City Of Lodi

Wastewater Master Plan

June 2012

City of Lodi
Wastewater Master Plan

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1. INTRODUCTION

1.1 BACKGROUND

Expansion of the City of Lodi Sanitary Sewer service is required to serve planned development areas. The "Lodi Sanitary Sewer System Technical Report General Plan Update", adopted in 1990, was prepared as an update to the 1961 sewer master plan. The "South Lodi Sanitary Sewer Study for The Harney Lane Lift Station Service Area" was prepared in July, 1992 to modify the plan for service in the southern service area. The "City of Lodi 2009 Wastewater Capacity Study" investigated the dry weather and wet weather flow capacities of the City's existing wastewater pipe system. The "2012 Wastewater Master Plan Update" (2012 Master Plan) determines the sewer system improvements needed to serve expansion of the City. The 2012 Master Plan consolidates the various wastewater studies listed above.

On April 7, 2010, the City adopted the General Plan Policy document that identifies areas to be developed within the City through the year 2030. The General Plan land use information is provided in Figure 1. The 2010 General Plan specifies in Section 3 – Growth Management and Infrastructure, page 3-30 – GM-P11, that the City "prepare master plan documents as necessary during the planning period to address the infrastructure needs of existing and projected growth, and to determine appropriate infrastructure provisions for each phase."

The 2012 Master Plan will present design criteria, define level of service standards, analyze service demands, consider alternative facilities plans and present the recommended plan for providing sanitary sewer service to the community.

1.2 1990 City of Lodi Sanitary Sewer Master Plan

The "Lodi Sanitary Sewer System Technical Report General Plan Update" (1990 Master Plan), was prepared by Black and Veatch Engineering-Architects in 1990. The study area boundary for the 1990 Master Plan encompassed the area approximately defined by the Central California Traction (C.C.T.) Railroad tracks on the east, one mile south of Harney Lane, one half mile west of Lower Sacramento Road and the Mokelumne River on the north.

The 1990 Master Plan identified a network of conveyance pipelines and five lift stations located throughout the City needed to serve future development. The collection system discharged to a 48-inch outfall wastewater pipeline, which conveys wastewater to the City's White Slough Water Pollution Control Facility, located southwest of the City adjacent to Interstate 5.

1.3 Study Area

The 2012 Master Plan study area has been defined to coincide with the General Plan limits for Phase 1 and 2 adding approximately 920 acres to the service area. The boundary of the 2012 Master Plan is shown in Figure 2.

