City of Petaluma

Floodplain Management Plan

October 2015

11 English Street
Petaluma, CA 94952
707-778-4303
Fax 707-776-3602
Email: publicworks@ci.petaluma.ca.us

CITY OF PETALUMA
FLOODPLAIN MANAGEMENT PLAN

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Plan Introduction

The Federal Emergency Management Agency (FEMA) first issued Flood Insurance Rate Maps in 1980. Since that time, the City of Petaluma has made a concerted effort to manage the development of its floodplain by the adoption of various ordinances, regulations and practices, and by incorporating floodplain management goals into the City's General Plan 2025, adopted in May of 2008. The City of Petaluma joined the National Flood Insurance Program (NFIP) in 1983 and adopted its first Floodplain Management Plan (FMP) in 1995. The City updated and re-adopted its plan in October of 2001 and October of 2010.

The City of Petaluma participates in the Community Rating System (CRS) as one of its efforts to reduce potential losses due to flooding for its citizens. This program, created by the NFIP, encourages communities to become proactive in their flood management planning activities. Under this program, participating communities receive a point rating reflective of their efforts in undertaking these activities. The CRS ratings result in reduced flood insurance premiums to floodplain residents and property owners.

The NFIP has conducted annual audits of the City's floodplain management efforts for over two decades and has awarded the City a Class 6 rating, thus reducing flood insurance premiums throughout the City by 20 percent. According to FEMA, as of June 30, 2015, there were approximately 393 flood insurance policies currently in effect, with an annual premium of over $418,774. It is estimated that the City's participation in the CRS program saves insured residents $83,755 per year.

1.1 Preparation of the Floodplain Management Plan (FMP) 2015 Update

To prepare this updated FMP, the City of Petaluma organized a technical advisory committee (TAC) of staff members from various departments as well as outside agencies and committees. The TAC members are:

Curtis M. Bates, P.E., City Engineer, City of Petaluma
Scott Duiven, Senior Planner, City of Petaluma
Leonard Thompson, Fire Chief, City of Petaluma
Erica Ahmann Smithies, Senior Civil Engineer P.E., City of Petaluma
Trae Cooper, GIS Manager, City of Petaluma
Philip Wadsworth, P.E., Sonoma County Water Agency
John FitzGerald, P.E., P.L.S., Zone 2A Flood Advisory Committee

The TAC met multiple times over the course of this update to participate in the Floodplain Management Plan update process. The meetings focused on the following plan elements:

- Assessing the Hazard
- Assessing the Problem
- Setting Goals
- Reviewing Possible Activities
- Drafting an Action Plan

The Floodplain Management Plan update process also involved the public in several ways. A questionnaire was developed soliciting the general public's views on flood control practices and how they may impact individual homeowners, as well as their opinion on how flood activities should be prioritized. The questionnaire was mailed to 696 properties located in the special flood hazard area. The City received approximately 87 completed questionnaires which is a 13% response.

A public meeting was held to involve the public in the planning process. The meeting was held at Petaluma Community Center, which is located in the special flood hazard area, on August 19, 2015. At this meeting, the attendees were presented with information regarding the status of flooding in the Petaluma area, a description of the floodplain management plan process and the CRS program, and a discussion of the structural and non-structural floodplain management activities the City is presently undertaking. A question/answer session was held after the formal presentation. Paper forms for additional comments that could be mailed or turned in to City staff were also available at the public meeting.

City staff also coordinated with the following agencies in the course of the Floodplain Management Plan update process. These agencies were invited to participate in the planning process and/or were provided with copies of the Draft FMP report for their review and comment:

U.S. Army Corps of Engineers
333 Market Street, 7th Floor
San Francisco, CA 94105

California State Dept. of Fish & Game
P.O. Box 47
Yountville, CA 94599

Sonoma County Permit
and Resource Management Dept.
2550 Ventura Avenue
Santa Rosa, CA 95403-2829

CA Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

1.2 The FMP Document

This document presents an updated FMP for the City of Petaluma. The purpose of this updated FMP is to ensure that an open public process is followed in pursuing the reduction of flood losses, and that the selected activities are best for the community. This plan describes the nature and magnitude of flooding the City has experienced in the past; floodplain management activities implemented to date; additional alternative remedies; and a plan for future action to address the current flooding problems. It is not the purpose or the intent of this plan to commit the City to large public expenditures. The objective is to quantify the problem and propose solutions that can be undertaken at this time, and in the future, if and when funds become available.

The FMP is intended to be a living document and will be subject to revisions to reflect changes in City policy and state and/or federal regulations.

2. Flood Hazard Assessment

2.1 Community Background

Incorporated in 1858, the City of Petaluma is situated in southern Sonoma County, in northern California, northwest of San Pablo Bay (Figure 1)**.** San Francisco is 35 miles to the southeast. Petaluma occupies an area of 13.6 square miles along U.S. Highway 101 (City of Petaluma GIS Data, 2015). According to the 2015 census, the current population of Petaluma is 59,322.

The Petaluma Valley is a relatively flat alluvial plain developed by overlapping and coalescing alluvial fans derived from the erosion of volcanic rocks in the bordering highlands. This alluvium is comprised of clays, silts, and floodplain sediments, with minor layers of sand and pebble gravels. The elevation ranges from sea level (National Geodetic Vertical Datum of 1929) at the Petaluma River to over 400 ft. in the surrounding hills. The valley enjoys a Mediterranean type of climate, characterized by long, dry summers and cool, wet winters. Temperatures remain moderate throughout the summer and seldom drop below 22 degrees Fahrenheit in the winter. The average annual precipitation over the basin is estimated at 26 inches (City's Consulting Meteorologist, Jim Goodridge).

Development in the urban area consists of residential subdivisions, office complexes, small businesses, schools, shopping centers parks and open space. Through the years, growth has resulted in encroachment upon many segments of the waterways and floodplains in the urban area. A typical waterway courses through a combination of natural and improved sections, with bridges and culverts located at frequent intervals. Buildings and homes have been built along the banks, often limiting the flood-carrying capacity (FEMA, 1989).

Petaluma is now in the final stages of a multi-million dollar Flood Control Project undertaken in partnership with the Army Corps of Engineers. Although the project has been marked with delays in funding and cost increases, the final stages are currently under construction and scheduled for completion in November of 2015. The Flood Control Project will be outlined in more detail later in this report. Once completed, it will effectively eliminate the repetitive loss zone within the Payran reach of the City, and will provide 100-year flood protection to this neighborhood.

In May of 2008, the City Council adopted a new General Plan. The General Plan contains several policies aimed at improving floodplain management within the City of Petaluma and its watershed. These policies will be described in more detail throughout this FMP. General Plan chapters 4, "the Natural Environment", and 8, "Water Resources" have been included in the FMP appendix A and B.

