = slope of pipe, feet per foot

Capacity analysis was performed on pipelines 24-inches in diameter and larger, as well as other critical facilities of all sizes. County Improvement Standards stipulates that storm drainage pipelines should be designed to convey flows associated with a 10-year, 24-hour design storm without surcharging. For 50-year or larger design storms, City streets were allowed to flood and provide an additional storage capacity, thus mitigating cost-prohibitive improvements. To determine allowable flow depths during the 50-year design storm, a typical contributing area representative of the first upstream street inlet was used. More information on the City's design storms is located in Section 3.2.2.

The City's Standard Specifications state that new storm drain pipes shall be 18-inches or greater unless otherwise approved by the City Engineer.

3.2.1.1 Manning Coefficient (n)

The Manning coefficient 'n' is a friction coefficient and varies with respect to pipe material, size of pipe, depth of flow, smoothness of pipe and joints, and build up of debris or other obstructions like root intrusion. For storm drain pipes, the Manning coefficient typically ranges between 0.012 and 0.015. For the City, the Manning's n value for all storm drains was assumed to be 0.014 for the hydraulic analysis. This is a conservative estimate for Manning's n value, but is reasonable considering the age of some pipes in the drainage system, and is consistent with County's design standards for uncoated cast iron pipes.

The Manning's n value for all new storm drainage pipes was assumed to be 0.013. The City's Standard Specifications state that allowable materials for new storm drain pipes may be reinforce concrete pipe, cast-in-place concrete pipe, poly vinyl chloride (PVC), and high density polyethylene (HDPE) ribbed pipe.

3.2.2 Surcharge Depth and Street Flooding

Storm drains are designed to surcharge under normal operation. It is common engineering practice in drainage to allow curb and gutter streets to act as storage and conveyance, similar to overland flow, for a given rainfall intensity and duration in order to protect adjacent properties from flooding. When evaluating the adequacy of the exiting conveyance facilities serving existing developments for the 50-year storm, City streets were allowed to flood up to 1.0 ft above drain inlets and provide flow attenuation and storage capacity, thus avoiding some cost-prohibitive improvements.

3.2.3 Open Channel Flow

Manning's equation for open channel flow was used to derive travel time, velocity, flow, and width relationships for channels. Ditch or channel travel time was calculated using values of slope, width, bank side slope, and Manning's n.

3.2.4 Pump Stations

There are approximately 40 active pump stations located throughout the City that typically pump water into stormwater detention or retention basins, or pump stormwater into one of the Turlock Irrigation District (TID) laterals. Typically, storm basins are utilized during a storm event and as well as immediately afterwards to collect runoff. Groundwater in the area can be close to the ground surface, so many of the storm water basins are relatively shallow. Therefore, based on system and basin elevations, pump stations are typically required to pump stormwater into the basins for temporary storage. Once storms pass, some of the runoff is drained to TID laterals or pumped back into the storm drainage system.

Planning criteria for storm pump stations should take into consideration that surcharging is allowed within the drainage system. Therefore, design capacities of pump stations should be developed with an appropriate amount of peak flow capacity and redundancy, while still utilizing the upstream pipelines as temporary storage of surcharging flows. Based on County standards, pump stations used for emptying drainage facilities should be designed to have a standby pump that can be operated with all pumps during peak conditions. According to County Standards, pumps should be sized to provide capacity for the design storm (specific storm not specified) with the largest pump out of service (firm capacity). For planning purposes, pump stations were sized to be able to pump the peak flow resulting from the 50-year, 24-hour design storm with the largest pump out of service.

3.2.5 Detention/Retention Basins

According to County Improvement Standards, drainage retention facilities (i.e. basins and ponds) should have the capacity to hold the total runoff from a 50-year, 24-hour design storm event. The storage volume should assume no allowance for percolation or outlet facilities.

3.3 HYDROLOGIC CRITERIA

This section describes the hydrological characteristics of the City and the design storms that were used to estimate existing and future storm flows.

3.3.1 Precipitation Characteristics

Turlock's wet season extends from October through May, though most (88 percent) of the City's rainfall typically occurs between November and April. Mean annual precipitation in

the City is approximately 11.4 inches.[1] Typically, storms that originate over the Pacific Ocean reach their maximum precipitation as they cross over the higher elevations of the coastal range, and decrease in precipitation as they reach lower elevations of the inland valleys. Turlock's dry season extends from June through September, during which temperatures over 100 degrees Fahrenheit (°F) may occur. However, the City's proximity to the Sierra foothills moderates average seasonal temperatures.

3.3.2 Elements of the Design Storms

The capacity of storm drainage facilities depends on the selection of a level of protection provided by those facilities. The level of protection is often expressed in terms of the frequency, or return period, of the storm for which the facilities are to prevent damage or for which the facilities will safely pass the stormwater flows. This storm is referred to as the design storm and is an idealized representation of a typical storm with a specified return period.

Selection of the design storm can have a significant impact on the size and cost of required drainage facilities. There are three elements of a design storm: precipitation depth, duration, and frequency.

3.3.2.1 Precipitation Depth

Precipitation depth is the amount of precipitation occurring during a specified storm duration. The depths of rainfall are statistical depths obtained by studying historical precipitation data to find the depth for each duration and for a particular frequency. Precipitation depth is usually expressed in inches.

3.3.2.2 Duration

Duration is the specified length of storm time considered. Duration of a design storm event should be at least four times the response time of the basin. The response time is the time required for the peak flow to reach the point of interest, such as a structure, outlet, or spillway. When the design of storage facilities is involved, the duration should be sufficiently long so that the runoff and storage volumes return to near their level at the beginning of the simulation. Duration may be expressed in any time unit such as minutes, hours, or days.

3.3.2.3 Frequency

Frequency is the number of occurrences of events with the specified precipitation depth and duration. It is expressed in terms of return period. In order to provide a reasonable level of flood protection, the statistical concept of return period or recurrence interval is utilized, which aids in assigning a probabilistic meaning to a precipitation event.

[1] Source: Historical data from Western Regional Climate Center, Modesto, CA (Station: Cty-Co H Sham FD APT [KMOD]).

3.3.3 Development of Design Storms

Developing a design storm can be accomplished in two ways. First, hourly rainfall data from a historical design storm event can be used. However, when rainfall data from a specific design storm is not available or a representative historical storm is not desired, a synthetic design storm can be generated. Two synthetic design storms were created for the evaluation of the City's existing storm drainage system and for sizing future storm drainage facilities. The 10-year, 24-hour event was used for evaluating storm conveyance facilities, while the 50-year, 24-hour event was used for evaluating the combined capacity of basins, streets, and pipes.

The 10-year and 50-year recurrence intervals have become standard selections in most locations in California because they provide a balance between level of service and affordability, and provide reasonable standards of care. Use of the 10- and 50-year design storms also conforms to the County's Improvement Standards. The County's Improvement Standards include Rainfall Intensity Curves for the 10-year, 50-year, and 100-year design storms for Modesto, which were developed using the Department of Water Resources (DWR) historical gage data. Similar methods were used to develop the design storm for Turlock, using the historical rain gage data specifically for the City. The sections below describe the development of the design storms for Turlock.

3.3.3.1 Rainfall Frequency

After the evaluation of a long historical record of maximum rainfall intensities for varying durations, a reasonable statistical interpretation can be made of the data to determine estimates of rainfall intensities or depths as a function of storm duration and of return frequency. This intensity and return period relationship is described as a design storm.

The design storms for the City were developed using U.S. Department of Agriculture and Natural Resources Conservation Service (NRCS) standardized 24-hour distribution curves with historical precipitation data. The NRCS developed normalized rainfall hyetograph distribution curves based on the storm's geographical location. The distribution curves are applied to total storm event volumes (design storm depth) in order to develop hourly storm event hyetographs. There are four types of rainfall distributions used to represent various regions throughout the United States (Type I, IA, II, and III). The City lies geographically within the Type IA boundary; therefore, the Type IA distribution was used.

The synthetic design storms were based on long-term, historical rainfall depth-duration-frequency (DDF) data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, published for California in 2011.[2] The NOAA Atlas 14 serves as an industry standard for determining total rainfall depth at specified frequencies and durations in Central and Northern California.

[2] NOAA Precipitation Frequency estimates (DDF data) for the City of Turlock can be found at http://hdsc.nws.noaa.gov/hdsc/pfds/index.html.

Based on the NOAA data, a 10-year, 24-hour design storm for the Turlock would create a total rainfall of 2.00 inches. This design storm has a ten percent chance (1/10) that 2.00 inches of rain will fall within any 24-hour period in a given year. Similarly, the 50-year, 24-hour storm event for Turlock would create a total rainfall of 2.67 inches. Design storms for the City are illustrated in Figure 3.1. DDF data is provided in Table 3.1.

Table 3.1 Precipitation Depth-Duration-Frequency
Stormwater Master Plan
City of Turlock

Duration	10-year		50-year	
	(in)	(in/hr)[(2)]	(in)	(in/hr)[(2)]
1-hour	0.58	0.58	0.85	0.85
2-hours	0.75	0.37	1.04	0.52
3-hours	0.88	0.29	1.20	0.40
6-hours	1.14	0.19	1.53	0.26
12-hours	1.51	0.13	2.00	0.17
24-hours	2.00	0.08	2.67	0.11

Notes:
(1) Table derived from data collected from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14.
(2) Represents the inches per hour (in/hr) rate if the total rainfall volume were distributed evenly over the specified duration of the storm event.

3.3.4 Soil Characteristics

According to the Soil Survey of Stanislaus County, California, from the United States Department of Agriculture (USDA) NRCS (http://www.ca.nrcs.usda.gov/), the dominant soil types within Study Area are Delhi loamy sand, Dinuba sandy loam, and Hilmar loamy sand. Numerous additional soil types are scattered throughout the Study Area and include Fresno, Greenfield, Hanford, Madera, Snelling, and Tujunga sandy loam soils. These soil types were used to identify infiltration characteristics of water into the soil throughout the Study Area.

There are several ways to estimate the volume and/or the rate of infiltration of water into a soil. Three common estimation methods are Green-Ampt, Soil Conservation Service (SCS) method, and Horton's method. All of these equations provide a relatively accurate assessment of the infiltration characteristics of the soil in question. The Horton equation is an empirical formula that states that infiltration starts at a given rate and decreases exponentially with time. After a period of time when the soil saturation level reaches a certain value, the rate of infiltration will become constant. Parameters for the Horton equation can be reasonably estimated from literature and USDA soil data. Therefore, for

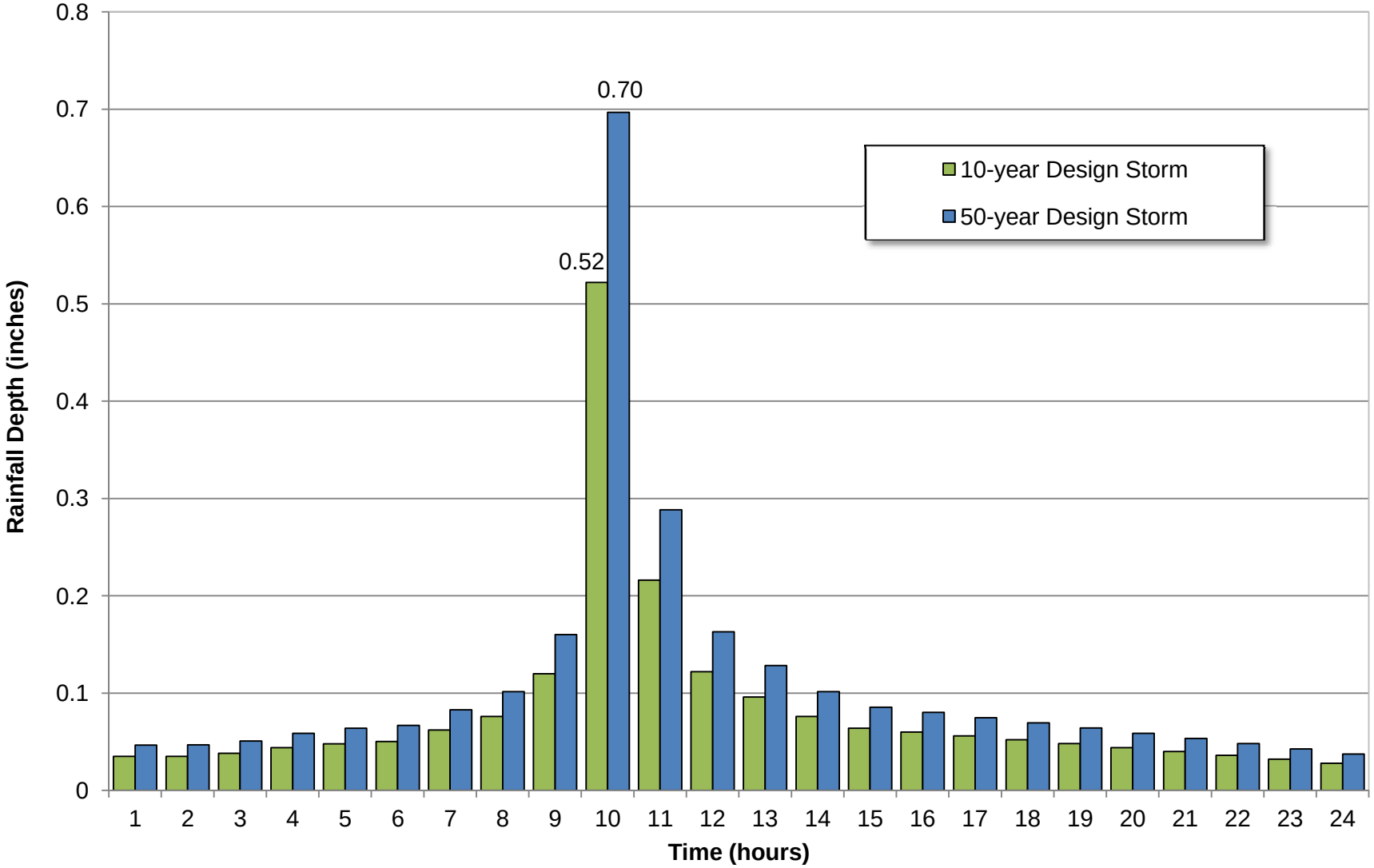

Figure 3.1
Design Storms
Stormwater Master Plan
City of Turlock

the Study Area, infiltration into the soil in pervious areas was estimated for each subbasin in the model using the Horton equation.

In order to determine infiltration parameters for use in the Horton equation, the soils within the study area were mapped based on Hydrologic Soil Group (Figure 3.2). The Horton equation uses four hydrologic soil groups. The soils are classified by water intake at the end of long duration storms after prior wetting and an opportunity for swelling and without the proactive effects of vegetation. The hydrologic soil groups, as defined by SCS soil scientists, are:

A. Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels. These soils have a high rate of water transmission.

B. Soils having moderate infiltration rates when thoroughly wetted and consisting of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

C. Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes the downward movement of water or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

D. Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with high swelling potential, soils with permanent high water table, soils with claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

Each soil group is associated with the typical infiltration soil properties as listed in Table 3.2. By determining the percentages of each hydrologic soil group within a subbasin, maximum and minimum infiltration rates can be calculated. The constant decay rate for Horton infiltration analysis was set to 0.0015 per second. Weighted average soil properties were determined for each hydraulic model subbasin based on the amount of each hydrologic soil group in the subbasin, and typical soil properties for each group.

As shown in Figure 3.2, the dominant Hydrologic Soil Groups within the study area are Hydrologic Soil Groups A and C, will minimal Group D designation and zero group B designation.

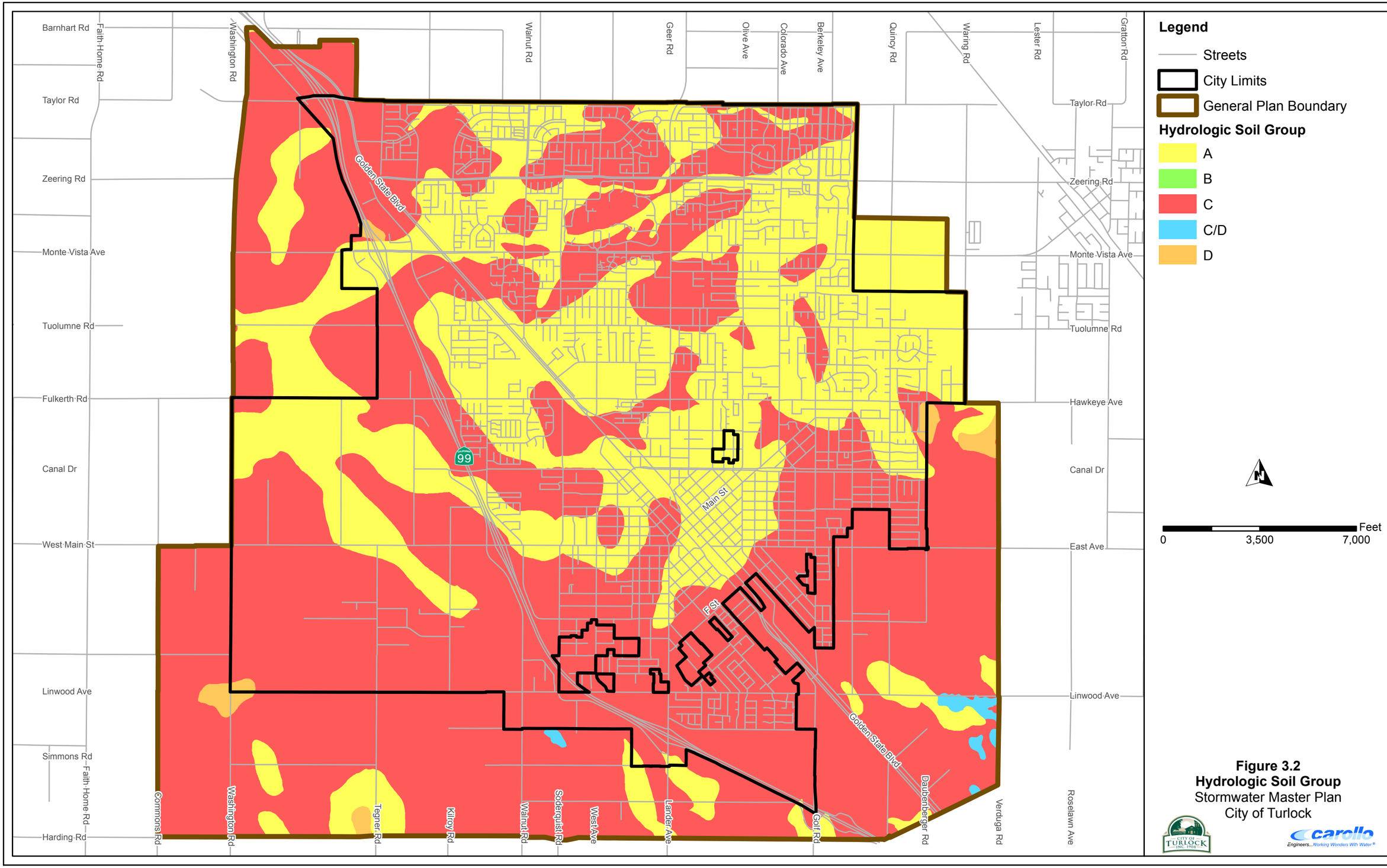

Figure 3.2
Hydrologic Soil Group
Stormwater Master Plan
City of Turlock

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Table 3.2 Infiltration Rates for NRCS Hydrologic Soil Groups Stormwater Master Plan City of Turlock		
Soil Group	**Maximum Infiltration Rate (in/hr)**	**Minimum Infiltration Rate (in/hr)**
A	2	0.065
B	1.5	0.05
C	1	0.035
D	0.5	0.02

3.3.5 Impervious Land Areas and Basis for Run-off Estimates

3.3.5.1 Estimating Impervious Land Areas

High-resolution satellite imagery was used to determine existing land use imperviousness throughout the Study Area. Multispectral imagery was used to identify vegetation, water bodies, and man-made features. Vegetation appears as shades of red, water as shades of blue or black, and urban areas as shades of blue-gray. Impervious and pervious surfaces were classified from the satellite imagery bands and then extracted based on user-defined variables. The classification method included at least 30 samples throughout the study area encompassing all lands uses including multiple areas of vegetation, urban areas, and water. While the analysis of the satellite imagery determines the percentage of impervious areas, the runoff to the stormwater collect system is characterized by the percent directly connected impervious area (DCIA). The following methods were used to determine percent DCIA of the Study Area.

3.3.5.2 Directly Connected Impervious Area (Effective Impervious Area)

DCIA refers to the impervious areas that are directly connected to stormwater conveyance systems, such as stream channels and storm sewers, with no opportunity for infiltration. For the existing conditions, transportation features (roads, bridges and highways) were merged with building footprints to create DCIA coverage. These features typically contribute the highest amounts of direct stormwater runoff to a storm sewer system.

If runoff from an impervious area flows directly into a concentrated flow path, i.e. into a gutter, it is considered directly connected. If it flows over a pervious area before becoming a concentrated flow, it is unconnected. The basin proportion of DCIA is related to land use, stormwater drainage system configuration, and recurrence interval.

The imperviousness derived from the satellite imagery represents the total average impervious area in a subbasin. To convert average percent imperviousness to DCIA, the following equation (developed by USGS) was used:

$$\%DCIA = 3.6 + 0.43I \quad (1)$$

Where: I = percent total impervious area.

Equation (1) is most appropriate for application to land areas where percent impervious (I) values are greater than 10 percent and less than 50 percent,[3] though it can be applied outside this range when other reasonable assumptions are not applicable. For I values outside this operating zone or for heavily urbanized areas with high I values, such as commercial and industrial areas, other assumptions were made to determine the percent DCIA. For each drainage subcatchment,[4] relative percent commercial/industrial area and residential/other area were identified. The satellite-measured I values were then adjusted to represent DCIA values based on the following assumptions:

- **Commercial/Industrial:** For subcatchments where satellite-measured I values were between 65 and 72 percent, the commercial/industrial portion of the DCIA for these land areas were assumed to be 65 percent. Where satellite-measured I values were less than 65 percent, no adjustment was made to the commercial/industrial portion of the DCIA (therefore, DCIA was set equal to the measured I value). A DCIA of less than 65 percent for heavily paved areas such as commercial and industrial areas is considered low, and adjustments were not made to lower the percent impervious further. For subcatchments where satellite-measured I values were greater than 72 percent, the commercial/industrial portion of the DCIA for these land areas was reduced by 10 percent.
- **Residential/Other:** For subcatchments where satellite-measured I values were greater than 6.3 percent, Equation (1) was applied to determine the residential/other portion of the DCIA. Where satellite-measured I values were less than 6.3 percent, no adjustment was made to the residential/other portion of the DCIA (therefore, DCIA was set equal to the measured I value). An I value of 6.3 percent indicates the threshold of Equation (1), where values less than the threshold result in a percent DCIA value that is higher than the original I value.
- **Overall DCIA:** The overall DCIA value for each drainage subcatchment was determined by finding the weighted average of DCIA based on relative percent commercial/industrial areas and residential/other areas, and using the DCIA adjustment assumptions above.

[3] Source: Sutherland, R.C. (Fall 1995). Methodology for Estimating the Effective Impervious Area of Urban Watersheds. Watershed Protection Techniques. Vol. 2, No. 1 (Fall 1995).
[4] Detailed explanation of drainage subcatchments is provided in Chapter 4.

3.3.5.3 Non-Directly Connected Percent Impervious Area

In residential urban areas, either a portion of the pervious runoff area has no flow path to the drainage system, or the flow path is via groundwater drains, which effectively delays runoff until it does not contribute to the design hydrographs. These areas are typically backyards, swimming pools, dense shrub landscaping, and gardens. Non-effective percent impervious areas was similarly determined using high-resolution satellite imagery and based off actual, existing land uses.

3.3.5.4 Determine Percent Imperviousness for Future Development

The impervious area for future land use was determined from proposed development maps contained in the General Plan. Based on the average values of imperviousness of existing land uses, an assumed percent DCIA was used to represent each particular land use for new development. Table 3.3 provides the values of percent DCIA for future land use categories.

For the industrial and commercial areas proposed as a part of the Westside Industrial Specific Plan (WISP) area, the future percent imperviousness was assumed to be 10 percent. The City's development plan for the WISP area will be to require that developers construct onsite storage of stormwater runoff. Therefore, the expected stormwater runoff from the WISP industrial and commercial areas is projected to be significantly less than the 70 percent projected for typical industrial areas in the City. Reducing the assumed percent imperviousness is a method for accounting for the onsite storage that will be required in the WISP area.

3.3.5.5 Pervious Area Runoff

3.3.6 Design Hyetograph

Design hyetographs (i.e., rainfall intensity versus time) for the City's design storms were balanced in the hydraulic model so that intensities for 5, 10, 15, etc. minute duration were nested symmetrically within the 24-hour storm. The rainfall hyetographs were entered in the computer hydraulic model, which converted the rainfall intensity information into hydrographical form (i.e., flow versus time).

3.3.7 Ground Slope

Ground slopes were determined using the City's elevation data and ArcView GIS. An average overland flow path slope was required for each hydraulic model subcatchment. This value was determined through intersection of subcatchment areas with the Digital Elevation Model (DEM) derived from the City elevation data points and survey data. The elevation grid was intersected with the subcatchments and the slope of each grid cell within the subcatchment was calculated. Using the number of cells within each subcatchment, the average subcatchment slope was calculated. To verify this procedure, slopes for selected subcatchments were manually estimated using available ground contour elevations and

following guidelines provided by the hydraulic model manufacturer. A summary of the average subctachment slope is provided in Chapter 4.

3.3.8 Manning's Coefficient (n) for Overland Flow

The overland flow travel time is affected by the type of surface cover. Manning's n coefficients for overland flow are summarized in Table 3.4. For each hydraulic model subcatchment, roughness coefficients were input into the model for both pervious and impervious surfaces. Baseline coefficients chosen to represent most of the Study Area was 0.02 for impervious surfaces and 0.2 for pervious surfaces. Roughness coefficients were adjusted for areas with significant differences in surface conditions.

Table 3.3 Assumed DCIA for Future Land Uses
Stormwater Master Plan
City of Turlock

Land Use Category	DCIA[3] (%)
Residential	
Urban Reserve	0
Very Low Density Residential	25
Low Density Residential	35
Low-Medium Density Residential	40
Medium Density Residential	50
Medium Density Residential/Office	55
High Density Residential	60
Commercial/Industrial	
Business Park	80
Community Commercial	80
Community Commercial/Office	70
Community Commercial/Office/High Density Residential	70
Heavy Commercial	80
Highway Commercial	80
Neighborhood Center	80
Downtown	80
Office	70
Industrial[1]	70

Table 3.3 Assumed DCIA for Future Land Uses Stormwater Master Plan City of Turlock	
Other	
Public	35
Park	2
Detention Basin	0
Streets, ROW, etc.	95

Note:

(1) Percent DCIA values were determined by analyzing the percent imperviousness of existing land uses and developing reasonable assumptions for future land use areas. These DCIA values were applied to future land development to estimate the amount of runoff generated from each parcel or drainage catchment.

Table 3.4 Parameters for Overland Flow
Stormwater Master Plan
City of Turlock

Surface	Overland Manning's n	Distance/Range (ft)
Pavement - smooth	0.02	50-200
Pavement - rough/cracked	0.05	50-200
Bare soil - newly graded areas	0.10	100-300
Range - heavily grazed	0.15	100-300
Turf - 1-2 in/lawns/golf courses	0.20	100-300
Turf - 2-4 in/parks/medians/pasture	0.30	200-500
Turf - 2-6 in natural grassland	0.40	200-500
Residential Landscaping	0.60	100-300
Few trees - natural grass undergrowth	0.50	300-600
Scattered trees - weed/shrub undergrowth	0.60	300-600
Numerous trees - dense undergrowth	0.80	300-600

Note:
(1) Manning's n for shallow flow depths is not the same as Manning's n for channels.

3.3.9 Depression Storage

Depression storage is a volume that must be filled prior to the occurrence of runoff on pervious and impervious areas and is often used as a calibration parameter. Depression storage is entered into the model as an average depth over the entire drainage area.

Because this value is difficult to estimate and is typically very small compared to other intentional storage methods, it was assumed that depression storage in the Study Area would be filled prior to the design storm event. Therefore, depression storage was set at zero in the hydraulic model.

3.4 PLANNING ASSUMPTIONS

For the modeled storm drainage retention/detention basins, custom storage curves were developed to model the design storm response. Modeled storage facilities were chosen based on connectivity to the main storm drain conveyance system and significance of storage volume. Storage curves were developed using as-built drawings when available, as well as aerial photography and AutoCAD when as-builts were not available. Some small, isolated storage ponds, whose connected conveyance pipes were less than 24 inches in diameter, were not modeled and storage curves were not prepared.

3.5 PLANNING CRITERIA SUMMARY

The recommended planning criteria for this Master Plan are summarized in Tables 3.5 through 3.7.

Table 3.5 Design Storms
Stormwater Master Plan
City of Turlock

Design Storms

Design Storm	Facilities to be Evaluated	Maximum HGL Depth/Flooding Depth Criteria
10-year, 24-hour	Storm Conveyance Facilities and Basins	Below manhole rim
50-year, 24-hour	Combined Capacity of Streets, Basins, and Pipes	Maximum 1.0 foot Flooding Depth above drain inlets.

Precipitation Depth-Duration-Frequency

	10-year		50-year	
Duration (hr)	(in)	(in/hr)	(in)	(in/hr)
1	0.58	0.58	0.85	0.85
2	0.75	0.37	1.04	0.52
3	0.88	0.29	1.20	0.40
6	1.14	0.19	1.53	0.26
12	1.51	0.13	2.00	0.17
24	2.00	0.08	2.67	0.11

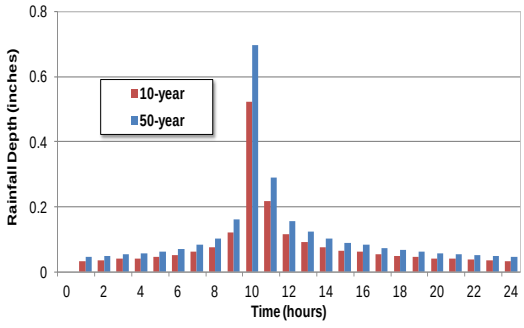

Table 3.6 Soil Imperviousness Stormwater Master Plan City of Turlock	
Soil Imperviousness	
Existing Land Use:	Imperviousness determined using satellite imagery.
Future Land Use:	Imperviousness projected using DCIA coefficients.
Land Use Category	**Effective Percent Impervious (DCIA)**
Residential	
Urban Reserve	0%
Very Low Density Residential	25%
Low Density Residential	35%
Low-Medium Density Residential	40%
Medium Density Residential	50%
Medium Density Residential/Office	55%
High Density Residential	60%
Commercial/Industrial	
Business Park	80%
Community Commercial	80%
Community Commercial/Office	70%
Community Commercial/Office/High Density Residential	70%
Heavy Commercial	80%
Highway Commercial	80%
Neighborhood Center	80%
Downtown	80%
Office	70%
Industrial(1)	70%
Other	
Public	35%
Park	2%
Detention Basin	0%
Streets, ROW, etc.	95%
Note:	
(1) Assumed DCIA based on existing average percent imperviousness, and includes adjustments for actual conditions and industry recommendations.	

Table 3.7 Other Planning Criteria and Assumptions
Stormwater Master Plan
City of Turlock

Design Hydrographs

The design hydrographs were determined using the SWMM RUNOFF Block of H_2OMAP SWMM software for the 10-year and 50-year 24-hour storms with 5-minute time steps.

Lag Time

Lag time was calculated by the travel time component method:

Lag time = To + Tg + Tp + Tc

where:

- To = Overland flow travel time
- Tg = Gutter flow travel time
- Tp = Pipe flow travel time
- Tc = Channel flow travel time

Infiltration Rates

NRCS Hydrologic Soil Groups

Soil Group	Max Infiltration Rate (in/hr)	Min Infiltration Rate (in/hr)
A	2	0.065
B	1.5	0.05
C	1	0.035
D	0.5	0.02

Overland Flow

Surface	Overland Manning's 'n'	Distance/Range
Pavement - smooth	0.02	50-200
Pavement - rough/cracked	0.05	50-200
Bare soil - newly graded areas	0.1	100-300
Range - heavily grazed	0.15	100-300
Turf - 1-2 in/lawn/golf courses	0.2	100-300
Turf - 2-4 in/park/medians/pasture	0.3	200-500
Turf - 2-6 in natural grassland	0.4	200-500
Residential Landscaping	0.6	100-300
Few trees - natural grass undergrowth	0.5	300-600
Scattered trees - weed/shrub undergrowth	0.6	300-600
Numerous trees - dense undergrowth	0.8	300-600

Chapter 4

STORMWATER SYSTEM FACILITIES AND HYDRAULIC MODEL

This chapter presents an overview of the City of Turlock's (City) storm drainage facilities and describes the development of the City's storm drainage hydrologic and hydraulic model. The model was used for identifying existing system deficiencies, identifying infrastructure needed for future growth, and developing capital improvements to mitigate deficiencies and meet the City's planning criteria.

4.1 SYSTEM OVERVIEW

The City's existing storm drainage system collects and conveys stormwater runoff from developed and undeveloped areas throughout the City. The system includes pipelines ranging in size from 4 to 60 inches in diameter, 45 detention and retention ponds, 40 stormwater pump stations and associated force mains, and various valves and diversion structures throughout the system. Figure 4.1 shows the existing storm drainage system, including storm drain diameters, detention/retention ponds, pump stations, canals, and outfall locations. In total, there are approximately 133 miles of storm drains.

4.2 DRAINAGE SYSTEM DESCRIPTION

The stormwater system includes centralized drainage systems and independent community systems. Beginning with the adoption of the City's 1992 General Plan, the City's development and infrastructure planning efforts have become increasingly comprehensive. Based on the City's growth management strategy, the City has adopted a number of Specific Plans and Master Plans to guide growth in specified areas. Recently installed storm drainage infrastructure throughout the City were integrated with the needs of individual communities as well as regional planning efforts for stormwater management.

The City's 2030 General Plan update provides a summary of the Specific Plans and Master Plans for proposed development projects that are currently underway or that are proposed for the future. Based on the type of development (residential, industrial, commercial, etc.), the Plans propose appropriate methods of stormwater manage infrastructure (ponds, pump stations, or underground storage in pipes).

The following sections describe some of the characteristics of the City's stormwater system and the stormwater management methods that are utilized in Turlock. Because of the variability of the City's infrastructure and the multitude of community systems, just a few examples of each method are provided.