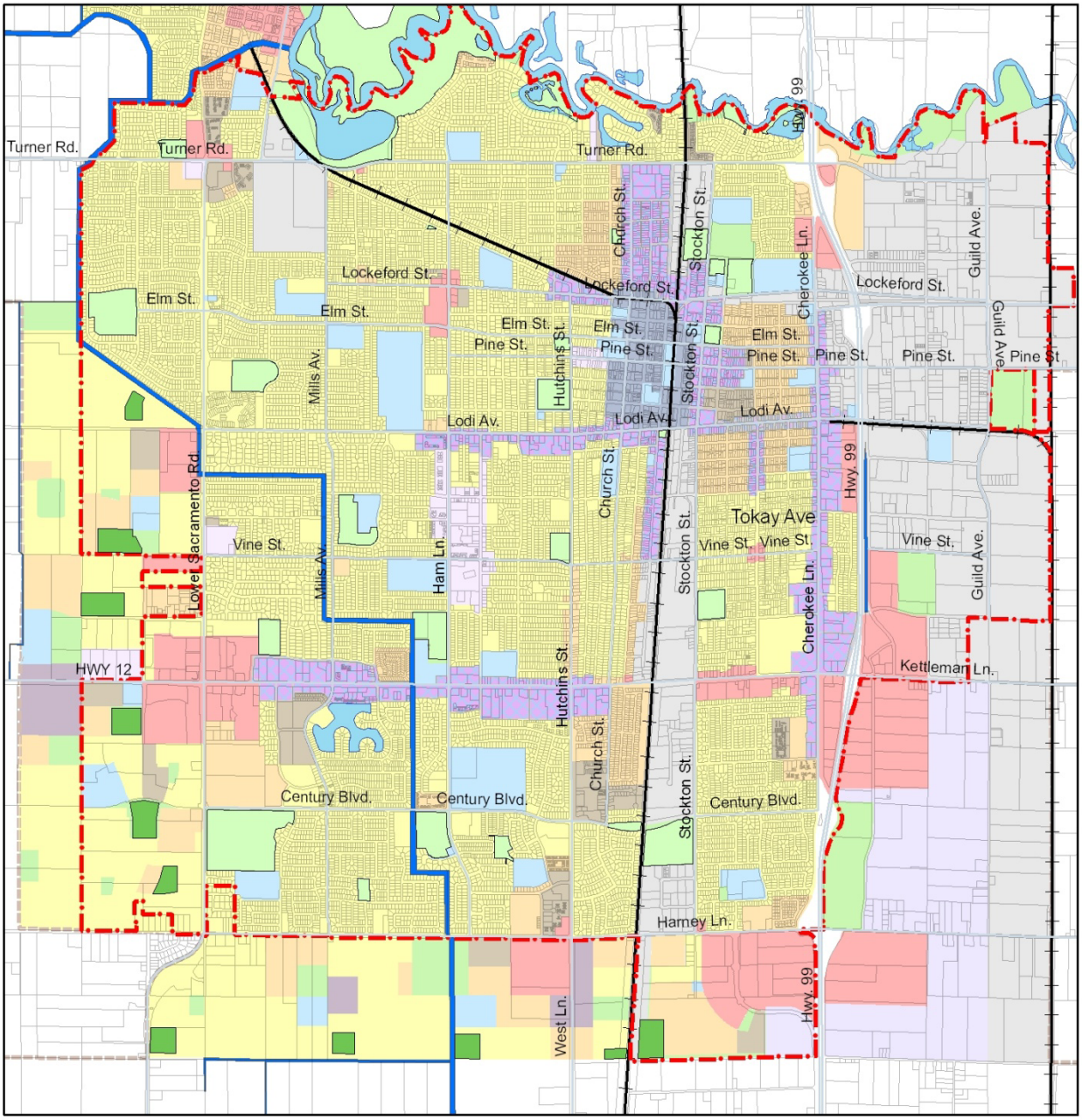

Figure 1
2010 General Plan Land Use Diagram

Legend

General Plan - Land Use

- Future Basins
- City Limits
- Parcels
- Canal
- Parks
- Railroad
- River
- Business Park
- Commercial
- Downtown Mixed Use
- High Density Residential
- Industrial
- Low Density Residential
- Medium Density Residential
- Mixed Use Center
- Mixed Use Corridor
- Office
- Open Space
- Public/Quasi-Public
- Right of Way
- Urban Reserve
- Water

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1 in = 3,000 ft

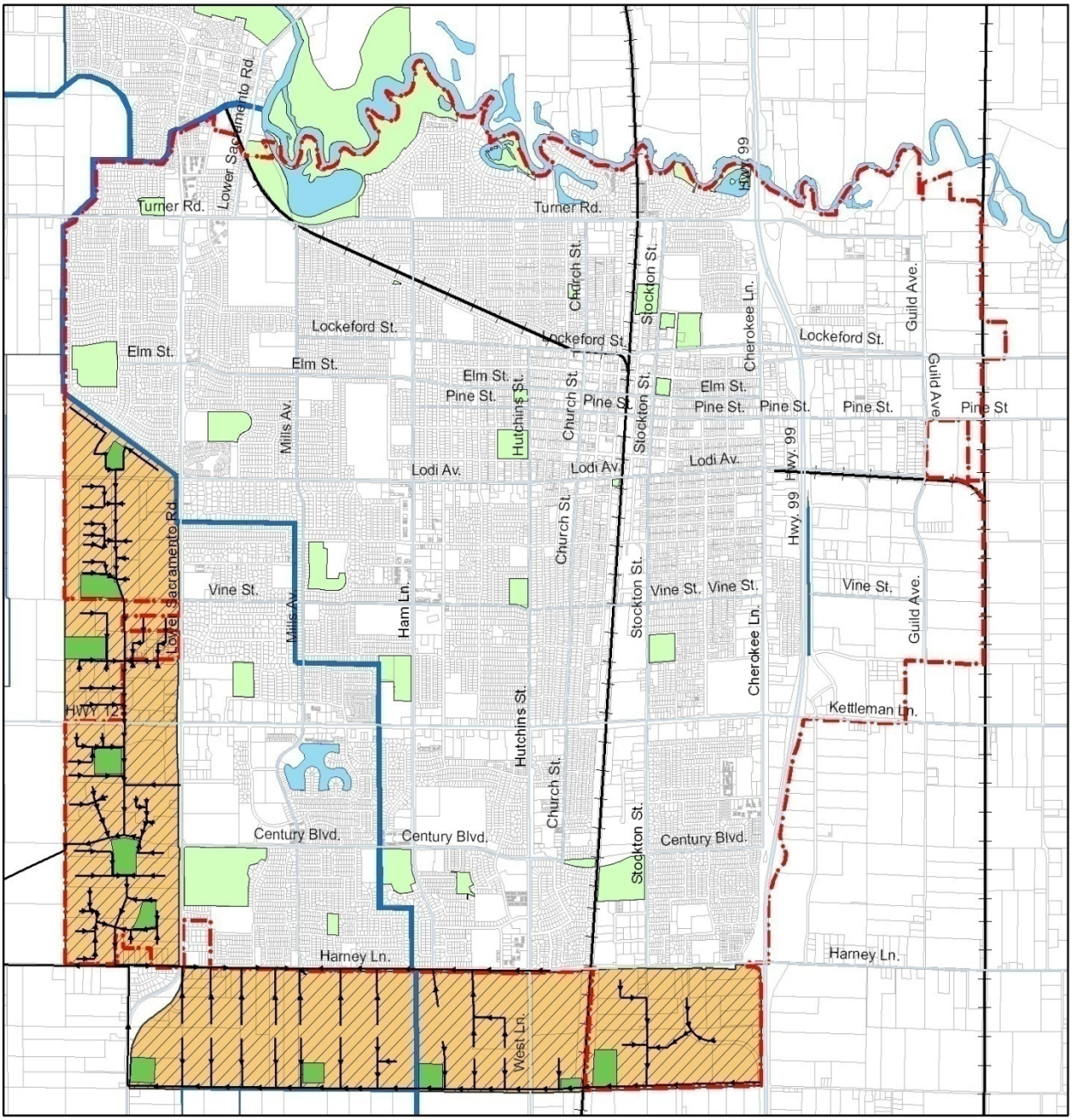

Figure 2
2012 Wastewater Master Plan
Service Area

Legend

- Wastewater Pipe Network
- Future Basins
- City Limits
- Parcels
- Canal
- Parks
- Railroad
- River
- Master Plan Boundaries

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1 in = 3,000 ft

2.1 Existing Collection Facilities

The City's wastewater system currently consist of about 191 miles of collection system pipelines ranging in sizes from 4 to 42 inches in diameter, with 6 inches being the predominant size. The pipelines discharge into a 48 inch sewer outfall line that was rehabilitated in 2008 reducing the pipe diameter from 48 inches to 42 inches, which flows southwest to the City's White Slough Water Pollution Control Facility (WSWPCF) located approximately 6 miles west of town. The existing wastewater collection system is shown in Figure 3.