2.2 History of Flooding

In the mid-1800's storm water runoff from the Petaluma watershed, which drained to the Petaluma River and its tributaries, often overtopped the existing channels and spread across the valley until it could return to the waterways and complete its flow to San Pablo Bay. In the ensuing century, with settlement of the town of Petaluma and the surrounding areas, and the urbanization of the region since the 1950's, such overflow could no longer be tolerated. Measures were implemented to improve drainage and control the flooding -- flood control projects were constructed, standards were adopted for private development, and floodplain zoning was instituted. All of these helped to solve many of the problems but, as was most dramatically evident during the storms of January 1982, February 1986 and most recently December 2005, many problems still existed. The most serious of these is the flooding that occurs along the Petaluma River itself. This waterway, which once meandered across the valley, now flows through the most heavily urbanized area of the City of Petaluma and causes significant damage and disruption when storm runoff from its tributary area exceeds its capacity.

The largest flood of record in the City of Petaluma occurred during the period of January 3-5, 1982, and caused an estimated 28 million dollars in damages. The flood is documented in an Army Corps of Engineers post-flood report. An excerpt of this report read:

> *"During the January 1982 storm, flooding occurred over a 50+ block area on both sides of the river through the City of Petaluma. Most of the 500 homes and the 100 commercial-industrial establishments in this area incurred flood damage. In many cases, water depth reached two to three feet inside the structure. The most severely hit area appears to be along Jess Avenue where most homes had four to five feet inside. Payran Street was also an area of major damage in which flooding reached over three feet inside the structure."*

Figure 1

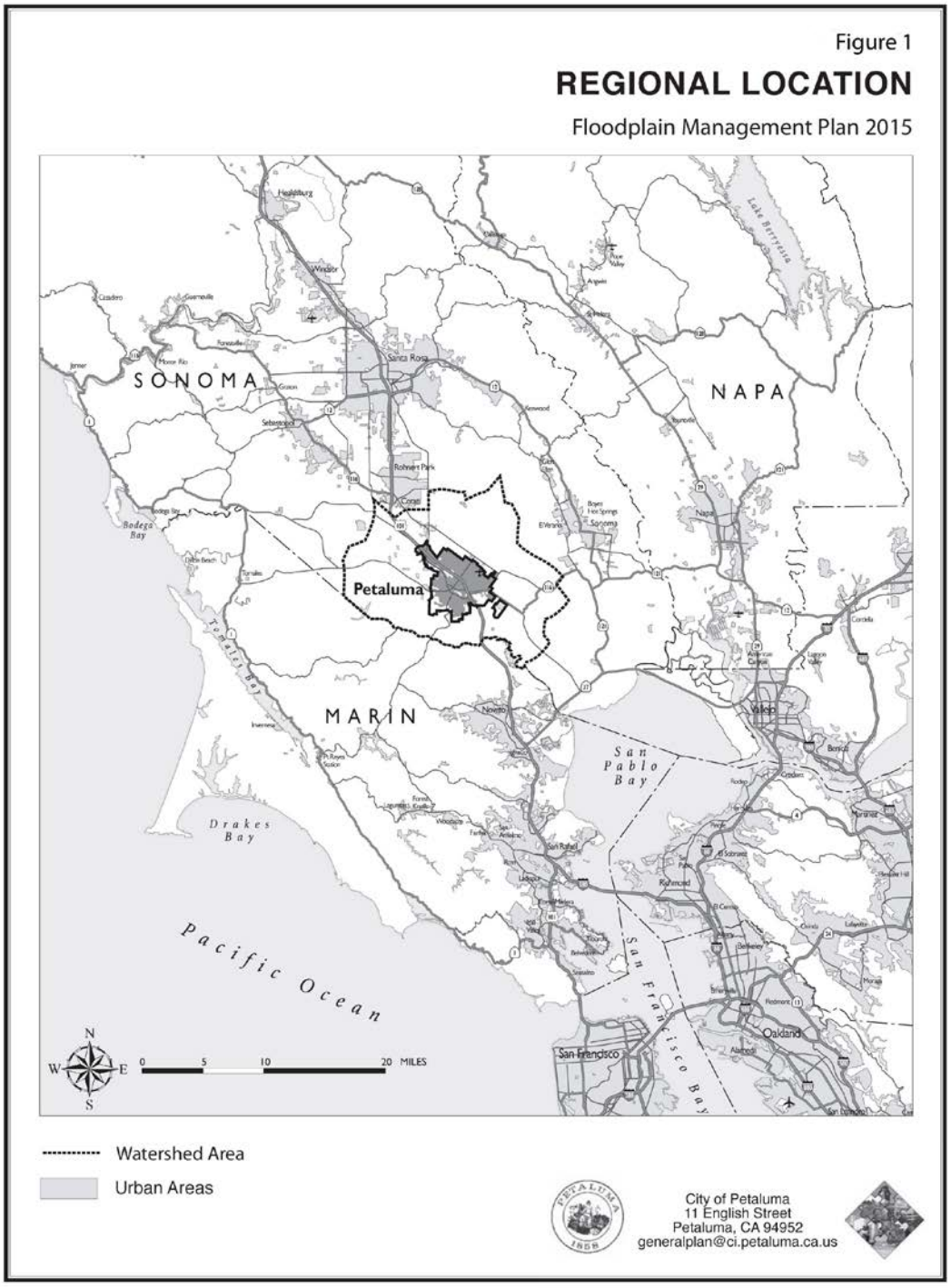


Figure 1
REGIONAL LOCATION
Floodplain Management Plan 2015
SONOMA
NAPA
MARIN
Petaluma
Bodega Bay
Tomales Bay
Drakes Bay
Pacific Ocean
San Pablo Bay
San Francisco Bay
Santa Rosa
Novato
Vallejo
Oakland
San Francisco
N
W
E
S
0 5 10 20 MILES
Watershed Area
Urban Areas
City of Petaluma
11 English Street
Petaluma, CA 94952
generalplan@ci.petaluma.ca.us

Approximately one million dollars in flood damages occurred in the urbanized reach of the Petaluma River between the Lynch Creek confluence and the Lakeville Street Bridge during the flood of February 14-17, 1986. On February 15, an article in the San Francisco Chronicle was headlined "Petaluma Takes to the Boats":

> *"Yesterday, most of the townsfolk put their experience to use and took their lumps like troupers. The relatively few newcomers in the hardest-hit Linda Del Mar subdivision, where the water depth in the street reached five feet, "absolutely panicked," according to a veteran of the 1982 deluge."*
>
> *At 4 a.m., a flood alert was posted for the city of 40,000 people. By dawn, a team of police officers, firefighters and volunteers was knocking on doors in Petaluma's flood prone flatlands.*
>
> *About 400 homes were evacuated in the Linda Del Mar subdivision and several trailer parks west and east of U.S.101. Those who could not drive over the flooded roads were removed by bus and, later, by boat.*

On March 9, 1995, Petaluma once again experienced significant flooding. This flooding resulted in approximately nine thousand dollars of damage to the Petaluma Wastewater Treatment plant when fencing and levees around an aerated lagoon were damaged. There was additional damage to Hopper Street, as well as increased need for electricity usage and monitoring. Seven schools in Petaluma were closed, and a total of 327 homes evacuated, although none were inundated. On March 10, 1995 an article in the San Francisco Chronicle titled "Soggy Anger on the Street That Always Floods" reads:

> *"This same area* (Payran Street) *has flooded over and over since the big flood of 1982. Yesterday was no exception with about 3.5 inches of rain pounding Petaluma during the 24 hours ending at noon. By 7:30 a.m., the raging waters were overflowing the Payran Street Bridge, sweeping over yards, into some garages and basements and forcing emergency workers to order the evacuation of 193 homes of Payran, Jess Avenue and Rocca Drive."*
>
> *"Another 134 residences were evacuated at the Leisure Lake Mobile Home Park, where Willow Creek was threatening to overflow its banks and turn the park into an island. By 5 p.m. the waters were dropping, and most residents were allowed to return to their homes.*

In the winter of 1997-1998 the effects of El Nino storms were felt throughout California and the rest of the country. Some large storms hit the West Coast in the first three weeks of February 1998, and these caused flooding in Petaluma as well as in many other parts of the state. The cost of damages in Petaluma was nearly six million dollars. Most of the damage occurred during the flooding on February 2-3, 1998, with some recurring damage from another storm on February 29, 1998. State and Federal governments declared the winter storms and flooding a disaster, and FEMA designated the event as "FEMA – 1203 – DR". The greatest damage was to the homes in the Payran area and businesses in the

Industrial Avenue/Auto Center Drive area. The oxidation ponds at the City of Petaluma's wastewater treatment facility were damaged once again. Considerable silt buildup in the Turning Basin required dredging, and many roads in the City suffered damages. On February 20, 1998 in an article titled "More Rain, More Havoc" the San Francisco Chronicle reported:

> *"A flash flood caused the Petaluma River to jump its banks and spill into the streets and homes of the hard-hit Payran area of Petaluma. It was the third time in three weeks that the low-lying community has been flooded. Nearly 50 homes were evacuated and cars parked by the river were nearly submerged. Petaluma firefighters used an inflatable boat to rescue a few stragglers. Others waded out of the neighborhood through streets that had as much as three feet of water.*
>
> *"Meanwhile, nearly 30 seniors were evacuated from the Leisure Lake mobile home park north of Petaluma when Stony Point Road flooded, cutting off automobile access to the community."*

On December 31, 2005, the City experienced significant flooding, particularly in the middle and northern areas of town. It is estimated that approximately 53 structures, not including mobile home parks, were damaged by flood waters at an approximate cost of $56,000,000. There was also damage to local streets and river channel banks as a result of the flooding. The greatest damage from this event was located within the Petaluma Factory Outlets, commercial structures and three of the City's mobile home parks. The Payran reach was not adversely affected by this flood, which is mainly attributable to a majority of the Petaluma River Flood Control Project being in place. The flooding event was declared a State and Federal disaster.

On December 29, 2006, the Press Democrat published the following excerpt from a year in review article:

> *"The New Year's Eve flood was the biggest news story of the year. The flooding - the most severe since 1997 - caused $56 million in damage, most of it in north Petaluma. In some cases, it took property owners months to recover. Hardest hit were businesses near the Petaluma River, including the auto mall, where hundreds of cars were damaged, and the outlet mall, where 1 to 2 feet of muddy water poured into many shops."*

(Aerial view of Factory Outlet Mall flooding, 12/31/05)

Most recently, on December 11, 2014, the City again experienced flooding particularly within the northern and southern portions of the City. Floodwaters overtopped banks along the Petaluma River which flooded Industrial Avenue and surrounding areas. The flood waters lead to road closures in the Industrial Avenue and Auto Center Drive areas between Old Redwood Highway and Corona Road. Evacuations of businesses in these areas occurred. Additional street flooding occurred in the Lakeville Street area between East Court and Caulfield Lane, Casa Grande Road near Adobe Creek, residential areas near Corona Creek and on Lakeville Highway near Ellis Creek. There were no reports of flooded or damaged structures as a result of this flood event.

2.3 Designated Floodplains and Flood Data

Approximately 1612 acres of the City of Petaluma lie within the FEMA designated 100-year Special Flood Hazard Area (SFHA), shown in Figure 2. In addition, 112 acres of this area are a designated floodway.

In December of 2008, under the flood map modernization initiative, FEMA issued updated flood insurance rate maps known as D-FIRMS. The D-FIRMS are very similar to the 1989 FIRM'S for Petaluma and are essentially an electronic version of the 1989 FIRM data. The D-FIRMS also included new information that the 1989 maps did not include such as aerial photography. The data was helpful in better determining floodplain locations. The D-FIRMS did not include revised floodplain boundaries based on post 1989 development and structural flood control projects. On February 19, 2014,

Petaluma's flood insurance rate maps were once again updated by FEMA and the City. As part of this process, the City developed a flood surface model of the Petaluma River basin using XPSWMM storm water modeling software. This modeling was used by FEMA to prepare the updated FIRM maps. The process included several iterations of modeling runs using the latest, best available topography, rainfall data and other technical information to produce the revised FIRMS. Subsequently, the City submitted an application to FEMA requesting an A99 flood zone designation for the Payran residential neighborhood. A99 flood zones are designated in areas which an overwhelming majority of a flood control project is complete, with the remaining sections scheduled to be complete with the near future. The remaining segments of the Petaluma River flood control project are currently under construction and are scheduled to be complete in November 2015, at which point, the project will be certified by the United States Army Corps of Engineers and there will no longer be a need for an A99 flood zone determination in this area. Upon certification of the project, the City will be submitting an application to FEMA to re-designate the A99 Payran area flood zone to a flood zone "X".

FEMA has also been studying the effects of coastal wave surge on flood surface elevations within the San Francisco Bay and its tributaries. Draft FIRM maps and flood insurance studies for the "Bay Coastal Study" have been prepared and are scheduled to become effective on October 20, 2015. The results of the study and corresponding FIRM maps show that there is very little impact within Petaluma as a result of this analysis. Flood surface elevations in the southern Petaluma City limits, including a portion of Downtown Petaluma, increased from 9.0 feet to 10.0 feet, North American Vertical Datum (NAVD) for the one percent flood event. This increase is largely contained within existing river banks although there are a few locations in which properties have been added to the special flood hazard area. The City has notified these property owners of this change and has held public meetings to discuss the affected areas.

The TAC members also identified the need to start studying climate change and the effects on weather patterns and special flood hazard areas with future flood studies. Currently, FEMA flood insurance rate mapping uses only existing data in preparation of flood hazard studies. Recent and projected weather patterns suggest that rain storms will come with higher intensity rainfall amounts. These storms have been termed "Atmospheric Rivers."