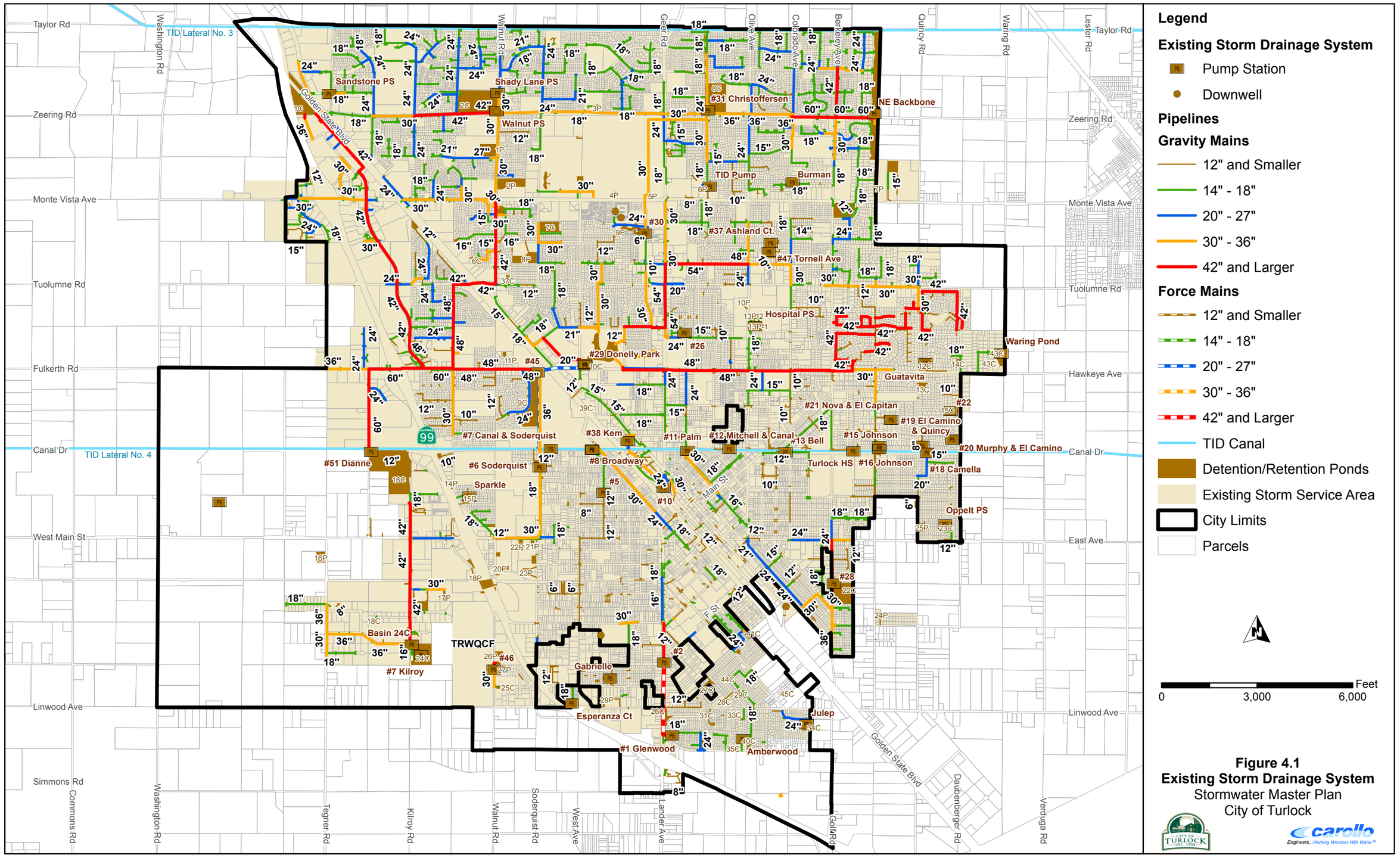

Figure 4.1
Existing Storm Drainage System
Stormwater Master Plan
City of Turlock

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4.2.1 Drainage Areas

The City's stormwater system utilizes several large detention/retention basins as regional storage for runoff. The City has also installed several valves and diversion structures throughout the system that direct the flow to either major trunk pipelines or to storage ponds. The City's storm drainage system is unique because it contains several locations where flow is split and can be conveyed in multiple directions. This flexibility allows for maximum storage in the underground pipes when parts of the system begin to surcharge. While this approach effectively redistributes flow, it also makes it difficult to define distinct drainage basins in the Study Area. For some areas of the City's system, it is difficult to define where stormwater runoff will be directed because it could go to multiple locations. However, during large storm events, such as the 50-year design storm, much of the City's storm system surcharges and all of these connections (and overflows) are utilized.

4.2.2 Detention/Retention Basins

Due to the City's relatively flat topography, detention/retention ponds are a critical tool in the management of stormwater. Many of the detention/retention ponds have pump stations that lift collected stormwater from the drainage system into the pond itself, which are usually at higher elevations than the conveyance system. The City has the ability to direct flow throughout the City, using valves and diversion structures, to detention/retention ponds where temporary capacity is available. Many of the detention/retention ponds in the City are less than 4 feet deep due to a high groundwater table throughout most of the Study Area. Consequently, the ability to direct flow from one part of the storm drainage system to another is a valuable tool.

4.2.3 Storm Drainage System Pump Stations

The City owns and operates approximately 40 storm pump stations. The pump stations serve a variety of functions based on their location in the system. Many pump stations correspond with detention/retention basins, and pump stormwater from the pipeline drainage system into the storage basins. Additionally, several pump stations are located along Turlock Irrigation District (TID) Lateral No. 4, and pump collected stormwater from the drainage system into the canal for disposal.

4.2.4 TID Lateral No. 4

While much of the new development in Turlock requires the utilization of onsite storage ponds to hold stormwater runoff, some of the older parts of town rely on other methods to discharge stormwater during a storm event (because storage ponds are not present). These areas of the City discharge directly to the TID Lateral No. 4 canal, which runs east to west through the center of the City, along Canal Drive. Lateral No. 4 is an irrigation canal, and the raw water from the canal is used for agricultural purposes outside of the City. The City maintains an agreement with TID that allows discharge of a limited amount of

stormwater to the Lateral No. 4 canal during a storm event. The agreement also allows for discharge of a limited amount of stormwater after a storm event, when the City needs to drain some of the detention/retention ponds to create more storage capacity in the system.

TID has expressed the desire to reduce the amount of stormwater runoff that is pumped into Lateral No. 4, primarily for the purposes of maintaining water quality and levels in the canal during and after a storm event. Accordingly, the direction of this Master Plan is to ultimately eliminate stormwater discharges to Lateral No. 4.

4.2.5 Storm Drain Connections to the Sanitary Sewer System

Several areas of the City drain to stormwater inlets that are directly connected to the City's sanitary sewer collection system. Figure 4.2 indicates the areas that have been identified to contribute direct inflow to the sanitary sewer system. These general areas were identified by City operations staff, and were further delineated based on the results of the flow monitoring program performed for the City of Turlock 2013 Sanitary Sewer Master Plan (2013 Sewer Master Plan). For additional information about the direct stormwater inflow areas to the sanitary sewer system, please refer to the 2013 Sewer Master Plan.

4.3 HYDRAULIC MODEL DEVELOPMENT

A storm drainage system model is a simulation of the City's actual storm system. The storm system model is used to assess the conveyance capacity for the drainage system, pumping capacity of pump stations, and storage capacity of detention/retention basins. In addition, storm drainage system models can perform "what if" scenarios to assess the impacts of future developments and land use changes. The City's storm drainage system hydraulic model was constructed using a multi-step process utilizing data from a variety of sources. This section summarizes the hydraulic model development process, including a summary of the modeling software selection, a description of the modeled collection system, the hydraulic model elements, and the model creation process.

4.3.1 Selected Hydraulic Modeling Software

H_2OMAP SWMM, by Innovyze (formerly MWH Soft), was selected for the City's storm drainage system model. H_2OMAP SWMM is a fully dynamic, geospatial wastewater and stormwater modeling and management software application. The hydraulic modeling engine for the H_2OMAP SWMM software package uses the Environmental Protection Agency's (EPA) Storm Water Management Model (SWMM), which is widely used throughout the world for planning, analysis, and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems. H_2OMAP SWMM routes flows through the model using the Dynamic Wave method, which solves the complete Saint Venant, one-dimensional equations of fluid flow.

The latest version (v 12.0) of H_2OMAP SWMM was used to assemble the H_2OMAP SWMM hydraulic model (H_2OMAP SWMM model).

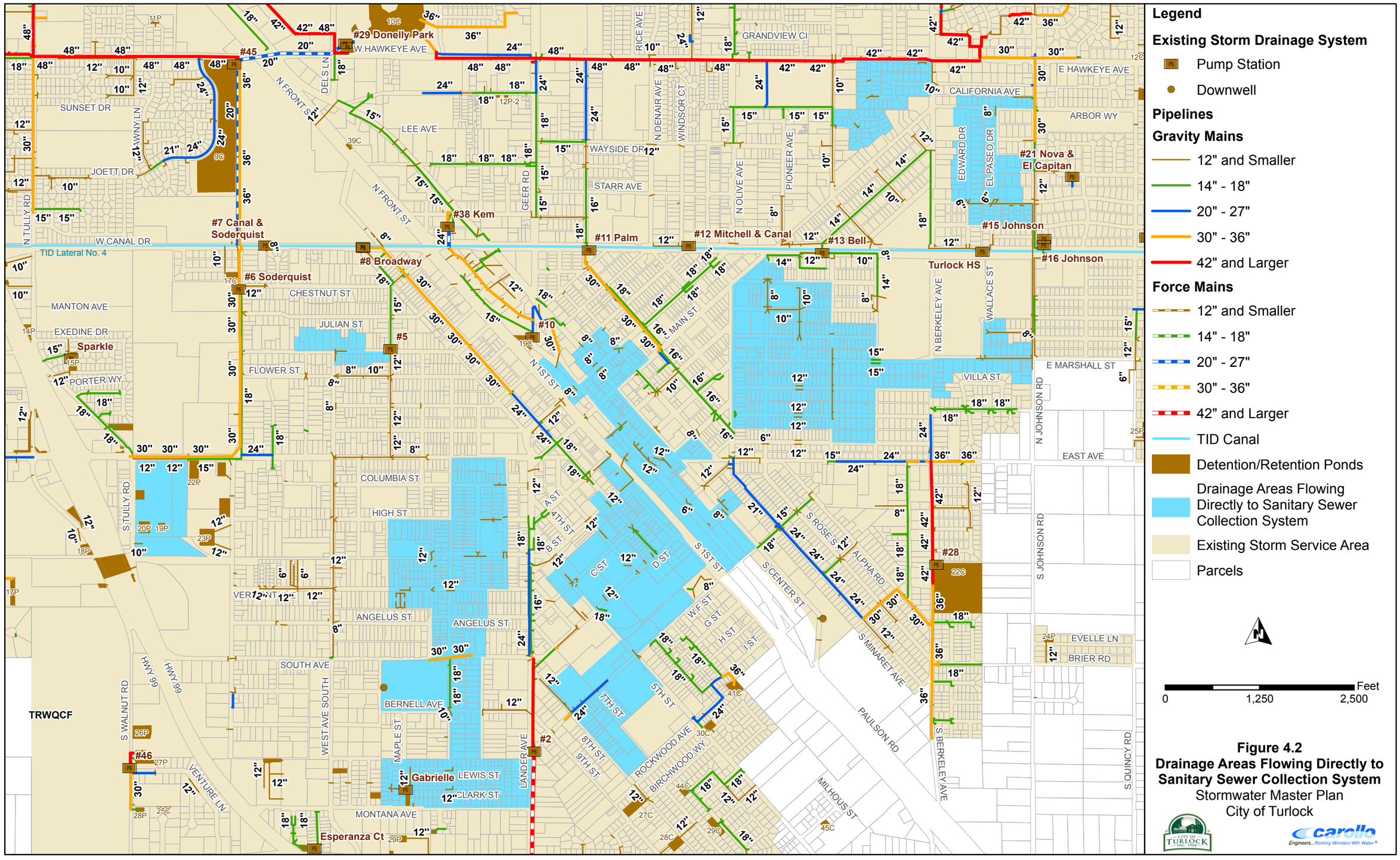

Figure 4.2
Drainage Areas Flowing Directly to Sanitary Sewer Collection System
Stormwater Master Plan
City of Turlock

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H_2OMAP SWMM can be used to model the entire land phase of the hydrologic cycle as applied to urban storm water and wastewater collection systems. The model can perform single event or long-term (continuous) rainfall-runoff simulations accounting for climate, soil, land use, and topographic conditions of the watershed. Once runoff quantity is simulated, the routing portion of H_2OMAP SWMM transports the flow through a conveyance system of pipes, channels, storage/treatment devices, pumps, and hydraulic regulators such as weirs and orifices.

4.3.2 Skeletonization

Skeletonization is the process by which storm drainage systems are stripped of pipelines not considered essential for the intended purpose of analysis. The purpose of skeletonizing a system is to develop a model that accurately simulates the hydraulics of a drainage system while reducing the complexity of a large model.

It is common practice in stormwater system master planning to exclude small diameter pipelines when developing a hydraulic computer model. The City's hydraulic model includes pipelines that are 24-inches in diameter and larger per the Scope of Work for this project. Some smaller diameter pipelines (less than 24-inches in diameter) were included in the City's hydraulic model if needed for connectivity, or if the pipelines serve a significant drainage purpose. Otherwise, pipelines 24-inches in diameter and smaller were excluded from the model.

4.3.3 Modeled Stormwater Drainage System

The modeled stormwater system consists of approximately 63 miles of pipelines ranging in diameter from 6-inches to 60-inches in diameter, 32 storm basins, and 30 stormwater pump stations. Figure 4.3 presents the City's modeled stormwater system. Table 4.1 provides a summary of the modeled pipelines.

A list of the modeled basins is provided in Table 4.2. Modeled storage basins were determined based on their proximity to the main conveyance pipelines, significance of volume for system storage, and connectivity to modeled pipelines (typically 24 inches in diameter and greater). Some of the basins are owned and maintained by the City (notated with a "C" in the basin name), and some are privately owned (notated with a "P" in the basin name). The Donnelly Basin (Basin No. 10C), Dianne Basin (Basin No. 16C), Kilroy Basin (Basin No. 24C), Christoffersen Basin (Basin No. 2C), Northeast Backbone Basins, and Basin 1C are large system basins that are heavily utilized during storm events for temporary storage and percolation.

Table 4.1 Summary of Modeled Stormwater Drainage System Pipelines
Stormwater Master Plan
City of Turlock

Diameter (inch)	Length (feet)	Diameter (inch)	Length (feet)
6	567	24	72,441
8	985	27	680
10	2,585	30	65,332
12	27,292	33	85
14	3,885	36	26,641
15	11,515	42	44,177
16	2,390	48	14,646
18	38,228	54	4,395
20	3,939	60	8,357
21	5,609	**Total (feet)**	**333,748**
		Total (miles)	**63.2**

Of the City's 40 pump stations, 30 were included in the stormwater hydraulic model. Modeled pump stations were determined based on their proximity to the main conveyance pipelines, significance of tributary area and pumped peak volume, and connectivity to modeled pipelines (typically 24 inches and greater). The modeled pump stations range in size from 400 gallons per minute (gpm; or 0.9 cubic feet per second [cfs]) to 39,000 gpm (or 86.9 cfs). Capacities and design heads provided by City staff were used to develop pump curves for each of the modeled pumps for simulation in the hydraulic model. Table 4.3 provides a summary of the modeled pump stations.

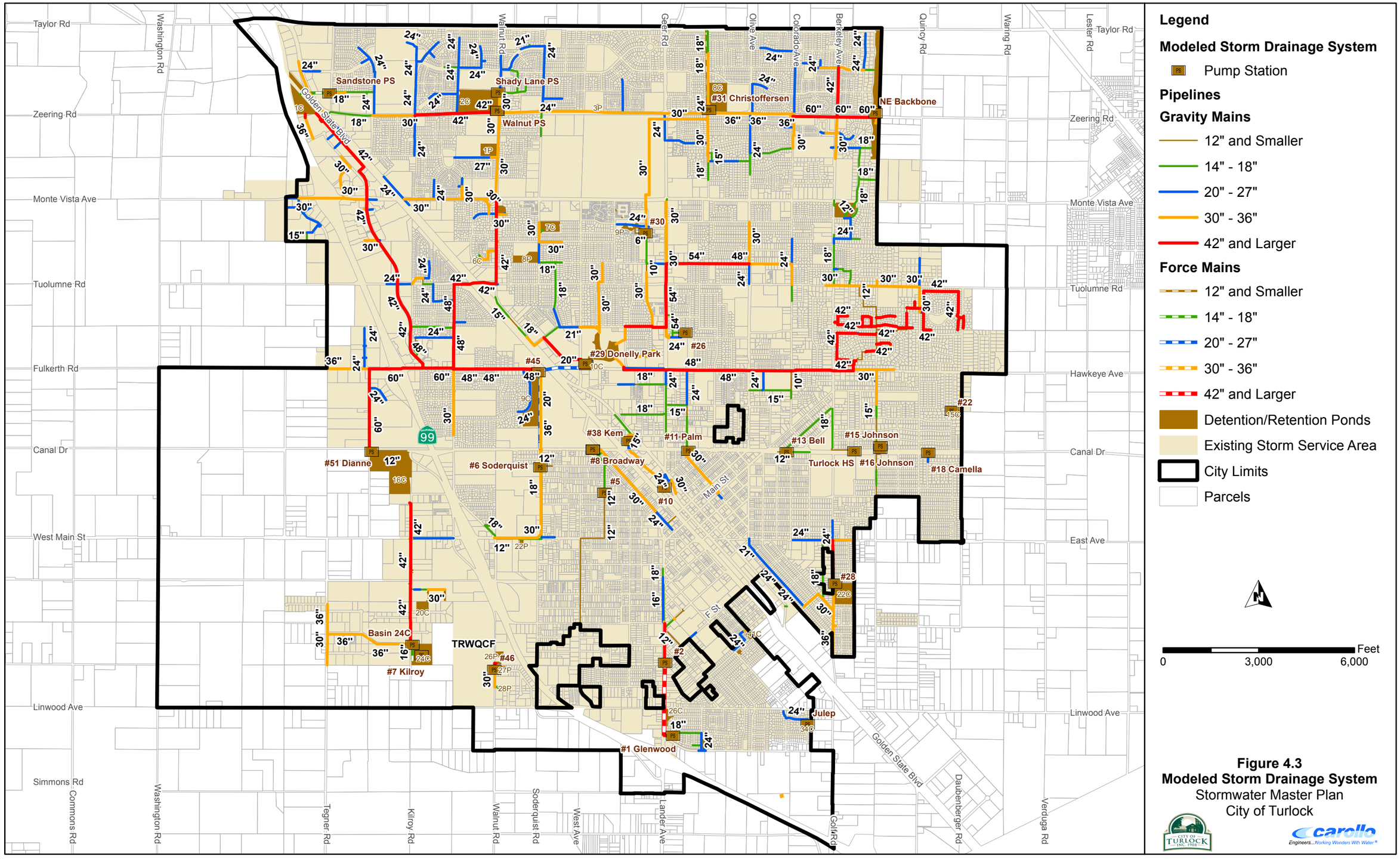

Figure 4.3
Modeled Storm Drainage System
Stormwater Master Plan
City of Turlock

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Table 4.2 Summary of Modeled Storage Basins
Stormwater Master Plan
City of Turlock

Map Name	Address	Surface Area[(1)] (acres)	Depth[(1)] (ft)	Volume[(1)] (acre-ft)	As-Built?[(2)] (Yes/No)
City					
1C (North)	4119 N Golden State	2.0	12.0	16.5	Yes
1C (South)	4119 N Golden State	6.1	9.0	35.1	Yes
5C	3090 N Walnut	1.1	3.0	2.5	Yes
6C	2610 Porshe Strasse	0.4	4.0	1.3	No
7C	1025 Gettysburg St	2.7	4.0	8.3	No
8C	601 E Christoffersen Pkwy	8.6	4.0	27.0	Yes[(3)]
9C	1350 Fulkerth Rd	21.4	7.0	118.6	Yes
10C	600 Pedras Rd	12.4	10.0	111.1	No
15C	2700 Volk Ave	0.2	6.0	1.0	No
16C	600 Dianne Dr.	24.2	6.0	127.5	No
19C	499 N Golden St.	0.7	4.0	2.5	Yes
2C	4013 N Walnut	19.8	9.0	127.7	Yes
20C	2525 Industrial Rowe	1.0	4.0	2.9	Yes
22C	500 S Berkeley Ave	4.5	4.0	14.9	No
24C	1100 S Kilroy Rd	3.6	10.0	29.3	Yes[(3)]
26C	1660 Lander Ave	0.9	4.0	2.8	No
3C	3180 N Berkeley Ave	4.3	4.0	15.0	No
30C	481 Pinewood St.	0.2	4.0	0.7	No
34C	1354 Impulse Ln	0.9	6.0	3.7	Yes[(3)]
41C	Behind 935 Katelyn Street	0.6	5.0	2.1	Yes

Table 4.2 Summary of Modeled Storage Basins
Stormwater Master Plan
City of Turlock

Map Name	Address	Surface Area[(1)] (acres)	Depth[(1)] (ft)	Volume[(1)] (acre-ft)	As-Built?[(2)] (Yes/No)
42C	1840 Baywood Lane	0.5	5.0	1.8	No
Tully & Homer	Tully Rd, just south of Homer Way	0.5	4.0	1.2	No
NE Backbone (North)	1947 Christoffersen Pkwy	4.8	3.25	12.1	Yes
NE Backbone (South)	1946 Christoffersen Pkwy	4.1	3.25	11.2	Yes
Private					
1P	3951 N Walnut Rd	1.3	3.0	3.4	No
9P	2925 Niagra St	1.5	8.0	10.6	No
17P	618 S Kilroy Rd	0.7	4.0	2.5	No
22P	1224 W Main St	0.8	4.0	2.1	No
26P	1020 S Walnut Rd	0.3	4.0	1.0	No
27P	1200 S Walnut Rd	0.3	4.0	1.2	No
28P	1506 S Walnut Rd	0.3	4.0	1.0	No
Termicold Corp	525 S Kilroy Rd	0.04	3.0	0.1	Yes

Notes:
(1) Source: Storage basin surface areas, depths, and volumes were taken from as-built drawings when they were available. When as-builts were not available, measurements were estimated using Google Earth, AutoCAD, and known conditions at the site.
(2) For basins where as-builts were not available, surface, intermediate, and base areas were estimated for Google Earth and using AutoCAD. Side slopes were assumed based on known, estimated, or observed conditions at the basin site.
(3) The as-builts available for this basin do not match what is existing at the site, based on visual observation from Google Earth.

Table 4.3 Summary of Modeled Storm Pump Stations
Stormwater Master Plan
City of Turlock

Pump Station No.	Name	Location	Pump	Pump Station Information[1] Capacity (gpm)	Capacity (cfs)	Horsepower (HP)	TDH (ft)	Total Capacity (gpm)	Total Capacity (cfs)	Firm Capacity (gpm)	Firm Capacity (cfs)
			1	2,000	4.5	15	15	5,000	11.1	2,000	4.5
Storm #1	Glenwood	NE corner of Lander & Glenwood	2	3,000	6.7	15	15				
			1	3,000	6.7	20	10	6,000	13.4	3,000	6.7
Storm #2	-	SE corner of Lander & F Street	2	3,000	6.7	20	10				
Storm #5	-	Intersection of Grant & Park	1	650	1.4	5	7	650	1.4	0	0.0
Storm #6	Soderquist	West of intersection of Soderquist & Chesnut	1	1,500	3.3	18	12	1,500	3.3	0	0.0
			1	750	1.7	10	10	3,400	7.6	1,500	3.3
			2	750	1.7	10	10				
Storm #8	Broadway	West of intersection of Broadway & Canal	3	1,900	4.2	18	10				
			1	1,500	3.3	10	8	3,000	6.7	1,500	3.3
Storm #10	Towncenter	Front Street near Golden State Highway & Storm Pond 19C	2	1,500	3.3	10	8				
			1	1,900	4.2	18	8	3,800	8.5	1,900	4.2
Storm #11	Palm	East of intersection of Palm & Canal	2	1,900	4.2	18	8				
			1	1,000	2.2	10	10	2,000	4.5	1,000	2.2
Storm #13	Bell	West of intersection of Bell & Canal	2	1,000	2.2	10	10				
			1	800	1.8	5	10	1,700	3.8	800	1.8
Storm #14	Turlock High	North of intersection of Canal & Wallace	2	900	2.0	8	10				
			1	900	2.0	10	10	1,800	4.0	900	2.0
Storm #15	Johnson 15	NE of intersection of Johnson & Canal	2	900	2.0	10	10				
Storm #16	Johnson 16	NE of intersection of Johnson & Canal	1	700	1.6	10	10	700	1.6	0	0.0
			1	800	1.8	7.5	10	2,300	5.1	800	1.8
Storm #18	Camellia	Intersection of Camellia and Canal	2	1,500	3.3	10	10		0.0		0.0
Storm #22	-	Intersection of Volk & Valleyview	1	500	1.1	5	8	500	1.1	0	0.0
			1	700	1.6	7.5	8	1,400	3.1	700	1.6
Storm #26	-	NW of intersection of North & Loyola	2	700	1.6	7.5	8				
			1	2,000	4.5	15	15	4,000	8.9	2,000	4.5
Storm #28	Sunnyview Park	SE of Berkeley & Daffodil	2	2,000	4.5	20	15				
			1	2,500	5.6	25	12	9,000	20.1	4,000	8.9
			2	1,500	3.3	40	12				
Storm #29	Donnelly Park Basin	NE corner Hawkeye & Dels	3	5,000	11.1	50	12				
			1	400	0.9	3	10	800	1.8	400	0.9
Storm #30	Professional Park	South of intersection of Niagra & Regis	2	400	0.9	3	10				
			1	2,000	4.5	40	15	14,000	31.2	7,000	15.6
			2	3,000	6.7	60	15				
			3	7,000	15.6	60	15				
Storm #31	Christofferson Basin	SE corner Christofferson & Fosberg	4	2,000	4.5	15	12				
			1	400	0.9	5	6	3,400	7.6	1,900	4.2
			2	1,500	3.3	10	12				
Storm #38	Bunker Hill	SW of intersection of Kern & W. Syracuse	3	1,500	3.3	10	12				
			1	1,500	3.3	14	12	3,000	6.7	1,500	3.3
Storm #43	Park Knoll	NW corner of Hawkeye & Dels	2	1,500	3.3	14	12				
			1	1,500	3.3	14	12	3,000	6.7	1,500	3.3
Storm #45	Summerfaire	SW corner of Fulkerth & Soderquist	2	1,500	3.3	14	12				
			1	1,500	3.3	14	12	3,000	6.7	1,500	3.3
Storm #46	-	West of intersection of Walnut & Venture	2	1,500	3.3	14	12				
			1	12,000	26.7	90	15	39,000	86.9	27,000	60.2
			2	12,000	26.7	90	15				
Storm #51	Dianne Pond	SE corner of Dianne & Canal	3	15,000	33.4	75	15				
			1	7,500	16.7	75	20	26,000	57.9	16,000	35.6
			2	7,500	16.7	75	20				
			3	10,000	22.3	100	20				
Storm #52	Walnut-1	NW corner of Walnut & Christofferson	4	1,000	2.2	14	20				
			1	12,000	26.7	90	15	24,800	55.3	12,800	28.5
			2	12,000	26.7	90	15				
Storm #52	Walnut-2	NW corner of Walnut & Christofferson	3	800	1.8	10	20				
			1	2,500	5.6	15	15	7,500	16.7	5,000	11.1
			2	2,500	5.6	15	15				
-	NE Backbone	NE of intersection of Christofferson & Welling	3	2,500	5.6	15	15				
			1	5,000	11.1	30	15	10,000	22.3	5,000	11.1
-	Kilroy @ WQC	Kilroy and Spengler	2	5,000	11.1	30	15				
-	Julep Way	Dead end of Julep Way	1	400	0.9	5	8	400	0.9	0	0.0
-	Shady Lane	Shady Lane & Walnut	1	3,500	7.8	25	12	3,500	7.8	0	0.0
			1	4,500	10.0	30	14	9,000	20.1	4,500	10.0
-	Sandstone	SW corner of Sandstone St & Tegner Rd	2	4,500	10.0	30	14				

Notes:
1. Source: Pump station information provided City of Turlock staff.

4.3.4 Elements of the Hydraulic Model

The following provides an overview of the elements of the hydraulic model.

- **Junctions:** Storm manholes, catch basins, drainage inlets, as well as other locations where pipe sizes change or where pipelines intersect are represented by junctions in the hydraulic model. Required inputs for junctions include rim elevation, invert elevation, and surcharge depth (used to represent pressurized systems). Junctions are also used to represent locations where flows are split or diverted between two or more downstream links.
- **Pipes:** Gravity pipes and force mains are represented as pipes in the hydraulic model. Input parameters for pipes include length, friction factor (e.g., Manning's n for gravity mains, Hazen Williams C for force mains), invert elevations, diameter, and whether or not the pipe is a force main.
- **Storage Nodes/Reservoirs:** For stormwater system modeling, storage nodes typically are used to represent detention/retention basins and pump station wet wells. Input parameters for storage nodes include invert elevation, depth, and cross sectional area. Storage curves can be specified for storage nodes, when cross sectional area varies as a function of depth.
- **Pumps:** Pumps are included in the hydraulic model as links. Input parameters for pumps include pump curves and operational controls.
- **Outfalls:** Outfalls represent areas where flow leaves the system. For storm system modeling, an outfall typically represents outfalls to canals or other waterways.
- **Rain Gauges:** Rain gauges are input into the hydraulic model to simulate historical or theoretical hourly rainfall events.
- **Subcatchments:** Subcatchments represent the hydrologic units of land area whose topography and drainage characteristics direct surface runoff to a single discharge point in the storm drainage system. Subcatchment parameters ultimately determine how much stormwater inflow enters the drainage system.

4.3.5 Hydrologic Model Components

Hydrologic analysis of the City's storm drainage system was performed using the SWMM Runoff Block, which was designed to simulate the surface water runoff response of a drainage basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. The Runoff Block was used to simulate the quantity of storm water runoff that flows overland in each subbasin during a particular storm event.

In the SWMM Runoff Block, each model parameter represents a specific component of the rainfall-runoff processes. A component may represent, for example, the runoff occurring in a subbasin, the routing of flows down a drainage channel, or the routing of flows through a

detention basin. The model operates by reading an input data file that contains the parameters describing each component of the drainage basin, along with information describing how the various components work together to form the drainage basin. The result of the modeling process is a tabulation of flow hydrographs at desired locations within the study area.

The Runoff Block output data was generated by the model based on the input parameters detailed below. The input parameters describe the various components of the model, including land use, soils, vegetation, drainage channels, and topography.

- **Design Rainfall.** Design hydrographs were determined for the 10-year, 24-hour and the 50-year, 24-hour design storms. Design hydrographs were automatically generated by the SWMM Runoff Block from depth duration frequency (DDF) data provided in Chapter 3.
- **SWMM Hydrologic Unit (Subcatchment).** Subcatchments are hydrologic land units whose topography and drainage characteristics direct surface runoff to a single discharge point. Subcatchments are an integral element of the hydrologic model because they define the tributary drainage areas for segments of the storm drainage system. The City was divided up into over 900 individual subcatchments and appropriate outlet points (i.e. drainage inlets and catch basins in City Streets, or nearby manholes) were defined. Table 4.4 summarizes the number of subcatchments created for the existing service area and future service areas, as well as the minimum, maximum, and average subcatchment area for each development scenario.

  The area and boundary of each subcatchment was determined with the use of development plans, available topographic data, and field observations to determine the drainage path. Determining the appropriate size of subcatchment is important in developing the modeled hydrologic characteristics of the City, because the size of the subcatchment (among other parameters) affects the peak and volume of water experienced at a single inlet point in the system. Subcatchments that are too large can create peak inflows that uncharacteristically overload portions of the storm drainage system, while subcatchments that are too small can be underestimates of peak flows experienced at different locations in the system.

  Some of the subcatchments within the City's existing storm drainage service area were determined to have direct connections to the sanitary sewer system. For the existing development condition in the hydraulic model, the storm runoff generated from these subcatchments was assumed to drain directly to the sewer. For the future development condition, some of these directly-connected subcatchments were assumed to be rerouted to the storm drainage system, corresponding to the City's plans to segregate the storm and sewer systems (described in Section 4.2.5).

Table 4.4 Subcatchment Summary Stormwater Master Plan City of Turlock

Service Area	Total Area (acres)	No. of Subcatchments	Subcatchment Area (acres)		
			Min	Max	Avg
Existing	7,924.8	861	0.3	193.3	9.2
Sewer Direct Connections[(1)]	501.0	58	1.4	26.3	8.6
Future[(2)]	3,215.4	80	4.9	140.4	40.2

Notes:
(1). Subcatchments with direct connections to the sanitary sewer system are in addition to the "Existing" development scenario totals; the 58 directly connected sewer subcatchments are not included in the 861 existing system subcatchments number total.
(2) Future subcatchments represent subcatchments created for new development areas only.

- **Width of SWMM Hydrologic Unit (Subcatchment).** The hydraulic model uses the width of each subcatchment to estimate the flow from the furthest point in the drainage area to the subcatchment outlet. Determination of this physical width of overland flow is difficult because it depends on storage and shape effects of the subbasin. The width is commonly used as a hydraulic model calibration parameter to account for the impact of varying drainage characteristics within each subcatchment on flow travel time. However, due to inadequate data for calibrating the runoff from each subbasin, subbasin width was not considered as a calibration parameter in this analysis. Instead, the width was estimated first by determining the maximum length of overland flow within each subcatchment and dividing the area by this length. This method is recommended in the SWMM User's Manual.

4.3.6 Hydraulic Model Components

The H_2OMAP SWMM model was used to simulate the hydraulic conditions in the City's storm drainage system, analyze the storm drainage system, identify deficiencies, and propose system improvements.

- **Flow Routing.** Flow routing within a conduit link in H_2OMAP SWMM is governed by the conservation of mass and momentum equations for gradually varied unsteady flow (i.e., the St. Venant equations). The H_2OMAP SWMM user has a choice on the level of sophistication used to solve these equations:
  - Steady Flow
  - Kinematic Wave Routing
  - Dynamic Wave Routing

The City's hydraulic model used Dynamic wave routing to analyze the storm drainage system. Dynamic wave routing solves the complete St. Venant flow equations and therefore produces the most accurate results. These equations consist of the continuity and momentum equations for conduits and a flow continuity equation at nodes.

Dynamic wave routing can account for channel storage, backwater, entrance/exit losses, flow reversal, and pressurized flow. Because it couples the solution for both water levels at nodes and flow in conduits it can be applied to any general network layout, even those containing multiple downstream diversions and loops. It is the method of choice for systems subjected to significant backwater effects due to downstream flow restrictions or flow regulation via weirs and orifices.

4.3.7 Model Construction

The hydraulic model performs calculations to solve a series of mathematical equations to simulate runoff from subcatchments and flows in pipes.

The model construction process consisted of six steps:

- **Step 1** - The City's geographic information system (GIS) shapefiles for the stormwater drainage system were obtained.
- **Step 2** - The GIS data were reviewed and formatted to allow easy import into the H_2OMAP SWMM modeling platform. The City's GIS did not include information on pipeline inverts or manhole rims. These data were input manually based on as-built drawings, survey data, and other available source of information.
- **Step 3** - The City's GIS data were skeletonized to exclude pipelines less than 24-inches in diameter (except where needed for connectivity).
- **Step 4** - The drainage system pipeline and facility (pump stations, storage basins) data were imported into the modeling software and verified. Certain physical and operational data for the City's stormwater drainage facilities was not available from the GIS data. This type of data, such as wet well and storage basin dimensions, pump stations, and other special features were input manually into the model based on available information. In addition, pipelines and junctions with invert discrepancies were reviewed and manually input or modified based on City records, field reconnaissance (survey), and engineering judgment.