The wastewater pipelines are constructed primarily of clay, concrete, and PVC pipe materials. The wastewater pipes in the central, eastern and downtown area of the City are the oldest (over 80 years of age) and are primarily clay pipe with concrete joints. The City has initiated a Wastewater Pipe Replacement Program to rehabilitate the wastewater pipes in these areas. The program includes lining the old wastewater pipes with a plastic liner to seal cracks in the pipes and pipe joints and to enhance system efficiency.

There are six wastewater trunk lines (Hutchins Street, Mills Avenue, Ham Lane, Lower Sacramento Road, Stockton Street/Washington Street, Beckman Road shown in Figure 3) serving the city that generally flow from the north to the south. The six wastewater trunk lines connect to the Century Boulevard Trunk Line that flows east to west, and into the 42 inch trunk sewer to the WSWPCF.

There are five lift stations located in the northern area of the city, Evergreen Pump Station, Woodlake Pump Station, Rivergate Pump Station, Mokelumne Pump Station and Cluff Pump Station, and three lift stations located in the southern area of the City, Tienda Pump Station, Harney Lane Pump Station and Reynolds Ranch Pump Station. Figure 3 provides the locations of the eight existing lift stations.

2.1.1 Reynolds Ranch Development

The Reynolds Ranch Development project is located between the Union Pacific Railroad and State Route 99 and south of Harney Lane. The Reynolds Ranch Development has a temporary connection to the wastewater trunk line in Stockton Street that connects to the Century Boulevard trunk line. The Century trunk line was not sized to convey the flows from the Reynolds Ranch Development. The Reynolds Ranch Development is in the south wastewater trunk line service area. The south wastewater trunk line will be constructed by future development. The Reynolds Ranch Development temporary connection to the Century trunk line will be allowed until such time as either the south wastewater trunk line is completed or development east of State Route 99 increases such that the capacity of the Century trunk line reaches its full capacity. The piping to re-route the wastewater flows south exists within the Reynolds Ranch Development. The Reynolds Ranch Pump Station will be abandoned once the project is connected to the South Wastewater Trunk Line.