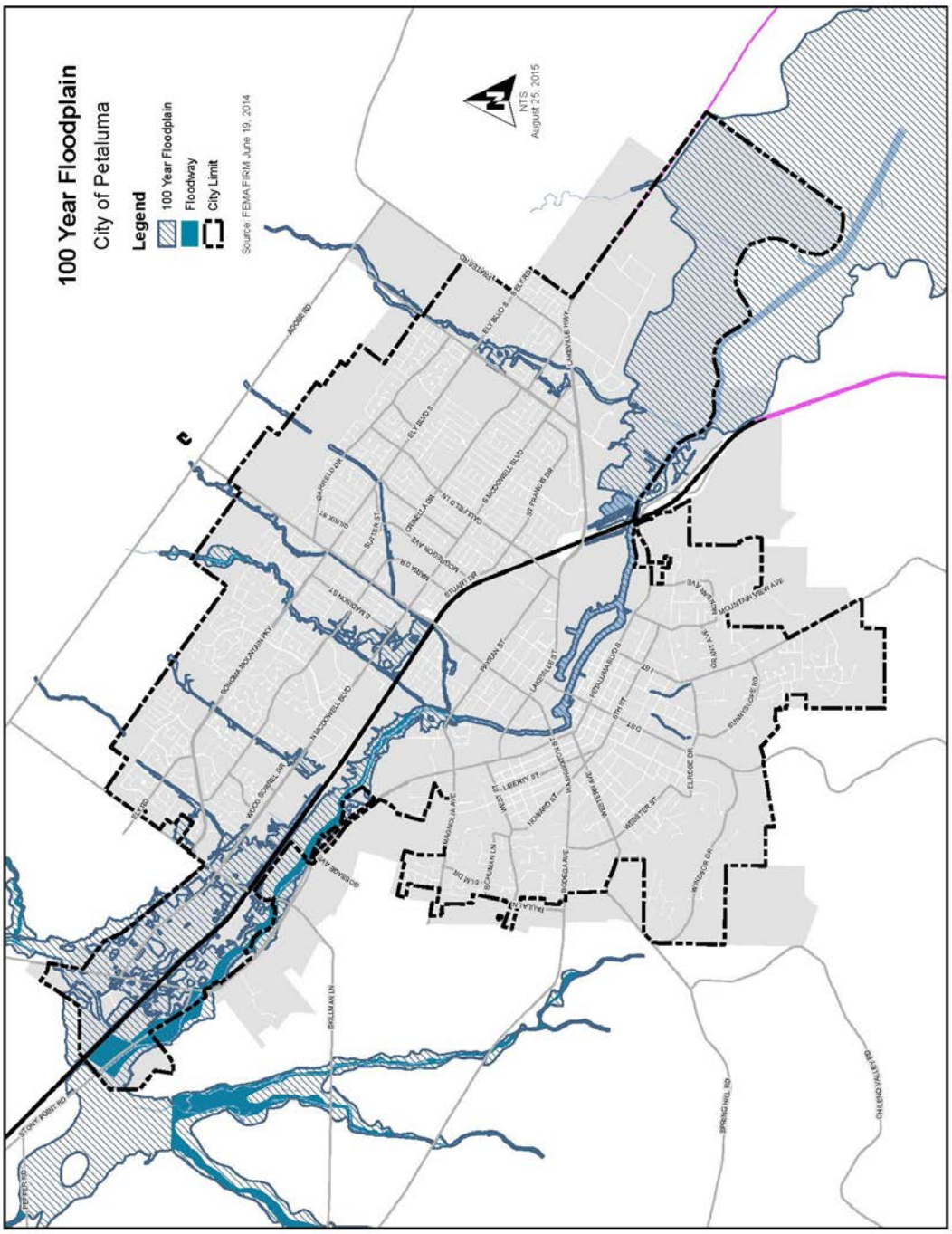
In addition to the FEMA FIRM maps, the City of Petaluma created and adopted "Figure 8.1, 100-year Flood Boundary General Plan 2005 build out." The exhibit with its defined boundary was created to identify limits of the New Year's Eve 2005 flood event and develop policies within the General Plan 2025 that require new development to comply with higher regulatory standards than those defined by FEMA. The limits of this floodplain boundary were determined by a post flood aerial and ground high water mark/debris line survey.

Historically, there are two main areas of significant flooding along the Petaluma River. The first area, lying between Denman Flat and the confluence of the Petaluma River with Lynch Creek, consists mainly of commercial, industrial, retail and undeveloped properties. The second area, located between the Lynch Creek/Petaluma River confluence and the Lakeville Street Bridge, consists mainly of residential properties developed during the 1960's. This residential area is referred to as the Payran reach Floodplain. Significant flooding once occurred in the urbanized "Payran Reach" between the Lynch Creek confluence and the Lakeville Street Bridge. However, since the Petaluma River Flood Control Project has been constructed, including the New Year's Eve 2005 and December 11, 2014 flood events, the Payran Area has not flooded.

The entire special flood hazard area within the City has been mapped as AE areas, with determined base flood elevations. Characteristic floods in the Petaluma River Basin are normally of short duration, lasting a few hours to one or two days. Floods on the Petaluma River may develop within hours after the beginning of a flood-producing storm and begin to recede within hours of the end of the storm. Although floods have been recorded as early as November and as late as April, most occur between December and February after prolonged rainy periods, which fully saturate the soil, increasing runoff volume. Flooding can occur along the entire length of the River.

The natural storage area of Denman Flat in the northwestern part of the City, where Willow Brook, Liberty, Marin and Wiggins Creeks come together to form the Petaluma River, acts as a detention basin and helps to reduce downstream peak discharges. Significant flooding occurs in this natural storage area and to the area east of Denman flat between Highway 101 and the Northwestern Pacific railroad line when excess flows in the Willow Brook channel escape as sheet flow to the southwest. Flooding from the Petaluma River can occur in the reach between Denman Flat and the confluence with Lynch Creek, and is generally shallow. Flooding is reduced in depth downstream of Lakeville Street and is fairly well contained in the Petaluma River channel below the "D" Street Bridge.

Figure 2


100 Year Floodplain
City of Petaluma
Legend
100 Year Floodplain
Floodway
City Limit
Source: FEMA FIRM June 19, 2014
N
NTS
August 25, 2015

2.4 Petaluma Benefit Assessment Zone 2A

In 1959, the Petaluma Benefit Assessment Zone 2A was created as a joint flood control endeavor between the City of Petaluma and Sonoma County Water Agency. This zone encompasses 87 square miles bounded by San Antonio Creek on the south; Browns Lane and Stage Gulch Road on the southeast; Railroad Avenue, Roberts Road, and Lichau Road on the North; and Laguna Road, Lake Street and Two Rock Road on the west. In general, the zone includes all tributary drainage reaching the Petaluma River north of the mouth of San Antonio Creek. Residents within this Zone pay an extra tax to fund structural projects that will reduce flooding risks in this area. There is a seven-member Zone 2A Advisory Committee consisting of citizens who reside within the Zone and representatives from the City of Petaluma and Sonoma County. This committee is responsible for recommending budget priorities to the Board of Directors of the SCWA for inclusion in the Zone budget for each fiscal year.

2.5 Petaluma Watershed Master Drainage Plan

As a result of the major flooding that occurred in 1982 and 1983, the City of Petaluma requested, and the Flood Control Zone 2A Advisory Committee recommended, that the Sonoma County Water Agency prepare a Drainage Master Plan for the Petaluma River Watershed. The plan was completed in March of 1986. Petaluma adopted the Master Drainage Plan as policy under Program 7 of the Community Health and Safety Element of the City's former General Plan (1987-2005), which stated:

> Program 7 - Adopt the most reasonable, sensitive, and effective proposal(s) of the Sonoma County Water Agency Master Drainage Plan in order to mitigate the 100-year flood.