  Once all the relevant data was input into the hydraulic model, the model was reviewed to verify that the data was entered correctly and that the flow direction and size of the modeled pipelines were logical. Additionally, the modeled pump stations were also checked to verify that they operated correctly.
- **Step 5:** Parameters describing the runoff characteristics of the model subcatchments were entered into the hydraulic model, including tributary drainage area, percent

imperviousness, width, slope, and Manning's n factors (development of these values is discussed in Chapter 3). Assigned outlets of system subcatchments were confirmed.

- **Step 6** - The hydraulic model contains certain run parameters that need to be set by the user at the beginning of the project. These include run dates, time steps, reporting parameters, output units, and flow routing method.

4.4 MODEL VERIFICATION

The reasonableness of the model results and the hydraulic grade line (HGL) profiles were evaluated during the initial model runs. This was accomplished by comparing areas of flooding predicted by the model with observations offered by the City. Areas around the City that experience flooding were confirmed by the model results. Following the verification process, the model was used for the existing and future storm drainage system analysis.

CAPACITY EVALUATION AND PROPOSED IMPROVEMENTS

This chapter presents the results of the capacity evaluation of the storm drainage system and the proposed projects that correct current capacity deficiencies and serve future users.

5.1 CAPACITY EVALUATION

Evaluation of the capacity of the City of Turlock's (City's) storm drainage system involved identifying areas in the system where street flooding exceeded the maximum planning criteria. Storm drains that lacked sufficient capacity to convey runoff generated from the design storm could produce backwater effects in the drainage system and potentially cause excessive flooding. This section discusses the possible locations of existing and future flooding caused by these deficiencies.

5.1.1 Storm Drain Connections to the Sanitary Sewer

As previously noted, the wastewater and stormwater systems are connected in the older downtown areas of the City. For this reason, an important consideration is whether to eliminate storm drainage system connections to the sanitary sewer system.

There are two options for how future management of the direct storm drain connections to the sanitary sewer system will be carried out. First, the City staff could leave the direct connections as they are currently, and make downstream modifications to the sanitary sewer collection system and Turlock Regional Water Quality Control Facility (TRWQCF) to have the capacity to convey and treat peak storm flows. While replacement of some parts of the sewer collection system may be required for rehabilitation due to deteriorated condition, the pipe diameters required to convey stormwater peak inflows will be much larger than would be required for just sanitary sewer peak flows. In addition, future upgrades to the TRWQCF will have to consider peak stormwater inflows, and capacity for each process unit will need to be sized to handle increased inflows.

Alternatively, City staff could remove the direct storm drain inlet connections to the sanitary sewer system and direct all of the stormwater inflow to the storm drainage system. Choosing this alternative would effectively segregate the stormwater drainage system and sewer collection systems. Removal of the stormwater inflow from the sanitary sewer system would reduce required capacity to hold peak sewer inflows, and would minimize stormwater impacts to the TRWQCF.

Analysis of these two alternatives was performed using the hydraulic model developed for this Master Plan and the 2013 Sewer Master Plan. Additional information on the analysis of the segregation of the storm drainage system and sewer collection system is provided in the 2013 Sewer Master Plan. Based on the available alternatives, City staff chose to plan future improvement projects with the goal of segregating the two systems (i.e., removing

the direct storm drain inlet connections from the sanitary sewer system). Therefore, future decisions regarding management of the stormwater in the City will assume that the existing areas that directly connect to the sewer collection system will ultimately flow to the stormwater drainage system.

5.1.2 Current Conditions

When evaluating the adequacy of the existing storm drainage facilities it was assumed that City streets would flood up to 1.0 feet above drain inlets to provide additional storage capacity of runoff (if available). Utilization of temporary storage in the streets and gutters reduces the number of storm drain improvements proposed and reduces the size of required improvements. For the 10-year, 24-hour design storm, the goal was to contain storm flows within the drainage pipelines, with minimal ponding in City streets. For the 50-year, 24-hour design storm, the storm drainage criteria allowed City streets to flood up to one foot above the manhole/drainage inlet rims. If flooding exceeded one foot and additional gutter capacity was not available, then an improvement was necessary to correct the problem.

Most areas of the existing storm drainage system have sufficient capacity to convey runoff generated during the 10-year design storm, though some locations exceed the criteria. It is in similar locations that the existing storm drain system lacks sufficient capacity to convey the 50-year design runoff while meeting the one-foot flooding criterion. Areas with existing deficiencies are dispersed throughout the City, but are generally limited to several locations where larger interceptors are required to convey flows collected from large tributary areas.

In the downtown area and along Canal Drive, improvements proposed for the existing system will be designed to resolve two major issues. First, in the downtown area and residential areas just west of downtown, improvements to the existing system will need to address the new storm flow resulting from the segregation of the storm and sewer systems. New infrastructure will need to be installed to collect flows that previously flowed to the sewer, and to collect runoff from infill development. Second, improvements proposed for the portions of the City along Canal Drive will need to consider regional planning motives and directions when determining routing of storm flows to service existing and future developments. Where deficiencies exist in the existing system, new proposed infrastructure can be designed in a way that takes advantage of future projects planned for future development. In addition, there are downwells in the existing system that were assumed to be removed as part of the development of proposed improvements. In general, major storm drain facilities (greater than 24-inches in diameter and larger) are not required for the removal of the downwells. For this reason, specific improvement projects are not identified to remove them, but the stormwater runoff associated with these areas in accounted for in the model.

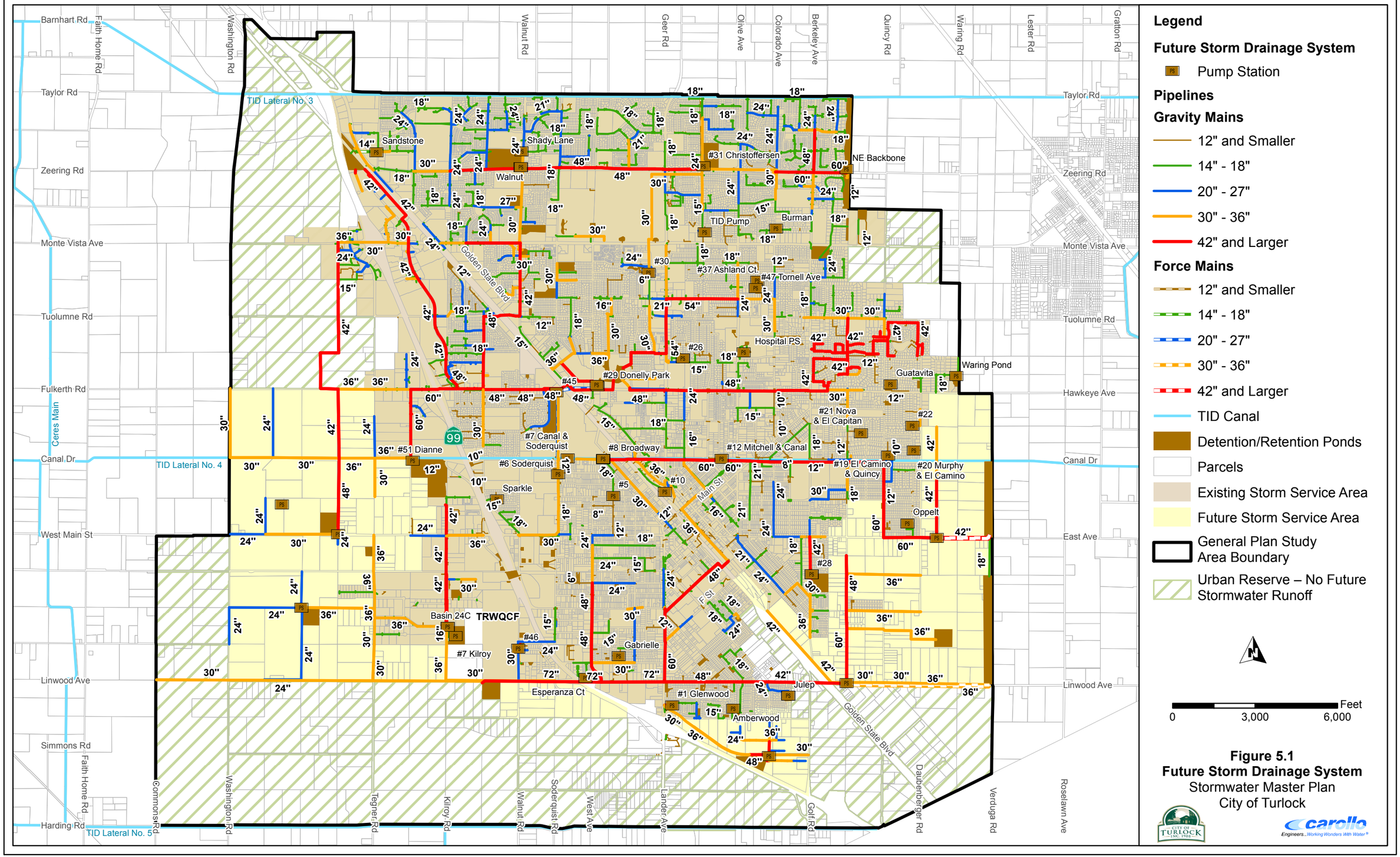
5.1.3 Build-Out Conditions

As the City develops beyond the current City limits to the General Plan study area boundary, the storm drainage system will grow. Build-out of the City's 2030 General Plan update will add residential, commercial, and industrial areas. In general, the City is planning three master plan development areas in the southeast area of the City, as well as the expansion of the Turlock Regional Industrial Park (TRIP) on the west side of the City. Figure 5.1 illustrates the future storm drainage system.

Development in the service area includes primarily residential development. The stormwater infrastructure proposed for new growth areas was preliminarily defined in the Infrastructure Planning for the City of Turlock General Plan Update Preferred Land Use Plan (Preferred Plan; prepared in 2012 by West Yost Associates). The future improvements proposed herein utilize the proposed layout and general drainage design in the Preferred Plan. Some pipeline diameters have been updated based on the runoff projected in the hydraulic model. The drainage design of this area is to utilize storage basins to hold runoff from storm events, and slowly drain these basins after the storm through the Harding Drain or to the TRWQCF for future reuse. The infrastructure proposed for new growth areas allows for flexibility of use based on available capacity and the drainage goals (and possibly future reuse goals) of the City. Regional improvements projects for the existing system will be able to utilize the storage basins proposed for future development, maximizing utilization of the proposed stormwater facilities.

Development in the TRIP is described in the Westside Industrial Specific Plan (WISP; prepared in 2006 by Wade Associates), and will consist of industrial and commercial development. The WISP contains a preliminary outline of the required storm drainage infrastructure that will be required to serve future growth in this area. The future improvements proposed herein utilize the layout proposed in the WISP, and confirm or update the proposed pipeline diameters based on projected runoff in the hydraulic model. An important feature of the development in this area will be that the City will require many of the commercial and industrial sites to retain stormwater onsite, rather than allowing regional collection. This planning method significantly reduces the projected runoff from this area and reduces the size of City-owned stormwater facilities needed to manage stormwater runoff. However, deficiencies in the existing system required modifications to the proposed infrastructure in the WISP, facilitating a more regional stormwater management approach to help address existing capacity issues.

The future service area will also include infill development within the existing City limits. As described in the 2030 General Plan, Turlock's growth management strategy is to first develop at least 70 percent of underutilized or vacant areas within the existing service area before allowing new growth in other Master Plan or Specific Plan areas. Comparatively, however, the stormwater runoff contributed to the City's drainage system from infill development is significantly less than that generated from the proposed developments in the master plan development areas and the Turlock Regional Industrial Park.



Legend

Future Storm Drainage System

- Pump Station

Pipelines

Gravity Mains

- 12" and Smaller
- 14" - 18"
- 20" - 27"
- 30" - 36"
- 42" and Larger

Force Mains

- 12" and Smaller
- 14" - 18"
- 20" - 27"
- 30" - 36"
- 42" and Larger
- TID Canal
- Detention/Retention Ponds
- Parcels
- Existing Storm Service Area
- Future Storm Service Area
- General Plan Study Area Boundary
- Urban Reserve – No Future Stormwater Runoff

N

0 3,000 6,000 Feet

Figure 5.1
Future Storm Drainage System
Stormwater Master Plan
City of Turlock

CITY OF TURLOCK INC. 1908

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5.2 STORM DRAINAGE SYSTEM IMPROVEMENTS

The Storm drainage system was analyzed under existing and future build-out conditions. Findings from the analysis were used to develop system improvements.

Improvements were identified for two different scenarios: (1) assuming that the direct storm drain connections to sewer would remain in place (existing situation), and (2) assuming that the storm drainage connections in the downtown area would be segregated from the sewer system (storm inlets removed). The results of this analysis were presented to City staff at a planning meeting on February 7, 2013. The City concluded that the preferred approach was to segregate (i.e., remove) the storm drainage system connections from the sanitary sewer system. Accordingly, the proposed improvements and costs presented in this Master Plan assume the separation of the sewer and storm drainage systems.

The proposed improvements that will serve future users were sized for build-out conditions. As the City continues to grow beyond its current limits, it is recommended that new pipelines and pump stations be designed so that the facilities have sufficient capacity for the ultimate build-out conditions. Building a smaller interim project with the plans of upsizing in the future to account for further growth is not recommended because a second project to expand would be more costly and impractical to construct. Therefore, the proposed pipe diameters for each project listed in the CIP represent the ultimate diameters for build-out conditions.

Figure 5.2 and Figure 5.3 illustrate the proposed storm drainage system improvements required to correct existing deficiencies and to accommodate future growth. Table 5.1 shows details of each improvement, including the improvement figure number corresponding to Figure 5.2 and Figure 5.3. For future storm drains, the proposed diameter is shown along with the length of pipe. Figure 5.2 , Figure 5.3 and Table 5.1 should be used together to locate the proposed improvement on the map and to gain details of the improvement (length, diameter, street location, etc.). Existing improvements are labeled “ESD” for “Existing Storm Drain” improvement; future improvements are labeled “FSD” for “Future Storm Drain” improvement.

5.2.1 Differentiating Between Improvements for Existing Users and Future Users

An existing storm drain, pump station, or basin may have sufficient capacity to convey current peak runoff, but as growth continues and more users are added to the system, the increased runoff results in capacity deficiencies. These projects, as well as new storm drainage system facilities to extend service to future growth areas, are considered future improvements and allocated to future users.

Table 5.1 Proposed Storm Drainage System Improvements
Storm Drainage System Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost				Capital Improvement Phasing				
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Phase 1 2013-2015	Phase 2 2016-2020	Phase 3 2021-2025	Phase 4 2026-2030	Phase 5 After 2030
Existing System Improvements													
Pipelines													
ESD-1	Pipe	Picadilly Lane	Midsummer Lane to Christoffersen Pkwy	A	24	36	Replace	1,060		Phase 2			
ESD-2	Pipe	Christoffersen Pkwy	Pump Station No. 31 Wet Well to Walnut Rd (Walnut Pump Station #1 Wet Well)	A	30	48	Replace	6,750		Phase 2			
ESD-3	Pipe	Monte Vista Dr	Four Seasons Dr to Walnut Rd	A	30	42	Replace	1,090			Phase 3		
ESD-4	Pipe	Countryside Dr	West side of Staples/Walmart Shopping Center, parallel to Countryside Dr	A	12/15	24	Replace	850				Phase 4	
ESD-5	Pipe	Pedras Road, Donnelly Park Drive	West of Geer Rd to South of De Pauw Dr	A	36/48	54	Replace	1,600		Phase 2			
ESD-6	Pipe	Colorado Ave	Waldorf Dr to Tuolumne Rd	A	18	30	Replace	520			Phase 3		
ESD-7	Pipe	Castleview Dr, Quincy Rd	Bristol Park Cl to Quincy Rd	A	12/24	42	Replace	200			Phase 3		
ESD-8	Pipe	Castleview Dr	Quincy Rd to west of Palace Ct	A	-	42	New	410			Phase 3		
ESD-9	Pipe	Johnson Rd	Tuolumne Rd to north of Castleview Dr	A	-	42	New	640			Phase 3		
ESD-10	Pipe	Johnson Rd	North of Castleview Dr to south of Jackson Ct	A	15	42	Replace	1,450			Phase 3		
ESD-12	Pipe	Canal Dr	Colorado Ave to west of Bell St	A	14	24	Replace	730				Phase 4	
ESD-13	Pipe	Almond Ave	Geer Rd and Almond Ave	A	18	-	Abandon	-				Phase 4	
ESD-14	Pipe	Almond Ave	Almond Ave and Golden State Blvd	A	-	18	New	210				Phase 4	
ESD-15	Pipe	Kern St	Canal Dr to Pump Station No. 38 Wet Well	A	12	36	Replace	330				Phase 4	
ESD-16	Pipe/Casing[1]	Canal Dr	Pipe & Casing under TID Canal #4, east of Front St	A	12	36/48	Replace	15				Phase 4	
ESD-18	Pipe	West Main St, West Ave South	Grant Ave to Columbia St	A	12	24	Replace	1,110		Phase 2			
ESD-23	Pipe	Montana Ave	East of Hwy 99 to West Ave South	A	-	15	New	660		Phase 2			
ESD-28	Pipe	West Main St	Walnut Rd to Kilroy Rd	A	24/30	36	Replace	1,350				Phase 4	
ESD-29	Pipe	Kilroy Rd	Parallel Pipe from Industrial Rowe to Spengler Way	A	-	48	New	1,000		Phase 2			
ESD-30	Pipe	West Main St	Corner of West Main St and Tully Rd, Add connection to existing storm drain	A	-	30	New	60		Phase 2			
ESD-31	Pipe	Canal Drive	East of Soderquist Rd to Lexington Ave	A	-	30	New	970				Phase 4	
ESD-32	Pipe	Canal Drive	Lexington to east of Front St	A	-	60	New	1,070				Phase 4	
ESD-33	Pipe/Casing[1]	Canal Drive	Boring under train tracks	A	-	60/84	New	90				Phase 4	
ESD-34	Pipe	Canal Drive	East of Front Street to Palm St	A	-	60	New	1,810				Phase 4	
ESD-35	Pipe	Canal Drive	Palm St to Rose St	A	-	60	New	2,380				Phase 4	
ESD-36	Pipe	Canal Drive	Rose St to Wallace St	A	-	60	New	2,890				Phase 4	
ESD-37	Pipe	Canal Drive	Wallace St to Quincy Rd	A	-	60	New	1,980				Phase 4	
ESD-38	Pipe	Canal Drive	Kern St and Canal Dr, provides connection to canal trunkline	A	-	36	New	30				Phase 4	
ESD-39	Pipe	Canal Drive	Canal and Palm, provides connection to canal trunkline	A	-	24	New	30				Phase 4	
ESD-40	Pipe	Canal Drive	Canal and Palm, provides connection to canal trunkline	A	-	30	New	20				Phase 4	
ESD-41	Pipe	Canal Drive	Canal and Sierra, provides connection to canal trunkline	A	-	24	New	40				Phase 4	
ESD-42	Pipe	Canal Drive	El Paseo Dr to Johnson Rd, provides connection to canal trunkline	A	-	24	New	830				Phase 4	
ESD-44	Pipe	Canal Drive	Camellia St to Quincy Rd	A	-	24	New	310				Phase 4	
ESD-45	Pipe	Quincy Rd	Canal Dr to East Ave	A	-	60	New	2,750				Phase 4	
ESD-46	Pipe	East Ave	Quincy Rd to Southeast 2 Area Pump Station (ESD-PS-6)	A	-	60	New	1,920				Phase 4	
ESD-49	Pipe	Johnson Rd	Marshall St to north of Zinfandel Ln	A	12	18	Replace	340				Phase 4	
ESD-67	Pipe	Hawkeye Ave	Donnely Park to connection at Fulkerth Rd and Joett Dr	A	-	48	New	3,045		Phase 2			
ESD-68	Pipe/Casing(1)	N Front St	Railroad Crossing at N Front St for Donnely Park Pipeline	A	-	48/60	New	295		Phase 2			
Pump Stations/Basins													
ESD-PS-1	Pump Station	Kilroy at WQC Pump Station	Spengler Way and Kilroy Road	-	22.3 cfs	120 cfs	Replace	-		Phase 2			
ESD-PS-2	Pump Station	Pump Station No. 28	Berkeley Ave, south of Daffodil Ln	-	8.9 cfs	37 cfs	Replace	-		Phase 2			
ESD-PS-3	Pump Station	Julep Pump Station	Warp Dr and Julep Way	-	0.9 cfs	4.3 cfs	Replace	-			Phase 3		
ESD-PS-4	Pump Station	Pump Station No. 26	Loyola Way and North Ave	-	3.1 cfs	6.5 cfs	Replace	-				Phase 4	
ESD-PS-5	Pump Station	Pump Station No. 8	Canal Dr and Lexington Ave	-	7.6 cfs	24.5 cfs	Replace	-				Phase 4	
ESD-PS-6	Pump Station	East Ave	East of Daubenberger Rd	-	-	160 cfs	New	-				Phase 4	
ESD-FM-1	Force Main	East Ave	Dual Force Mains to Northern East Linear Basin	B	-	42	New	3,740				Phase 4	
ESD-BN-1	Basin	Northern East Linear Basin	Northern East Linear Basin	-	-	55.8 ac-ft	New	-				Phase 4	
Projects to Remove Direct Connections to Sewer System													
ESD-11	Pipe	Johnson Rd	Marshall St to Canal Dr	A	8/12/15	30	Replace	1,120				Phase 4	
ESD-17	Pipe	D St	6th to Lander Ave	A	10/18	48	Replace	780		Phase 2			
ESD-19	Pipe	West South Ave	Columbia St to High St	A	12	36	Replace	490		Phase 2			
ESD-20	Pipe	West South Ave	High St to Vermont Ave	A	12	36	Replace	900		Phase 2			

Table 5.1 Proposed Storm Drainage System Improvements
Storm Drainage System Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost				Capital Improvement Phasing				
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Phase 1 2013-2015	Phase 2 2016-2020	Phase 3 2021-2025	Phase 4 2026-2030	Phase 5 After 2030
ESD-21	Pipe	West South Ave	Vermont Ave to South Ave	A	12	48	Replace	910		Phase 2			
ESD-22	Pipe	West Ave South	South Ave to Linwood Ave	A	-	48	New	2,820		Phase 2			
ESD-24	Pipe	South Ave	Corner of West Ave South, remove outfall to existing infrastructure	A	15	-	Abandon	-		Phase 2			
ESD-25	Pipe	Montana Ave	Gabriel St to West Ave South	A	-	30	New	670		Phase 2			
ESD-26	Pipe	Lander Ave	E St to Linwood Ave, Adjust inverts to match prposed Linwood trunkline	A	-	60	Replace	1,580	Phase 1				
ESD-27	Pipe	Lander Ave	At F St, influent pipe to Pump Station No. 2 Wet Well	A	42	-	Abandon	-		Phase 2			
ESD-43	Pipe	Canal Drive	Johnson Rd and Canal Dr, provides connection to canal trunkline	A	-	30	New	50				Phase 4	
ESD-47	Pipe	Marshall St	Berkeley Ave to Johnson Rd	A	-	30	New	1,720				Phase 4	
ESD-48	Pipe	Rose St	Merritt St to Canal Dr	A	-	21	New	2,150				Phase 4	
ESD-50	Pipe	Olive Ave, Golden State Blvd	Thor St to southeast of Minerva St	A	-	36	New	3,490		Phase 2			
ESD-51	Pipe/Casing[1]	Golden State Blvd, 1st Street	Pipe & Casing under Train Tracks, east of Golden State Blvd	A	-	48/60	New	130		Phase 2			
ESD-52	Pipe	D St	1st St to 6th St	A	-	48	New	2,060		Phase 2			
ESD-53	Pipe	F St	8th St to Lander Ave	A	-	36	New	680	Phase 1				
ESD-54	Pipe	F St	Southwest of 8th St, Remove connection to sewer	A	33	-	Abandon	-	Phase 1				
ESD-55	Pipe	Lander Ave	D St to E St	A	42	60	Replace	950		Phase 2			
ESD-56	Pipe	Lander Ave	Linwood Ave to Glenwood Ave	A	42	-	Abandon	-	Phase 1				
ESD-57	Pipe	Linwood Ave	Lander Ave to West Linwood Ave Basin	A	-	72	New	6,690	Phase 1				
ESD-58	Pipe	Columbia St	Locust St to West Ave South	A	-	18	New	2,280		Phase 2			
ESD-59	Pipe	Castor St, Laurel St	Locust St to High St	A	-	15	New	830		Phase 2			
ESD-60	Pipe	High St	Laurel St to West Ave South	A	-	24	New	1,910		Phase 2			
ESD-61	Pipe	Vermont Ave	Orange St to West Ave South	A	-	24	New	1,540		Phase 2			
ESD-62	Pipe	Martinez St, Williams Ave	Parnell Ave to West Ave South	A	-	15	New	1,070		Phase 2			
ESD-63	Pipe	Orange St	South Ave to Montana Ave	A	-	24	New	1,980		Phase 2			
ESD-64	Pipe	Lewis St	Maple St to Orange St	A	-	15	New	600		Phase 2			
ESD-65	Pipe	Montana Ave	Orange St to west of Gabriel St	A	-	30	New	900		Phase 2			
ESD-66	Pipe/Casing[1]	Linwood Ave, under Highway 99	Boring under Highway 99, under Linwood Ave	A	-	72/84	New	240	Phase 1				
ESD-BN-2	Basin	Linwood Ave	West Linwood Ave Basin	-	-	123 ac-ft	New	-	Phase 1				
Buildout System Improvements													
Pipelines													
FSD-1	Pipe	Monte Vista Dr	Summer Creek Dr to Four Seasons Dr	A	30	42	Replace	890			Phase 3		
FSD-2	Pipe	Monte Vista Dr	West of Tegner Rd to Tegner Rd	A	24	36	Replace	426					Phase 5
FSD-3	Pipe	Tully Rd	Branding Iron Dr to Fulkerth Rd	A	30	36	Replace	980				Phase 4	
FSD-4	Pipe	Oxford Ave, Pedras Rd	Jacquelinelee Dr to Northeast of Divanian Dr	A	18/21	30	Replace	1,220				Phase 4	
FSD-5	Pipe	Kilroy Rd	Parallel Pipe from Castor St to Industrial Rowe	A	-	48	New	940		Phase 2			
FSD-6	Pipe	Syracuse Ave	Palm St to Geer Rd	A	8	18	Replace	660			Phase 3		
FSD-7	Pipe	Golden State Blvd	Monroe Ave to Geer Rd	A	24	36	Replace	200			Phase 3		
FSD-8	Pipe	Washington Rd, Canal Dr	Fulkerth Rd to Fransil Ln	B	-	30	New	6,490					Phase 5
FSD-9	Pipe	Unnamed Rd	Fulkerth Rd to Canal Dr	B	-	24	New	2,530					Phase 5
FSD-10	Pipe	Canal Dr	Dianne Dr to Fransil Ln	B	-	36	New	2,560					Phase 5
FSD-11	Pipe	Tegner Rd	South of Fulkerth Rd to Canal Dr	B	-	24	New	1,540					Phase 5
FSD-12	Pipe	Tegner Rd	North of West Main St to Canal Dr	B	-	30	New	1,400					Phase 5
FSD-13	Pipe	Fransil Ln	Fulkerth Rd to Canal Dr	B	-	42	New	2,510					Phase 5
FSD-14	Pipe	Fransil Ln	Canal Dr to West Main St, to FSD-PS-2 Wet Well	B	-	48	New	2,760					Phase 5
FSD-15	Pipe	Dianne Dr	Overflow Pipe from Dianne Pump Station (No. 51) to FSD-11	B	-	36	New	70					Phase 5
FSD-16	Pipe	Unnamed Roads, Agricultural Land	Monte Vista Ave to Fulkerth Rd	B	-	42	New	6,620					Phase 5
FSD-17	Pipe	Fulkerth Rd	Tegner Rd to Fransil Ln, Overflow pipe from Fulkerth Rd storm drains	B	-	36	New	1,310					Phase 5
FSD-18	Pipe	West Main St, Clinton Rd, Fransil Ln	Near intersection of West Main St and Clinton Rd, and along Fransil Ln	B	-	24	New	2,980					Phase 5
FSD-19	Pipe	West Main St	Clinton Rd to Fransil Ln	B	-	30	New	2,640					Phase 5
FSD-20	Pipe	West Main St	Dianne Dr to Kilroy Rd	B	-	24	New	1,270					Phase 5
FSD-21	Pipe	Tegner Rd	West Main St to Liberty Square Pkwy	B	-	36	New	2,070					Phase 5
FSD-22	Pipe	Tegner Rd	Linwood Ave to south of Humphrey Ct	B	-	30	New	1,300					Phase 5
FSD-23	Pipe	Washington Rd, Ruble Rd	Clayton Rd to FSD-PS-2 Wet Well	B	-	24	New	3,920					Phase 5
FSD-24	Pipe	Linwood Ave, Unnamed Rd	Linwood Ave and along Unnamed Rd, to FSD-PS-2 Wet Well	B	-	24	New	5,290					Phase 5
FSD-25	Pipe	Ruble Rd	Tegner Rd to Unnamed Rd	B	-	36	New	2,670					Phase 5
FSD-26	Pipe	Linwood Ave	Glenwood Ave to Kilroy Rd	A	-	30	New	3,990					Phase 5
FSD-27	Pipe	Kilroy Rd	Linwood Ave to Spengler Way	A	-	36	New	1,950					Phase 5

Table 5.1 Proposed Storm Drainage System Improvements
Storm Drainage System Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost				Capital Improvement Phasing				
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Phase 1 2013-2015	Phase 2 2016-2020	Phase 3 2021-2025	Phase 4 2026-2030	Phase 5 After 2030
FSD-28	Pipe	Soderquist Rd	South Ave to Jordan Ave	A	-	15	New	2,500					Phase 5
FSD-29	Pipe/Casing[1]	Highway 99	West of Soderquist Rd to the east side of Highway 99, north of Venture Ln	A	-	24/42	New	200					Phase 5
FSD-30	Pipe	North of Venture Ln, Walnut Rd	Soderquist Rd to Walnut Rd, Linwood Ave to Venture Ln	A	-	24	New	2,820					Phase 5
FSD-31	Pipe	Unnamed Dr	South of Hawkeye Ave to north of Canal Dr	B	-	42	New	1,980				Phase 4	
FSD-32	Pipe	Unnamed Dr	South of Canal Dr to East Ave	B	-	42	New	2,080				Phase 4	
FSD-33	Pipe	West of Verduga Rd	Connection pipeline from Northern to Southern East Linear Basin	B	-	18	New	1,420				Phase 4	
FSD-34	Pipe	Johnson Rd	South of East Ave to Unnamed Rd	B	-	42	New	620			Phase 3		
FSD-35	Pipe	Johnson Rd	Unnamed Rd to Brier Rd	B	-	60	New	1,340			Phase 3		
FSD-36	Pipe	Johnson Rd	Brier Rd to Linwood Ave	B	-	60	New	2,620			Phase 3		
FSD-37	Pipe	Unnamed Rd, Brier Rd	Daubenberger Rd to Johnson Rd	B	-	36	New	5,410			Phase 3		
FSD-38	Pipe	South of Brier Rd	FSD-BN-5 (Future Basin) to Johnson Rd	B	-	36	New	3,580			Phase 3		
FSD-39	Pipe	Linwood Ave	West of Verduga Rd to Johnson Rd	B	-	30	New	4,030			Phase 3		
FSD-40	Pipe	Paulson Rd	Center St to Linwood Ave at Future Pump Station (FSD-PS-3) Wet Well	B	-	42	New	4,050			Phase 3		
FSD-41	Pipe	Linwood Ave	Johnson Rd to 5th St	B	-	42	New	2,830			Phase 3		
FSD-42A	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	60	New	220		Phase 2			
FSD-42B	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	2,230		Phase 2			
FSD-42C	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	670		Phase 2			
FSD-42D	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	440		Phase 2			
FSD-42E	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	720		Phase 2			
FSD-42F	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	2,310		Phase 2			
FSD-42G	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	150		Phase 2			
FSD-42H	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	1,440		Phase 2			
FSD-42I	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	560		Phase 2			
FSD-42J	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	380		Phase 2			
FSD-42K	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	490		Phase 2			
FSD-42L	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	670		Phase 2			
FSD-42M	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	770		Phase 2			
FSD-42N	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	510		Phase 2			
FSD-42O	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	280		Phase 2			
FSD-42P	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	800		Phase 2			
FSD-42Q	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	260		Phase 2			
FSD-43	Pipe	Lander Ave	Southeast 1 Area (FSD-PS-4) to Lander Ave	B	-	30	New	4,270		Phase 2			
FSD-44	Pipe	Linwood Ave	5th St to Lander Ave	A	-	48	New	3,770		Phase 2			
FSD-45	Pipe	Linwood Ave	West Linwood Ave Basin to Harding Drain Outfall	B	-	30	New	23,760			Phase 3		
Pump Stations/Basins													
FSD-PS-1	Pump Station	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Pump Station	-	-	60 cfs	New	-					Phase 5
FSD-PS-2	Pump Station	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Pump Station	-	-	48.5 cfs	New	-					Phase 5
FSD-PS-3	Pump Station	Linwood Ave	At Johnson Rd	-	-	136 cfs	New	-			Phase 3		
FSD-FM-1	Force Main	Linwood Ave	Johnson Rd to Verduga Rd (Dual Force Mains)	B	-	36	New	10,320			Phase 3		
FSD-PS-4	Pump Station	Unnamed Rd	Southeast 1 Area Future Pump station	-	-	47 cfs	New	-		Phase 2			
FSD-BN-1	Basin	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Retention Basin	-	-	40 ac-ft	New	-					Phase 5
	Land Acquisition	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Retention Basin	-	-	10 acres	New	-					Phase 5
FSD-BN-2	Basin	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Detention Basin	-	-	40 ac-ft	New	-					Phase 5
	Land Acquisition	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Detention Basin	-	-	10 acres	New	-					Phase 5
FSD-BN-3	Basin	Southern East Linear Basin	Southern East Linear Basin	-	-	81 ac-ft	New	-			Phase 3		
	Land Acquisition	Southern East Linear Basin	Southern East Linear Basin	-	-	20.25 acres	New	-			Phase 3		
FSD-BN-4	Basin	Highway 99 Basin	Southeast 1 Area, Highway 99 new basin	-	-	24.6 ac-ft	New	-		Phase 2			
	Land Acquisition	Highway 99 Basin	Southeast 1 Area, Highway 99 new basin	-	-	6.2 acres	New	-		Phase 2			
FSD-BN-5	Basin	Unnamed Rd	Southeast of Daubenberger Rd and Brier Rd	-	-	40 ac-ft	New	-			Phase 3		
	Land Acquisition	Unnamed Rd	Southeast of Daubenberger Rd and Brier Rd	-	-	10 acres	New	-			Phase 3		

Notes:
1. Proposed casings size and carrier pipe size.
2. Pump station capacities refer to the total capacity unless noted otherwise.