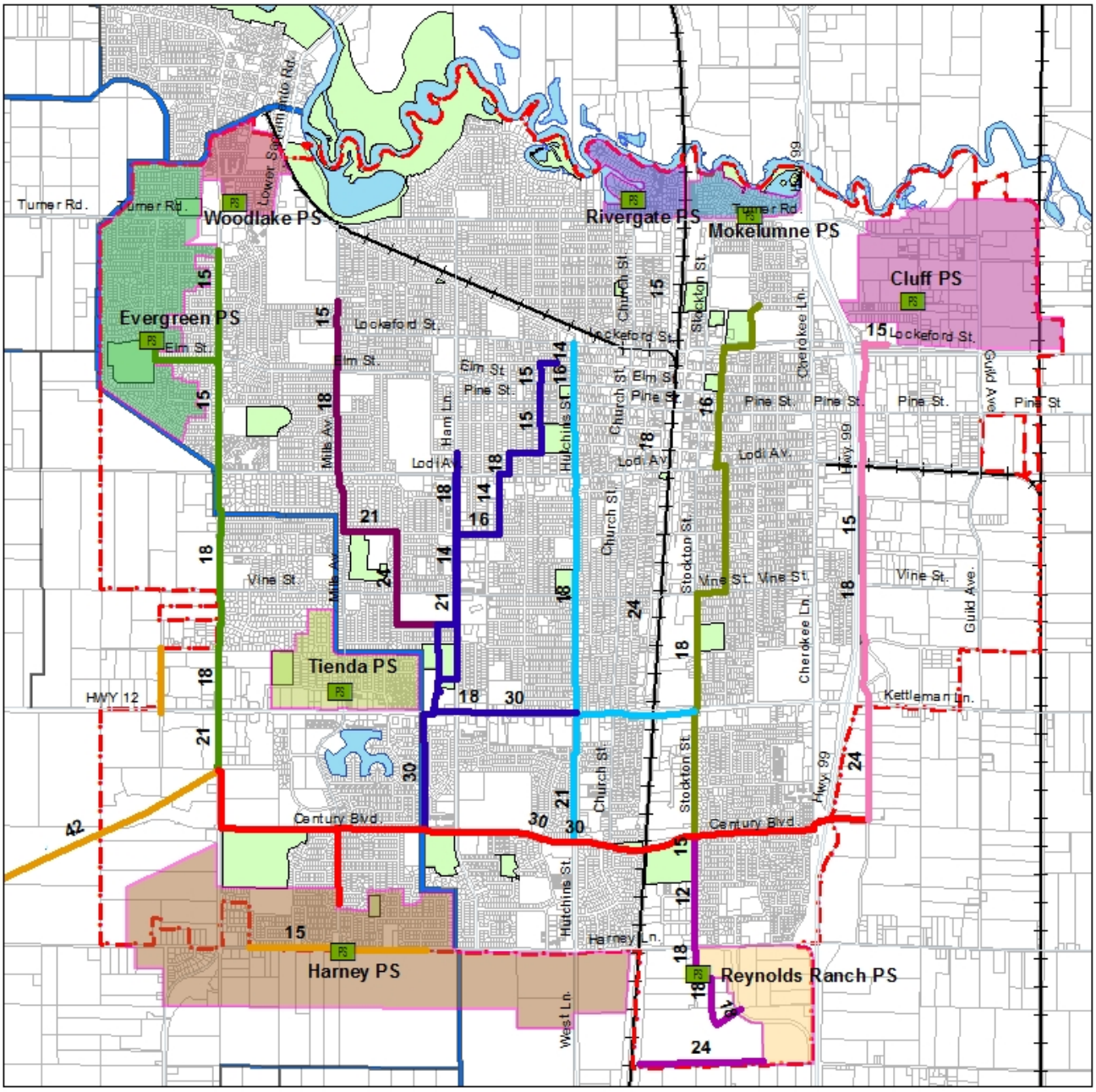

Figure 3
Existing Wastewater Trunk Lines and Pump Station Locations

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1 in = 3,000 ft

Legend

- WW-Lift Stations
- Beckman Trunk Line
- Century Trunk Line
- Ham Trunk Line
- Hutchins Trunk Line
- Lower Sacramento Trunk Line
- Mills Trunk Line
- Reynolds Ranch Trunk Line
- Stockton Trunk Line
- WW - Trunk Lines
- City Limits
- Parcels
- Canal
- Parks
- Railroad
- River

Wastewater Pump Station Service Boundary Map

STATION NAME

- Cluff Avenue Pump Station
- Evergreen Pump Station
- Harney Lane Pump Station
- Mokelumne Village Pump Station
- Rivergate Pump Station
- Tienda/Kettleman Pump Station
- Woodlake Pump Station
- Reynolds_Ranch_Pump_Station

2.1.2 Wastewater Outfall

The existing wastewater collection system flows to a common discharge point on Lower Sacramento Road between Kettleman Lane and Century Boulevard. From this point, a sewer outfall conveys wastewater from the city to the wastewater treatment facility. The outfall was constructed in 1967 using reinforced concrete pipe. It was recently (2008) slip-lined to remediate corrosion problems, thereby reducing the pipe diameter from 48 inches to 42 inches. The existing ditch to Lower Sacramento Road segment in Table 1 below, was not slip-lined in 2008 because it will be replaced and realigned by new development bordering this segment (see Appendix A for realignment of the pipeline segment). Although the liner has reduced the outfall trunk line diameter from 48 inches to 42 inches, the reduction in the interior roughness of the outfall pipeline will increase the pipe capacity to offset the slight decrease in capacity due to the reduced pipe diameter.

The outfall pipeline has three segments with different slopes and different corresponding capacities. The segment capacities are summarized in Table 1. Based on the City's sewer design criteria, sewers must convey the peak wet weather flow at a water depth of no more than 75% of the pipe diameter. The capacity of the outfall pipeline is 19.0 mgd as shown in Table 1. The existing peak flows are estimated at 14.21 mgd and the future peak flows are estimated at an additional 5.91 mgd for a total of 20.12 mgd. A parallel outfall pipeline will be needed to convey the peak wet weather flow before complete development of the 2012 Master Plan can occur. Alternatively, a recycled water treatment facility or a peak flow equalization/storage facility might be constructed near the city.

Table 1: Evaluation of Outfall Capacity

Segment of Slip Lined 42 inch Pipe	Pipe Capacity (MGD)[1] Full Pipe Capacity	3/4 Full Capacity
Treatment Plant to Thorton Rd (2,950 ft)	20.4	18.6
Thornton Rd to Existing Ditch[2] (17,830 ft)	19.0	17.3
Existing Ditch to Lower Sacramento Rd (2,980 ft)	16.6	15.1

[1] Capacity analysis is based on the drawing set "Sanitary Sewer Outfall Pipeline No. 2" as-built drawings dated December 28, 1967 using a Manning's n value of 0.013.

[2] Existing ditch is 3,000 feet downstream of Lower Sacramento Road.

Source: West Yost Associates, 2009

2.2 Wastewater Treatment Plant Description

The wastewater treatment facility has a current average dry weather flow capacity of 8.5 million gallons per day (mgd). Current dry weather flow is slightly less than 6.0 mgd. The wastewater treatment facility was originally constructed in 1966 with a capacity of 5.8 mgd.

In the late 1980's and early 1990's the City expanded the treatment capacity to 6.3 mgd, and also improved the level of treatment. Between 2003 and 2009 the City again expanded the dry weather treatment capacity to the current 8.5 mgd and added denitrification, tertiary treatment and ultraviolet light disinfection improvements.

In conjunction with the 2007 improvements to the WSWPCF, the 48 inch trunk line from the City limits to the treatment plant influent headworks was lined, thereby reducing the diameter to 42-inches.

2.3 Regulatory Requirements

Wastewater lines shall be designed in accordance with acceptable engineering principles, California OSHA Standards, State of California Title 22 requirements and shall conform to City Standards. Storm water collection facilities shall not be connected to a wastewater line. Industrial waste sources may be connected or discharged into a wastewater line with approval of the City Engineer.

2.4 2009 Wastewater Capacity Study

The "2009 Wastewater Capacity Study" (Capacity Study) investigated the dry weather and wet weather flow capacities of the City's wastewater pipe system in accordance with State Water Resources Control Board Statewide General Waste Discharge Requirements Order No. 2006-0003. Data for wastewater mains having diameters of 8 inches or larger was used to develop a wastewater model to simulate various flow scenarios. In addition, a city-wide flow monitoring study was conducted to provide the necessary flow data to calibrate the wastewater model under both dry weather and wet weather conditions.