The Master Drainage Plan is used by the Sonoma County Water Agency and the City of Petaluma in their capital improvement planning and construction, and in review and approval of land developments. It provides a valuable tool for consulting engineers by alerting them to the approximate scope of the drainage improvements needed for land development. The Master Plan is used by the Flood Control Zone 2A Advisory Committee to select projects for construction using SCWA funds. On a daily basis, the Master Drainage Plan is used by the SCWA and the City for resource information to respond to questions from the public. The Master Plan has three basic elements.

1. The watershed is described as to size, location, land use and other significant information.
2. The flooding and drainage problems of the watershed are described.
3. Structural solutions are described; including anticipated changed conditions or environmental effects.

The report includes maps to identify the area studied and also the flood hazard and drainage problem areas; as well as drawings to show the location, size and type of drainage improvements, which, if constructed, would alleviate or eliminate the problem.

The Sonoma County Water Agency updated the Petaluma River Watershed Master Drainage Plan in June of 2003. The City of Petaluma continues to work with the Sonoma County Water Agency and Zone 2A committee on implementing various projects identified in the master plan. Policy 8-9-29 of the City's General Plan 2025 acknowledges the updated master plan and contains policies and programs to work with Sonoma County Water Agency and County of Sonoma staff to implement projects from the 2003 master plan. A copy of the Petaluma River Watershed Master Drainage Plan is available for public review at the City of Petaluma.

2.6 Phase II NPDES Storm Water Management Plan

In November of 2003, the City of Petaluma adopted a Storm Water Management Plan (SWMP) per the mandated requirements of the Federal Clean Water Act. The plan identifies the following six minimum control measures that the City must undertake to improve storm water quality:

- Public Education and Outreach
- Public Participation and Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Storm Water Management
- Pollution Prevention for Municipal Operations

The SWMP identifies programs and projects aimed at minimizing accelerated erosion and the amount of sediment laden runoff from entering the Petaluma River. A new storm water ordinance (Chapter 15.80 of the City's Municipal Code) was adopted as part of the SWMP requirements in June of 2005. In 2013, the City of Petaluma filed an updated application with the State Water Resources Control Board and Regional Water Quality Control Board. The new permit requires the City implement various storm water quality and treatment activities including increased regulations on smaller construction projects.

2.7 Seismic and Geologic Hazards

Two active faults affect the Petaluma area: the San Andreas Fault and the Healdsburg-Rodgers Creek Fault. Based on a fault evaluation report conducted by the California Division of Mines and Geology, the Tolay Fault zone was removed from the special studies zone designation. Subsequently, the City removed the Hazard Management Zone for the Tolay Fault. Nevertheless, the City's Building Division staff maintains that site-

specific geotechnical field studies should be required for proposed developments on or in the immediate vicinity of the Tolay Fault.

3. Assess the Problem

3.1 Impact of Potential Flooding on the Community

Over the past 30 years, the City of Petaluma has experienced significant, documented flooding events. Evacuations and/or property damages have occurred on an average of once every five years. The Payran area, which historically received the brunt of Petaluma River overflow during flood events, is a fairly densely populated residential area. In their previous responses to the questionnaire that was sent to all residents and property owners in the City's Special Flood Hazard Area as part of the FMP update process, and at the public meetings that were held to obtain public input on the FMP, residents expressed both anger and frustration at the continued losses and disruptions caused during flood events. Residents also expressed frustration at the time it has taken for the Petaluma River Flood Control project to be completed and for FEMA to review and issue revised flood insurance rate maps. Now that the Petaluma River Flood Control project is nearly complete, and the Payran Area has been removed from the special flood hazard area, the City has noticed a significant reduction in flooding related concerns in this area.

Buildings in the Floodplain Based on the City's Geographic Information System (GIS) data analysis conducted in 2012, there are approximately 1,000 properties in the City of Petaluma's special flood hazard area.

Impacts on Buildings/Infrastructure/Public Health and Safety The following information was obtained from various City staff at a Technical Advisory Committee meeting for the FMP update:

- During the December 11, 2014 flood event, several commercial, industrial and Auto Dealership buildings were inaccessible because of flooded roadways surrounding the Industrial Avenue area. Evacuations were conducted by the City's Fire Department and Public Works and Utilities personnel.

- Upgrades to the City's sewer pump stations have been necessary due to floodwater inundation of these facilities;

- Extreme damage to additional roadways resulted from nearly every major flooding event in the past twenty years;

- To the best of the TAC members' knowledge, no public bridge crossings or water mains have been damaged in recent flood events;

- Flood events have caused tremendous siltation problems in the Turning Basin;

- Every flooding event created public safety issues, primarily involving the closure of transportation corridors;

- Power (gas and electricity) had to be shut off during all major flood events;

- There were recollections that both sewer manholes and storm drain manholes have floated off in past flood events;

- City emergency vehicles have sustained damage from negotiating through flood waters to warn and/or evacuate residents;