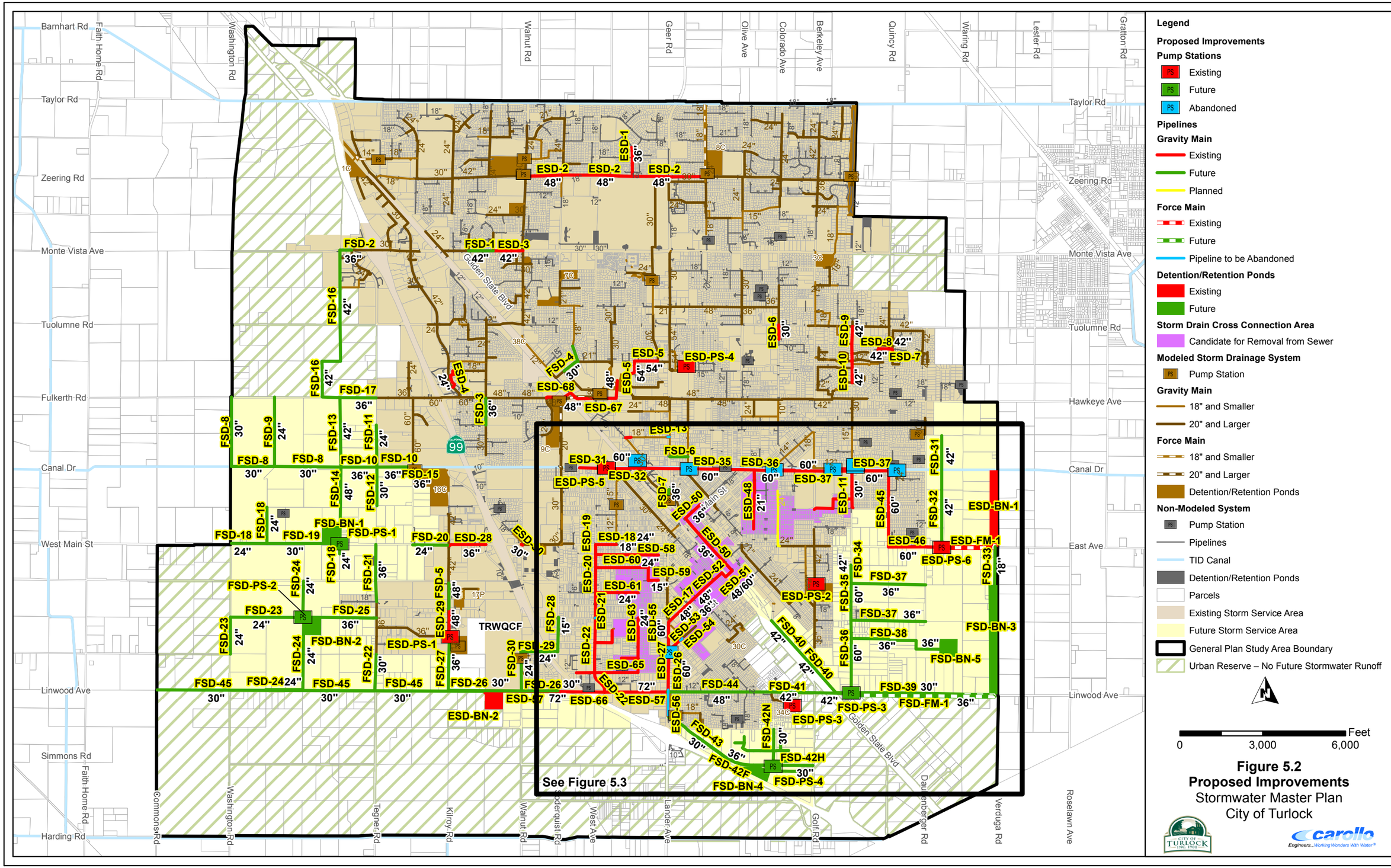

Figure 5.2
Proposed Improvements
Stormwater Master Plan
City of Turlock

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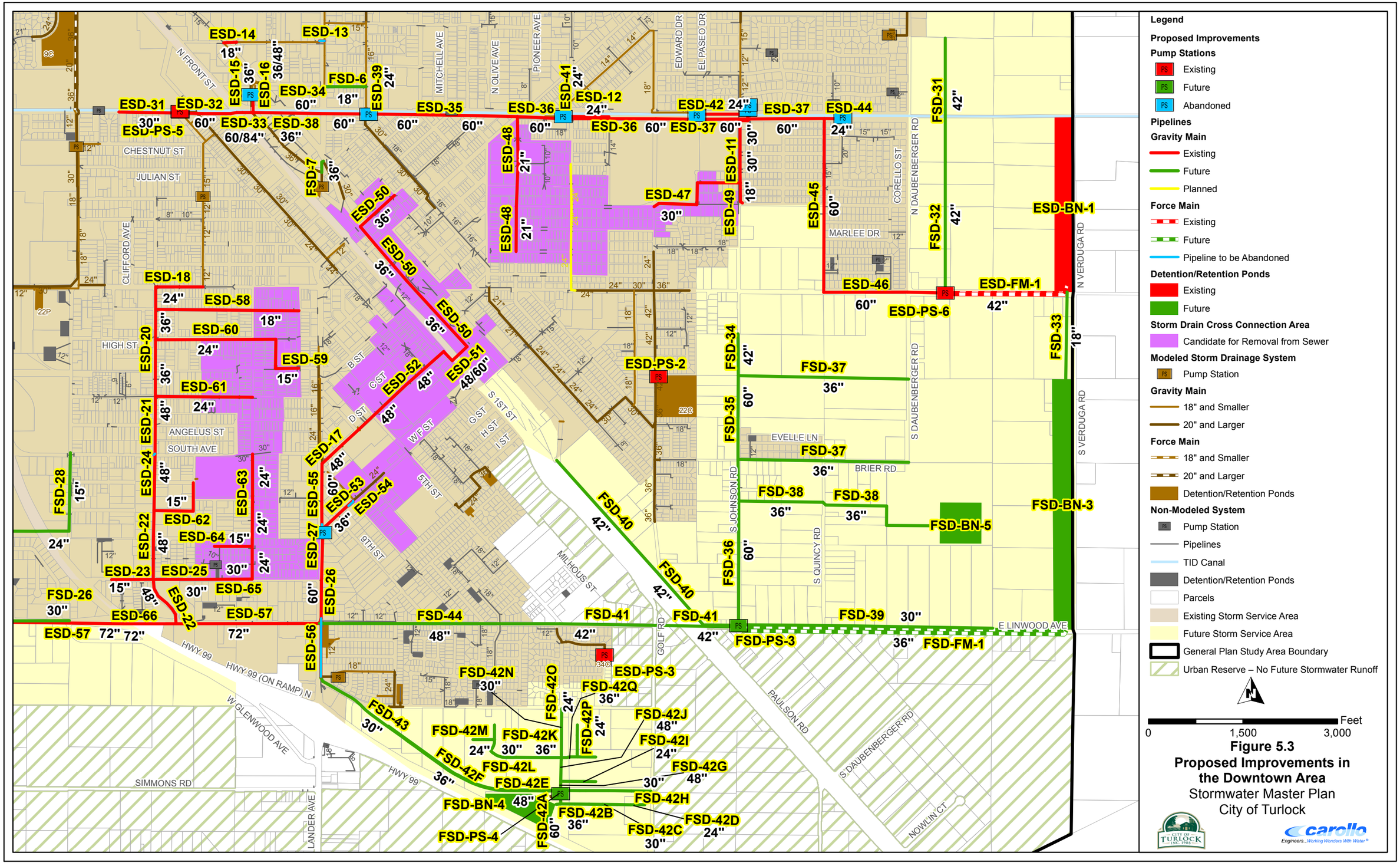


Figure 5.3
Proposed Improvements in the Downtown Area
Stormwater Master Plan
City of Turlock

In some cases a project is needed to correct an existing capacity deficiency but it is sized to accommodate additional runoff from future development. In these cases, the hydraulic modeling results were used to determine the cost breakdown between existing and future users. More information on the breakdown in cost split between existing and future users is provided in Chapter 6.

5.2.2 Existing System Improvements

Many of the recommended improvements to the existing system help resolve capacity deficiencies of major trunklines that collect stormwater runoff from large tributary areas. Larger pipelines are needed in these locations to convey large peak runoff volumes and to prevent flow bottlenecking, which currently results in flooding of City streets. Therefore, there are several locations where existing storm drains will need to be replaced by larger diameter storm drains, or new storm drainage infrastructure will need to be constructed to reduce peak flows through hydraulically-deficient storm drain pipes.

- **Christoffersen Parkway.** The pipeline infrastructure along Christoffersen Parkway between Geer Road and N Walnut Road is deficient, leading to street flooding over the maximum allowable depth. Flow bottlenecking in this pipeline may cause flooding in the community surrounding Piccadilly Lane and in the Hillsdale Drive and Cedar Ridge Drive areas during a 50-year design storm. Recommended improvements include:
  - Replace the existing 24-inch storm drain on Piccadilly Lane from Midsummer Lane to Christoffersen Pkwy with a 36-inch storm drain (ESD-1).
  - Replace the existing 30-inch storm drain on Christoffersen Parkway from Geer Road to N Walnut Road with a 48-inch storm drain (ESD-2).
- **Monte Vista Drive.** An improvement is proposed along Monte Vista Drive between Four Seasons Drive and Walnut Road to resolve flooding during the 50-year design storm. The hydraulic model indicates that the capacity deficiencies in the pipeline cause flooding along Four Seasons Drive and Monte Vista Drive. Recommended improvements include:
  - Replace the existing 30-inch storm drain on Monte Vista Drive from Four Seasons Drive and Walnut Road with a 42-inch storm drain (ESD-3).
- **Donnelly Park.** The hydraulic model indicates that the existing pipeline infrastructure conveying flow to the Donnelly Park basin from the Donnelly Park Rd and Pedras Rd inlet creates a capacity deficiency that causes flooding along Geer Rd and E Minnesota Ave. Recommended improvements to mitigate the existing deficiencies include:
  - Replace the existing 36-inch and 48-inch storm drains along Donnelly Park Drive and Pedras Rd with a 54-inch storm drain (ESD-5).

The City indicated that the Donnelly Park storage basin fills up quickly after storm events. Based on the connectivity of the City's drainage system, the Donnelly Park basin has a very large tributary basin, reaching as far north as Monte Vista Drive and as far east as N Daubenberger Rd. As simulated in the hydraulic model during the 50-year storm, the Donnelly Park basin does fill up to near its maximum estimated capacity, assuming the basin is nearly empty prior to the storm event and that no stormwater is removed from the basin during the storm.

The capacity of the Donnelly Park basin is strained during large storm events (especially if there is significant amount of water in the basin prior to the storm). To address this issue, we recommend that the City install a 48-inch pipeline from Donnelly Basin to the connection on Fulkerth Rd and Joett Dr. This will act as an overflow drain which will allow water to flow out of the basin when the water level reached a certain height. The City should also take precautions to ensure that the starting level of the Donnelly Basin is relatively low if a large storm event is expected in the City.

- **Johnson Road.** The storm drainage pipeline in the Johnson Road area between Tuolumne Rd and Hawkeye Ave is mostly flat. From Tuolumne Rd, flow generally surcharges in the pipelines and travels south towards the major interceptor on Hawkeye Ave, and west towards Donnelly Park basin. There are several locations where flows can surcharge to overflows into other parts of the system, such as north to Christoffersen Parkway or south to Canal Street. However, most of the stormwater collected in this area is conveyed to the Donnelly Park basin.

  The hydraulic model indicated that small diameter storm drains in several areas inhibited the surcharged flow from exiting the areas with the flat pipes. Therefore, several improvements are recommended that increase underground storage capacity and facilitate movement of surcharged flows through the flat areas of the system. The following improvements are recommended:

  – Replace the existing 12-inch and 24-inch storm drains along Castleview Drive and Quincy Rd with 42-inch storm drains (ESD-7).
  – Install a new 42-inch pipeline along Castleview Drive from Quincy Rd to west of Palace Ct (ESD-8).
  – Install a new 42-inch pipeline along Johnson Rd from Tuolumne Rd to north of Castleview Drive (ESD-9).
  – Replace the existing 15-inch storm drain along Johnson Rd , just north of Castleview Drive to south of Jackson Ct, with 42-inch storm drains (ESD-10).

- **Canal Drive.** The pipeline improvements proposed along Canal Drive serve three primary benefits. First, the hydraulic model indicated that several of the pump stations along Canal Drive that pump stormwater into TID Lateral No. 4 have inadequate capacity leading to upstream flooding in City streets. In lieu of replacing each of these

pump stations, utilization of a larger trunk drainage system would eliminate the need for new or upgraded pump stations along Canal Drive.

Second, with the proposed future development in the southeast, the City is hoping to initialize an integrated regional drainage system that ultimately discharges much of the collected stormwater from the new developments either to the Harding Drain or to the TRWQCF for reuse purposes. The proposed improvements along Canal Drive take advantage of this future development strategy, and will maximize the amount of stormwater available to the City once reuse plans have been more fully developed.

Third, the improvements along Canal Drive eliminate a significant amount of flow that is currently discharged to TID Lateral No. 4 during storm events. The City is currently in conversations with TID about reducing discharged stormwater to Lateral No. 4, and this proposed trunkline project will help achieve this goal. If the Canal Drive. improvements are implemented, the only remaining discharge points to TID Lateral No. 4 will be from the force main from Donnelly Park basin, the Dianne Basin, and two or three other small pump stations that were not modeled as a part of this Master Plan.

Therefore, proposed improvements ESD-31 through ESD-46 are recommended to resolve existing deficiencies and to take advantage of the proposed regional drainage system that supports future infill and new growth. The improvements consist of the following:

– Upgrade Pump Station No. 8 to be capable of pumping 24.5 cfs (10,976 gpm) peak flow, and modify configuration to discharge to the new Canal Drive. trunk infrastructure (in lieu of discharge to TID Lateral No. 4).
– Install a new 60-inch trunk line along Canal Drive, from north of The Burl to Quincy Rd (ESD-31 through ESD-37)
– Abandon seven pump stations, including Pump Stations Nos. 11, 13, 14, 15, 16, 18, and 38. Install new pipelines ranging in size from 24 inches to 36 inches that provide connection from the pump station wet wells or influent pipes to the new Canal Drive trunk line (ESD-38 through ESD-42, and ESD-44).
– Install a new 60-inch pipeline connecting to the proposed future pump station east of Daubenberger Rd (ESD-45 and ESD-46).
– Install a new pump station (ESD-PS-6) with a capacity of 160 cfs (71,000 gpm), dual 42-inch force mains (ESD-FM-1), and a new 55.8 ac-ft linear retention basin (ESD-BN-1). The volume of the retention basin is based on the estimates provided by West-Yost Associates in the Preferred Plan[1]. The hydraulic model indicates that a basin of this volume can adequately hold the runoff from the existing service area for the 50-year storm. However, the runoff expected as a result of the future development proposed for the southeast area will require

[1] Infrastructure Planning for City of Turlock General Plan Update, November 2012, West Yost Associates

additional storage, which will be provided by a second adjacent linear retention basin (future basin FSD-BN-3). Therefore, FSD-BN-3 should be constructed before future development in the southeast area is constructed.

- **Downtown Improvements to Remove Storm to Sewer Connections.** There are three primary areas of the City where cross connections between the storm and sewer systems should be estimated. As indicated on Figure 5.2, the areas highlighted in purple indicate areas where stormwater runoff was identified to flow directly to the sanitary sewer collection system. Many of the proposed improvements for these areas are recommended to remove the direct connections to the sanitary sewer collection system. However, some of the proposed improvements were necessary to resolve existing capacity deficiencies in the system. The following improvements are recommended:

  West of Downtown

  – Install a new storm drain traveling south along West Ave, from West Main St to Linwood Ave. The stormwater main will range in size from 24 inches to 48 inches (ESD-18 through ESD-22).

  – Install new lateral pipe infrastructure connecting to the proposed stormwater main along West Ave. The pipeline laterals range in size from 15 inches to 30 inches (ESD-58 through ESD-65, ESD-23, and ESD-25). The primary purpose of the lateral pipelines is to remove direct connections to the sanitary sewer system.

  – Install a new 72-inch interceptor along Linwood Ave from Lander Ave to the proposed new storage basin ESD-BN-2.

  – Install a new retention basin (ESD-BN-2) with a capacity of 123 ac-ft. The storage basin capacity was proposed in the Preferred Plan prepared by West Yost Associates, and was confirmed in the hydraulic model as sufficiently sized to hold runoff projected from the 50-year design storm.

  Downtown

  – Install a new storm drain traveling through the City's downtown area, from the intersection of E Olive Ave and S Thor St to Lander Ave. The storm drain will range in size from 36-inches to 48-inches (ESD-50 through ESD-52, and ESD-17).

  – Replace the pipeline infrastructure along Lander Ave, from D St to Linwood Ave, with a new 60-inch pipeline (ESD-26, ESD-27, and ESD-55). This improvement involves abandoning Pump Station No. 2, which was shown in the hydraulic model to be deficient. The improvement along Lander Ave will utilize lower inverts than currently exist in the pipes along Lander Ave, to be able to connect by gravity to the infrastructure along Linwood Ave.

- Connect existing stormwater infrastructure on F St to the new proposed 60-inch pipeline along Lander Ave with a new 36-inch pipeline (ESD-53) and remove the existing connection to the sanitary sewer system (ESD-54).
- Abandon the pipeline along Lander Ave that currently directs stormwater to Pump Station No. 1.

Northeast of Downtown

- Install a new 21-inch pipeline along Rose St, from Merritt St to the proposed 60-inch interceptor along Canal St (ESD-48).
- Install a new 30-inch pipeline from the intersection of Berkeley Ave and Marshall St to Johnson Rd (ESD-47).
- Replace the existing pipes along N Johnson Rd, from E Marshall St to the proposed interceptor along Canal St, with 18-inch and 30-inch pipelines, respectively (ESD-11 and ESD-49). The proposed pipelines along N Johnson Rd of this improvement serve dually to convey collected storm to sewer flows, but also to correct an existing deficiency identified in the system. Therefore, even if proposed improvement ESD-47 were not implemented, for example, improvements would still need to be made to the length of pipeline covered by ESD-11 and ESD-49 to resolve existing system capacity deficiencies.

- **Pump Stations.** Several pump stations have capacity deficiencies that caused flooding above allowable levels during the 50-year storm event. The following capacity upgrades to the City's pump stations are recommended:
  - Upgrade the capacity of the Kilroy Pump Station at Spengler Way and Kilroy Rd to 120 cfs (ESD-PS-1). The hydraulic model indicated that this pump station is significantly undersized during the 50-year design storm. In addition to upgrades of the pump station capacity, addition improvements are recommended to help alleviate the flooding that is projected to occur in this area. Parallel 48-inch gravity pipes are recommended along S Kilroy Rd from the train tracks to the pump station. Additional improvements are recommended to flow bottlenecking in this area, including proposed tie-in to the new infrastructure proposed for the Westside Industrial Specific Plan development, described in Section 5.2.3.2.
  - Upgrade the capacity of Pump Station No. 28 on Berkeley Ave, just south of Daffodil Lane, to pump a peak flow of 37 cfs (ESD-PS-2). The hydraulic model indicated flooding in the community upstream of this pump station because of insufficient pumping capacity. Upgrading the pump station eliminated the need to make improvements to the conveyance system to increase underground storage in pipes.
  - Upgrade the capacity of the Julep Pump Station, in between Warp Drive and Julep Way, to pump a peak flow of 4.3 cfs (ESD-PS-3). The hydraulic model

indicated that the current pump capacity causes upstream flooding in the streets above the planning criteria.

  – Upgrade the capacity of Pump Station No. 26 near the intersection of Loyola Way and North Ave to 6.5 cfs. The hydraulic model indicated the peak runoff collected from the area tributary to this pump station exceeds the capacity of the pump station to the point where flooding over the planning criteria occurs.

- **Other Existing System Improvements.** There are several other improvements recommended to mitigate existing system deficiencies that are not specifically described in the above sections, but that are included in Figure 5.2 and Table 5.1. These improvements are required to correct capacity deficiencies identified in the hydraulic model, and generally involve replacing existing pipelines with larger diameter pipelines.

5.2.3 System Improvements to Serve Future Development

Improvements proposed to resolve capacity deficiencies to accommodate future users for future development fall into four categories. The four areas are discussed below and proposed future improvements are identified in green in Figure 5.2, and correspond to the improvements listed in Table 5.1.

- **Infill Development.** Infill development contributes to a small portion of the stormwater runoff generated as a result of future development, compared to some of the larger development areas planned in the City. However, infill development in some locations increases the amount of stormwater runoff to the point where City streets flood over the planning criteria. For these areas, improvements were proposed to correct capacity deficiencies and reduce the potential for flooding. In addition, infill development in the Monte Vista Drive area, will create additional storm runoff. As infill occurs an extension to existing improvement ESD-3 will be required. In the future build-out condition, the hydraulic model indicates that flooding above the criteria occurs from the 24-inch pipeline just west of Summer Creek Drive. Therefore, the future improvements FSD-1 is recommended to mitigate the flooding in this area. FSD-1 includes replacing an existing 30-inch pipe with a 42-inch storm drain.

  The following improvements are recommended:

  – Replace the existing 24-inch pipeline along Monte Vista Dr, west of Tegner Rd to Tegner Rd, with a 36-inch pipeline (FSD-2). This improvement helps alleviate flow bottlenecking that would prevent flow from traveling south through proposed improvement FSD-16 to the WISP area for storage. The hydraulic model showed significant flooding in the Tegner Rd area during the 50-year design storm, and the overflow to the WISP area provides a solution that takes advantage of planned regional stormwater infrastructure.

  – Replace the existing 30 inch pipeline along Tully Rd, from Branding Iron Drive to Fulkerth Rd, with a 36-inch pipeline (FSD-3).

– Replace the existing 18-inch and 21-inch pipelines along Oxford Ave and Pedras Rd with a 30-inch pipeline, from Jacquelinelee Drive to northeast of Divanian Drive (FSD-4). The hydraulic model showed that the small pipelines in this area creates bottlenecks that result in flooding along Oxford Ave.

Several other future improvements related to infill development are recommended, but are not described here (FSD-5 through FSD-7). Table 5.1 includes a description of all the proposed pipeline improvement projects.

- **Westside Industrial Specific Plan (WISP).** The improvements related to the Turlock Regional Industrial Park (TRIP) area were initially defined in the WISP plan, prepared by Wade Associates, and updated for this Master Plan based on projected runoff in the hydraulic model. The overall concept of drainage management in this area is utilization of onsite storage, in addition to regional storage in two proposed retention basins. The growth plan in this area stipulates that developers will be required to build storage structures on development properties (mostly commercial and industrial) to retain stormwater onsite. Stormwater runoff that is not collected on properties will be collected in the City's drainage infrastructure to be stored in the storage basins. Pipeline improvements vary from 24 inches to 48 inches in diameter (FSD-8 through FSD-30). Both of the proposed basins for this area (FSD-BN-1 and FSD-BN-2) having corresponding pump stations to lift stormwater from the drainage system into the basins (FSD-PS-1 and FSD-PS-2). Both basins are proposed to be 40 ac-ft. To pump the projected peak runoff volume, pump station FSD-PS-1 is recommended to have a capacity of 60 cfs, and pump station FSD-PS-2 is recommended to have a capacity of 48.5 cfs.

  Several locations were identified on the west side of the City's existing system where flooding above the planning criteria was simulated in the hydraulic model during the 50-year storm. To resolve these flooding issues, the WISP area improvements were incorporated into a regional drainage plan that diverts stormwater from the existing system to the proposed storage basins in the WISP area. The connections to the existing system occur with improvements FSD-16, FSD-10, and FSD-25. These connections can be constructed either as direct connections (where pipe inverts match) or as overflows (where stormwater flows to the WISP area once the hydraulic grade line reaches a certain level in the system). Either operation method allows stormwater to be collected in the proposed WISP system during a large storm event and prevents flooding in the existing service area.

- **General Plan Development Areas.** The improvements recommended for the general plan development areas were initially proposed in the Preferred Plan prepared by West Yost Associates, and updated for this Master Plan based on projected runoff in the hydraulic model. The drainage model for this area proposes a regional drainage system that will ultimately collect stormwater runoff from a significant portion of the City. First, all of the stormwater collected east of Golden State Blvd is proposed to be temporarily stored in proposed basin FSD-BN-3. Following a storm event, City staff

would drain basin FSD-BN-3 by gravity through the interceptor along Lindwood Ave, and ultimately to the Harding Drain or to the TRWQCF. For the smaller drainage area south of Linwood Ave and west of Golden State Blvd, stormwater runoff would be pumped (by proposed pump station FSD-PS-4) into basin FSD-BN-4. Similarly, the City would drain basin FSD-BN-4 by gravity after a storm event to the desired outfall location.

The improvements for the southeast area, east of Golden State Blvd, include construction of two retention basins (FSD-BN-3 and FSD-BN-5). Improvement FSD-BN-3, or the Southern East Linear Basin, will provide significant storage of collected runoff and is recommended to have a capacity of 81 ac-ft. Pump station FSD-PS-3 is associated with basin FSD-BN-3, and is designed to pump collected stormwater into the storage basin through two parallel 36-inch forcemains (FSD-FM-1). Retention basin FSD-BN-5 serves to provide additional storage for the runoff collected upstream of pump station FSD-PS-3. Pipeline improvements in this area range from 36 inches to 60 inches (FSD-31 through FSD-40).

The improvements in the Southeast area, west of Golden State Blvd, include construction of one retention basin (FSD-BN-4) and one pump station (FSD-PS-4). Recommended pipeline infrastructure in this area ranges from 18 inches to 36 inches.

To connect the Southeast area improvements to the outfall drainage system, 42-inch and 48-inch diameter pipelines are proposed (improvements FSD-41 and FSD-44, respectively). These pipelines will serve as the drainage lines from the storage basins in the Southeast area, and will ultimately direct stormwater flow to either the Harding Drain outfall or to the TRWQCF for reuse.

5.2.4 Project Prioritization

When fully implemented, the capital projects will facilitate the collection, conveyance, storage, and discharge of peak storm flows to limit street flooding to the maximum allowed. Prioritizing the required capital improvements for the City's storm drainage system is an important aspect of the Master Plan. The improvement projects were prioritized on a short-term and long-term basis to mitigate existing deficiencies and meet the needs of proposed development.

The projects are grouped into the following phases based on project priorities and future growth:

- Phase 1: Years 2013 through 2015
- Phase 2: Years 2016 through 2020
- Phase 3: Years 2021 through 2025
- Phase 4: Years 2026 through 2030
- Phase 5: After 2030

The projects were phased based on the best available information for how the City will develop moving forward. The actual implementation of the improvements serving future users ultimately depends on growth. The priorities presented below are estimates, and changes in the City's planning assumptions or growth projections could increase or decrease the priority of each improvement.

- **Phase 1 Projects (2013-2015).** The highest priority projects are the main backbone features of the storm drainage system improvement projects needed to remove storm drainage system connections to the sewer system. These include a new storm basin (ESD-BN-2) and other major storm drain pipelines to the basin (ESD-26, ESD-53, ESD-57, and ESD-66). These improvements are indentified on Figure 5.2 and Table 5.1. However, costs associated with these projects are included in the Sewer System CIP.
- **Phase 2 Projects (2016-2020).** The second phase targets the majority of the remaining improvement projects to remove storm drain connections from the sewer system. These include:
  - ESD-17
  - ESD-19 to ESD-22
  - ESD-24 and ESD-25
  - ESD-50 to ESD-52
  - ESD-55
  - ESD-58 to ESD-65

  Other high priority projects to address storm drainage system deficiencies targeted for implementation phase 2 include:
  - ESD-1 and ESD-2
  - ESD-5
  - ESD-18, ESD-23
  - ESD-29 and ESD-30
  - Kilroy at WQCF Pump Station (ESD-PS-1)
  - Pump Station 28 (ESD-PS-2)

  Phase 2 also targets additional growth related improvements which could potentially be required in the relatively near term. These projects include:
  - FSD-5
  - FSD-42 to FSD-44
  - Future Pump Station in Southeast Area 1 (FSD-PS-4)
  - Future Basin in Southeast Area 1 (FSD-BN-4)
- **Phase 3, 4, and 5 Projects (2021-2025, 2026-2030, and After 2030)**. Lower priority projects to address existing storm drainage system deficiencies are targeted for

implementation in phases 3 and 4. In addition, the remaining storm drainage system projects that remove storm drain connections to the sewer system (ESD-11, ESD-43, ESD-47, and ESD-48) are targeted for phase 4.

For the purposes of prioritizing future system improvements, the Phase 3 through 5 growth projects are viewed as longer-term projects driven by development at the outer edges of the planning area. The Phase 3 through 5 growth projects are provided in Table 5.1 for reference.

CAPITAL IMPROVEMENT PROGRAM

This section presents the recommended capacity related capital improvement plan (CIP) for the City of Turlock (City) stormwater system and a summary of the capital costs.

6.1 CAPITAL IMPROVEMENT PROJECT COSTS

The cost estimates presented in this study are opinions developed from bid tabulations, cost curves, and information obtained from previous studies. The costs are based on an Engineering News Record Construction Cost Index (ENR CCI) of 10,386 (San Francisco, March 2013), with a base year of 1913. The City has indicated that they use a less commonly used version of the ENR CCI index, in which the index was reset to 100 in the year 1967. Based on a review of available documentation from ENR, it was determined that an ENR CCI of 10,386 for San Francisco with a base year of 1913 would be equivalent to an ENR CCI of 821 for San Francisco with a base year of 1967. The following summarizes the cost basis for this Master Plan:

$ENR\ CCI_{1913} = 10{,}386$ (San Francisco, March 2013)

$ENR\ CCI_{1967} = 821$ (San Francisco, March 2013)

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as preliminary alignment generation, investigation of alternative routings, and detailed utility and topography surveys.

The Association for the Advancement of Cost Engineering (AACE) defines an Order of Magnitude Estimate, deemed appropriate for master plan studies, as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within plus 50 percent to minus 30 percent. This section presents the assumptions used in developing order of magnitude cost estimates for recommended facilities.

6.2 CONSTRUCTION UNIT COSTS

The construction costs are representative of storm drainage system facilities under normal construction conditions and schedules. Costs have been estimated for public works construction.

6.2.1 Pipeline Unit Costs

Storm drainage system pipeline improvements in this study range in size from 15-inches to 72 inches in diameter. Pipe casings are included for major crossings (e.g. creeks, canals, highways, railroad). Pipeline unit costs are shown in Table 6.1.

The construction cost estimates are based upon these unit costs. The unit costs are for "typical" field conditions with construction in stable soil at a depth ranging between 10 to 15 feet. Construction of pipelines in undeveloped areas is anticipated to cost less than those constructed in developed areas, such as downtown. The unit costs in Table 6.1 are discounted by 30 percent for pipelines that will be built in undeveloped areas. This discount is based on a review of bid tabulations that were constructed in developed and undeveloped areas. Pipelines built in undeveloped areas ranged from 30 to 50 percent less than pipelines built in developed areas.

Table 6.1 Storm Drain Unit Costs
Stormwater Master Plan
City of Turlock

Diameter (inches)	Pipeline Unit Costs[1] ($/LF)	
	Schedule A (Developed Area)	Schedule B[2] (Undeveloped Area)
15	174	122
18	189	133
21	221	155
24	252	177
27	284	199
30	316	221
33	347	243
36	379	265
42	442	309
48	505	353
54	568	398
60	631	442
66	694	486
72	757	530

Notes:

(1) Costs are based on the Engineering News Record Construction Cost Index of 821 (1967 base year, San Francisco, March 2013).

(2) Schedule B Unit Cost = 70 percent of Schedule A Unit Cost

6.2.2 Detention/Retention Basin Unit Costs

Unit cost estimates for new detention basins include earthwork and piping. The unit costs do not include fencing, landscape, and land acquisition. Land acquisition costs are discussed below. The detention/retention basin cost versus capacity curve shown in Figure 6.1 was developed based on projects of similar size in California.

6.2.3 Pump Station Unit Costs

Pump station improvements include the construction of new facilities or increasing the capacity of exiting pump stations to convey storm runoff. Cost estimates for pump stations were developed based on projects of similar size in California. Pump station construction costs are estimated based on capacity according to the following equation:

$$\text{Cost} = (13{,}143 \times Q_{mgd}) + 65{,}573$$ [1]

This equation is applicable for pump stations with a total dynamic head (TDH) between 20 and 30 feet. This cost estimate includes spare pumps and associated equipment, but does not specify the number of pumps or configuration.

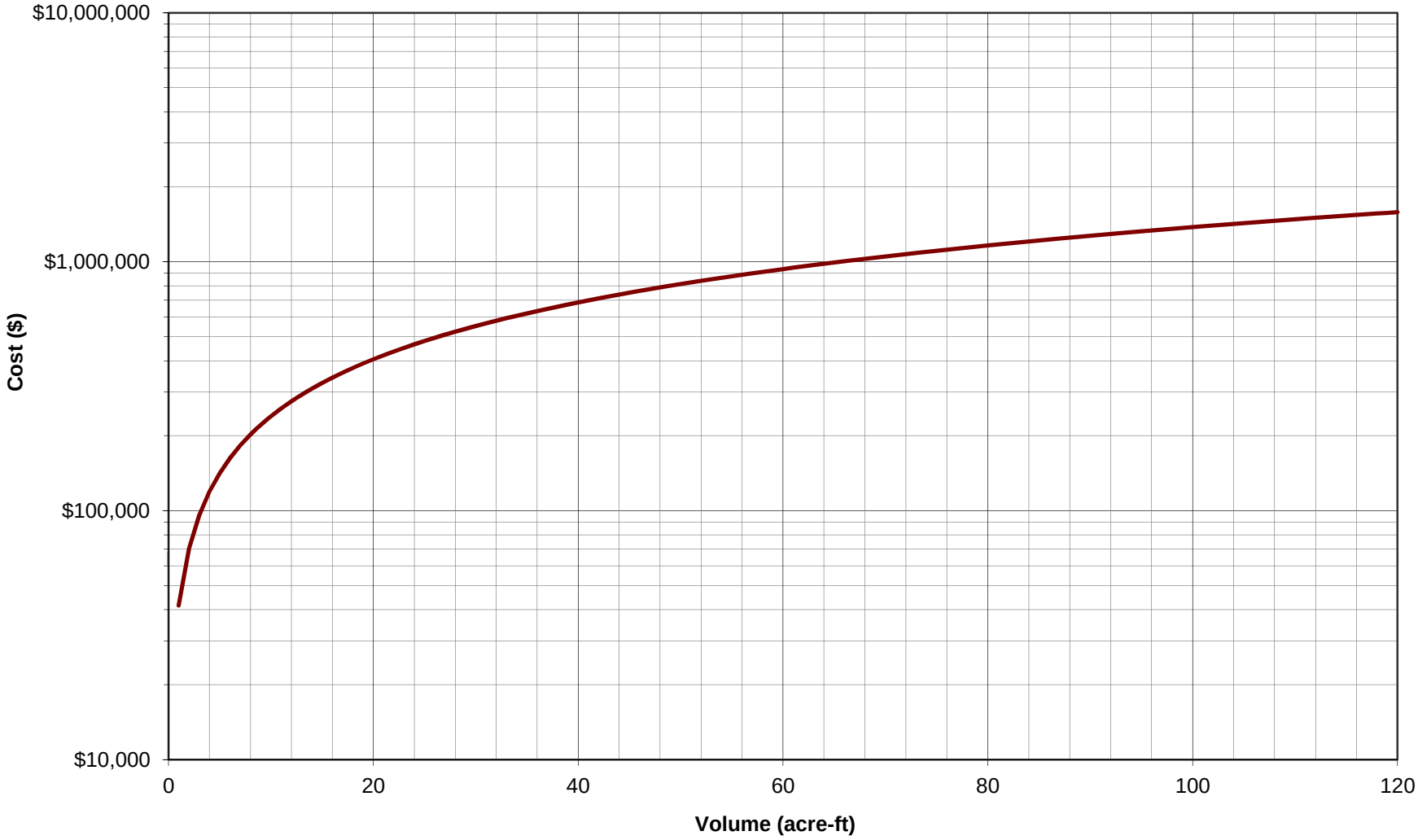
6.2.4 Land Acquisition Unit Costs

Acquisition of property, easements, and right-of-way (ROW) may be required for some of the recommended projects. For the majority of sewers and storm drains, pipeline corridor or easements are assumed to be in public ROW, and therefore do not require land acquisition. However, land may be required for the storage basins, pump stations, lift stations recommended in this Master Plan and are noted in the sewer and storm drainage system CIP tables. Land costs were assumed to be $100,000 per acre, based on typical land acreage costs in Turlock during the preparation of this report.