The model results indicate that the City's wastewater collection facilities can accommodate existing dry weather peak flow conditions without surcharging. During peak wet weather conditions, the model has identified several locations throughout the City that experience surcharged conditions, but in no scenario did the model predict a wastewater overflow condition (hydraulic grade line elevation higher than structures).

Table 2 summarizes the peaking factors presented in the Capacity Study incorporating factors for a 2 year design storm, 5 year design storm and 10 year design storm. The 2012 Storm Drainage Master Plan changed the design criteria from a 2 year storm to a 5 year storm to provide greater protection against localized flooding events. To be consistent with the Storm Drainage Master Plan, the 2012 Wastewater Master Plan will use the 5 year storm for design purposes.

Table 2: Wastewater Collection System Design Standards Wastewater Peak Flow Factors

Land Use	2-year Storm[1]	5-year Storm	10-year Storm
Commercial	3	3.2	3.5
Industrial	2	2.8	3
Residential	1	1.1	1.2

[1] Table 3-4 from Capacity Analysis Study

2.5 Design Criteria

Design criteria for the wastewater system are outlined in the City of Lodi Public Improvement Design Standards (Design Standards). Criteria include generation factors, peak flow factors, minimum pipe size, design depth, minimum and maximum velocity, minimum cover, manhole placement and spacing.

2.5.1 Wastewater Flow

Wastewater flow will be estimated as follows:

1. Generation factors will be obtained from the Capacity Study Wastewater generation factors are shown in the table below.

Table 3: Wastewater Collection System Design Standards
Wastewater Generation Factors

Land Use	Designation	Density (units/acre)	Wastewater Generation Factor[1] (gpd/acre)
Commercial	C	--	2,000
Industrial	IND	--	1,500
High Density Residential	HDR	25	3,500[2]
Medium Density Residential	MDR	15	2,520[3]
Low Density Residential	LDR	6	1,197[4]
School	School	--	

[1] Table 2-1 from 2009 Wastewater Capacity Study
[2] Generation rate based on 70 gpd/person, 2 persons/unit and 25 units/acre
[3] Generation rate based on 70 gpd/person, 2.4 persons/unit and 15 units/acre
[4] Generation rate based on 70 gpd/person, 2.85 persons/unit and 6 units/acre
[5] School generation factor is 22 gallons/student

2. Peak flow factors are defined in the Design Standards. The factors include allowances for inflow and infiltration (I/I):

   Commercial land use peaking factor – 3.2

   Industrial land use peaking factor – 2.8

3. Residential land use peaking factor curve based upon the upstream population generating wastewater. The Residential Peaking Factor chart is included in the Design Standards Section 2.200.

2.5.2 Collection and Conveyance Facilities

The collection system is a gravity flow system that meets the hydraulic grade line criteria set forth in Section 2.300 of the City of Lodi Design Standards. The actual collection system that is constructed will be different in that the alignments will follow the street patterns, and the slopes and lengths may vary. At the time of development, preparation of detailed sanitary sewer master plans will be a required.

2.5.3 Pipe Design

Pipes shall be designed for peak flow conditions in conformance with City Design Standard 2.300. Wastewater pipes 10 inches or smaller shall be designed to flow a maximum of one-half full at peak design flow. Wastewater trunk lines 12 inches or larger shall be designed to flow a maximum of three-fourths full at peak design flow.

All wastewater pipes shall be designed to use the available slope to give flow velocities of not less than 2.0 feet per second based on Manning's formula using an "n" value of 0.013. Minimum slopes and corresponding design capacity are shown in Table 4 below.

Table 4: Minimum Slopes and Design Capacity

Size (inches)	Minimum Slope	Design Cap (cfs)	Full Capacity (cfs)
6	0.0048	0.20	0.39
8	0.0033	0.35	0.70
10	0.0025	0.55	1.10
12	0.0019	1.45	1.56
15	0.0014	2.25	2.42
24	0.00085	5.60	6.50

Maximum velocity shall not exceed 10 feet per second under peak flow conditions. It is understood that it is impractical to meet these velocities at upstream ends of the collection system, and the standard may be waived in most cases.

2.5.4 Pipe Alignment

Public wastewater main alignments shall be in conformance with City Design Standard 2.300. All public wastewater mains shall be located in public streets unless installation in a public utility easement is specifically approved by the Public Works Director. For installations in public utility easements, sufficient easement width shall be provided to allow access for future maintenance. The wastewater mains shall be located under paved surfaces wherever possible to allow all weather access.

The future wastewater pipeline sizes and alignments are shown in Appendices A, B, C and D.

3. FUTURE COLLECTION SYSTEM

3.1 Model Software

The City selected Bentley's SewerCAD V8i modeling software for the wastewater model. The City is using Bentley's WaterCAD and StormCAD software for modeling the City's water and storm drainage systems. SewerCAD contains a graphical/GIS interface and has the ability to model dry/wet weather flows in extended period simulations along with other useful tools for wastewater system modeling. The software has the ability to import GIS layers and output files to AutoCAD and GIS.

3.2 New Facilities

Proposed lift stations shall be specifically approved by the City Engineer after consideration of all reasonable gravity flow alternatives. Design standards for temporary stations shall be determined on a case-by-case basis. Lift station structures, electrical and mechanical equipment shall be located and designed such that they are protected from physical damage by the 100 year flood and will remain fully operational and accessible during the design storm.