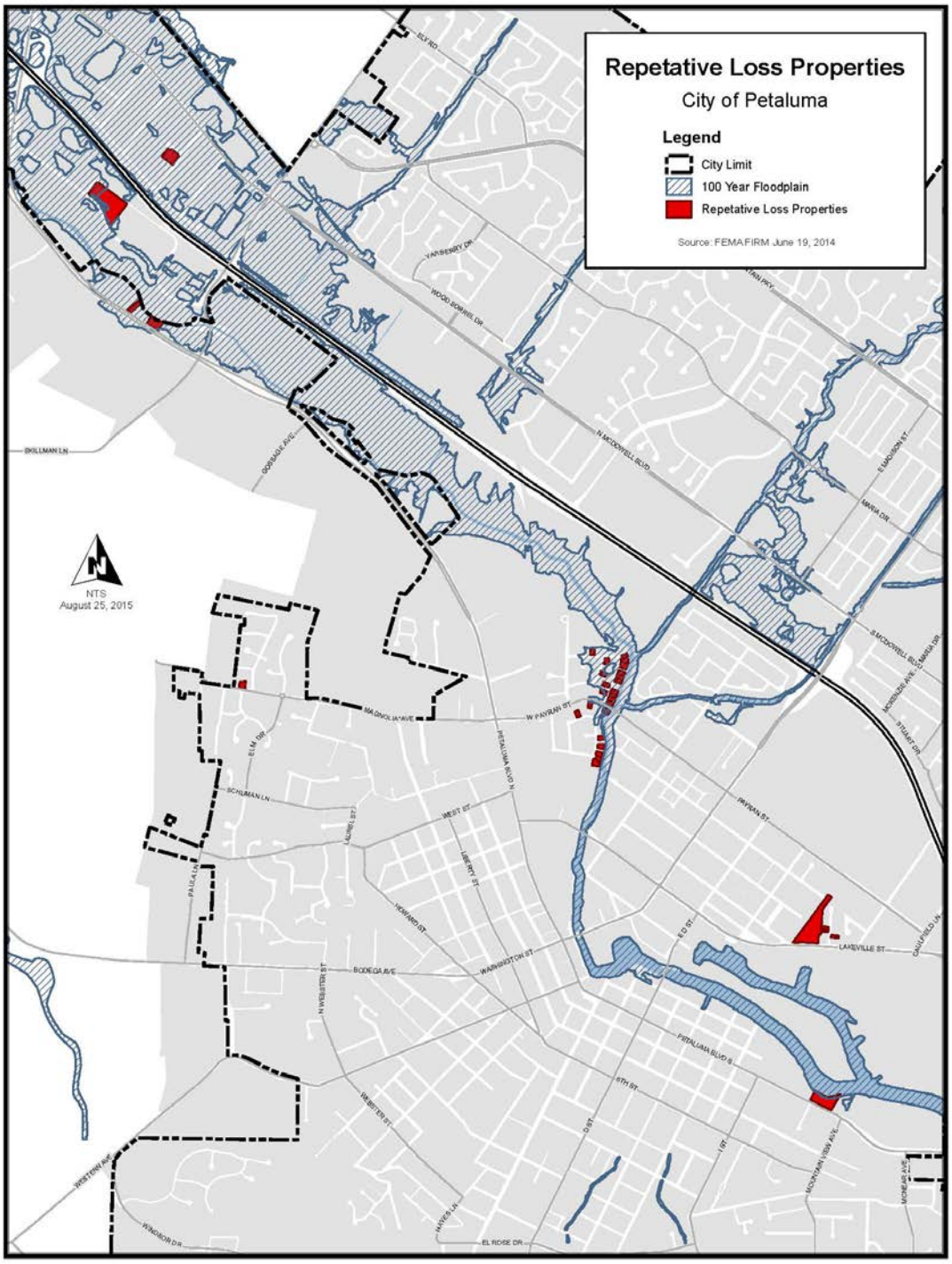
- Storm water pipes filled at Adobe Creek and Casa Grande Road causing flood waters to be diverted to the overflow channel, which then became the main creek channel, resulting in scour and erosion of the retaining structure and flood flows along Casa Grande Road.

Repetitive Losses in the Floodplain Based on the NFIP's records for flood damage claims as of December 31, 2014, a total of 34 properties are listed as repetitive loss properties (i.e. the property owners have filed flood damage claims exceeding $1,000 at least twice in a 10-year period since 1978). The general locations of these properties are shown in Figure 3. However, a majority of the 34 existing repetitive loss properties, which are primarily located in the Payran Area neighborhood, have not filed a claim in the past 10 years. This is largely due to the Petaluma River structural flood control project. The City of Petaluma will be working closely with FEMA and the Insurance Services Office, Inc. to request that the properties in question be removed from the City's repetitive loss property list.

Table 1. Repetitive Loss Properties, City of Petaluma

Property Address	**Claims Filed In Years**
1327 Clegg St	2005, 2008
56 Cordelia Dr	1982, 1986, 1998
44 Cordelia Dr	1982, 1986, 1998
109 East Ct	1982, 1983, 1986
111 East Ct	1980, 1982, 1983, 1986
100 East Ct	1982, 1983, 1986
1150 Industrial Ave	1998, 2005, 2008
1160 Industrial Ave	1998, 2005, 2008
4 Jess Ave	1983, 1986
8 Jess Ave	1983, 1986
9 Jess Ave	1983, 1986, 1998
12 Jess Ave	1983, 1986
16 Jess Ave	1982, 1986, 1998
17 Jess Ave	1982, 1986, 1998
28 Jess Ave	1982, 1986, 1998
32 Jess Ave	1983, 1986
36 Jess Ave	1983, 1986, 1998
44 Jess Ave	1983, 1986
48 Jess Ave	1982, 1983, 1986, 1995, 1998
50 Jess Ave	1983, 1986, 1998
78 Jess Ave	1982, 1986, 1998
519 Lakeville St	1983, 1986
1238 Magnolia Ave	1982, 1983
3624 Petaluma Blvd N	1999, 2000
3700 Petaluma Blvd N	1986, 1995, 1996, 1997, 1998
811 Petaluma Blvd S	1982, 1983
3 Rocca Dr	1982,1986, 1998
27 Rocca Dr	1982, 1986, 1998
35 Rocca Dr	1982, 1986, 1998
43 Rocca Dr	1983, 1986, 1998
47 Rocca Dr	1982, 1986, 1995, 1998
49 Rocca Dr	1983, 1986, 1998
115 W. Payran St	1982, 1986
20 Woodworth Way	1982, 1986

Figure 3


Repetative Loss Properties
City of Petaluma
Legend
City Limit
100 Year Floodplain
Repetative Loss Properties
Source: FEMA FIRM June 19, 2014
NTS
August 25, 2015

3.2 Flood Warning Procedures

The City of Petaluma has installed and maintains a computerized Flood Alert System to enhance its ability to provide timely emergency flood response and evacuation warning to residents in flood prone areas. This system was originally installed approximately 25 years ago after the catastrophic floods of 1982 and has recently been updated. The system consists of forty one stations which monitor either river levels, rainfall and/or weather data. The locations of these gauging stations are presented in Figure 4. These stations are listed in Table 2. At the time of printing, the City was in the beginning processes of installing 9 additional stream gauges, 8 additional rain gauges, including one by Kelly Creek at the intersection of Sunnyslope Road and Sunnyslope Avenue, as well as updating the City's software system to Flood Alert 2.0. These additional gauges will be shown in future updates of the City's floodplain management plan.

The City of Petaluma maintains an Emergency Operations Center (EOC). Emergency procedures are initiated during a flood event. These procedures were used for the first time during the 1986 flooding. Data from stream monitoring stations is radio relayed to a central computer and a central base station at the City's Emergency Operations Center in the Police Department. Data is logged to files by the computer. The intent of the monitoring system is to enable personnel to study the cumulative impact, in real time, of inclement weather on various areas of the City. In general, when a rainfall rate of ½ inch per hour continues for more than one hour, emergency personnel begin continuous monitoring of river levels. Weather records are kept on file to document flood events and flood related claims.

As water elevations are registered on these gauges, various City procedures are activated. The first of these procedures is the activation of the City's Emergency Operations Center (EOC). Once activated, City staff begins to execute standard management operation plans. Key City personnel have been trained in FEMA's Incident Command System (ICS) and, during an emergency event or incident, follow the principles of the ICS. City staff has installed a remote webcam called "long watch" on the Willow Brook Creek gauge so staff can visually see real time stream levels in Willow Brook Creek.