6.3 PROJECT COSTS AND CONTINGENCIES

Baseline construction costs are the total estimated construction costs, in dollars, of the proposed improvements. Pipeline baseline construction costs were calculated by multiplying the estimated length by the unit cost. Lift and pump station baseline construction costs were calculated based on the required pump capacity in the pump capacity cost equation. Detention/retention basin baseline construction costs were calculated based on the required basin volume in the volume cost curve.

[1] ENR CCI = 821, 1967 base year, San Francisco, March 2013



ENR CCI_{1967} = 821 (San Francisco, March 2013)
ENR CCI_{1913} = 10,368 (San Francisco, March 2013)

Figure 6.1
Detention Basin Cost Curve
Sewer System and Stormwater Master Plan
City of Turlock

Contingency costs are applied to the baseline construction costs to account for unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities, and other project considerations. A 25 percent contingency was applied to account for unknown site conditions such as poor soils, unforeseen conditions, environmental mitigations, and other unknowns and is typical for master planning projects. An additional 30 percent project construction contingency cost was added to account for project engineering, construction phase professional services, and project administration.

Example:

Baseline Construction Cost	**$1,000,000**
Construction Contingency (25%)	$250,000
Estimated Construction Cost	**$1,250,000**
Engineering Cost + Construction Management + Project Administration (30%)	$375,000
Capital Improvement Cost	**$1,625,000**

The proposed storm drainage system CIP is presented in Table 6.2. This table show the recommended project phasing. The implementation timeframe was based on the priority of each project to correct existing deficiencies or to serve future users.

6.3.1 Capital Improvement Project Implementation

The CIPs are prioritized based on their urgency to mitigate existing deficiencies and for servicing anticipated growth. It is recommended that improvements to mitigate existing deficiencies be assigned the highest priority. Expansion of the system to accommodate growth should be implemented as the City grows.

The implementation phases are in 5-year increments, except for the first phase, which runs from 2013 through 2015. Each project is itemized by phase in Table 6.2 and a summary by phase is provided in Table 6.3. The total capital cost of the City's CIP for the stormwater improvements is $125.8 million.

Table 6.2 **Capital Improvement Plan**
Stormwater Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost					Capital Improvement Phasing					Future Users Benefit (%)	Cost Allocation Category	
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Capital Improvement Cost[2],[3] ($)	Phase 1 2013-2015 ($)	Phase 2 2016-2020 ($)	Phase 3 2021-2025 ($)	Phase 4 2026-2030 ($)	Phase 5 After 2030 ($)		Existing Improvements ($)	Future Improvements ($)
Existing Service Area MASTER CIP																	
Pipelines																	
ESD-1	Pipe	Picadilly Lane	Midsummer Lane to Christoffersen Pkwy	A	24	36	Replace	1,060	$ 652,000		$ 652,000				0%	$ 652,000	$ -
ESD-2	Pipe	Christoffersen Pkwy	Pump Station No. 31 Wet Well to Walnut Rd (Walnut Pump Station #1 Wet Well)	A	30	48	Replace	6,750	$ 5,538,000		$ 5,538,000				10%	$ 4,984,200	$ 553,800
ESD-3	Pipe	Monte Vista Dr	Four Seasons Dr to Walnut Rd	A	30	42	Replace	1,090	$ 783,000			$ 783,000			20%	$ 626,400	$ 156,600
ESD-4	Pipe	Countryside Dr	West side of Staples/Walmart Shopping Center, parallel to Countryside Dr	A	12/15	24	Replace	850	$ 349,000				$ 349,000		5%	$ 331,550	$ 17,450
ESD-5	Pipe	Pedras Road, Donnelly Park Drive	West of Geer Rd to South of De Pauw Dr	A	36/48	54	Replace	1,600	$ 1,477,000		$ 1,477,000				0%	$ 1,477,000	$ -
ESD-6	Pipe	Colorado Ave	Waldorf Dr to Tuolumne Rd	A	18	30	Replace	520	$ 267,000			$ 267,000			5%	$ 253,650	$ 13,350
ESD-7	Pipe	Castleview Dr, Quincy Rd	Bristol Park Cl to Quincy Rd	A	12/24	42	Replace	200	$ 143,000			$ 143,000			0%	$ 143,000	$ -
ESD-8	Pipe	Castleview Dr	Quincy Rd to west of Palace Ct	A	-	42	New	410	$ 294,000			$ 294,000			35%	$ 191,100	$ 102,900
ESD-9	Pipe	Johnson Rd	Tuolumne Rd to north of Castleview Dr	A	-	42	New	640	$ 460,000			$ 460,000			5%	$ 437,000	$ 23,000
ESD-10	Pipe	Johnson Rd	North of Castleview Dr to south of Jackson Ct	A	15	42	Replace	1,450	$ 1,042,000			$ 1,042,000			0%	$ 1,042,000	$ -
ESD-12	Pipe	Canal Dr	Colorado Ave to west of Bell St	A	14	24	Replace	730	$ 299,000				$ 299,000		0%	$ 299,000	$ -
ESD-13	Pipe	Almond Ave	Geer Rd and Almond Ave	A	18	-	Abandon	-	$ -				$ -		60%	$ -	$ -
ESD-14	Pipe	Almond Ave	Almond Ave and Golden State Blvd	A	-	18	New	210	$ 65,000				$ 65,000		60%	$ 26,000	$ 39,000
ESD-15	Pipe	Kern St	Canal Dr to Pump Station No. 38 Wet Well	A	12	36	Replace	330	$ 203,000				$ 203,000		0%	$ 203,000	$ -
ESD-16	Pipe/Casing[1]	Canal Dr	Pipe & Casing under TID Canal #4, east of Front St	A	12	36/48	Replace	15	$ 47,000				$ 47,000		0%	$ 47,000	$ -
ESD-18	Pipe	West Main St, West Ave South	Grant Ave to Columbia St	A	12	24	Replace	1,110	$ 455,000		$ 455,000				0%	$ 455,000	$ -
ESD-23	Pipe	Montana Ave	East of Hwy 99 to West Ave South	A	-	15	New	660	$ 187,000		$ 187,000				30%	$ 130,900	$ 56,100
ESD-28	Pipe	West Main St	Walnut Rd to Kilroy Rd	A	24/30	36	Replace	1,350	$ 830,000				$ 830,000		0%	$ 830,000	$ -
ESD-29	Pipe	Kilroy Rd	Parallel Pipe from Industrial Rowe to Spengler Way	A	-	48	New	1,000	$ 821,000		$ 821,000				5%	$ 779,950	$ 41,050
ESD-30	Pipe	West Main St	Corner of West Main St and Tully Rd, Add connection to existing storm drain	A	-	30	New	60	$ 31,000		$ 31,000				0%	$ 31,000	$ -
ESD-31	Pipe	Canal Drive	East of Soderquist Rd to Lexington Ave	A	-	30	New	970	$ 497,000				$ 497,000		0%	$ 497,000	$ -
ESD-32	Pipe	Canal Drive	Lexington to east of Front St	A	-	60	New	1,070	$ 1,097,000				$ 1,097,000		0%	$ 1,097,000	$ -
ESD-33	Pipe/Casing[1]	Canal Drive	Boring under train tracks	A	-	60/84	New	90	$ 288,000				$ 288,000		0%	$ 288,000	$ -
ESD-34	Pipe	Canal Drive	East of Front Street to Palm St	A	-	60	New	1,810	$ 1,856,000				$ 1,856,000		0%	$ 1,856,000	$ -
ESD-35	Pipe	Canal Drive	Palm St to Rose St	A	-	60	New	2,380	$ 2,441,000				$ 2,441,000		0%	$ 2,441,000	$ -
ESD-36	Pipe	Canal Drive	Rose St to Wallace St	A	-	60	New	2,890	$ 2,964,000				$ 2,964,000		0%	$ 2,964,000	$ -
ESD-37	Pipe	Canal Drive	Wallace St to Quincy Rd	A	-	60	New	1,980	$ 2,031,000				$ 2,031,000		0%	$ 2,031,000	$ -
ESD-38	Pipe	Canal Drive	Kern St and Canal Dr, provides connection to canal trunkline	A	-	36	New	30	$ 18,000				$ 18,000		0%	$ 18,000	$ -
ESD-39	Pipe	Canal Drive	Canal and Palm, provides connection to canal trunkline	A	-	24	New	30	$ 13,000				$ 13,000		0%	$ 13,000	$ -
ESD-40	Pipe	Canal Drive	Canal and Palm, provides connection to canal trunkline	A	-	30	New	20	$ 10,000				$ 10,000		0%	$ 10,000	$ -
ESD-41	Pipe	Canal Drive	Canal and Sierra, provides connection to canal trunkline	A	-	24	New	40	$ 16,000				$ 16,000		0%	$ 16,000	$ -
ESD-42	Pipe	Canal Drive	El Paseo Dr to Johnson Rd, provides connection to canal trunkline	A	-	24	New	830	$ 341,000				$ 341,000		0%	$ 341,000	$ -
ESD-44	Pipe	Canal Drive	Camellia St to Quincy Rd	A	-	24	New	310	$ 127,000				$ 127,000		0%	$ 127,000	$ -
ESD-45	Pipe	Quincy Rd	Canal Dr to East Ave	A	-	60	New	2,750	$ 2,821,000				$ 2,821,000		15%	$ 2,397,850	$ 423,150
ESD-46	Pipe	East Ave	Quincy Rd to Southeast 2 Area Pump Station (ESD-PS-6)	A	-	60	New	1,920	$ 1,970,000				$ 1,970,000		15%	$ 1,674,500	$ 295,500
ESD-49	Pipe	Johnson Rd	Marshall St to north of Zinfandel Ln	A	12	18	Replace	340	$ 104,000				$ 104,000		0%	$ 104,000	$ -
ESD-67	Pipe	Hawkeye Ave	Donnely Park to connection at Fulkerth Rd and Joett Dr	A	-	48	New	3,045	$ 2,499,000			$ 2,499,000			0%	$ 2,499,000	$ -
ESD-68	Pipe/Casing[1]	N Front St	Railroad Crossing at N Front St for Donnely Park Pipeline	A	-	48/60	New	295	$ 941,000			$ 941,000			0%	$ 941,000	$ -
Pump Stations/Basins																	
ESD-PS-1	Pump Station	Kilroy at WQC Pump Station	Spengler Way and Kilroy Road	-	22.3 cfs	120 cfs	Replace	-	$ 1,763,000		$ 1,763,000				0%	$ 1,763,000	$ -
ESD-PS-2	Pump Station	Pump Station No. 28	Berkeley Ave, south of Daffodil Ln	-	8.9 cfs	37 cfs	Replace	-	$ 618,000		$ 618,000				0%	$ 618,000	$ -
ESD-PS-3	Pump Station	Julep Pump Station	Warp Dr and Julep Way	-	0.9 cfs	4.3 cfs	Replace	-	$ 166,000			$ 166,000			0%	$ 166,000	$ -
ESD-PS-4	Pump Station	Pump Station No. 26	Loyola Way and North Ave	-	3.1 cfs	6.5 cfs	Replace	-	$ 197,000				$ 197,000		0%	$ 197,000	$ -
ESD-PS-5	Pump Station	Pump Station No. 8	Canal Dr and Lexington Ave	-	7.6 cfs	24.5 cfs	Replace	-	$ 445,000				$ 445,000		0%	$ 445,000	$ -
ESD-PS-6	Pump Station	East Ave	East of Daubenberger Rd	-	-	160 cfs	New	-	$ 2,316,000				$ 2,316,000		40%	$ 1,389,600	$ 926,400
ESD-FM-1	Force Main	East Ave	Dual Force Mains to Northern East Linear Basin	B	-	42	New	3,740	$ 1,984,000				$ 1,984,000		40%	$ 1,190,400	$ 793,600
ESD-BN-1	Basin	Northern East Linear Basin	Northern East Linear Basin	-	-	55.8 ac-ft	New	-	$ 1,441,000				$ 1,441,000		40%	$ 864,600	$ 576,400
	Land Acquisition	Northern East Linear Basin	Northern East Linear Basin	-	-	14 acres	New	-	$ 1,400,000				$ 1,400,000		40%	$ 840,000	$ 560,000
Projects to Remove Direct Connections to Sewer System																	
ESD-11	Pipe	Johnson Rd	Marshall St to Canal Dr	A	8/12/15	30	Replace	1,120	Note (6)				X		30%	-	-
ESD-17	Pipe	D St	6th to Lander Ave	A	10/18	48	Replace	780	Note (6)		X				45%	-	-
ESD-19	Pipe	West South Ave	Columbia St to High St	A	12	36	Replace	490	Note (6)		X				20%	-	-
ESD-20	Pipe	West South Ave	High St to Vermont Ave	A	12	36	Replace	900	Note (6)		X				20%	-	-
ESD-21	Pipe	West South Ave	Vermont Ave to South Ave	A	12	48	Replace	910	Note (6)		X				20%	-	-
ESD-22	Pipe	West Ave South	South Ave to Linwood Ave	A	-	48	New	2,820	Note (6)		X				25%	-	-
ESD-24	Pipe	South Ave	Corner of West Ave South, remove outfall to existing infrastructure	A	15	-	Abandon	-	Note (6)		X				-	-	-

Table 6.2 Capital Improvement Plan
Stormwater Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost					Capital Improvement Phasing					Future Users Benefit (%)	Cost Allocation Category	
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Capital Improvement Cost[2],[3] ($)	Phase 1 2013-2015 ($)	Phase 2 2016-2020 ($)	Phase 3 2021-2025 ($)	Phase 4 2026-2030 ($)	Phase 5 After 2030 ($)		Existing Improvements ($)	Future Improvements ($)
ESD-25	Pipe	Montana Ave	Gabriel St to West Ave South	A	-	30	New	670	Note (6)		X				45%	-	-
ESD-26	Pipe	Lander Ave	E St to Linwood Ave, Adjust inverts to match prposed Linwood trunkline	A	-	60	Replace	1,580	Note (6)	X					30%	-	-
ESD-27	Pipe	Lander Ave	At F St, influent pipe to Pump Station No. 2 Wet Well	A	42	-	Abandon	-	Note (6)		X				-	-	-
ESD-43	Pipe	Canal Drive	Johnson Rd and Canal Dr, provides connection to canal trunkline	A	-	30	New	50	Note (6)				X		20%	-	-
ESD-47	Pipe	Marshall St	Berkeley Ave to Johnson Rd	A	-	30	New	1,720	Note (6)				X		50%	-	-
ESD-48	Pipe	Rose St	Merritt St to Canal Dr	A	-	21	New	2,150	Note (6)				X		50%	-	-
ESD-50	Pipe	Olive Ave, Golden State Blvd	Thor St to southeast of Minerva St	A	-	36	New	3,490	Note (6)		X				50%	-	-
ESD-51	Pipe/Casing[1]	Golden State Blvd, 1st Street	Pipe & Casing under Train Tracks, east of Golden State Blvd	A	-	48/60	New	130	Note (6)		X				50%	-	-
ESD-52	Pipe	D St	1st St to 6th St	A	-	48	New	2,060	Note (6)		X				50%	-	-
ESD-53	Pipe	F St	8th St to Lander Ave	A	-	36	New	680	Note (6)	X					50%	-	-
ESD-54	Pipe	F St	Southwest of 8th St, Remove connection to sewer	A	33	-	Abandon	-	Note (6)	X					-	-	-
ESD-55	Pipe	Lander Ave	D St to E St	A	42	60	Replace	950	Note (6)		X				30%	-	-
ESD-56	Pipe	Lander Ave	Linwood Ave to Glenwood Ave	A	42	-	Abandon	-	Note (6)	X					-	-	-
ESD-57	Pipe	Linwood Ave	Lander Ave to West Linwood Ave Basin	A	-	72	New	6,690	Note (6)	X					30%	-	-
ESD-58	Pipe	Columbia St	Locust St to West Ave South	A	-	18	New	2,280	Note (6)		X				50%	-	-
ESD-59	Pipe	Castor St, Laurel St	Locust St to High St	A	-	15	New	830	Note (6)		X				50%	-	-
ESD-60	Pipe	High St	Laurel St to West Ave South	A	-	24	New	1,910	Note (6)		X				50%	-	-
ESD-61	Pipe	Vermont Ave	Orange St to West Ave South	A	-	24	New	1,540	Note (6)		X				50%	-	-
ESD-62	Pipe	Martinez St, Williams Ave	Parnell Ave to West Ave South	A	-	15	New	1,070	Note (6)		X				50%	-	-
ESD-63	Pipe	Orange St	South Ave to Montana Ave	A	-	24	New	1,980	Note (6)		X				50%	-	-
ESD-64	Pipe	Lewis St	Maple St to Orange St	A	-	15	New	600	Note (6)		X				50%	-	-
ESD-65	Pipe	Montana Ave	Orange St to west of Gabriel St	A	-	30	New	900	Note (6)		X				50%	-	-
ESD-66	Pipe/Casing[1]	Linwood Ave, under Highway 99	Boring under Highway 99, under Linwood Ave	A	-	72/84	New	240	Note (6)	X					30%	-	-
ESD-BN-2	Basin	Linwood Ave	West Linwood Ave Basin	-	-	123 ac-ft	New	-	Note (6)	X					65%	-	-
								Existing System Improvements Subtotal	**$ 44,307,000**	**$ -**	**$ 11,542,000**	**$ 6,595,000**	**$ 26,170,000**	**$ -**		**$ 39,728,700**	**$ 4,578,300**
Buildout System Improvements																	
Pipelines																	
FSD-1	Pipe	Monte Vista Dr	Summer Creek Dr to Four Seasons Dr	A	30	42	Replace	890	$ 639,000			$ 639,000			20%	$ 511,200	$ 127,800
FSD-2	Pipe	Monte Vista Dr	West of Tegner Rd to Tegner Rd	A	24	36	Replace	426	$ 262,000					$ 262,000	0%	$ 262,000	$ -
FSD-3	Pipe	Tully Rd	Branding Iron Dr to Fulkerth Rd	A	30	36	Replace	980	$ 603,000				$ 603,000		5%	$ 572,850	$ 30,150
FSD-4	Pipe	Oxford Ave, Pedras Rd	Jacquelinelee Dr to Northeast of Divanian Dr	A	18/21	30	Replace	1,220	$ 626,000				$ 626,000		30%	$ 438,200	$ 187,800
FSD-5	Pipe	Kilroy Rd	Parallel Pipe from Castor St to Industrial Rowe	A	-	48	New	940	$ 772,000		$ 772,000				5%	$ 733,400	$ 38,600
FSD-6	Pipe	Syracuse Ave	Palm St to Geer Rd	A	8	18	Replace	660	$ 203,000			$ 203,000			65%	$ 71,050	$ 131,950
FSD-7	Pipe	Golden State Blvd	Monroe Ave to Geer Rd	A	24	36	Replace	200	$ 124,000			$ 124,000			25%	$ 93,000	$ 31,000
FSD-8	Pipe	Washington Rd, Canal Dr	Fulkerth Rd to Fransil Ln	B	-	30	New	6,490	$ 2,330,000					$ 2,330,000	100%	$ -	$ 2,330,000
FSD-9	Pipe	Unnamed Rd	Fulkerth Rd to Canal Dr	B	-	24	New	2,530	$ 726,000					$ 726,000	100%	$ -	$ 726,000
FSD-10	Pipe	Canal Dr	Dianne Dr to Fransil Ln	B	-	36	New	2,560	$ 1,103,000					$ 1,103,000	10%	$ 992,700	$ 110,300
FSD-11	Pipe	Tegner Rd	South of Fulkerth Rd to Canal Dr	B	-	24	New	1,540	$ 442,000					$ 442,000	100%	$ -	$ 442,000
FSD-12	Pipe	Tegner Rd	North of West Main St to Canal Dr	B	-	30	New	1,400	$ 502,000					$ 502,000	100%	$ -	$ 502,000
FSD-13	Pipe	Fransil Ln	Fulkerth Rd to Canal Dr	B	-	42	New	2,510	$ 1,261,000					$ 1,261,000	10%	$ 1,134,900	$ 126,100
FSD-14	Pipe	Fransil Ln	Canal Dr to West Main St, to FSD-PS-2 Wet Well	B	-	48	New	2,760	$ 1,586,000					$ 1,586,000	10%	$ 1,427,400	$ 158,600
FSD-15	Pipe	Dianne Dr	Overflow Pipe from Dianne Pump Station (No. 51) to FSD-11	B	-	36	New	70	$ 31,000					$ 31,000	0%	$ 31,000	$ -
FSD-16	Pipe	Unnamed Roads, Agricultural Land	Monte Vista Ave to Fulkerth Rd	B	-	42	New	6,620	$ 3,326,000					$ 3,326,000	0%	$ 3,326,000	$ -
FSD-17	Pipe	Fulkerth Rd	Tegner Rd to Fransil Ln, Overflow pipe from Fulkerth Rd storm drains	B	-	36	New	1,310	$ 564,000					$ 564,000	0%	$ 564,000	$ -
FSD-18	Pipe	West Main St, Clinton Rd, Fransil Ln	Near intersection of West Main St and Clinton Rd, and along Fransil Ln	B	-	24	New	2,980	$ 856,000					$ 856,000	100%	$ -	$ 856,000
FSD-19	Pipe	West Main St	Clinton Rd to Fransil Ln	B	-	30	New	2,640	$ 947,000					$ 947,000	100%	$ -	$ 947,000
FSD-20	Pipe	West Main St	Dianne Dr to Kilroy Rd	B	-	24	New	1,270	$ 364,000					$ 364,000	100%	$ -	$ 364,000
FSD-21	Pipe	Tegner Rd	West Main St to Liberty Square Pkwy	B	-	36	New	2,070	$ 892,000					$ 892,000	100%	$ -	$ 892,000
FSD-22	Pipe	Tegner Rd	Linwood Ave to south of Humphrey Ct	B	-	30	New	1,300	$ 466,000					$ 466,000	100%	$ -	$ 466,000
FSD-23	Pipe	Washington Rd, Ruble Rd	Clayton Rd to FSD-PS-2 Wet Well	B	-	24	New	3,920	$ 1,126,000					$ 1,126,000	100%	$ -	$ 1,126,000
FSD-24	Pipe	Linwood Ave, Unnamed Rd	Linwood Ave and along Unnamed Rd, to FSD-PS-2 Wet Well	B	-	24	New	5,290	$ 1,519,000					$ 1,519,000	100%	$ -	$ 1,519,000
FSD-25	Pipe	Ruble Rd	Tegner Rd to Unnamed Rd	B	-	36	New	2,670	$ 1,151,000					$ 1,151,000	10%	$ 1,035,900	$ 115,100
FSD-26	Pipe	Linwood Ave	Glenwood Ave to Kilroy Rd	A	-	30	New	3,990	$ 2,046,000					$ 2,046,000	100%	$ -	$ 2,046,000
FSD-27	Pipe	Kilroy Rd	Linwood Ave to Spengler Way	A	-	36	New	1,950	$ 1,199,000					$ 1,199,000	100%	$ -	$ 1,199,000
FSD-28	Pipe	Soderquist Rd	South Ave to Jordan Ave	A	-	15	New	2,500	$ 705,000					$ 705,000	100%	$ -	$ 705,000

Table 6.2 **Capital Improvement Plan**
Stormwater Master Plan
City of Turlock

Figure No.	Type of Improvement	Description/ Street	Description / Limits	Pipeline Cost Schedule (A or B)	Project Length/Size and Cost					Capital Improvement Phasing					Future Users Benefit (%)	Cost Allocation Category	
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Capital Improvement Cost[2],[3] ($)	Phase 1 2013-2015 ($)	Phase 2 2016-2020 ($)	Phase 3 2021-2025 ($)	Phase 4 2026-2030 ($)	Phase 5 After 2030 ($)		Existing Improvements ($)	Future Improvements ($)
FSD-29	Pipe/Casing[1]	Highway 99	West of Soderquist Rd to the east side of Highway 99, north of Venture Ln	A	-	24/42	New	200	$ 559,000					$ 559,000	100%	$ -	$ 559,000
FSD-30	Pipe	North of Venture Ln, Walnut Rd	Soderquist Rd to Walnut Rd, Linwood Ave to Venture Ln	A	-	24	New	2,820	$ 1,157,000					$ 1,157,000	100%	$ -	$ 1,157,000
FSD-31	Pipe	Unnamed Dr	South of Hawkeye Ave to north of Canal Dr	B	-	42	New	1,980	$ 995,000				$ 995,000		100%	$ -	$ 995,000
FSD-32	Pipe	Unnamed Dr	South of Canal Dr to East Ave	B	-	42	New	2,080	$ 1,045,000				$ 1,045,000		100%	$ -	$ 1,045,000
FSD-33	Pipe	West of Verduga Rd	Connection pipeline from Northern to Southern East Linear Basin	B	-	18	New	1,420	$ 306,000				$ 306,000		40%	$ 183,600	$ 122,400
FSD-34	Pipe	Johnson Rd	South of East Ave to Unnamed Rd	B	-	42	New	620	$ 312,000			$ 312,000			100%	$ -	$ 312,000
FSD-35	Pipe	Johnson Rd	Unnamed Rd to Brier Rd	B	-	60	New	1,340	$ 962,000			$ 962,000			100%	$ -	$ 962,000
FSD-36	Pipe	Johnson Rd	Brier Rd to Linwood Ave	B	-	60	New	2,620	$ 1,882,000			$ 1,882,000			100%	$ -	$ 1,882,000
FSD-37	Pipe	Unnamed Rd, Brier Rd	Daubenberger Rd to Johnson Rd	B	-	36	New	5,410	$ 2,330,000			$ 2,330,000			100%	$ -	$ 2,330,000
FSD-38	Pipe	South of Brier Rd	FSD-BN-5 (Future Basin) to Johnson Rd	B	-	36	New	3,580	$ 1,542,000			$ 1,542,000			100%	$ -	$ 1,542,000
FSD-39	Pipe	Linwood Ave	West of Verduga Rd to Johnson Rd	B	-	30	New	4,030	$ 1,446,000			$ 1,446,000			100%	$ -	$ 1,446,000
FSD-40	Pipe	Paulson Rd	Center St to Linwood Ave at Future Pump Station (FSD-PS-3) Wet Well	B	-	42	New	4,050	$ 2,036,000			$ 2,036,000			100%	$ -	$ 2,036,000
FSD-41	Pipe	Linwood Ave	Johnson Rd to 5th St	B	-	42	New	2,830	$ 1,422,000			$ 1,422,000			100%	$ -	$ 1,422,000
FSD-42A	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	60	New	220	$ 158,000		$ 158,000				100%	$ -	$ 158,000
FSD-42B	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	2,230	$ 960,000		$ 960,000				100%	$ -	$ 960,000
FSD-42C	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	670	$ 241,000		$ 241,000				100%	$ -	$ 241,000
FSD-42D	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	440	$ 127,000		$ 127,000				100%	$ -	$ 127,000
FSD-42E	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	720	$ 413,000		$ 413,000				100%	$ -	$ 413,000
FSD-42F	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	2,310	$ 995,000		$ 995,000				100%	$ -	$ 995,000
FSD-42G	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	150	$ 86,000		$ 86,000				100%	$ -	$ 86,000
FSD-42H	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	1,440	$ 517,000		$ 517,000				100%	$ -	$ 517,000
FSD-42I	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	560	$ 161,000		$ 161,000				100%	$ -	$ 161,000
FSD-42J	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	48	New	380	$ 218,000		$ 218,000				100%	$ -	$ 218,000
FSD-42K	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	490	$ 211,000		$ 211,000				100%	$ -	$ 211,000
FSD-42L	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	670	$ 241,000		$ 241,000				100%	$ -	$ 241,000
FSD-42M	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	770	$ 221,000		$ 221,000				100%	$ -	$ 221,000
FSD-42N	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	30	New	510	$ 184,000		$ 184,000				100%	$ -	$ 184,000
FSD-42O	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	280	$ 80,000		$ 80,000				100%	$ -	$ 80,000
FSD-42P	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	24	New	800	$ 229,000		$ 229,000				100%	$ -	$ 229,000
FSD-42Q	Pipe	Unnamed Rd, parallel to Hwy 99	Morgan Ranch	B	-	36	New	260	$ 112,000		$ 112,000				100%	$ -	$ 112,000
FSD-43	Pipe	Lander Ave	Southeast 1 Area (FSD-PS-4) to Lander Ave	B	-	30	New	4,270	$ 1,532,000		$ 1,532,000				100%	$ -	$ 1,532,000
FSD-44	Pipe	Linwood Ave	5th St to Lander Ave	A	-	48	New	3,770	$ 3,094,000		$ 3,094,000				100%	$ -	$ 3,094,000
FSD-45	Pipe	Linwood Ave	West Linwood Ave Basin to Harding Drain Outfall	B	-	30	New	23,760	$ 8,530,000			$ 8,530,000			45%	$ 4,691,500	$ 3,838,500
Pump Stations/Basins																	
FSD-PS-1	Pump Station	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Pump Station	-	-	60 cfs	New	-	$ 934,000					$ 934,000	10%	$ 840,600	$ 93,400
FSD-PS-2	Pump Station	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Pump Station	-	-	48.5 cfs	New	-	$ 777,000					$ 777,000	40%	$ 466,200	$ 310,800
FSD-PS-3	Pump Station	Linwood Ave	At Johnson Rd	-	-	136 cfs	New	-	$ 1,984,000			$ 1,984,000			100%	$ -	$ 1,984,000
FSD-FM-1	Force Main	Linwood Ave	Johnson Rd to Verduga Rd (Dual Force Mains)	B	-	36	New	10,320	$ 4,693,000			$ 4,693,000			100%	$ -	$ 4,693,000
FSD-PS-4	Pump Station	Unnamed Rd	Southeast 1 Area Future Pump station	-	-	47 cfs	New	-	$ 756,000		$ 756,000				100%	$ -	$ 756,000
FSD-BN-1	Basin	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Retention Basin	-	-	40 ac-ft	New	-	$ 1,116,000					$ 1,116,000	10%	$ 1,004,400	$ 111,600
	Land Acquisition	Fransil Ln & West Main St	At Fransil Ln and West Main St, Future Retention Basin	-	-	10 acres	New	-	$ 1,000,000					$ 1,000,000	10%	$ 900,000	$ 100,000
FSD-BN-2	Basin	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Detention Basin	-	-	40 ac-ft	New	-	$ 1,116,000					$ 1,116,000	40%	$ 669,600	$ 446,400
	Land Acquisition	Ruble Rd	At Ruble Rd and Unnamed Rd, Future Detention Basin	-	-	10 acres	New	-	$ 1,000,000					$ 1,000,000	40%	$ 600,000	$ 400,000
FSD-BN-3	Basin	Southern East Linear Basin	Southern East Linear Basin	-	-	81 ac-ft	New	-	$ 1,908,000			$ 1,908,000			100%	$ -	$ 1,908,000
	Land Acquisition	Southern East Linear Basin	Southern East Linear Basin	-	-	20.25 acres	New	-	$ 2,025,000			$ 2,025,000			100%	$ -	$ 2,025,000
FSD-BN-4	Basin	Highway 99 Basin	Southeast 1 Area, Highway 99 new basin	-	-	24.6 ac-ft	New	-	$ 780,000		$ 780,000				100%	$ -	$ 780,000
	Land Acquisition	Highway 99 Basin	Southeast 1 Area, Highway 99 new basin	-	-	6.2 acres	New	-	$ 620,000		$ 620,000				100%	$ -	$ 620,000
FSD-BN-5	Basin	Unnamed Rd	Southeast of Daubenberger Rd and Brier Rd	-	-	40 ac-ft	New	-	$ 1,116,000			$ 1,116,000			100%	$ -	$ 1,116,000
	Land Acquisition	Unnamed Rd	Southeast of Daubenberger Rd and Brier Rd	-	-	10 acres	New	-	$ 1,000,000			$ 1,000,000			100%	$ -	$ 1,000,000
								Buildout System Improvements Subtotal	**$ 81,500,000**	**$ -**	**$ 12,708,000**	**$ 34,154,000**	**$ 3,575,000**	**$ 31,063,000**		**$ 20,549,500**	**$ 60,950,500**
Capital Improvement Plan Total																	
								CIP Total (Existing and Future)	**$ 125,807,000**	**$ -**	**$ 24,250,000**	**$ 40,749,000**	**$ 29,745,000**	**$ 31,063,000**		**$ 60,278,200**	**$ 65,528,800**

Notes:
1. Proposed casings size and carrier pipe size.
2. Baseline Construction Cost plus 25% to account for unforeseen events and unknown conditions.
3. Estimated Construction Cost plus 30% to cover other costs including Engineering, Construction Management, and Project Administration.
4. Pump station capacities refer to the total capacity unless noted otherwise.
5. Costs are based on the Engineering News Record Construction Cost Index of 821 (1967 base year, San Francisco, March 2013).
6. Project costs are included in the Sewer System CIP. Projects are listed here for reference.

Table 6.3	Capital Cost Summary Stormwater Master Plan City of Turlock					
	Project Phasing					
User Type	Phase 1 2013-15 ($, mill.)	Phase 2 2016-20 ($, mill.)	Phase 3 2021-25 ($, mill.)	Phase 4 2026-30 ($, mill.)	Phase 5 Post 2030 ($, mill.)	Total ($, mill.)
Storm Drainage System[(2)]						
Exiting Users	0.0	11.6	11.7	23.7	13.3	60.3
Future Users	0.0	12.6	29.1	6.0	17.8	65.5
Total	**0.0**	**24.3**	**40.7**	**29.7**	**31.1**	**125.8**

Notes:

(1) Costs are based on the Engineering News Record Construction Cost Index of 821 (1967 base year, San Francisco, March 2013).

(2) Costs for storm drainage projects to remove storm drain cross connections from the sewer system are included in the sewer system CIP.

Table 6.4 summarizes the total estimated capital costs by facility type. Pipelines account for $94.7 million of the $125.8 million CIP (75 percent) of the total CIP. Pump Stations account for $16.6 million (13 percent). The remaining $14.5 million (12 percent) is associated with storm basins.

Table 6.4	Capital Cost Summary by Facility Type Stormwater Master Plan City of Turlock
Facility Type	**Capital Cost[(1),(2)] ($, mill.)**
Pipelines	94.7
Pump Stations	16.6
Basins	14.5
Total	**125.8**

Notes:

(1) Costs are based on the Engineering News Record Construction Cost Index of 821 (1967 base year, San Francisco, March 2013).