Lift stations shall be located off the travelled way of streets and alleys and shall be provided with paved vehicular access and appropriate security as required by the City Engineer.

3.3 Pipe Alignment and Sizing

Two new trunk lines are expected to be added to the existing wastewater system. The south wastewater trunk line will flow from the east to the west and will be located along the southern boundary of the City limits. The trunk line will extend from one-half mile east of State Route 99, westward to Lower Sacramento Road, north along Lower Sacramento Road/Extension Road and west along Harney Lane to Davis Road where the trunk line will connect to the existing 42 inch wastewater outfall line. The south wastewater trunk line shall be constructed of either lined concrete pipe (T-Lock) or vitrified clay pipe. Alternative west end alignment will be evaluated during the preliminary design of construction.

A second trunk line will flow from the north to the south along the western boundaries of the 2012 Master Plan. The trunk line will extend from north of Lodi Avenue, south along Westgate Drive and connect into the 48 inch wastewater outfall line approximately 2,400 feet south of Kettleman Lane.

The proposed wastewater collection system for the 2012 Master Plan is shown in Appendix A, B, C and D. The layout is based on the General Plan Land Use plan presented in Figure 1. The wastewater collection system shown has been skeletonized and only the major wastewater lines (8 inch pipes or larger) are shown. Additional wastewater pipelines required for interior collection shall be master planned as future development occurs.

3.4 Interim Facilities

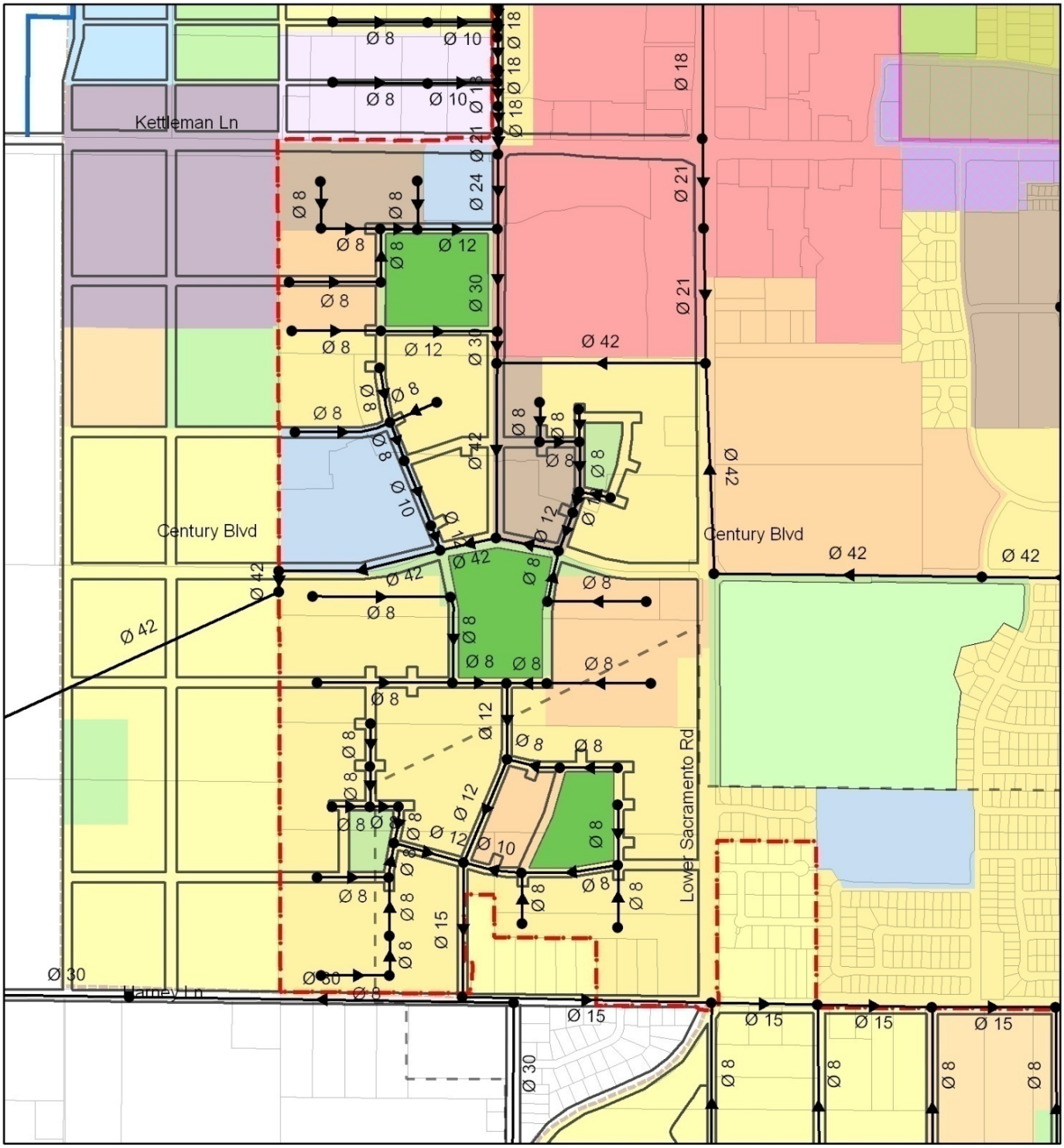
In the event a property develops prior to the construction of the master facilities, interim facilities may be required that would provide the same level of service as the master plan facilities.