Table 2. Existing Stream, Rain and Weather Gauge Locations

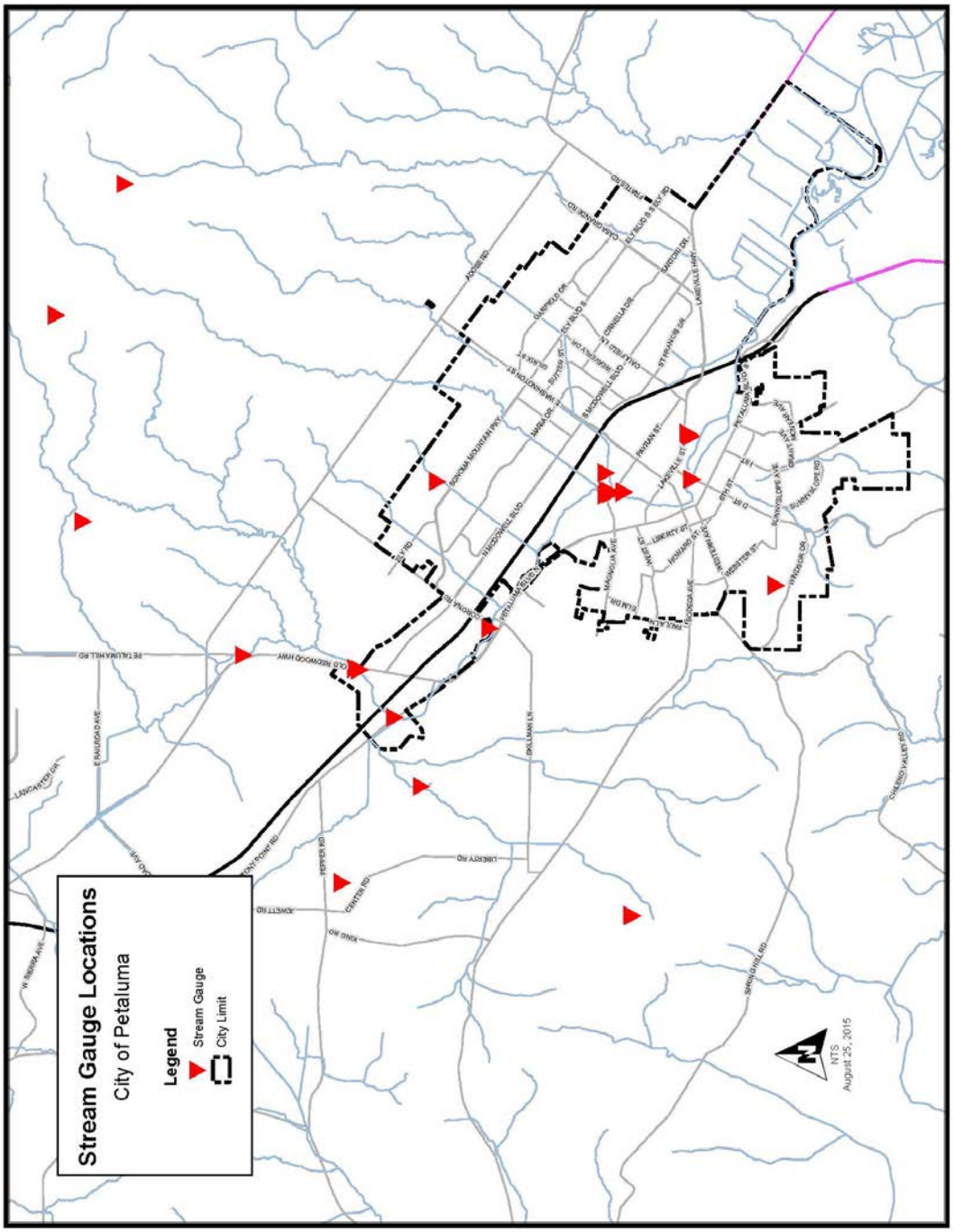
Gauge Number	Sensor Number	Type of Gage	Location
1	2000	Wind	D Street Br.
2	2002	Stream	D Street Br.
3	2003	Rain	D Street Br.
4	2004	Humidity	D Street Br.
5	2005	Temp	D Street Br.
6	2006	Peak Wind	D Street Br.
7	2007	Pressure	D Street Br.
8	2009	Stream	Corona Rd.
9	2010	Rain	Corona Rd.
10	2011	Stream	Payran St.
11	2013	Stream	Old Redwood @ Willow Creek
12	2014	Rain	Washington Creek
13	2015	Stream	Twin Creek at Washington Creek
14	2016	Rain	Willow Creek
15	2018	Rain	Lichau Creek
16	2020	Rain	Liberty Road
17	2022	Rain	Middle Two Rock
18	2023	Stream	Stony Point Road
19	2026	Rain	Wilson Street
20	2177	Stream	Penngrove
21	2179	Stream	Rainsville
22	2180	Rain	Leghorn Park
23	2181	Stream	Leghorn Park
24	2182	Rain	La Cresta Tanks
25	2183	Stream	Shollenberger Park
26	2184	Rain	Shollenberger Park
27	2185	Stream	Kelly Creek
28	2186	Rain	Kelly Creek
29	2187	Stream	Twin Bridges
30	2188	Rain	Twin Bridges

31	2189	Stream	Lynch Creek
32	2190	Rain	Lynch Creek @ North McDowell
33	2191	Stream	Washington Creek @ North McDowell
34	2192	Rain	Washington Creek @ North McDowell
35	2193	Stream	East Washington Creek @ Garfield
36	2194	Rain	East Washington Creek @ Garfield
37	2195	Stream	Adobe Creek @ Sartori
38	2196	Rain	Adobe Creek @ Sartori
39	2197	Stream	Corona Creek @ Sonoma Mountain Pkwy.
40	2198	Rain	Corona Creek @ Sonoma Mountain Pkwy.
41	2199	Stream	Thompsen Creek @ Sunnyslope Road

Evacuation plans exist with City emergency operations staff, for several known flooding areas within Petaluma. These plans are labeled and prioritized, with the lowest topographical areas designated as most at risk for flooding. Once the evacuation order is given, field personnel go door-to-door to notify residents that they must leave. Additionally, the City uses the NIXLE on-line/e-mail system as well as social media to notify residents of impending flooding threats and evacuation orders.

When stream gauge readings reflect a pre-determined level, the National Weather Service Alert System is activated, and a flash flood warning is automatically announced to the National Oceanic and Atmospheric Administration (NOAA). These warnings are relayed as standard radio and TV broadcasts. In addition, the Sonoma County EOC releases warnings to the media; however it is up to the media to distribute the information at their discretion.

Figure 4


Stream Gauge Locations
City of Petaluma
Legend
Stream Gauge
City Limit
N
NTS
August 25, 2015

3.3 Critical Facilities in the Floodplain

A number of critical facilities exist in the flood hazard areas within the City of Petaluma. As defined by the CRS Program, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic and/or water reactive materials;
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a flood;
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during, and after a flood; and
- Public and private utility facilities that are vital to maintaining or restoring normal services to flooded areas before, during, and after a flood.

One of the City's three fire stations is located within the flood hazard area. This station was built prior to the City's participation in the National Flood Insurance Program and has incurred minor flooding damage in the past. In no event has this station been rendered uninhabitable or inaccessible due to flooding, including the 250-year event in 1982. The Fire Department has developed contingency parking at the Santa Rosa Junior College as an alternative staging area in the event that the station is inundated or otherwise deemed unusable.