(2) Costs for storm drainage projects to remove storm drain cross connections from the sewer system are included in the sewer system CIP.

6.3.2 Cost Allocation Between Existing and Future Users Cost

The improvements either benefit existing users or are required for new development and future users. Some of the projects provide benefit to both existing and future users. An opinion of benefit to future users, based on preliminary project information, is included in

Table 6.2. A summary of the existing and future user cost share for the proposed projects by phase is summarized in last column of Table 6.5. As shown in Table 6.5, existing users account for roughly $60.3 million (48 percent) of the total CIP, and future users account for the remaining $65.5 million (52 percent).

Table 6.5 Capital Cost Summary by User Type
Stormwater Master Plan
City of Turlock

User Type	**Capital Cost[(1),(2)] ($, mill.)**
Existing Users	60.3
Future Users	65.5
Total	**125.8**

Notes:

(1) Costs are based on the Engineering News Record Construction Cost Index of 821 (1967 base year, San Francisco, March 2013).

(2) Costs for storm drainage projects to remove storm drain cross connections from the sewer system are included in the sewer system CIP.

APPENDIX A - DESCRIPTION OF DIFFERENT LAND USES (GENERAL PLAN EXCERPTS)

2 Land Use and Economic Development

The way in which a City allocates its land to meet the needs of residents and businesses is central to the General Plan. In order to accommodate a growing, changing population and increasingly diversifying employment, Turlock must meet the needs of these groups and uses while still maintaining the aspects of the built environment that current citizens value: a compact city with a small-town feel.

Chapter 2, the Land Use and Economic Development Element, begins by describing the City's existing land use pattern, and then describes land use classifications and the City's development potential. Policies and a land use plan, referred to as the General Plan Land Use Diagram, designate the proposed general location and extent of each use category. The Element also includes policies to manage growth and inter-jurisdictional relationships. The following chapter, Chapter 3: New Growth Areas and Infrastructure, focuses on detailed standards for land use, design, infrastructure, and development phasing in the areas for new urban development. Issues related to city form, design, and character are addressed in Chapter 6: City Design.

The General Plan Land Use Diagram and the land use policies will have a major impact on Turlock's form and character over the life of the General Plan. Critical issues faced by Turlock that are addressed in this Element include: direction of urban expansion and phasing of growth, location of retail and neighborhood centers, revitalization of downtown, and location of proposed parks and recreational facilities. The General Plan Land Use Diagram is a graphic representation of the planning values and ideals of the community as expressed throughout the Plan. General Plan text should be read in conjunction with the Land Use Diagram.

Land use decisions affect residents and business interests alike.

2.1 CURRENT LAND USE PATTERN

Overview

Turlock's current land use pattern and built form are products of the City's historical growth within an agricultural area. Turlock was incorporated in 1908. Like many San Joaquin Valley towns from the time period, the original downtown core was focused around the railroad station, with streets arranged in a grid oriented to the tracks. The town proceeded to grow outward, shifting to an orthogonal north-south grid matching the rural road and parcel pattern around it. Golden State Boulevard, paralleling the railroad, was part of the original highway through the Central Valley, which became U.S. 99 roadway in 1926.

The city's growth since the 1940s has mainly occurred north of the downtown area and east of the railroad. When the California State University, Stanislaus campus opened in 1965, it was still well to the north of town. By the end of the 1980s housing boom, Turlock had reached Zeering Road on the north and Daubenberger Road on the east. Completion in 1973 of the Route 99 freeway bypass, a long arc to the west, also drew development west of the railroad.

Beginning in the 1990s, Turlock's growth occurred through a master planning process, one area at a time. Almost all the recent residential development has occurred north of Monte Vista Avenue on the east side of the railroad. The "Northwest Triangle," north of Fulkerth Road between the railroad and Highway 99, has also grown to be a major new commercial area.

It is the City's goal to continue to provide a balance of jobs and housing in Turlock, which stimulates the local economy, reduces commuting, and maintains Turlock's competitiveness in the region. Therefore, the master planning process has extended to the non-residential sector, as well. In 2006, Turlock completed the Westside Industrial Specific Plan (WISP), which identified land use, transportation improvements, infrastructure improvements, and design guidelines for industrial and business park uses for some 2,500 acres west of Route 99. Aided by this specific plan, the city's industrial sector is expanding and shifting to this area.

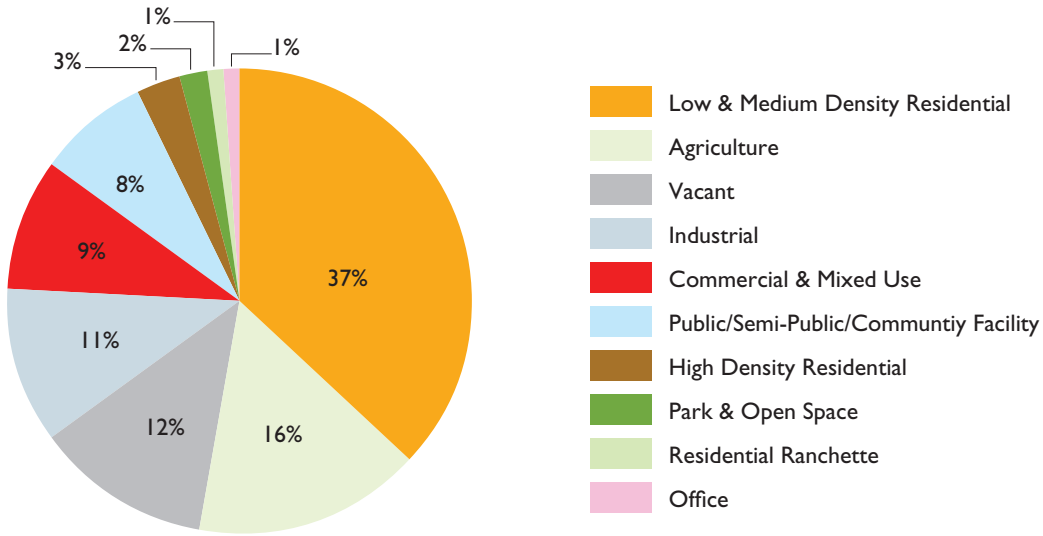
LAND USE DISTRIBUTION AND MAGNITUDE

There are approximately 8,730 acres in the current city limits (not including the County islands), and an additional 8,560 acres of land are contained within the Study Area outside of city limits. Figure 2-1 and Table 2-1 show the breakdown of existing land uses in the city limits, and each

TABLE 2–1: EXISTING LAND USE IN THE CITY LIMITS		
LAND USE	**ACRES**	**PERCENT OF CITY LIMITS**
Residential	3,589	41%
Very Low Density "Ranchettes" (< 3 du/ac)	125	1%
Low and Medium Density (3-15 du/ac)	3,235	37%
High Density (15-30 du/ac)	229	3%
Agriculture	1,413	16%
Vacant	1,023	12%
Industrial	934	11%
Commercial and Mixed Use	760	9%
Public/Semi-Public/Community Facility	683	8%
Park and Open Space	209	2%
Office	118	1%
Total	**8,730**	**100%**

Sources: City of Turlock; Dyett & Bhatia, 2009

Figure 2-1: Existing Land Use in Turlock City Limits



The majority of the developed land in Turlock is traditional single family detached homes, built at less than seven units per acre.

land use is discussed in more detail in the paragraphs that follow. It is important to note that the existing land uses shown in these figures and described below, which illustrate how land is currently actually developed and/or being used, are not the same as the General Plan land use *classifications,* which express desired land uses, as described in the following section.

Residential

Altogether, residential land uses occupy 41 percent of the land in the city limits. The majority of existing residential development is located on the east side of the railroad, north of Downtown. There are also several residential neighborhoods on Turlock's west side, between the railroad and Highway 99. Of the 3,589 acres of residential development, 90 percent is low- and medium-density (3 to 15 units per acre), 6 percent is high density or multifamily (15 to 30 units per acre), and three percent is residential "ranchettes," which are very low density homes on large lots (less than 3 units per acre). The majority of Turlock's residential development is low density single family homes, ranging from three to seven dwelling units per acre. Older neighborhoods close to Downtown also consist of predominantly single family homes, but have slightly higher densities than the more recently developed areas. While multifamily housing types occupy just three percent of the land area in Turlock, these high density projects contain many more units than single family development on comparable acreage. Some of the more recently developed neighborhoods in the northwest quadrant of the city include a greater diversity of housing types, including townhouses and three-story apartment complexes.

Residential "estate" lots, with densities from 0.2 to 3.0 units per acre, make up much of the eastern border of the city near Denair. They function as part of the rural buffer between the two communities. Residential development outside of the city limits, in the southeastern quadrant of the Study Area, is primarily very low density "ranchette" style homes, generally on five- to ten-acre parcels.

Commercial, Office, and Mixed Use

Commercial development in Turlock is comprised of several specific nodes in different locations, and makes up approximately nine percent of the land within city limits. Mixed use development, which generally involves a mix of commercial and residential or office uses, is also included in this category. The largest concentration of retail development is Monte Vista Crossings, located just east and south of the Monte Vista interchange of SR 99. Developed over the last ten years, Monte

Vista Crossings includes numerous large anchor tenants such as Target, Safeway, Home Depot, and Kohl's; two hotels; and numerous smaller national-brand specialty stores and restaurants.

Community-oriented shopping areas, comprising both national chains and locally-owned businesses, characterize the Downtown core and the Geer Road corridor. Much of the development Downtown can be characterized as mixed use, though it is primarily commercial with some office and residential uses mingled throughout. Emanuel Medical Center is a large office land use northeast of downtown, with the hospital anchoring a collection of smaller medical offices surrounding it. Older automobile-oriented commercial development lines Golden State Boulevard and is also concentrated just south of Downtown.

Industrial

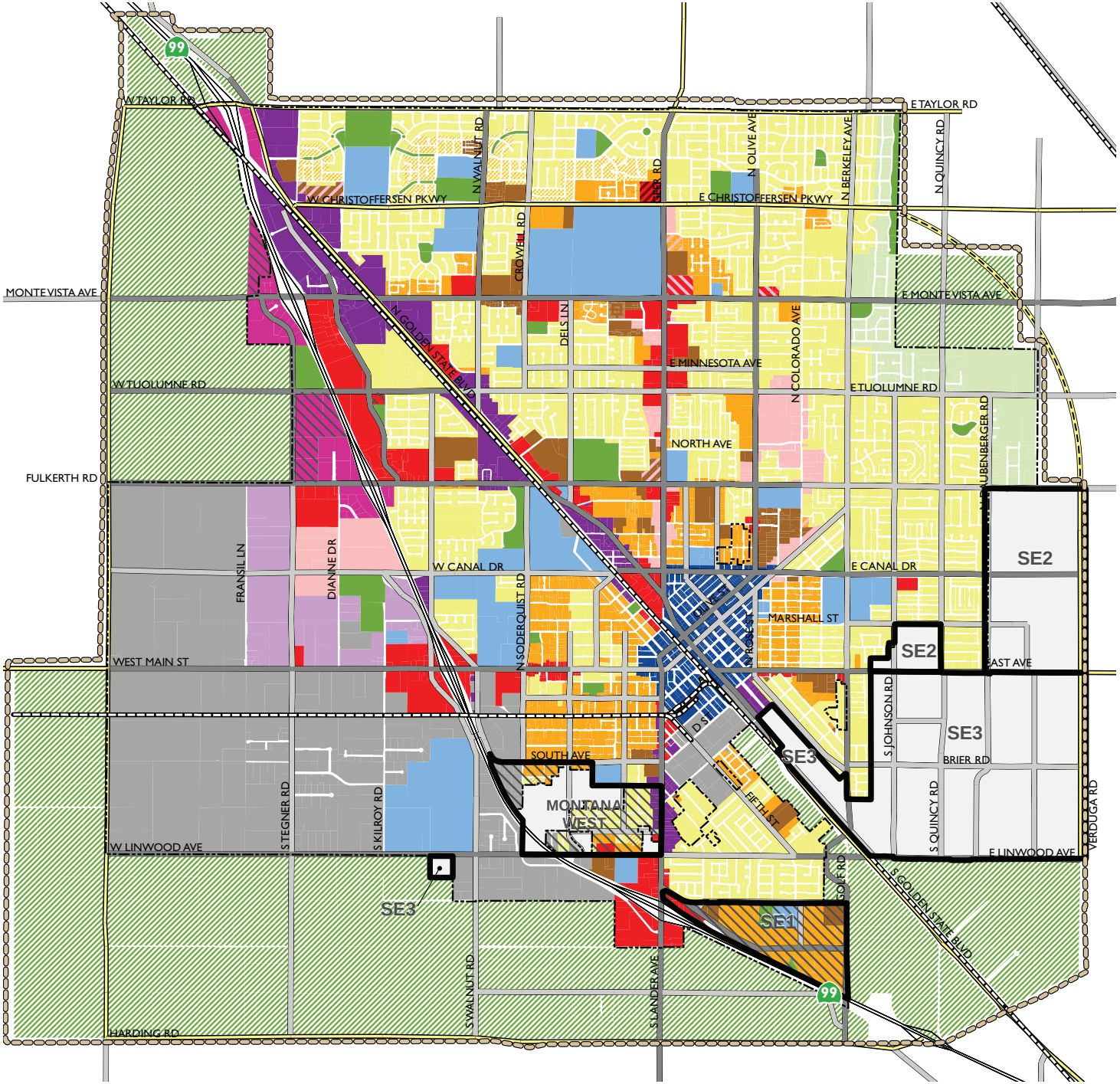
Eleven percent of the Study Area (934 acres) is currently developed with industrial uses. The industrial development east of Highway 99 is located immediately south of the downtown core, on both sides of the railroad tracks. Additional industry is located just west of the SR 99/Lander Avenue interchange. In 2006, approximately 2,000 acres were designated for industrial and industrial business park uses in the Turlock Regional Industrial Park (TRIP). Approximately 450 acres has been developed as such. Most of Turlock's industrial users are in the food processing industry, including Foster Farms, Sensient Flavors, and Kozy Shack.

Public, Semi-Public, and Community Facility

Public, semi-public, and community facility uses account for approximately eight percent of development within city limits. These uses include city buildings, schools and other government-owned facilities. Several large public and institutional users have sizable land holdings in Turlock. The California State University, Stanislaus (CSUS) occupies 210 acres along Monte Vista Avenue and Geer Road. The Stanislaus County Fairgrounds are on 67 acres, just northwest of the downtown core on the west side of the railroad. The City wastewater treatment facility is on 166 acres in the TRIP. The remainder of acreage in public, semi-public or community facility use consists primarily of public school grounds and stormwater detention areas.

Prior to the adoption of the Westside Industrial Specific Plan, the majority of industrial development in Turlock was centrally located, south of Downtown.

Figure 2-2: Land Use Diagram



- Very Low Density Residential
- Low Density Residential
- Low-Medium Density Residential
- Medium Density Residential
- Medium Density Residential/ Office
- High Density Residential
- High Density Residential/ Office
- Downtown
- Highway Commercial
- Community Commercial
- Community Commercial/ Office
- Community Commercial/High Density Residential
- Heavy Commercial
- Office
- Business Park
- Industrial
- Park
- Public
- Urban Reserve
- New or updated master plan required before redesignated land uses take effect

Circulation 2030

- Freeway
- Expressway
- Potential Expressway Connection
- Arterial
- Collector
- Railroads

Boundaries

- Study Area Boundary
- City Limits & County Islands
- Master Plan Areas

0 0.25 0.5 1
Miles

Source: General Plan data, City of Turlock, 2002; Infill Area data and Opportunity sites data, Dyett and Bhatia, 2012; Map base data, City of Turlock, 2008.

Vacant Sites

Vacant land is scattered throughout the city. Parcels range from small urban infill sites measuring less than one acre to large, formerly agricultural parcels measuring up to 25 acres. Some vacant parcels are clustered, creating larger development opportunity sites of 100 acres or more. Altogether, vacant sites make up around 12 percent of the land area within the city limits, approximately 1,020 acres. Areas where vacant land is more concentrated include along SR 99, in the TRIP, along major corridors such as Geer and Golden State Boulevard, and near CSU-Stanislaus. The County islands in the southern part of town also contain vacant sites, though most are a quarter acre or less in size.

Larger Study Area and Agricultural Uses

Agriculture is the predominant existing land use in the unincorporated area outside of city limits but inside the Study Area boundary. Additionally, many vacant parcels within city limits are currently in agricultural use, especially those in the TRIP and in the undeveloped portions of the far eastern edge of the city. In the TRIP, there are over 1,000 acres of farmland, while the area is zoned for industrial uses.

Agriculture characterizes most large undeveloped parcels in the Study Area.

2.2 LAND USE CLASSIFICATIONS

The following descriptions apply to land uses indicated on the Land Use Diagram (Figure 2-2) and the Master Plan Area Diagram (Figure 2-3). The legend on the diagram is an abbreviated version of the descriptions. The classifications are adopted as General Plan policy and are intentionally broad enough to avoid duplicating existing City or County zoning regulations. More than one zoning district may be consistent with a single General Plan land use category, and revisions to the zoning regulations will be necessary to implement the General Plan.

According to State law, the General Plan must establish standards of population density and building intensity for each land use classification. The General Plan stipulates residential densities in housing units per gross acre; population density can be obtained by applying average persons per housing unit count[1] to the housing unit densities. For nonresidential uses, the Plan specifies a maximum permitted ratio of gross floor area to site area (Floor Area Ratio or FAR).

1 Based on 2000 U.S. Census data, the number of persons per total housing units is 2.9.

Table 2-2 shows gross density standards for residential categories and FAR standards for the other uses. Assumed averages for residential categories are listed in the descriptions that follow.

RESIDENTIAL

Residentially-designated areas permit housing, as well as childcare facilities, places of religious assembly, retail grocery stores not exceeding 2,500 square feet in size, and Residential Care Facilities consistent with applicable Federal and State Laws. A brief description of each of the Residential General Plan designations follows.

Residential densities are per gross acre of developable land, provided that at least one housing unit may be built on each existing legal parcel designated for residential use. State-Mandated second dwelling units and density bonuses for the provision of affordable housing are in addition to densities otherwise permitted.

Assumed average densities and persons per unit (based on Census information and recent demographic trends) are used to calculate probable housing unit and population holding capacity for each residential classification; however, neither the averages nor the totals constitute General Plan policy. The housing types referred to in the discussion below are illustrated in the City Design Element.

Very Low Density (VLDR)

The Very Low Density Residential uses allows 0.2 - 3.0 units per gross acre. It assumes three persons per unit, resulting in population density of one to nine persons per gross acre. Typical lots will be one-third of an acre in size. This designation is proposed primarily for the northeast edge of Turlock and is to act as a residential, large lot buffer between the higher density urban uses in Turlock and the lower density rural uses in Denair; the intent is to maintain parcel sizes that can serve to keep both Turlock and Denair as separate, independent communities. The average density assumed for General Plan calculations is 1.6 units per gross acre.

Low Density (LDR)

The Low Density Residential designation allows 3.0 to 7.0 units per gross acre and assumes 3.2 persons per household resulting in a range of population density of 13 to 22 persons per gross acre. Housing in this density range is typical of recent subdivisions built throughout Turlock, though

TABLE 2–2: LAND USE CLASSIFICATIONS AND DENSITY – MINIMUMS AND MAXIMUMS			
LAND USE		MINIMUM AND MAXIMUM RESIDENTIAL DENSITY (GROSS DWELLING UNITS PER ACRE)	TYPICAL NON-RESIDENTIAL DENSITY (FAR)[1]
VLDR	Very Low Density Residential	0.2 – 3.0	
LDR	Low Density Residential	3.0 – 7.0	
LDR_MDR	Low and Medium Density Residential	5.0 – 10.0	
MDR	Medium Density Residential	7.0 – 15.0	
HDR	High Density Residential	15.0 – 40.0	
DT	Downtown Mixed Use[2]	7.0 – 40.0	Plus 4.0
O	Office		0.35
CC	Community Commercial		0.25
HC	Heavy Commercial		0.35
HWC	Highway Commercial		0.35
RC	Regional Commercial		0.35[3]
I	Industrial		0.60
BP	Business Park		0.35
PUB	Public/Semi-Public (includes detention basins)		NA
P	Park		NA
UR	Urban Reserve		NA

1. FAR = Floor Area Ratio, defined as the ratio between gross floor area of structures on a site and gross site area. Thus, a building with a floor area of 100,000 square feet on a 50,000 square-foot lot will have a FAR of 2.0.
2. Downtown Mixed Use allows a combination of residential development of 7.0-40.0 units per acre as well as non-residential development of FAR 4.0 maximum.
3. FAR for a hotel in the Regional Commercial designation may be up to 3.0.

Low-Medium Density Residential development in North Turlock.

few subdivisions have achieved densities at the high end of the range. The intent of the classification is to provide locations for construction of single-family homes with a range of lot sizes. The typical density assumed for General Plan calculations is 5.0 units per gross acre.

Low-Medium Density (LDR-MDR)

Low-Medium Density Residential areas have between 5.0 and 10.0 units per gross acre. At three persons per unit, this translates to a population density of 15 to 30 persons per gross acre. The intent of the LDR-MDR designation is to accommodate a range of more compact housing types in a traditional neighborhood environment, including small-lot single family homes as well as single family attached townhouse units. The establishment of an RL4.5 zoning district as part of the new zoning ordinance adopted in January of 1997, allows for 4,500 square foot lots (gross density = 9 units per acre), which are typically located in the LDR-MDR area. Because housing at this density accommodates a range of traditional single family homes, small-lot single family homes, and townhouses, it will reach Turlock's largest residential market and is expected to account for about half of all housing added in the Study Area during the next twenty years. The typical density assumed for General Plan calculations is 7.5 units per gross acre.

Medium Density (MDR)

The Medium Density Residential area allows 7.0 to 15.0 units per gross acre and assumes 2.7 persons per household, with an equivalent population density of 19 to 41 persons per gross acre. Virtually all new attached residences are expected to be built in this density range, which recognizes that attached townhome and multifamily units will make up an increasing percentage of the City's housing stock in years to come. Attached family units offer a way to reduce the cost of owner-occupied housing. Housing of this type is consistent with the General Plan policies seeking to limit the expansion of the City in order to preserve agricultural lands and maintain a compact urban form, while responding to many households' preference for family units. Mobile home parks and apartments within this density range will meet the needs of many households without the financial means or the desire to be homeowners.

At the lower end of the range, this designation allows zero-lot-line homes, semi-detached houses and duplexes, typically built at 7 to 11 units per acre. The upper end of the density range accommodates townhouses (ranging from 12 to 15 units per acre) and low-rise garden or "walk-up" apartments (around 15 units per acre). Most existing mobile-home parks at full occupancy are

also within the Medium Density range. The typical density assumed for General Plan calculations is 11.0 units per gross acre.

In some cases, particularly in older residential neighborhoods immediately surrounding the Downtown core, the MDR designation is applied to lots that are smaller than one acre in size. Traditionally, these lots have been developed with single family homes, but recent "tear-downs" and redevelopment have created small multifamily projects amidst single family neighborhoods. While a mix of housing types within a neighborhood is desirable, the General Plan puts additional standards describing "graduated density" in place for development of medium density multifamily housing on traditional single family lots so as to ensure continued neighborhood quality and character (see Section 2.5).

High Density (HDR)

The High Density Residential designation allows 15.0 to 40.0 units per gross acre and assumes 2.4 persons per household (plus State-mandated bonus for affordability where applicable). The resulting range of population density will be approximately 36 to 84 persons per gross acre. Similar to MDR, the HDR classification supports the policy direction of achieving more compact development as Turlock grows over the next 20 years. High density housing supports compact development, provides housing choices to match changing demographics, and facilitates needed affordable housing. The State-mandated density bonus could result in net densities as high as 48 units per acre at the top end of the range. The resulting housing type will to a great extent be determined by unit size, parking, and open space requirements but will include triplexes and quadruplexes, stacked townhouses, walk-up garden apartments, and apartment buildings with elevators. The typical density assumed for General Plan calculation is 22.5 units per gross acre.

The Sierra Oaks apartments, High Density Residential development in northwest Turlock, are built at approximately 22 units per acre.

Professional and medical office uses are found along Geer Road, Downtown, and close to the Emanuel Medical Center (top). Community commercial uses serve residents' daily shopping needs and are primarily located along major corridors (bottom).

COMMERCIAL AND MIXED USE

The General Plan includes a number of commercial land use classifications, each with a separate purpose. This category also includes mixed use designations, which generally consist of a combination of commercial and residential and/or office uses.

Downtown Mixed Use (DT)

This classification is applied to Turlock's traditional Downtown and indicates the area in which the Downtown Overlay zoning districts apply. The classification provides for a full range of retail and personal services uses, including apparel stores, restaurants, specialty shops, entertainment uses, bookstores, travel agencies, hotels/motels and other similar uses serving a community-wide market and a larger daytime employment population. It is also intended to accommodate banks, financial institutions, medical and professional offices, and other general offices and community institutional uses. Additional use limitations and special development standards, including separate parking requirements, are applicable to the downtown core area as identified in the Downtown Turlock Plan (centered on Main Street) and Overlay Zoning regulations. Nonresidential development in this classification shall generally not exceed a FAR of 4.0. The DT classification also applies to the older residential neighborhoods in the downtown area and provides for both single and multiple-family uses at densities ranging from 7.0 to 40.0 units per gross acre. Residential development either as a mixed use or as an independent use in the downtown area is encouraged.

Office (O)

The Office category includes business and professional offices, with a maximum FAR of 0.35. The areas near the Police Services/TID headquarters, Emanuel Medical Center, and on Geer Road between West Canal Drive and Hawkeye Road are suitable for offices but not for retail businesses (except for employee-serving uses such as restaurants and child care).

Community Commercial (CC)

This designation provides for a full range of retail and personal service uses, including retail stores, food and drug stores, apparel stores, specialty shops, home furnishings, durable goods, offices, restaurants and other similar uses that serve a neighborhood or community wide market. Scale, rather than use, distinguishes areas serving a neighborhood versus community wide

market. Large scale commercial uses (large discount centers, big box retailers, etc.) serving a region wide market are specifically excluded from this designation. Development in this designation shall not exceed 0.25 FAR. While facilitating automobile access and parking, Community Commercial areas shall also be designed such that they are pedestrian- and bicycle-oriented, in order to enable nearby residents to accomplish their daily shopping needs without a vehicle.

Regional Commercial (RC)

This designation provides for region-serving commercial uses, including large-scale shopping centers, discount "club" type stores, factory outlets, and other commercial uses such as retail stores, food and drug stores, apparel stores, specialty shops, motor vehicle sales, home furnishings, commercial entertainment facilities, hotels/motels and other similar uses that serve a region wide market. Development in this designation shall not exceed 0.35 FAR, except for hotels/motels, which may have FARs up to 2.0. In the future, as development shifts from the north Turlock area to the south, the area east of State Route 99 south of Glenwood Avenue could also been an attractive site for region serving retailers, in close proximity to the proposed new freeway interchange. Regional Commercial and/or large-scale region serving uses are not permitted on Geer Road and other areas classified for Community and Neighborhood Commercial development.

Market analysis has demonstrated that as of the time of this General Plan Update, regional commercial uses (specifically discount superstores) are currently not economically prudent land uses in Turlock. While the Land Use Diagram does not designate any areas in Turlock as Regional Commercial, City Council has determined that further study should be undertaken on this topic once the city reaches approximately 27,000 housing units, at which time the land use can be reconsidered. Policy 2.6-e provides detail on implementation.

Highway Commercial (HWC)

This designation provides for uses designed to serve motorists traveling along State Route 99 at or near interchanges that are convenient and safe for such uses, and to a lesser extent along Golden State Boulevard. This designation is also intended to provide locations for uses that depend on high visibility from the freeway. Allowable uses in this designation include service stations, hotels/motels, restaurants, auto sales and other similar types of automobile-dependent uses. This designation corresponds to the Commercial Thoroughfare zoning district. The maximum allowable FAR is 0.35.

Multiple use designations allow, but do not require, horizontal and/or vertical mixed use developments.

Heavy Commercial (HC)

This designation provides for heavy, wholesale and service commercial uses that do not need highly visible locations, or in locations where noise levels or other conditions may limit the suitability for other more retail-oriented uses. These uses can often serve as a buffer, transitioning between industrial activities or major transportation corridors and residential areas. Typical uses in this classification include repair facilities, distributing uses, sales of building materials, motor vehicle sales and service, contractor's yards and storage-oriented uses. The uses in this classification are often similar in character to industrial uses. Historically, many of these types of uses have been located along Golden State Boulevard. Development in this designation shall not exceed a FAR of 0.35.

Multiple Use Designations

The General Plan Land Use Diagram also shows several "multiple use" designations, which combine several land use designations. Examples include "CC_O" and "O_HDR." In these cases, the property may be developed either as a mixed use project (horizontal or vertical) or developed as any one of the single uses in the designation. In other words, a site designated O_HDR may be developed as high density residential, office, or both. The project is permitted to develop at the highest density or FAR allowed by the multiple designations.

INDUSTRIAL

Industrial (I)

This designation provides for large and small scale industrial, manufacturing, distributing and heavy commercial uses such as food processing, fabricating, motor vehicle service and repair, truck yards and terminals, warehousing and storage uses, wholesale uses, construction supplies, building material facilities, offices, contractors' yards and the like. The majority of Industrial uses are found in the Turlock Regional Industrial Park (TRIP), encompassing approximately 2,500 acres west of S.R. 99 between Fulkerth Road and Linwood Avenue. Incidental retail and services may also be permitted provided they are primarily oriented to employees and businesses within the area. Development in the designation shall not exceed a FAR of 0.6.

Business Park (BP)

This designation provides for office centers, research and development facilities, medical and professional offices, institutional uses, limited light industrial uses, warehousing and distributing, "back-office" uses, and other similar uses locating in a low intensity, landscaped setting with high design and development standards. Similar to the Industrial designation, Business Park uses are found primarily in the TRIP. Incidental retail and services may also be permitted provided they are primarily oriented to provide services to employees and businesses within the area. Development in this designation shall not exceed a FAR of 0.35.

PUBLIC / INSTITUTIONAL (PUB)

This classification is applied to the city's major public and private institutional uses, including public safety facilities, public schools, California State University Stanislaus (CSUS), the State fairgrounds, and other prominent public uses and facilities. The Land Use Diagram shows the specific locations of existing major Public/Institutional facilities. Stormwater detention basins are also designated as public uses on the Land Use Diagram. Except for sites that have been acquired, the Land Use Diagram shows only the general location of future public or institutional uses in the area they will be needed. Selection of specific sites is the responsibility of the applicable governmental agencies and/or private institutions serving the Turlock area.

The designation on the Land Use Diagram of any future public or institutional site that has not been acquired shall not be construed to limit the existing or future use of the designated land. The predominant land use designation surrounding any property designated for public facilities shall be used to determine the potential use of the property prior to its acquisition by the applicable governmental agency or private institution.

PARKS (P)

This designation is applied to existing and planned public parks and open space, including specialized public recreational facilities such as Pedretti Park and the Regional Sports Park. Except for sites that have been acquired, the Land Use Diagram shows only the general location of future parks in the areas they will be needed.

The designation on the Land Use Diagram of any future park site that has not been acquired shall not be construed to limit the existing or future use of the designated land. The predominant

The Westside Industrial Specific Plan designates a large area as Business Park, accommodating office, research & development, light industrial, and similar uses (top). Public and institutional uses in Turlock include schools, public safety facilities, CSUS, and the County Fairgrounds (bottom).

land use designation surrounding any property designated for a future park site shall be used to determine the potential use of the property prior to its acquisition by the City of Turlock.

Parks shown on the Land Use Diagram are those that the City has determined are required to support the needs of Turlock's future population, and will be funded. However, this does not preclude additional parkland from being developed. Parks are also allowed in residential districts upon approval of a Minor Discretionary Permit (MDP). Also, given their small size, some the mini-park sites may not be large enough to be displayed on the Land Use Diagram, but this shall not prevent a site from being considered to have been appropriately classified. Chapter 4: Parks, Schools, and Community Facilities contains information and policies pertaining to park locations, types, and standards both within existing city limits and in new growth areas.

URBAN RESERVE (UR)

This classification is established for the purpose of identifying land that is reserved for future unspecified urban uses. Additional environmental analysis, a General Plan amendment, master planning, and annexation, if located outside the city, will be required before urban uses and/or development is permitted on land classified Urban Reserve. However, given the master plan programming and phasing described in Chapter 3, it is unlikely that areas designated Urban Reserve on the Land Use Diagram will be required for urban uses during the buildout period of this General Plan. Agricultural uses are permitted on property classified Urban Reserve, although they may eventually be replaced by permanent urban development. Public facilities and recreation facilities may also be located on land classified Urban Reserve.

In some cases, areas designated as Urban Reserve may already have some developed uses (for example, in the area north of Taylor Road to Barnhart Road, near State Route 99). Should these properties desire incorporation, the City shall work with the property owners on annexation agreements (see Policy 2.10-b).

MASTER PLAN AREAS

The Land Use Diagram also shows areas that are designated as new Master Plan Areas. These correspond to areas that shall be planned, pre-zoned, and annexed to the city one at a time, according to the phasing diagram (see Section 3.1). Rather than depicting specific plan uses on parcels, the Master Plan Area designation requires that each area achieve a specific mix of land

uses, intensities, and other requirements (described in detail in Section 3.2) that are to be determined through the preparation of a master plan for each one. Figure 2-3 shows the residential density ranges planned for each new Master Plan Area.

2.3 DEVELOPMENT POTENTIAL

Development potential is calculated based on assumptions about new residential and commercial development that could be built under the General Plan land use designations and their respective densities and intensities over the timeframe of the General Plan. It also takes into account properties that have approved or pending development project applications associated with them at the time of the General Plan's writing, which, along with vacant and underutilized properties, accommodate a portion of the city's expected future growth. A detailed list of the proposed, pending, and approved development projects at the time of the General Plan's writing is found in the *Existing Conditions and Key Issues* report (March 2009).

POPULATION AND EMPLOYMENT PROJECTIONS

Over the next 20 years, Turlock is expected to attract a substantial number of new residents and new jobs. Historical and recent growth trends give some indication of the amount and type of growth that Turlock can expect to see. The General Plan plays an important role in projecting these growth numbers, estimating how much land for housing and employment the new growth will require, analyzing Turlock's existing capacity for new development, and determining where the remaining demand for urban land uses should go.

This section describes Turlock's projected population and employment in 2030, the time horizon of the General Plan. The location, phasing, and land uses of this growth are described in Chapter 3: New Growth Areas and Infrastructure.