3.5 Finance and Implementation Plan

Construction of the 2012 Master Plan Facilities will be dependent upon the rate and pattern of development in the study area. The cost and financing of the improvements shall be determined as part of the City of Lodi Impact Mitigation Fee Program Update that is being adopted concurrently with this report. Financing alternatives include, but are not limited to, developer financing on a pay-as-you-go basis or through a new City-wide development impact fee program. Special financing for construction of the south wastewater trunk line will likely be required.

Appendix A

Wastewater Pipe Layout Kettleman Lane to Harney Lane



Wastewater Pipe Layout
Kettleman Lane to Harney Lane

Legend

- Wastewater Piipe Network
- Manhole
- Future Basins
- City Limits
- Harney Lift Sta Bdry
- Canal
- Parks
- Railroad
- River

General Plan - Land Use

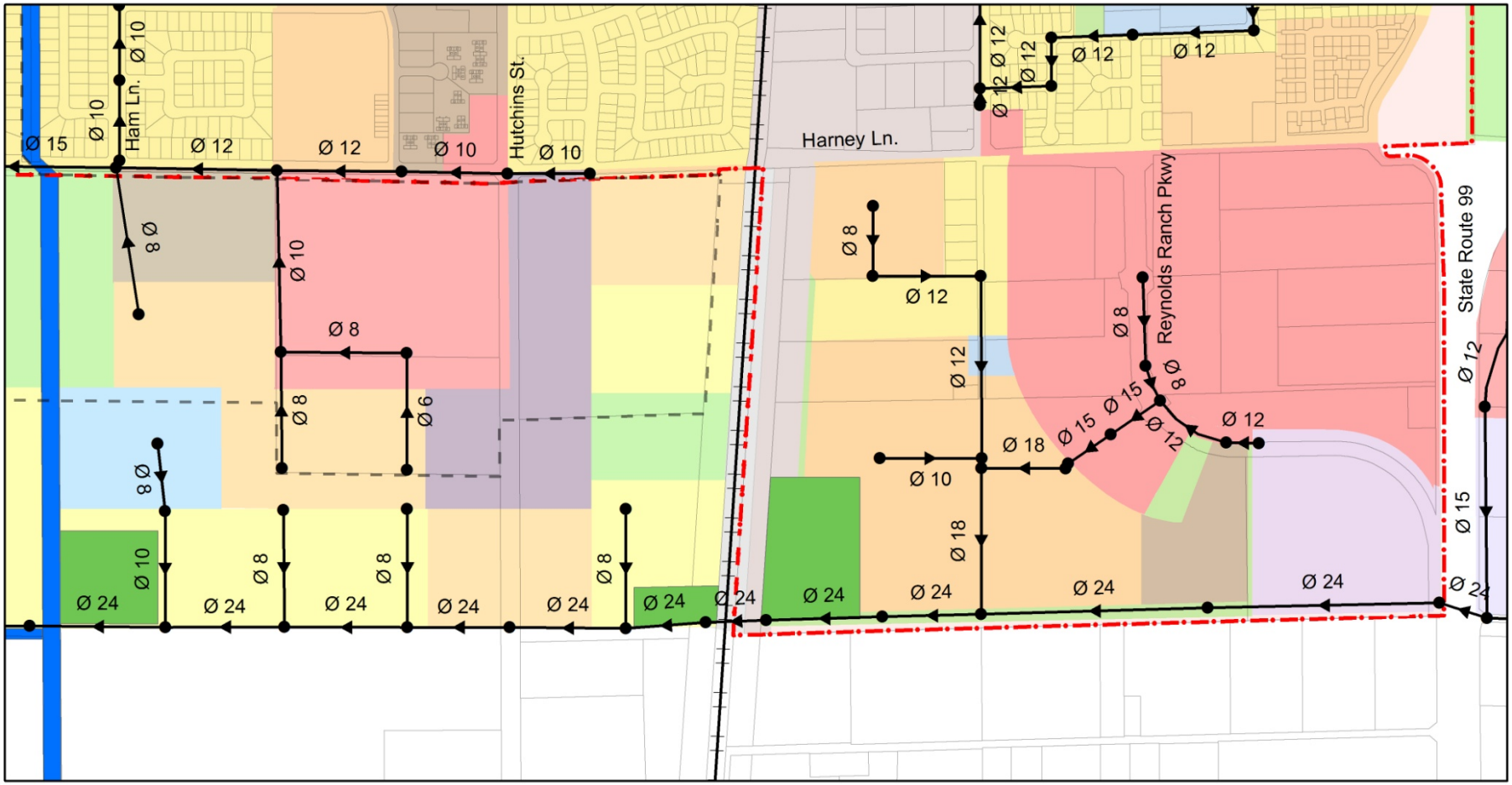
- Business Park
- Commercial
- Downtown Mixed Use
- High Density Residential
- Industrial
- Low Density Residential
- Medium Density Residential
- Mixed Use Center
- Mixed Use Corridor
- Office
- Open Space
- Public/Quasi-Public
- Right of Way
- Urban Reserve
- Water

N W E S

1 in = 800 ft

Appendix B

Wastewater Pipe Layout South of Harney Lane State Route 99 to WID Canal



Wastewater Pipe Layout
South of Harney Lane
State Route 99 to WID Canal

Legend

- Wastewater Pipe Network
- Future Basins
- City Limits
- Canal
- Harney Lift Station Boundary
- Parks
- Railroad
- River

General Plan - Land Use

- Business Park
- Commercial
- Downtown Mixed Use
- High Density Residential
- Industrial
- Low Density Residential
- Medium Density Residential
- Mixed Use Center
- Mixed Use Corridor
- Office
- Open Space
- Public/Quasi-Public
- Right of Way
- Urban Reserve
- Water

N W E S

1 in = 800 ft

Appendix C

Wastewater Pipe Layout South of Harney Lane WID Canal to Lower Sacramento Road

Wastewater Pipe Layout
South of Harney Lane
WID Canal to Lower Sacramento Road

Legend

- Pipe Network
- Manhole
- Future Basins
- City Limits
- Harney Lift Station Boundary
- Canal
- Parks
- Railroad
- River

General Plan - Land Use

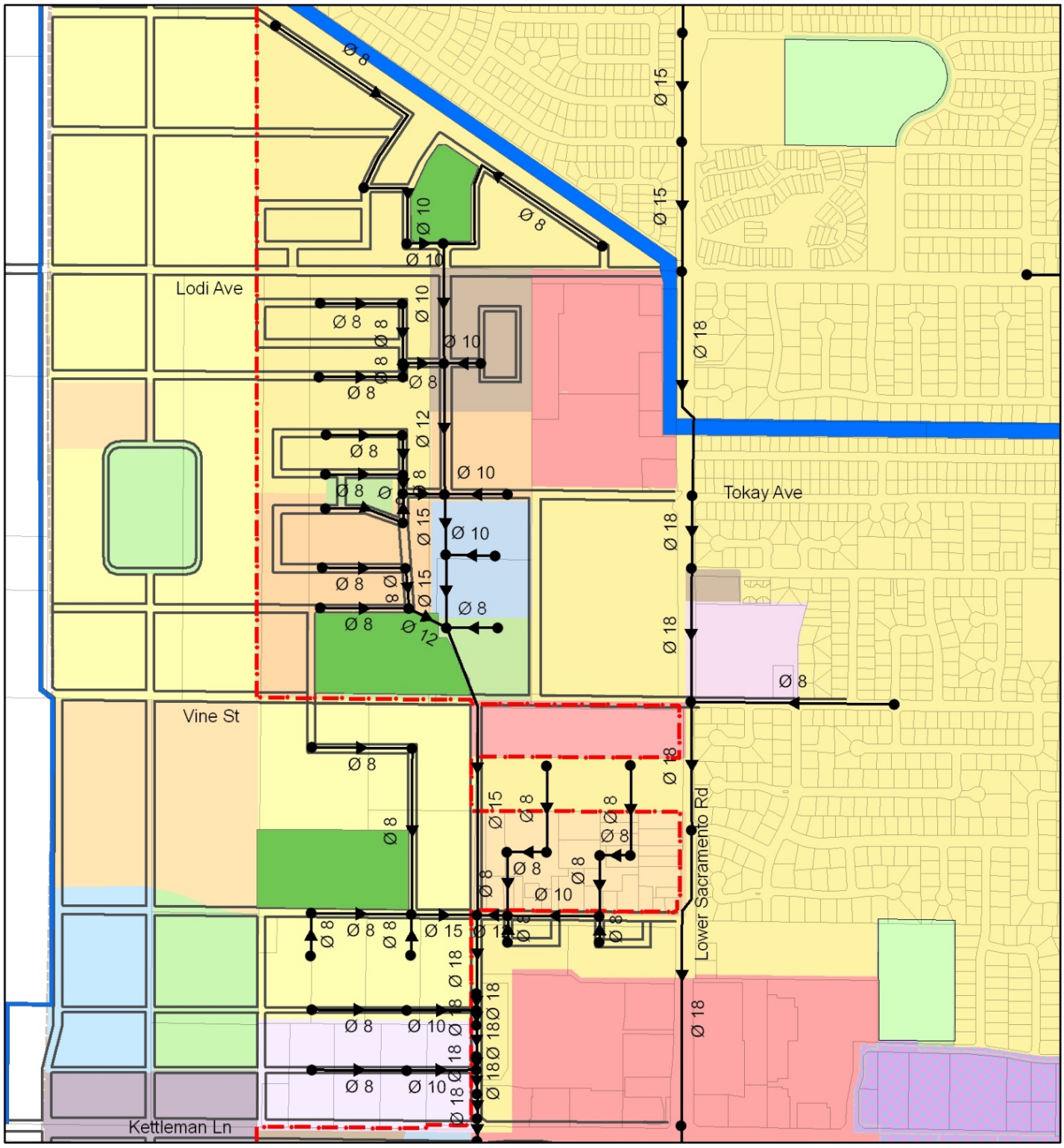
- Business Park
- Commercial
- Downtown Mixed Use
- High Density Residential
- Industrial
- Low Density Residential
- Medium Density Residential
- Mixed Use Center
- Mixed Use Corridor
- Office
- Open Space
- Public/Quasi-Public
- Right of Way
- Urban Reserve
- Water

N W E S

1 in = 800 ft

Appendix D

Wastewater Pipe Layout Lodi Avenue to Kettleman Lane



Wastewater Pipe Layout
Lodi Avenue to Kettleman Lane

Legend

- Pipe Network
- Future Basins
- City Limits
- Canal
- Parks
- Railroad
- River

General Plan - Land Use

- Business Park
- Commercial
- Downtown Mixed Use
- High Density Residential
- Industrial
- Low Density Residential
- Medium Density Residential
- Mixed Use Center
- Mixed Use Corridor
- Office
- Open Space
- Public/Quasi-Public
- Right of Way
- Urban Reserve
- Water

N W E S

1 in = 800 ft