Residential Population

Population Projections

Turlock has grown rapidly since the 1970s. Its 2000 population of 55,810 was a 32 percent increase over the 1990 count. The 2007 American Community Survey shows 26 percent growth between 2000 and 2007, bringing the estimated population to 70,412. Turlock added some 3,644 housing

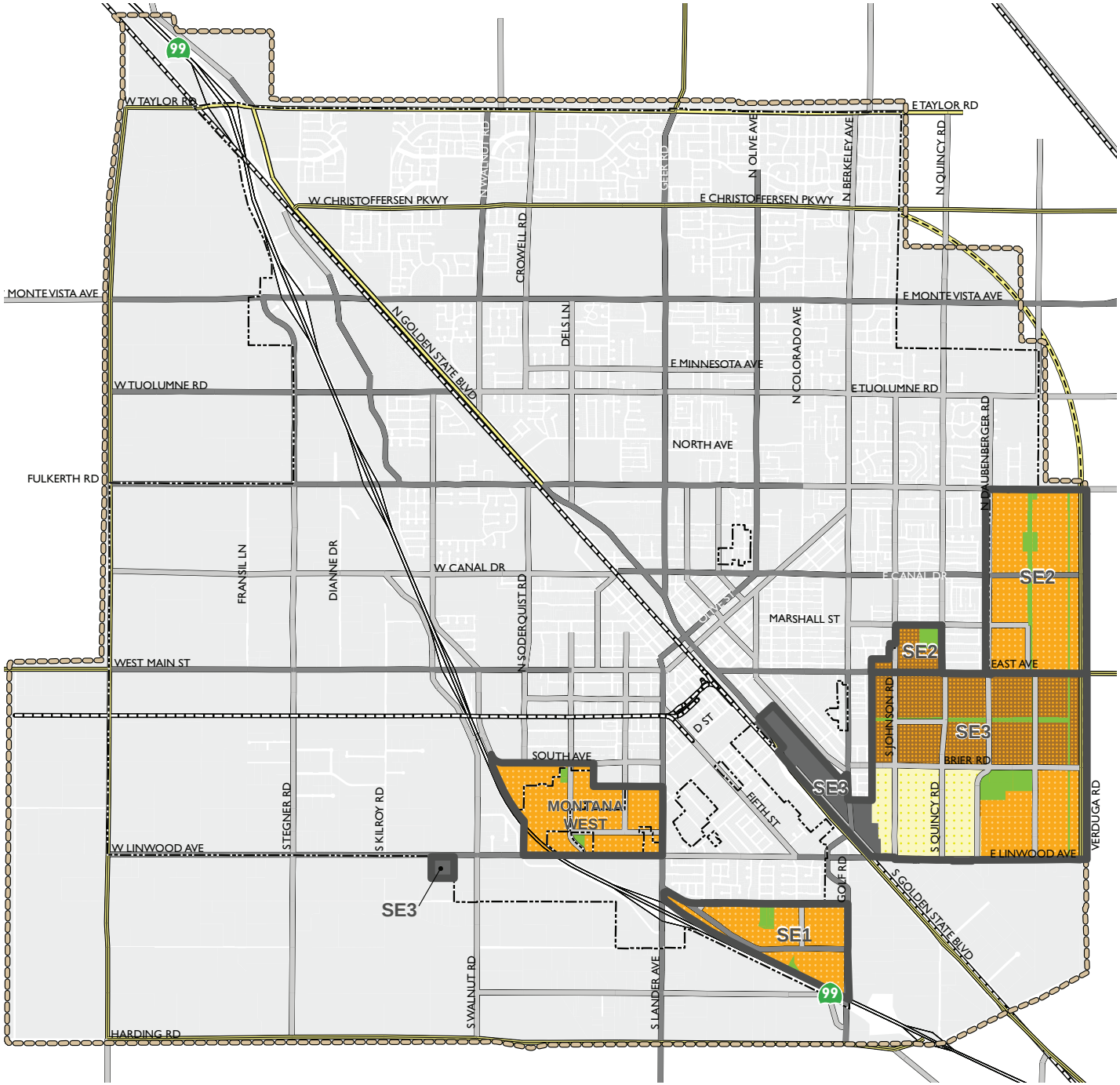


Figure 2-3: Proposed Master Plan Areas

- Very Compact Mixed Use
  (Minimum Average Density: 11 du/acre; Maximum Average Density 20% Higher)
- Compact Mixed Use Neighborhood
  (Minimum Average Density: 8 du/acre; Maximum Average Density 20% Higher)
- Low Density Neighborhood
  (Minimum Average Density: 5 du/acre; Maximum Average Density 20% Higher)
- Non-Residential Only
- Park

Circulation (2030)

- Freeway
- Expressway
- Potential Expressway Connection
- Arterial
- Collector
- Railroads

Boundaries

- Proposed Master Plan Areas
- Study Area Boundary
- City Limits & County Islands

0 0.25 0.5 1
Miles

Source: General Plan data, City of Turlock, 2002; Infill Area data and Opportunity sites data, Dyett and Bhatia, 2012; Map base data, City of Turlock, 2008.

units in the 1990s and issued permits for another 4,745 units between 2000 and 2008. Since 2000, housing development has kept pace with estimated population growth.

Population projections for the City of Turlock in 2030 are derived from countywide forecasts from a variety of public and private sources. These sources cite a variety of factors driving growth in the Central Valley in general and Stanislaus County in particular. According to the Public Policy Institute of California (PPIC), over half of the growth in the Central Valley has been due to migration. Job growth, affordable housing, and strong family relationships are the primary reasons for migrating to the Central Valley. Although most of the migration comes from coastal California where housing is less affordable, an additional component is also generated from outside the U.S. (e.g. Latin America, Asia). Additionally, the Central Valley's newest residents are more likely than its out-migrants to be married and have children.

This trend is supported by analysis from the Center for the Continuing Study of the California Economy (CCSCE). According to the CCSCE, net migration (the difference between immigration into and emigration from the area) now accounts for the majority of the population growth in the San Joaquin Valley. Additionally, net migration has been the largest component of growth in Stanislaus County since 2000.

At the outset of the General Plan Update process, Turlock was estimated to gain between 36,000 to 55,000 new residents by 2030. The low end forecast projects 106,500 people by 2030, or a 51 percent increase over current levels; this forecast assumes the City's percentage share of County population of 13.2 percent remains constant. In contrast, the high end forecast projects 127,000 people by 2030, or a 76 percent increase over current levels; this forecast assumes that the change in the City's population growth rate relative to historic trends will mirror the projected change in the County's population growth rate.

Buildout Population

At buildout, assuming construction at midpoint densities and intensities, the Study Area could support approximately 104,500 residents. This represents an average 1.9 percent annual growth rate from 2008 through 2030. In light of an extended period of slower growth in California between 2008 and 2012, this General Plan uses the low end population forecast as its guidance for buildout. This is also more consistent with recently developed forecasts that revise downward the amount of projected growth in the San Joaquin Valley by 2030.

With an average household size of 2.92 persons per household, 36,000 new residents equates to approximately 12,300 new households and 12,800 new housing units (assuming a vacancy rate of approximately 3.6 percent). Different housing types often attract different household sizes. Traditional single family homes are assumed to have 3.1 to 3.3 persons per household, whereas multifamily housing types may average 2.4 to 2.8 persons per household. Overall, Turlock's average household size across all housing types is around three persons per household.

However, it is important to note that current economic conditions have placed a strain on the Central Valley that may require a longer recovery period than other areas of the State. Until unemployment and housing market conditions stabilize, growth will likely occur at a substantially slower rate in the short term, and the ultimate buildout of the General Plan may not occur by 2030. In order to accommodate population and job growth at the pace at which it occurs, this plan stipulates that development occur in phases. These are discussed in more detail in Chapter 3.

Non-Residential

Similar to population, employment projections for the City of Turlock are based on forecasts provided at the County level. Given the various economic factors that could influence future growth in the City, the General Plan relies on these county-wide forecasts to provide a high and low range estimate for Turlock and bracket potential outcomes. Again, the actual outcome will depend on a variety of demographic and policy considerations as well as differences between the City and County growth patterns.

A number of factors drive job growth in the Central Valley in general and Stanislaus County in particular. A significant proportion of the future job growth in the County will be related to providing goods and services to the local and regional population. In other words, growth in the local population and workforce will be an important driver for future employment growth. North San Joaquin's economy (Merced, Stanislaus, and San Joaquin) is also likely to get a boost from the continued expansion of educational facilities such as CSU Stanislaus and UC Merced, as well as spill-over from the San Francisco Bay Area economy. The presence of lower-skilled workers, inexpensive land, and central location in the State will also ensure that the region remains competitive for manufacturing.

According to the Stanislaus Council of Governments (StanCOG), the region anticipates more rapid growth in the Service and Retail Trade industry sectors relative to education or other

industries. Government jobs are expected to experience minimal growth. Additionally, because of the changing nature of the local economy, StanCOG anticipates unemployment levels will gradually decrease by 2030, and become more reflective of statewide rates.

Turlock is estimated to gain between 17,200 and 35,000 new jobs by 2030. The low end forecast (46,200 total jobs or a 59 percent increase over current levels) assumes the City's percentage share of County employment of 14.3 percent remains constant. The high end forecast (64,000 total jobs by 2030 or a 121 percent increase over current levels) assumes that the change in the City's employment growth rate relative to historic trends will mirror the projected change in the County's employment growth rate. At buildout, the land uses described in the General Plan would support around 51,000 total jobs—close to the midpoint of the jobs forecast.

TABLE 2–3: GENERAL PLAN BUILDOUT BY LAND USE DESIGNATION: RESIDENTIAL

LAND USE	ACRES	AVERAGE GROSS DENSITY (DU/AC)	HOUSING UNITS	POPULATION
Very Low Density Residential	289	1.6	460	1,300
Low Density Residential	2,916	5.0	14,580	41,050
Low/Medium Density Residential	408	7.5	2,930	8,230
Medium Density Residential	875	11.0	8,890	25,030
High Density Residential	345	22.5	7,130	20,070
Office and/or High Density Residential[1]	15	22.5	170	470
Office and/or Medium Density Residential[2]	6	11.0	30	100
Community Commercial and/or Office and/or High Density Residential[3]	9	22.5	60	180
Downtown Mixed Use[4]	164	22.5	2,780	7,810
Neighborhood Center[5]	22	22.5	80	230
Total	**5,049**		**37,120**	**104,480**

Note: Items may not sum to totals due to rounding.

1. Assumes 50% buildout as residential. Assumption supported by Housing Element analysis. Actual buildout may vary.
2. Assumes 50% buildout as residential. Assumption supported by Housing Element analysis. Actual buildout may vary.
3. Assumes 33% buildout as residential. Assumption supported by Housing Element analysis. Actual buildout may vary.
4. Assumes 75% buildout as residential. Assumption supported by Housing Element analysis. Actual buildout may vary.
5. Neighborhood Center classification applies only to master plan areas and is defined in Chapter 3. Assumes 25% buildout as residential. Actual buildout may vary.

General Plan Development Potential

Full buildout of the General Plan, including all master plan areas, would result in a total of around 37,120 housing units citywide (including existing) and a cumulative population of around 104,500 (Table 2-3). Of these, new housing units and population would be 12,800 and 36,000 respectively. More detail on phasing and buildout by phase is found in Chapter 3: New Growth Areas and Infrastructure.

Table 2-4 shows the potential non-residential buildout in terms of square feet of new buildings and number of jobs. Jobs are calculated based on standard assumptions about square footage per employee for various employment types. An average vacancy rate of 7 percent is also assumed.

TABLE 2–4: GENERAL PLAN BUILDOUT BY LAND USE DESIGNATION: NON-RESIDENTIAL

LAND USE	ACRES	TYPICAL FAR	SQUARE FEET	JOBS
Downtown Mixed Use[1]	164	1.0	1,791,120	4,160
Office	255	0.35	2,541,250	7,820
Office and/or High Density Residential[2]	15	0.35	112,770	350
Community Commercial	510	0.25	5,550,210	10,320
Community Commercial and/or Office	15	0.30	198,380	460
Community Commercial and/or Office and/or High Density Residential[3]	9	0.30	75,580	180
Office and/or Medium Density Residential[4]	6	0.35	47,620	150
Heavy Commercial	367	0.35	5,593,930	8,670
Highway Commercial	172	0.35	2,618,140	4,870
Industrial[5]	1,857	0.60	12,555,430	11,680
Business Park[6]	272	0.35	621,110	1,925
Neighborhood Center[7]	22	0.30	215,260	400
Total	**3,664**		**31,920,900**	**51,040**

Note: Items may not sum to totals due to rounding.

1. Assumes 25% buildout as non-residential. Actual buildout may vary.
2. Assumes 50% buildout as office. Actual buildout may vary.
3. Assumes 50% buildout as non-residential. Actual buildout may vary
4. Assumes 50% buildout as non-residential. Actual buildout may vary.
5. Assumes 15% buildout of available land inventory, per employment projections.
6. Assumes 15% buildout of available land inventory, per employment projections.
7. Neighborhood Center classification applies only to master plan areas and is defined in Chapter 3. Assumes 75% buildout as non-residential. Actual buildout may vary.

An important consideration to recognize in this calculation is that the TRIP in particular represents an approximately 50-year (or more) industrial land supply—far beyond the time horizon of this General Plan. Altogether, available land in the TRIP alone (Industrial and Business Park designations) could support nearly 56,000 jobs. However, employment projections for Turlock indicate that over the course of the General Plan buildout, through 2030, the city is likely to gain between 6,000 and 8,000 industrial jobs. This corresponds to roughly 15 percent of the TRIP being built out, or around 390 acres. Using this assumption regarding the TRIP, and assuming full buildout of the other non-residential land uses, Turlock will be able to support approximately 51,000 jobs at General Plan buildout.

It should be noted that for the purposes buildout calculations, approximate acreages of various residential and non-residential land uses are assumed for the master plan areas. These amounts are based on the conceptual plans for these areas, described in Chapter 3. Actual buildout of each land use type will depend on subsequent master planning processes. Similarly, for the purpose of infrastructure capacity calculations, the General Plan and supporting documents assume a 25 percent buildout of the TRIP. By using this higher buildout assumption for capacity calculations, the plan allows for a "cushion" in industrial development, as many large industrial users require substantial flexibility in site size and location.

Downtown Turlock is home to many thriving small businesses in a walkable, mixed use environment.

2.4 DOWNTOWN

The Downtown is roughly one quarter-mile square (160 acres), consisting of a core commercial area of approximately 90 acres, and residential, civic and heavy commercial uses at the periphery. It owes its location and geometry to the Union Pacific Railroad. Historic records indicate that the town survey started at what is now the southeast corner of the intersection of Center and East Main streets. From there, as in most towns of the San Joaquin Valley, an orthogonal street network was extended out parallel and perpendicular to the railroad tracks. Newer parts of the town were laid out in true cardinal directions; the transition between the new grid and the older diagonal one is never clean and is often disorienting.

The emergence of newer shopping centers in recent years, first along Geer Road and then at Monte Vista Crossings, has significantly reduced Downtown's share in the retail and commercial growth experienced by the City. The shopping complexes along Geer Road rival the retail

Implementation of the Downtown Design Guidelines has contributed to a cohesive aesthetic and improved streetscape.

in Downtown in size and proximity to residents and exceed it in activity. Both Geer Road and Monte Vista Crossings have better access and orientation to the automobile, proximity to newer neighborhoods, easier parking and larger sites than Downtown.

Compared to the newer shopping centers, Downtown, with its narrow streets, short blocks (typically 400-foot square), and historic buildings, is more appealing and better suited to exploration on foot. However, it lacks both a critical mass of supporting activity and attractions that could draw people from afar.

A survey conducted as part of the 1992 Downtown Plan estimated the amount of commercial space in Downtown to be about 1.4 million square feet. Of the 0.8 million square feet of retail space in the Downtown, automobile dealers and home furnishings accounted for the two largest groups of businesses. Eating and drinking establishments, specialty retail and apparel stores together constituted about 350,000 square feet of space. The survey did not consider Downtown's condition at that time as being prosperous. Banking establishments, the post office and other service establishments have been strong stabilizing elements, and cooperative marketing efforts, such as the Farmer's Market, have increased Downtown's visibility.

A second study of Turlock's Downtown was completed in 2008, which focused on marketing and branding opportunities. The study identified wedding planning and bridal shopping as a brand for Downtown, which, driven by a concerted marketing effort, could guide local business development and spur tourism and visitor spending.

LONG-TERM VIABILITY

Downtown's long-term economic viability will depend on its ability to compete not only with the newer shopping centers, but more critically with regional discount and retail operations, such as Wal-Mart and freeway-oriented regional shopping centers. Its success will depend on specialty stores offering wider selection than department stores, competitive pricing by merchants, and a pleasant environment for pedestrians where one-of-a-kind shops, restaurants and entertainment facilities can attract patronage from the entire City and beyond.

The 1992 Downtown Master Plan

The 1992 Downtown Master Plan offered a comprehensive urban design, parking-landscape framework, and a funding mechanism for implementation. It helped to identify infrastructure and beautification improvements for Downtown Turlock, which were implemented successfully and are responsible for many positive aspects of Downtown's environment today..

The 2003 Downtown Design Guidelines and Zoning Regulations

Adopted in 2003, the Downtown Design Guidelines and Zoning Regulations build on the vision for Downtown Turlock outlined in the Downtown Master Plan. The Zoning Regulations and Guidelines are intended to encourage and facilitate appropriate private investment within the Downtown Area that reflects the historic commercial character of the core and the traditional residential character of the adjoining neighborhoods. The documents contain guidelines and standards for physical design and land use in the area, emphasizing the importance of pedestrian access and accessibility throughout the Downtown Area, making it a place people can access easily and where they will want to linger and spend time.

The goals for the Zoning Regulations and Design Guidelines include:

- To ensure the current and future success of the Downtown by preserving and enhancing its unique historic character.
- To encourage future development that is compatible with the overall feel of Downtown.
- To protect and enhance the pedestrian environment and accessibility in and around the Downtown Core Area.
- To conserve the traditional character of the immediate surrounding residential neighborhoods while guiding future development for use and reinvestment through alternative uses.
- To promote renovation of historic buildings in Downtown and promote new investment and construction.

Downtown Planning Update

Using a portion of the funding that the city received through the Smart Valley Places Partnership, Turlock initiated an update to the Downtown Design Guidelines and Zoning Regulations in January 2011. Issues to be addressed in this update include the location of a potential train station downtown, as well as the possibility of allowing heights up to 60 feet in certain zones (Office/Residential and Industrial/Residential) for the purpose of providing additional housing. The infrastructure analysis in the General Plan will ensure that adequate infrastructure exists to support this potential increased intensity.

POLICIES

Guiding Policies

The Downtown Plan offers specific recommendations for guiding Downtown's growth into the future.

2.4-a **Preserve and enhance Downtown Turlock**. Continue efforts to preserve and enhance Downtown. Encourage development of Downtown as a mixed-use, day and evening activity center. Encourage office and residential development near Downtown.

Continuing viability of the Downtown is of economic as well as symbolic value to the City. Downtown has scale and character that is hard to replicate in shopping centers elsewhere. Downtown should be the preferred location for accountants, attorneys, dentists, realtors, engineers, and other local-serving office tenants, unless they provide medical services and need to be near the Emanuel Medical Center. Downtown provides a good location for the concentration of non-medical offices.

Implementing Policies

See also policies in Section 2.11, Economic Development, concerning economic support for Downtown; and in Section 7.5, Cultural and Historic Resources, concerning preserving Downtown's historic character.

2.4-b **Update the Downtown Zoning Overlay District and Design Guidelines.** Undertake a comprehensive update to the 2003 Downtown Zoning and Design guidelines to update uses and standards to respond to current economic needs and trends. Evaluate

potential locations for intermodal hub, public parking needs, design standards, and maximum densities.

2.4-c **Downtown Property-Based Improvement District (PBID).** Support the continuation of the Downtown Property-Based Improvement District (PBID) for the Plan's funding and implementation.

2.4-d **Preserve and promote historic character.** Work with the Turlock Historical Society and the Turlock Downtown Property Owners' Association to provide information and guidance to property owners interested in restoring or recapturing the original architectural style and integrity of historical buildings.

2.4-e **Support arts and culture Downtown.** Continue to demonstrate the City's commitment to the arts and historic resources by supporting private and nonprofit arts and cultural efforts.

2.4-f **Continue to improve access and wayfinding.** Continue to improve access to and within Downtown. Issues addressed should include entrances to Downtown and signage.

For detailed policies refer to the Downtown Master Plan.

2.4-g **Facilitate mixed use.** Facilitate and encourage development of mixed-use projects in Downtown through the development review, permitting, and fee process.

2.4-h **Preserve residential adjacency.** Preserve residential areas north and east of Downtown.

These areas are well established and contribute to the diversity of scale and use near Downtown. Permitting non-residential uses will create pressure on surrounding residences to convert to other uses as well.

General Plan policies encourage a mix of housing types in compact, walkable neighborhoods, to provide for Turlock's diverse population.

2.5 RESIDENTIAL AREAS

The General Plan promotes the development of walkable, compact, mixed use residential neighborhoods in new development areas. Compact neighborhoods use resources more efficiently, conserve valuable farmland, and are convenient to residents. New residential development will include a broad mix of housing types, from traditional single family homes to townhouses and apartments, in order to serve the needs of Turlock's diverse population and changing demographics.

Some community facilities that are appropriate for residential environments, such as day care, elderly care, and alcohol and drug abuse treatment facilities, shall be allowed within neighborhoods in accordance with State and federal law.

Below are the land use policies related to residential areas. For detailed information on housing types and program policies, refer to the Housing Element, and for design policies, refer to the City Design Element.

POLICIES

Guiding Policies

2.5-a **Housing type diversity.** Increase the diversity in the citywide mix of housing types by encouraging development of housing at a broad range of densities and prices, including small-lot single-family, townhouses, apartments, and condominiums. Aim to achieve an overall housing type mix of 60 percent traditional single family, 40 percent medium and higher density housing types.

The current mix is 70 percent single family and 30 percent medium and high density.

2.5-b **New neighborhood character.** Foster the development of new residential areas that are compact, mixed use, and walkable, with a distinct identity, an identifiable center, and a "neighborhood" orientation.

See also Chapter 3: New Growth Areas and Infrastructure; and Chapter 6: City Design.

2.5-c **Infill and existing neighborhoods.** Preserve the scale and character of existing neighborhoods while allowing and encouraging appropriate infill development.

Implementing Policies

2.5-d **Zoning ordinance revision to match General Plan.** Revise the zoning ordinance and residential design guidelines to be consistent with the objectives and classifications in the General Plan, including the General Plan Land Use Diagram. These would include, but are not limited to:

- Establishing minimum and maximum densities consistent with the Plan
- Establishing graduated density standards (see Policy 2.5-l)
- Establishing overlay districts for traditional neighborhoods (see Policy 2.5-m)
- Accommodating potential future regional retail uses, such as discount superstores (see Policy 2.6-e)

2.5-e **"No net loss" of housing.** Do not allow development at less than the minimum density prescribed by each residential land use category, without rebalancing the overall plan to comply with the "no net loss" provisions of State housing law.

2.5-f **Master planning required.** Require comprehensive master planning of new residential neighborhoods in expansion areas consistent with the requirements in the General Plan. Also require that 70 percent of one master plan area is completed (building permits issued) before another starts.

See Chapter 3: New Growth Areas and Infrastructure.

2.5-g **Locations for high density development.** Maintain the highest residential development intensities Downtown, along transit corridors, near transit stops, and in new neighborhood centers.

2.5-h **Transit and pedestrian accessibility from housing.** Work with developers of affordable and multifamily housing to encourage the construction of transit-oriented and pedestrian-oriented amenities and appropriate street improvements that encourage walking and transit use.

2.5-i **Housing downtown.** Create incentives to increase residential development Downtown, on infill sites and in existing buildings. Examples include:

- Providing public subsidies for the development of affordable housing
- Utilizing Historic Building Code where applicable to encourage development of the second floors in Downtown Turlock
- Reducing on-site parking requirements
- Updating the Capital Facility Fee program to more closely reflect the reduced contribution of walkable neighborhoods to the need for additional roadway and operational infrastructure (see Policy 5.3-k).

2.5-j **Redevelopment in existing neighborhoods.** Preserve and enhance existing pedestrian-oriented neighborhoods and commercial districts by pursuing redevelopment that reinforces activity, making investments in the public realm, establishing overlay districts to preserve the neotraditional character of development, and avoiding designating competing commercial areas in close proximity.

2.5-k **Improvements in existing neighborhoods.** Enhance the character of existing neighborhoods by implementing public realm improvements where needed, and by allowing changes in scale and/or use on specified sites.

2.5-l **Graduated density.** Amend the zoning ordinance to establish graduated density standards for medium and high density residential development in neighborhoods with narrow lots, by today's standards, generally located south of Canal, east of Soderquist, north of South Avenue and west of Golden State Boulevard. In these neighborhoods, the narrow lots often cannot support Medium Density Residential development unless combined with neighboring parcels. The standard would tie allowable density to lot size, ensuring that the maximum residential density is only permitted on single lots over a certain minimum size, or on adjacent lots being developed as a single site.

2.5-m **Traditional Neighborhood Overlay Zones.** Establish overlay zoning districts for areas immediately adjacent to the Downtown, but outside the Downtown Overlay Districts which were developed post-WWII to preserve the historic quality and cohesiveness of these neighborhoods. Areas include Southwest Turlock generally bounded by Canal, Golden State, Linwood and Highway 99. Other neighborhoods may also qualify for special overlay zoning based upon prior zoning practices.

TABLE 2–5: PER CAPITA TAXABLE RETAIL SALES, 2000 AND 2008						
	TURLOCK		MODESTO		STANISLAUS COUNTY	
TYPE OF BUSINESS	2000	2008	2000	2008	2000	2008
Retail Stores						
Apparel	$139	$438	$539	$730	$247	$398
General Merchandise	1,879	3,160	2,516	2,286	1,504	1,692
Food Stores	724	763	591	668	509	596
Eating and Drinking Places	977	1,398	1,052	1,296	734	982
Home Furnishings and Appliances	262	357	556	485	313	323
Building Materials and Farm Implements	680	1,079	861	570	649	727
Auto Dealers and Auto Supplies	1,830	1,372	1,123	750	1,720	1,472
Service Stations	949	1,655	586	878	641	1,472
Other Retail Stores	985	1,328	1,816	1,553	1,358	1,255
Retail Total	8,426	11,549	9,642	9,217	7,675	8,720
Other Outlets	2,905	2,607	1,888	2,271	3,004	3,704
Total All Outlets	**$11,332**	**$14,156**	**$11,530**	**$11,489**	**$11,124**	**$12,795**
Notes:						
Population in 2000: Turlock = 55,810; Modesto = 188,856; Stanislaus County = 466,997						
Population in 2008: Turlock = 70,158; Modesto = 209,936; Stanislaus County = 525,903						

Sources: Census 2000; California Department of Finance, 2008; California Board of Equalization, 2000 and 2008

2.6 RETAIL, COMMERCIAL AND MIXED USE AREAS

Retail areas offer convenience to Turlock residents and help shape the City's image. As of 2007, about 14 percent of Turlock's residents are employed in the retail trade sector. (See Table 2-7 in Section 2.10: Economic Development for more information on employment by industry.) Shopping and use of services are activities that enable social contact as well as business transactions. Though residents may not be familiar with neighborhoods outside their own, community shopping areas are likely to be equally well known by people living in all areas of the City. Therefore, retail districts are a critical element of people's perception of their city.

Retail and related uses within the City are also important ingredients in the City's success from a fiscal and employment viewpoint. Sales tax revenues represent the largest single revenue source

Mixed use developments with ground-floor retail are encouraged in new neighborhood centers (top). Regional retail serves both Turlock residents and the surrounding area, and can be an important source of tax revenue. However, its development also runs the risk of hurting existing local businesses if not timed appropriately (bottom).

in the City's General Fund: in fiscal year 2008-2009, sales tax revenues accounted for over 26 percent of General Fund revenue (approximately $10.6 million). Moreover, such businesses also provide jobs in the community.

As shown in Table 2-5, per capita sales in Turlock in 2000 were above the average for Stanislaus County but below the city of Modesto. By 2008, per capita sales in Turlock were higher than both Modesto and the county as a whole, showing substantial increases in many categories, including apparel, general merchandise, building materials, and service stations. The strong increases in general merchandise and apparel is related to the opening of Monte Vista Crossings Shopping Center in 2000, and its subsequent growth, with Home Depot and Target as the main anchors. Additionally, residents of smaller communities (Patterson, Newman, Delhi, and Hughson, as well as Keyes and Denair) come to Turlock to make purchases.

However, despite Turlock's per capita sales growth in apparel, it is still small relative to Modesto. This is also the case with home furnishings and appliances, which are types of merchandise for which shoppers like to have a wide selection. Turlock's relatively weak per capita sales in these categories reflect continuing weak selection in the City compared to other nearby destinations. Plan policies support the addition of retail facilities that will provide more choice in these and other categories.

Turlock's previous General Plan succeeded in considerably expanding the retail sector in the City. As such, there remains ample land designated for retail uses that is yet undeveloped. Regarding retail, the focus of this plan is to maintain the viability of existing retail, allow regional-serving retail to develop at key locations along the freeway, and encourage the development of small, neighborhood-serving commercial uses in new neighborhoods that are walkable to a majority of new homes. The following policies relate to the land use aspects of retail and related uses. For urban design policies relating to neighborhood center design, refer to the City Design Element.

POLICIES

Guiding Policies

2.6-a **Regional retail areas.** Foster strong, attractive regional retail developments in the City along the Highway 99 corridor that serve both local and regional needs, at a time when market conditions indicate that Turlock can support these uses without undermining existing local businesses.

2.6-b **Neighborhood and community commercial areas.** Facilitate the development of neighborhood and community commercial areas, which will: (a) conveniently serve current and future residential needs, (b) provide employment opportunities, (c) contribute to the attractiveness of the community, and (d) contribute to the City's tax base. Mixed use commercial areas are also encouraged, and shall be incorporated into new master plan areas.

2.6-c **Downtown retail.** Make Downtown a unique shopping district emphasizing specialty shops, entertainment opportunities, restaurants, and professional services.

See Section 2.4 for discussion and policies on Downtown.

2.6-d **Pedestrian orientation of commercial areas.** Emphasize compact form and pedestrian orientation in new community and neighborhood commercial areas, in locations that many residents can reach on foot, by bicycle, or by short drives.

Local-serving shopping centers are key elements of the neighborhoods described in Section 3.2.

Implementing Policies

2.6-e **Timing and location of regional retail.** Once Turlock grows to approximately 27,000 housing units, conduct an updated Discount Superstore Market Demand Analysis to determine the economic impacts of allowing this type of retail use within the city. As appropriate, evaluate a range of zoning options to accommodate discount superstores, including, but not limited to:

- Increasing the allowable percentage of non-taxable floor area for discount superstores; or
- Designating a new Regional Commercial zoning district or an overlay district that may include areas along State Route 99 located adjacent to Monte Vista Avenue, Fulkerth Road, Lander Avenue, or by the new southeast interchange.

2.6-f **Regional commercial developments fund transportation improvements.** Require regional commercial center developers to fund transportation improvements that will be necessary to accommodate the level of activity anticipated.

2.6-g **Local-serving shopping in new neighborhoods.** In new master-planned residential neighborhoods, ensure development of neighborhood-oriented mixed-use centers that provide convenience shopping for nearby residents. Local shopping centers

The adoption of the Westside Industrial Specific Plan has enabled substantial new industrial development on large parcels west of Highway 99.

should be collocated with uses such as parks, schools, offices, and community facilities in order to create a neighborhood center where multiple tasks can be accomplished in one trip.

Section 3.2 includes more detail on requirements for neighborhood centers in master plans.

2.6-h **Incentives for mixed use projects.** Encourage the development of mixed use (vertical and horizontal) developments on sites that have dual use designations by providing incentives. These could include:

- Updating the Capital Facility Fee program to more closely reflect the reduced contribution of walkable neighborhoods to the need for additional roadway and operational infrastructure
- FAR or residential density bonuses
- Reduced parking requirements and opportunities for shared parking

2.6-i **Limit future retail on Geer Road.** Limit additional "neighborhood/community commercial" and "strip commercial" centers along Geer Road by restricting changes in zone districts from residential or office to commercial.

2.6-j **Distribution of retail.** Distribute shopping areas so that new neighborhood centers will be located in conjunction with new housing development in master plans or in areas currently underserved by existing retail.

This policy will improve access to neighborhood centers and avoid proposals for more shopping centers than can be supported. A rule of thumb is that at least 5,000 households are needed to support a supermarket that must compete with large existing stores. In each trade area only one is likely to succeed, and duplication will cause vacancy, substandard development, or attempts to locate inappropriate uses on sites that are unable to attract a supermarket.

2.6-k **Small neighborhood groceries allowed.** Continue to allow neighborhood grocery stores not exceeding 2,500 square feet in areas wherever they can be supported and will not create unacceptable traffic problems or nuisance due to hours of operation.

The Land Use Diagram does not recognize all existing neighborhood groceries or indicate sites at all locations suitable for additional stores.

2.6-l **Retail in the Downtown Master Plan.** Continue to implement the Downtown Master Plan, emphasizing the creation of a retail district that serves both everyday and specialty retail needs.

See Section 2.4 for discussion of the Downtown.

2.7 INDUSTRIAL AREAS

Turlock's agricultural setting has historically provided a basis for the City's industry. Food processing is the primary industry, providing the largest number of industrial jobs in Turlock. Four of the top ten employers in the city are food processors, and Foster Farms, the third-largest employer in the city, employs 1,500 workers. Fourteen percent of jobs in Turlock are in manufacturing, and four percent are in the warehousing and transportation industries, which are large users of industrial space. More detail on employment by industry is found in Section 2.11, Economic Development.

Through the creation and implementation of the Westside Industrial Specific Plan (WISP), Turlock has reaffirmed the continuing importance of industrial development as a main source of jobs and economic growth in the City. Policies in this section reinforce the WISP and aim to make industrial development a viable enterprise without negatively impacting other land uses in the city.

POLICIES

Guiding Policies

2.7-a **Concentrate industrial uses in the TRIP.** Minimize conflicts between industry and other land uses by concentrating industrial activity west of Highway 99, specifically in the Turlock Regional Industrial Park (TRIP) area.

Though some industry, including major poultry processing operations, is located east of the freeway, future industrial growth will be directed to the west, into the TRIP, where land use conflicts will be minimized.

2.7-b **Attract industry to Turlock.** Enhance the positive factors that have made the City attractive to industry, including freeway access, available large parcels of land,

inexpensive power, a streamlined development process, and an appropriately-skilled workforce.

Some of the factors that affect industrial location are not within the control of the City; for example, the long-term availability of water. The City's investigation of alternative water sources including well-head treatment may result in a solution to this problem before it becomes a constraint on future development. Plan policies in section 3.3 address these issues.

Implementing Policies

2.7-c **Focus industrial uses west of Highway 99.** Focus industrial development west of Highway 99 by continuing to implement the Westside Industrial Specific Plan.

2.7-d **Incentives for public amenities.** Offer added incentives to industrial projects in the TRIP that contribute to the pedestrian, bicycle, or transit networks and/or public amenities and open space.

2.7-e **Truck routes and industrial streets.** Designate appropriate truck routes and "industrial streets" in order to accommodate industrial traffic and avoid unanticipated conflicts.

See Policy 5.5-k.

2.7-f **Design to minimize impacts.** Design industrial development to minimize potential community impacts adversely affecting residential and commercial areas in relation to local and regional air quality and odor, adequacy of municipal service, local traffic conditions, visual quality, and noise levels.

2.7-g **Buffers between uses.** Buffer industrial and heavy commercial areas from adjacent residential, commercial, and recreation areas using public infrastructure, right-of-way, landscaping, or a combination thereof.

2.7-h **Single-use industrial areas.** Designate industrial areas to be solely utilized by industrial uses to maintain and encourage mutually supportive, attractive, and compact industrial environments and to be protected from encroachment or preemption by other incompatible uses.

2.8 PROFESSIONAL OFFICE AND BUSINESS PARK AREAS

In recent years, office employment in Turlock is provided by jobs in education (Turlock school districts and CSUS), government (City of Turlock and Turlock Irrigation District), and the health care industry (Emanuel Medical Center). The City's largest concentrations of office space are along East Main Street and Canal Drive in the central part of the city, City Hall on South Broadway, around Emanuel Medical Center, and Downtown. Offices are also found along the southern part of Geer Road, mixed with retail businesses. As the City grows, it is likely that the space needed for both government services and health-care related services will increase.

While office employment has not historically been a major contributor to the City's economy, there are good reasons to implement strategies to increase office activities. Growth in trade, manufacturing and service sectors, projected to account for the largest increase in employment over the next 20 years, is likely to spur office development. Office employment does not create heavy demands on the City's water supply and wastewater treatment facilities, or directly generate air pollution emissions. Further, expansion of office activities such as those in the finance, insurance and real estate (FIRE) category would diversify the City's economic base and offer more varied employment opportunities for Turlock area residents.

POLICIES

Guiding Policies

2.8-a **Provision of sites for office and business park uses.** Contribute to diversifying the City's employment base by maintaining large sites designated for office/business park use, including sites on Golden State Boulevard and business park sites in the TRIP.

2.8-b **Office locations.** Encourage local-serving offices to locate in and near Downtown and in proximity to existing professional office clusters, such as the Emanuel Medical Center.

Implementing Policies

2.8-c **Nodes of offices throughout the city.** Continue creating a concentration of medical offices in the vicinity of Emanuel Hospital, while still encouraging new nodes of office development along Geer Road and North Golden State Boulevard.

2.8-d **Offices linking destinations.** Link two prominent office clusters—Emanuel Medical Center and Downtown—by extending the Office designation along Colorado Avenue to East Main Street. These offices may be part of mixed use developments that include retail and/or residential uses.

2.8-e **Largest office users in the TRIP.** Direct the largest office users to appropriately designated sites in the TRIP office and business park areas.

2.8-f **City administrative offices located Downtown.** Prioritize Downtown as a preferred location for the construction of any new City administrative offices, to maintain the government's central location and to set a precedent for Downtown office development.

2.9 THE PLANNING AREA AND CITY/COUNTY RELATIONSHIPS

As described in Section 1.3, The Planning Area is the geographic area for which the General Plan establishes policies about future urban growth, long-term agricultural activity, and natural resource conservation. The boundary of the Planning Area, which encompasses approximately 40 square miles, was determined by the City Council in response to State law requiring each city to include in its General Plan all territory within the boundaries of the incorporated area as well as "any land outside its boundaries which in the planning agency's judgment bears relation to its planning" (California Government Code Section 65300). The Planning Area is defined as such because it is that portion of the unincorporated area that has a direct impact on City services and infrastructure demands.

Turlock also defines a Study Area, which is a smaller area (27 square miles) defining the outer limit of where urban development may take place over the next 20 years. The Study Area includes land that is currently unincorporated, as well. As described in Chapter 3: New Growth Areas and Infrastructure, unincorporated areas within the Study Area shall be annexed into Turlock following an explicit phasing and master planning process. Inclusion of unincorporated land in the Planning Area and the Study Area does not mean that the City disagrees with County policies—in many cases the intent of the General Plan is to support or express agreement with County policies for surrounding areas. Additional policies relating to City/County relationships are addressed in Chapter 3: New Growth areas and Infrastructure; and Section 7.2: Agriculture and Soil Resources.

POLICIES

Guiding Policies

2.9-a **Agriculture belongs in unincorporated areas.** Support Stanislaus and Merced County policies that promote continued agricultural activity on lands surrounding the urban areas designated on the General Plan Diagram.

2.9-b **Urban land uses belong in incorporated areas.** Work with Stanislaus County to direct growth to incorporated areas and established unincorporated communities.

A key policy of the General Plan is the limited and orderly expansion of the City. This policy would be undermined by approval of urban activities in unincorporated areas.

2.9-c **Encourage infill and more compact development to protect farmland.** Relieve pressures to convert valuable agricultural lands to urban uses by encouraging infill development.

2.9-d **Incorporate existing urbanized areas.** Seek to include in the City all urbanized areas contiguous with City territory. The City's first priority for annexation shall be the numerous unincorporated County islands located wholly within Turlock (see accompanying policies in Section 3.1). A second area of priority, should property owners desire it, is the area of commercial uses north of Taylor Road on both sides of State Route 99 to Barnhart Road. While the City shall not initiate the annexation of these properties, it will work with property owners on developing financing and infrastructure improvement strategies to facilitate annexation should they express interest.

2.9-e **Work with County on regional projects.** Cooperate with County agencies in planning for transportation improvements and other major projects affecting multiple agencies.

The Stanislaus County Expressway Study and the County's Congestion Management Program are two of the major projects in which the City and County are participating. Both projects are led by the Stanislaus Council of Governments (StanCOG), the County's Regional Transportation Agency.

2.9-f **Work with County on mitigating impacts of growth.** Work with Stanislaus County to implement financing mechanisms to ensure that development within the Planning Area pays its fair share of both City and County improvements required to mitigate the impacts of growth.

Implementing Policies

2.9-g **Stanislaus County plans for Denair and Keyes.** Stanislaus County shall remain responsible for land use planning for the unincorporated communities of Keyes and Denair. However, the City of Turlock shall review development proposals in these communities to ensure that they are consistent with the City's ability to provide wastewater treatment services, on which they depend.

2.9-h **Cooperate at the City/County line.** Seek Stanislaus County cooperation in designating unincorporated land for uses compatible with adjacent City lands.

2.9-i **LAFCO approval for Sphere of Influence changes.** Seek LAFCO approval of Sphere of Influence changes to reflect the General Plan Diagram, upon completion of the master plan updates for the sewer, water, and wastewater treatment systems, and upon completion of the Capital Facilities Fee update (within two years of adoption of the General Plan).

LAFCO action would clearly demarcate those areas that are expected to be urbanized and incorporated in the future. Lands not within the City's Sphere of Influence (and outside of Keyes and Denair) are to remain subject to the County's regulations for lands designated for agricultural use. Including Turlock's expansion areas in the City's sphere will mean that prezoning and annexation criteria relating to orderly expansion of the City will have to be met before development proposals will be considered.

2.9-j **Phasing of annexations.** Annexations to the City should proceed according to the phasing plan described in Section 3.1.

2.9-k **Fee-sharing programs.** Update the City's agreement with Stanislaus County regarding collection of the public facilities fee. The agreement should stipulate that the City will collect and pass on to the County development fees for County improvements, and the County will refer to the City applications for development in the City's Sphere of Influence.

The fee sharing agreement helps avoid the fiscalization of land use decisions in the county, discourage urban commercial development in unincorporated areas, and promote urban infill and redevelopment.

This policy is consistent with the Stanislaus County General Plan, which was amended following a pioneering agreement made between the City and County. Subsequent to that time, the County entered into similar agreements with each of the cities in the

County. However, the agreement between Turlock and the County lapsed without renewal. This policy advocates renegotiation of the agreement without provision of a sales tax revenue pass-through.

2.9-l **County island incorporation.** Work with Stanislaus County to identify possible revenue tools for underwriting necessary improvements in order to encourage incorporation of County islands.

Development standards in the islands differ from those in the surrounding areas. Incorporation should be made a condition of project approval on any property in any of the islands. See also policies in Section 3.1, Growth Strategy, for timing strategies related to County island incorporation.

2.9-m **Work with StanCOG on regional issues.** Continue to participate with StanCOG on matters of mutual concern to the City and County. These include programs such as regional expressway studies, housing needs determination, the Regional Transportation Plan (RTP), the Sustainable Communities Strategy (SCS), and others.

Land in Urban Reserve is predominantly agricultural in nature, and is anticipated to remain as such through the buildout of this General Plan.

2.10 URBAN RESERVE

The General Plan Diagram classifies land in the Turlock Study Area for a variety of land uses, which the City believes addresses future community needs through the year 2030. Land classified as Urban Reserve in this General Plan is that which is believed may remain committed to agricultural uses for the foreseeable future. On the other hand, land outside current city limits that is believed to be necessary to accomodate future growth is designated as master plan areas. It is the City's intent that land classified as Urban Reserve should remain agricultural in use over the course of the planning period (through 2030), but may eventually give way to urban uses as the community's economic needs continue to evolve over time (likely beyond the time horizon of this General Plan). The timing of conversion of Urban Reserve land to urban uses may be reconsidered if development occurs at a substantially slower or faster pace than projected in this Plan. However, this conditions would generally give way to another update of the General Plan.

Policies that address the timing and circumstances for the reclassification of land classified Urban Reserve to specific land use classifications to accommodate urban uses are outlined below. The conversion of Urban Reserve land to urban uses is treated in more detail in Chapter 3: New Growth Areas and Infrastructure.

POLICIES

Guiding Policies

2.10-a **Consider needs beyond the year 2030.** Ensure the City's ability to accommodate future urban growth and development beyond the 2030 time horizon of the General Plan.

Implementing Policies

2.10-b **Reclassifying Urban Reserve land.** Land classified Urban Reserve, located within the Study Area but situated outside the city's Sphere of Influence, may not be reclassified to accommodate specific urban uses and annexed until the following occurs:

a) the City Council finds that the City has less than a four year supply of vacant land for development in its inventory and all master plans identified in this General Plan have been fully developed; or

b) the City Council, by a 4/5ths affirmative vote, finds in the public interest to reclassify property to accommodate an industrial or commercial use that will be the source of significant employment. A comprehensive General Plan Amendment shall accompany any secondary residential use in this area.

In either case, the reclassification must take place as part of a master planning process, or, ideally, trigger an update to the General Plan.

2.11 ECONOMIC DEVELOPMENT

Turlock's economy has traditionally been based on agriculture, agriculture-related industries (primarily food processing), and other manufacturing. Its location in the heart of the San Joaquin Valley, home to some of the most fertile farmland in the world, naturally led to Turlock's agricultural heritage and employment base.

Over the past 50 years, Turlock's population has grown from 9,000 in 1960 to 70,000 today. The economy has shifted to focus on schools, government, and service businesses to serve the population. The largest single employer is now the Turlock Unified School District. The largest industry sectors are state and local government (15 percent), retail (14 percent), manufacturing (14 percent), health care and social assistance (12 percent) and accommodation and food services (10 percent). These activities will likely remain the strongest components of the city's job base as the population continues to grow.

While most economic activity occurs in the private sector, the City can take an active role in furthering its economic prosperity. Examples of what the City can do to spur economic development include:

- Ensuring that local policies do not impede the needs of businesses to move or expand;
- Facilitating and acting as a catalyst for development in strategic market segments, especially those that may spur other activities or provide fiscal benefits;
- Coordinating and providing for infrastructure improvements; and
- Generating revenue to support community development objectives.

This section describes Turlock's economic development strategy and provides policies to implement the City's goals.

ECONOMIC CONTEXT AND EMPLOYMENT PROFILE

Overall, the key economic drivers in Stanislaus County are retail trade, manufacturing, and public or non-profit (e.g. health care) related sectors. While the manufacturing sector reflects the regions' competitive location and labor force characteristics, the latter two sectors are primarily

population driven. Modesto currently serves as the primary employment center in Stanislaus County, providing about 70 percent of the total jobs, with Turlock in second at about 20 percent.

Turlock's employment composition is reflective of the County as a whole. Turlock's major sectors are State and Local Government (15 percent), Retail Trade (14 percent), Manufacturing (14 percent), Health Care and Social Assistance (12 percent) and Hotel and Food Services (10 percent). For the County, Manufacturing and Retail Trade represent the largest employment sectors, followed by "Health Care & Social Assistance." These three sectors account for about 40 percent of total jobs in Turlock and 45 percent Countywide (Table 2-6).

The leading employers in Turlock and the County reflect the trends described above. As shown in Table 2-7, the Turlock Unified School District (TUSD) employs the highest number of employees in the City with 2,200 employees. Emanuel Medical Center is second, with over 1,500 employees. The City's poultry processing plant, Foster Farms, is the third-largest employer in the City with a total of 1,500 employees. Overall, the top ten employers employ a total of approximately 8,000 employees in the City or close to 30 percent of the total. Four of the top employers within the County are located in the City, which includes California State University (CSU) Stanislaus, Emanuel Medical Center, Foster Farms, and Stanislaus County Community Services.

For the most part, historical employment growth has reinforced the economic patterns described above and substantiates the declining importance of agriculture both regionally and locally (near and within urbanized areas). Specifically, population-driven sectors such as State and Local Government, Health Care & Social Assistance and Accommodations & Food Services have provided the largest contributions to employment growth in Turlock and the County as a whole since 2000. Meanwhile, agriculture was the only sector to experience declining employment across all jurisdictions during this period. Turlock also experienced a significant decrease in Management of Companies and Enterprises (with 1,100 jobs) and Construction (with 300 jobs).

Jobs/Housing Balance

Commute patterns play an increasingly important role in population growth and thus, urban land demand. Information on Turlock's jobs-housing balance and the travel patterns of both local residents and employees provide important insight into its evolving role in the regional economy. In the long-run, areas such as Turlock that are not centrally located relative to major job centers need to expand economically in order to sustain future population.

TABLE 2–6: EMPLOYMENT BY INDUSTRY IN STANISLAUS COUNTY AND TURLOCK (2007)

	STANISLAUS COUNTY		TURLOCK CITY	
MAJOR INDUSTRY[1]	#	%	#	%
Accommodation & Food Services	13,629	7.8%	2,693	9.5%
Admin & Support & Waste Mgmt.	7,732	4.4%	1,140	4.0%
Agriculture, Forestry, Fishing & Hunting	12,880	7.3%	1,840	6.5%
Arts, Entertainment, & Recreation	1,660	0.9%	N/A	N/A
Construction	11,164	6.4%	1,793	6.3%
Educational Services[2]	2,246	1.3%	100	0.4%
Federal Government	1,100	0.6%	90	0.3%
Finance & Insurance	3,985	2.3%	725	2.6%
Health Care & Social Assistance	19,821	11.3%	3,398	12.0%
Information	2,331	1.3%	203	0.7%
Local Government	23,500	13.4%	2,908	10.3%
Mgmt. of Companies and Enterprises	1,866	1.1%	207	0.7%
Manufacturing	22,771	13.0%	4,004	14.2%
Mining	29	0.0%	0	0.0%
Non-Classified	71	0.0%	N/A	N/A
Other Services	7,595	4.3%	1,211	4.3%
Professional, Scientific, & Tech Skills	5,460	3.1%	676	2.4%
Public Administration	66	0.0%	0	0.0%
Real Estate & Rental & Leasing	2,166	1.2%	252	0.9%
Retail Trade	22,111	12.6%	4,018	14.2%
State Government (Includes CSU Stanislaus)[2]	1,800	1.0%	1,227	4.3%
Transportation, Warehousing, and Utilities	5,600	3.2%	1,034	3.7%
Wholesale Trade	6,027	3.4%	739	2.6%
Total Employment (All Industries)	**175,610**	**100.0%**	**28,258**	**100.0%**
Total Employment as a % of County	**100.0%**		**16.1%**	

1. Based on the annual average employment for each industry. N/A represents confidential data.

2. According to the U.S. Census NAICS code for 2007, public schools and college universities are generally categorized in the Educational Services industry. However, California EDD included the primary and secondary public schools in Local Government and higher education (e.g. CSU Stanislaus) employees in the State Government category.

Sources: California EDD and EPS

TABLE 2–7: CITY OF TURLOCK TOP 10 MAJOR EMPLOYERS

EMPLOYER	INDUSTRY	NUMBER OF EMPLOYEES[1]
Turlock Unified School District	School District	2,202
Emanuel Medical Center	Healthcare Facility	1,549
Foster Farms	Poultry Processor	1,500
CSU, Stanislaus	Public University	1,100
Turlock Irrigation District	Water & Electric Utility	495
Wal-Mart	Retailer	415
City of Turlock	City Government	351
Mid-Valley Dairy (Sunny Side Farms)	Dairy Products	215
Sensient Dehydrated Flavors Inc.	Food Manufacturer	180
Subtotal		8,007
Estimated Jobs in Turlock in 2008		28,995
% of Total Turlock Jobs		27.6%

1. Information as of March 2008.

Sources: Indicators (Stanislaus Economic Development & Workforce Alliance) and City of Turlock.

Historical data on Turlock's jobs-housing balance and jobs to employee ratios suggest that the City has maintained relatively balanced population and employment growth. Specifically, since 1991 the City has consistently provided about 1.1 jobs per household (Table 2-8). This ratio compares favorably to the County as a whole which provides about one job per household. In addition, the City provided about one job per resident in the workforce in 2007, a 12 percent increase from 1991. Again, the City has out-performed the County in this regard as the County currently provides about 0.8 jobs per resident in the workforce.

The 2000 Census provides detailed data on travel patterns by both place of work and place of residence. Although relatively dated, this data also suggest that most of Turlock's residents and employees work and live locally. Specifically, about 48 percent of the City's employed residents worked in Turlock while about 82 percent worked in the County in 2000 (Table 2-9). In addition, about 54 percent of Turlock employees live in the City and about 81 percent live in the County. Turlock is a city where most people work locally: over 50 percent of jobs in Turlock are held by Turlock residents, and 82 percent of Turlock residents work somewhere in Stanislaus County.

TABLE 2–8: JOBS TO EMPLOYEES RATIO AND JOBS TO HOUSING UNIT RATIO			
COUNTY/CITY	1991	2001	2007
Stanislaus County			
Jobs to Housing Unit Ratio			
Jobs	133,549	164,475	175,124
Housing Units	132,027	150,807	176,622
Jobs to Housing Unit Ratio	**1.01**	**1.09**	**0.99**
Jobs to Employees Ratio			
Employees	159,100	196,400	210,900
Jobs to Employees Ratio	**0.84**	**0.84**	**0.83**
City of Turlock			
Jobs to Housing Unit Ratio			
Jobs	18,720	22,906	28,258
Housing Units	15,921	19,096	23,993
Jobs to Housing Unit Ratio	**1.18**	**1.20**	**1.18**
Jobs to Employees Ratio			
Employees	19,800	24,900	26,700
Jobs to Employees Ratio	**0.95**	**0.92**	**1.06**

Sources: California EDD Quarterly Census of Employment and Wages; California Department of Finance; California Employment Development Department Labor Market Info

A healthy, active Downtown is an important economic asset.

Over 75 percent of the Turlock workforce commutes less than 30 minutes to work. Less than five percent of Turlock workers commute to the San Francisco Bay Area.

ECONOMIC DEVELOPMENT STRATEGY

Over the time frame of this General Plan, the City of Turlock is expected to add around 45,000 new residents, an increase of nearly 65 percent. In order to support this population, the City will need to add jobs. While many jobs will "naturally" arise from the services needed to support this growing population (such as schools, retail and personal services, police and fire protection, and others), additional jobs in other sectors—appropriate for workers with a range of skill types—will also be necessary.

TABLE 2–9: SUMMARY OF EMPLOYED RESIDENTS' PLACE OF WORK AND RESIDENCE IN 2000		
PLACE[1]	TOTAL	% OF TOTAL
Local Residents		
Place of Work		
Turlock	10,000	48.6%
Modesto	3,920	19.0%
Ceres	555	2.7%
Other Cities	1,055	5.1%
Remainder of County	2,305	11.2%
Subtotal Stanislaus County	**16,780**	**81.5%**
Other Counties		
Alameda	213	1.0%
San Joaquin	754	3.7%
Merced	2,090	10.1%
Remainder of Other Counties	756	3.7%
Subtotal Other Counties	**3,813**	**18.5%**
Total Employed Residents	**20,593**	**100.0%**
City Jobs		
Place of Residence of Employees		
Turlock	10,000	54.4%
Modesto	2,360	12.8%
Ceres	775	4.2%
Other Cities	1,850	10.1%
Remainder of County	1,815	9.9%
Subtotal Stanislaus County	**14,950**	**81.3%**
Other Counties		
Alameda	38	0.2%
San Joaquin	338	1.6%
Merced	2,764	13.4%
Remainder of Other Counties	307	1.5%
Subtotal Other Counties	**3,447**	**18.7%**
Total City Jobs	**18,397**	**100.0%**
1. Data available for the year 2000 only.		

Source: U.S. Census

The City recognizes that while its location in the Central Valley lends many advantages in job attraction, it is also a competitive environment. Many similar cities in the Valley possess the same assets—central location, available inexpensive land, freeway and rail access—and therefore Turlock must build upon its unique strengths and differentiate itself from its neighbors.

Turlock's Strengths

Turlock's strongest assets for economic development include:

- **CSU-Stanislaus,** a four-year public university campus with approximately 6,800 full-time equivalent students. Disciplines seeing the most significant growth include business, health sciences and services, psychology, security and protective services, agriculture, and biomedical sciences. Similarly, Turlock has a well-educated workforce, with education levels exceeding those of Stanislaus County overall (23 percent of Turlock residents had a bachelor's degree or higher in 2007, versus 16 percent countywide).
- Adoption of the **Westside Industrial Specific Plan (WISP)** in 2006, which allocated over 2,600 acres for industrial and business park development on the west side of Highway 99. Through development of the TRIP, Turlock aims to enable significant industrial development and improve the jobs-housing balance in the area. The plan covers land use regulations, design guidelines, and phasing. Through the creation and nurturing of an 'Agri-Science' industry cluster, which would include biotech, life sciences, and agri-business, the TRIP aims to create a "bridge" for Turlock's current agriculture and manufacturing industries to transition to newer products and technologies.
- **A strong existing food processing sector,** including such large employers as Foster Farms, Sensient Flavors, Supherb Farms, and Mid-Valley Dairy. These businesses form an "anchor" and may help attract similar establishments by appearing as a long-time successful industrial node.
- **Emanuel Medical Center,** with its 209-bed acute care hospital, 145-bed skilled nursing facility, 49-bed assisted living facility, and outpatient medical offices for primary care on Colorado Avenue and Monte Vista Avenue, is both a community and a regional asset and a source of high paying, high-skilled jobs.

Many unincorporated county islands are in need of substantial investment and public infrastructure improvements.

- **Downtown Turlock,** anchored by City Hall, is home to historic building stock, recently implemented streetscape and public realm improvements, and a number of restaurants and specialty shops. The Downtown Property Owners Association is actively involved in the betterment and continued development of Downtown and works closely with the City. Additionally, in 2008, a Branding, Development, and Marketing Action Plan was completed for the Downtown that posed the idea of a bridal shopping and wedding planning theme for the area.
- **Youth Sports.** Particularly with the completion of the Regional Sports Park, Turlock has become a center for youth sports competitions attracting teams from across the State. This activity has had noticeable positive "spin-off" impacts, providing business for hotels and restaurants. With the establishment of more community parks through 2030, as well as increased utilization of the County Fairgrounds, Turlock can further establish itself as a youth and amateur sports destination.
- **Competitively priced electricity.** Turlock's homes and businesses receive electric power from the Turlock Irrigation District (TID), which offers power at significantly lower rates than many other providers. For many industrial users with large power needs, such as cold storage facilities, this is a significant asset.
- **An active Chamber of Commerce.** The Turlock Chamber of Commerce, comprised of over 500 members, plays an active role in advocating for business interests and a strong local economy. The Chamber facilitates networking and business opportunities amongst its members, and it maintains a strong working relationship with the City.
- **Available water and wastewater treatment capacity.** With the development and recent upgrade of the Turlock Regional Water Quality Control Facility (TRWQCF), Turlock is well positioned to accommodate future growth in the residential, commercial and industrial sectors. The TRWQFC now produces recycled water suitable for reuse in city landscaping and in industrial processes. The current and planned treatment facilities will occupy less than half of the facility's 140 acre site, allowing for ample future expansion.
- **Land available at low cost.** Not only does the TRIP enable significant industrial development in Turlock, but the specific plan area has ample developable land. Land costs in Turlock are significantly lower than those in coastal California or even the outer edges of the Bay Area; this is the case for both industrial/commercial as well as residential land.

- **Presence of County Fairgrounds.** Turlock hosts the Stanislaus County Fairgrounds, a major asset for business generation and tourist attraction. The Fairgrounds are used not only for the annual County Fair but also for other regional events throughout the year. The County has also expressed interest in expanding the fairgrounds.

Turlock's Challenges

Turlock's economic development strategy must not only capitalize on the City's strengths, but also recognize and address its challenges. Some challenges that Turlock faces regarding economic growth include:

- **Location.** While Turlock is ideally located for distribution to west coast markets, particularly the San Francisco Bay Area, other nearby cities enjoy this same advantage, including Modesto, Manteca, and Lodi. Moreover, Turlock has excellent access to Highway 99 but limited access to Interstate 5. The City cannot change its location, but it can direct its efforts toward economic development that benefits from the City's location but is not entirely dependent upon it. Additionally, planning efforts are underway with Stanislaus County and the City of Patterson to develop West Main Street as an east-west expressway that would connect Turlock more efficiently to I-5.

- **Downtown Turlock.** While Downtown has made great strides in recent years, the current economic downturn has taken a toll on the area's vitality. The deep recession that has affected the entire nation has also impacted Downtown Turlock, raising vacancy rates and turnover in the past few years. The existing stores and the presence of City Hall create activity during the day, but the area experiences less activity at night. More people living close to Downtown, and more active uses in Downtown buildings (or new buildings) would be of great benefit.

- **Lack of linked economic activities.** While Turlock has numerous economic assets and several employers with over 1,000 jobs, they have not attracted a significant amount of linked economic activities—either because they take care of their needs in-house, or because they rely on suppliers and other businesses outside of Turlock or even the State. Some examples of linked activities and economic synergies do exist, such as between the hospital and the university's nursing program, but more horizontal and vertical linkages could be made.

Economic development policies aim to both attract new economic growth as well as support and strengthen the city's existing business establishments.

New industrial establishments are an important employment generator for the city.

- **Social Issues and Public Safety.** Turlock, like many other communities in the Central Valley, struggles with a number of social issues such as homelessness. While the majority of Turlock's neighborhoods are safe and secure, the persistence of some of these social and public safety issues may affect the city's image.
- **Perception of Permit Process for Small Businesses.** Many involved in Turlock's economic development have voiced concern over the City's practices as not being sufficiently "business friendly" to attract new employers. Even though the City has made strides in improving its permitting process, some involved in Turlock's economic development voice concern over the perception of the City's practices as not being sufficiently easy and welcoming to attract new employers. Rigid code enforcement for small businesses and renovations were cited as potential problem areas.
- **Transportation and Infrastructure Maintenance.** The City has struggled to maintain the quality of existing city streets that are seeing heavy industrial truck traffic, and those in the western neighborhoods. Much of this is attributable to fiscal issues. Investment in infrastructure is critical to attracting businesses, but at the same time, the City must maintain a fee structure that requires major users to help pay the way.
- **County Islands.** Turlock has several areas of unincorporated county land surrounded on all sides by the incorporated city, creating "county islands." Because the county is lands are not served by city infrastructure, the lack of improvements and the quality of development is generally below the City's standards and therefore negatively impacts Turlock's image. The City is engaged in developing a strategy with Stanislaus County to incorporate and upgrade these areas.

Economic development policies aim to both leverage the City's assets and address its challenges in order to foster continued economic growth through 2030. The policies presented in this section include specific economic development programs as well as more generalized strategies for improving the City's overall business climate and image, and promote a positive working relationship with the private sector. Other related policies, especially pertaining to Downtown, transportation and utilities, and public safety can be found elsewhere in this Chapter, as well as in Chapter 3 (New Development Areas), Chapter 5 (Circulation), Chapter 6 (City Design), and Chapter 10 (Safety).

POLICIES

Guiding Policies

2.11-a **Support existing businesses.** Retain, improve, and promote existing businesses in Turlock and foster local start-up businesses.

2.11-b **Attract businesses to serve local residents and regional shoppers.** Attract community-serving retail, and basic industrial and service activities to meet the needs of our residents, while continuing to promote and develop Turlock as a regional shopping destination.

2.11-c **Facilitate new development.** Define clear development standards and process development applications expeditiously.

2.11-d **Support and maintain Downtown Turlock.** Support and contribute to a clean, safe, pedestrian-friendly, and well-maintained Downtown.

2.11-e **Strengthen the City's image.** Create an image for Turlock that will help attract and retain economic activity, and proactively market that image regionally and statewide.

2.11-f **Sustain fiscal health.** Ensure the continued economic sustainability of the community and fiscal health of the City government.

2.11-g **Maintain the jobs-workers balance.** Maintain a balance between jobs and the number of employed residents.

2.11-h **Recognize and promote strength in the food processing sector.** Even as Turlock pursues jobs in new industries, continue to recognize and promote the City's current strength as a food processing center, with a workforce highly skilled in this industry.

Implementing Policies

Industry Targeting and Recruitment

2.11-i **Monitor new industrial trends.** Monitor regional, state, and national economic trends in order to identify new and emerging industries suitable for Turlock.

Among others, industries to watch include agricultural and food sciences, clean technology manufacturing, and health care,

2.11-j **Engage in strategic planning.** Every five years, complete a citywide economic development strategic plan that focuses on industry targeting, job creation, marketing, and local business support. Evaluate progress, accomplishments, and challenges every year in an annual report that will help guide subsequent efforts.

2.11-k **Increase linked activities and businesses.** Work with large existing employers to identify and recruit related businesses and those that provide goods and services to meet their business needs.

2.11-l **Attract jobs for local residents.** Set economic development target and implementation measures to increase the percentage of employed residents who work in the City to 60 percent of the total by 2020.

As of 2000, 49 percent of employed Turlock residents worked in the city.

2.11-m **Bolster sports tournament industry.** Incorporate sports facilities suitable for tournaments into the design of new community parks and recreation areas. Encourage local hotels and other traveler-supported businesses to sponsor sports tournaments and contribute to the upkeep of the facilities in exchange for advertising and marketing rights.

Promoting and Facilitating Industrial Development

2.11-n **Direct industrial users to the TRIP.** Direct new industrial users to the TRIP and continue to implement the WISP.

2.11-o **Advertise available land.** Continue to market the availability of development sites by routinely updating the City's database of available vacant and underutilized parcels and making it available on the City's website. These can include both large industrial and business park parcels in the TRIP as well as smaller office or retail sites in shopping centers, along major roads, and Downtown.

2.11-p **Promote the TRIP.** Develop and implement a marketing strategy aimed at potential large industrial, R&D, and business park employers in order to attract more development and jobs to the TRIP.

2.11-q **Continue to review permit streamlining.** Ensure that the City's permitting procedures are streamlined through the continuing review of the system by the Development Collaborative to solicit input from the business community and work with the City to improve business processes.

2.11-r **Continue to offer economic incentives.** To the extent possible, continue to offer economic development incentives in specific economic zones.

At present, this includes the Enterprise Zone 40. All of the TRIP is included in this zone. The zone makes available a number of beneficial tax deductions, credits, and incentives that reduce the cost of development, hiring, and capital investment.

2.11-s **Re-evaluate fees.** Continue the current effort to update the City's building permit fees to better reflect actual costs to the city. Periodically reevaluate development impact fees to reflect any adjustments in the cost of construction, any outside grant funding awarded to the City, and any other appropriate adjustments.

2.11-t **Improve connection to Interstate 5.** Work with Stanislaus County and the City of Patterson to establish West Main Street as an expressway connecting Turlock to I-5.

2.11-u **Encourage land assembly.** Continue to encourage landowners of small parcels to assemble their properties to better facilitate commercial or industrial development. Strategies can include hosting informational meetings at the City, contacting property owners directly, developing financial incentives for land assembly, and promoting new graduated density zoning amendment (forthcoming; see Policy 2.4-l).

Fostering Partnerships

2.11-v **Engage business organizations.** Maintain a strong working relationship between the City and the Turlock Chamber of Commerce, as well as other local and regional business groups such as the Downtown Property Owners Association and the Stanislaus County Workforce Alliance.

2.11-w **Continue to participate in annual meetings with Chamber of Commerce and the Workforce Alliance.** Continue to participate in the annual summits and business conferences sponsored by the Chamber of Commerce and the Stanislaus County Workforce Alliance in order to identify how the City can best assist them or improve City services.

2.11-x **Continue to participate in local business organizations' meetings.** Continue to attend and participate in all meetings of the Chamber of Commerce and the Downtown Property Owners Association.

2.11-y **Support business outreach strategies.** Continue to support the business outreach strategies of the Development Collaborative Advisory Committee to solicit input on how the City can improve its services.

2.11-z **Foster ongoing and new partnerships with CSUS.** Maintain the City's relationship with CSUS, and continue to pursue new opportunities to work with the university on workforce training, community services, sharing of facilities, and employer recruitment efforts, among others.

2.11-aa **Provide a City resource for regional events management.** Establish a "go-to" person at the City who will be a source of information on upcoming regional events, such as youth sports tournaments. This City resource will be someone that businesses, such as hotels, can contact for information on when large groups of visitors will be coming to Turlock and pursue business opportunities accordingly. Also establish a monthly calendar on the City's website that shows local events.

2.11-ab **County Fairgrounds strategy.** Work with the Stanislaus County Fair Board to either expand the County Fairgrounds at its current site, or to identify a new site west of State Route 99 for relocation.

Workforce Training and Local Start-up Support

2.11-ac **Partner with CSU-Stanislaus in workforce training.** Coordinate with CSU-Stanislaus to publicize available educational and training programs by using the City's website and making information available through the library and City Hall.

2.11-ad **Support new start-ups.** Continue to support the assistance program for local start-up businesses.

Continue to work with the Stanislaus Economic Development and Workforce Alliance and CSU-Stanislaus to establish a branch of the Central California Small Business Development Center (SBDC) in Turlock. SBDCs offer classes in starting and operating a small business.

Supporting Downtown and Neighborhood Commercial Centers

2.11-ae **Enable renovation of Downtown buildings.** Work with the Building Division and a structural engineer to identify less expensive seismic retrofit, fire safety, and ADA compliance options for older buildings Downtown in order to encourage their renovation.

2.11-af **Market the Downtown Turlock commercial district.** Continue working with the Chamber of Commerce and the Downtown Property Owners Association to support marketing, promotions, and events that bring people to Downtown.

In particular, the focus should be on establishing ongoing events (weekly, monthly) that will bring people Downtown on a regular basis. Examples include an additional farmers' market or craft market, children's activities, or an outdoor performing arts/ concert series.

Fostering a Positive Image

2.11-ag **Pursue beautification projects.** Continue implementation of the Downtown Design Guidelines, and begin implementation of the Turlock Beautification Master Plan.

2.11-ah **Market Turlock's assets.** Market information about Turlock's livability, great schools and parks, relative affordability, and other features to prospective employers to help encourage businesses to locate in the city.

2.11-ai **Educate users about the improved permitting process.** Work to diffuse any lingering negative perceptions about Turlock's permitting process by showcasing improvements that have been made in recent years, as well as any future improvements.

2.11-aj **Promote Turlock's workforce.** In addition to marketing Turlock as a desirable destination for new employees, strongly promote the quality of Turlock's existing workforce (high educational attainment, specific skill sets, etc.) to potential employers. Similarly, promote the City's capacity for additional workforce training through partnerships with CSUS.

2.11-ak **Master Wayfinding Program.** Continue to implement Turlock's Master Wayfinding Sign Program, aimed at improving signage and wayfinding throughout the City, improving visitors' experiences in Turlock, and promoting the City's assets.

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