One school, McKinley Elementary, used to be located within the flood hazard area in the Payran area but has been removed as a result of the Petaluma River Flood Control Project and revised flood insurance rate maps. During both the 1995 and the 1998 flood events, this school, along with many others, was closed. McKinley Elementary school did not flood during the 2005 New Year's Eve and December 11, 2014 events. The McKinley Elementary attendance system was modified from K-sixth grades to fourth through sixth in 2010. A portion of Bernard Eldridge Elementary School was newly mapped into the special flood hazard area as shown on the revised flood insurance rate maps dated February 19, 2014.

Leisure Lake Mobile Home Park houses many elderly citizens. During a flood event, this area has the potential to become an island surrounded by floodwaters which can leave the area inaccessible to emergency vehicles. The City of Petaluma has organized a procedure of evacuating this area using buses to aid the residents in transportation to the Evacuation Care Shelter or to friends and relatives.

Both Petaluma Valley Hospital and Kaiser Medical Clinic are located outside of the Flood Hazard Area. In 2011, the Petaluma Health Center opened for business at 1179 North McDowell Boulevard. An existing commercial building was retrofitted to

accommodate the new health center. Work on the building was a substantial improvement and a commercial flood proofing system was installed. The police station, where the City's EOC is headquartered, is also located outside of the Flood Hazard Area. A portion of the City's Community Center property, including the pond, and portions on the parking lot and ball fields are located within the special flood hazard area. The Community Center building is not within the flood area. A portion of the City's Public Works and Utilities Department building at 202 North McDowell Boulevard is located within the special flood hazard area.

A portion of the City's new wastewater treatment plant property is located inside of the Flood Hazard Area because of FEMA's decision to remove unaccredited existing levees for floodplain mapping purposes unless certified by a Professional Engineer. However, the structures and wastewater treatment systems are elevated above the special flood hazard area. Also critical to the continued operation of the treatment facility are three pump stations located within the floodplain. Both the Wilmington Street, and the Copeland Street pump stations, have been elevated one foot above the base flood elevation. The C Street pump station has been flood-proofed with watertight doors and recently underwent a major update including new pumps and a generator. Additionally, all stations have emergency generators to insure their continued operation. The City also maintains a mobile emergency back-up generator at the City's corporation yard facility on Hopper Street.

3.4 Natural and Beneficial Areas

Petaluma River Access and Enhancement Plan In May of 1996, the City approved and adopted the Petaluma River Access and Enhancement Plan. The overall purpose of the Plan was to describe the community's vision for the Petaluma River, including its riverfront uses, activities, and developments. Nine goals for the Petaluma River corridor were established within the Access and Enhancement Plan:

- Maintain the navigability of the Petaluma River;
- Improve flood control;
- Promote the balanced use of the river corridor;
- Restore, create, and protect natural habitats, and enhance native vegetation along the river corridor;
- Expand public access to and awareness of the river;
- Assure permanent maintenance and promote public safety along the river;
- Create guidelines to integrate development into the river corridor;
- Preserve the economic viability of property within the river corridor, and;
- Identify sources and strategies for funding and implementing the Petaluma River Access and Enhancement Plan.

These goals, as well as the methods and activities outlined in the Access and Enhancement plan and have been updated and included in the City's General Plan 2025.

Enhancement Plan for the Petaluma River Marsh An area of approximately 150 acres of the Petaluma River's floodplain lies in a marsh that is regularly flooded by high tides. The Petaluma River Marsh Enhancement Plan was developed to insure the preservation of this area in its natural state; including its water quality and endangered species habitat, as well as making it accessible to the public for passive recreational and educational/interpretive opportunities.

Adopted in 1992, the Plan inventories the natural resources of the plan area, identifies resource management and biological enhancement needs and opportunities, and presents a number of individual enhancement and restoration design elements, as well as designating possible public access trails, waterfront access points, and park and recreational facility areas. Further detailed engineering and planning studies will be required to define the exact location and design of these features. Permits from State and Federal agencies, also requiring further studies, will be necessary prior to implementation of some Plan elements (City of Petaluma, 1991).

Although the majority of the plan area is in public ownership, some private lands are also included. The private lands each carry General Plan Open Space designations for the marsh area. Acquisition of these Open Space areas is being pursued through a number of different means including purchase, California State Lands Commission reclamation or dedication required at time of private development. In addition, on those marshlands not acquired by the City, buffer zones along the edge of the Open Space areas have been created to ensure that development does not encroach on, or negatively affect, the marsh habitat.

3.5 Development and Redevelopment in the Floodplain

Petaluma was built adjacent to the Petaluma River to take advantage of the river's natural transportation route to and from San Francisco Bay. Development continued in the westerly direction from the river until the 1950's, when it began to move to the north and east.

Development Constraints The 2015 census results indicated the City's current population to be 59,322. At the present time the City's ultimate build out population at 2025 is estimated at 72,707. The Urban Growth Boundary (UGB), which was adopted by the City in 1998 and originally contained a 20 year lifespan, has severely limited the amount of new urban residential growth in the areas surrounding the City. The General Plan 2025 recognized the UGB as being in place until 2025. A ballot measure, known as Measure T, was passed by Petaluma voters in November 2010, extending the expiration date of the urban growth boundary to coincide with the timeframe of the City's General Plan 2025. Other constraints to development, particularly in the floodplain, include the Floodplain/Floodway regulations contained within the City of Petaluma Zoning

Ordinance, the Petaluma General Plan, subdivision/infrastructure requirements, and environmental regulation.

The City of Petaluma originally adopted comprehensive Floodplain/Floodway regulations in 1973 as part of the 1973 Zoning Ordinance. These regulations have undergone a number of revisions to keep them current with State of California and National Flood Insurance Program regulations. The Floodplain Ordinance was most recently updated in 1999.

Wetland and habitat preservation also restricts development within the Floodplain. An inventory of sites within the City that have been surveyed for wetland characteristics along with a photo interpretation of potential wetland sites has been compiled as part of a cumulative impact analysis for expanding wastewater facilities and flood improvement projects. All future development within the areas identified will be required to comply with all local, State, and Federal regulations governing wetlands and habitat.

The Petaluma General Plan 2025 was adopted by the Petaluma City Council in May of 2008. The previous General Plan, (GP 1987-2005) stated a number of major goals, one of which is to "enhance the Petaluma River as a resource to be preserved, seen and used" (City of Petaluma, 1987). The City's new General Plan significantly builds upon the previous plan and contains several new programs and policies that are aimed at further reducing flooding and protecting lives and property from flooding. The plan focuses on implementing higher regulatory development standards, restoring and enhancing natural and beneficial areas, using increased technology to better define flood hazard areas, increased flood and surface water coordination with other agencies and implementing structural and non-structural improvements. These are listed in the General Plan's Water Resources and Natural Environment Elements. Both of these elements are included in the appendix of this FMP.

The City of Petaluma remains committed to the goals, policies and programs outlined in the existing General Plan, and will expand upon them, utilizing both the conclusions of more recent studies, as well as the gained experience and knowledge from flood events in the past.

3.6 Impact of Flooding on Community Economy and Tax Base

As previously mentioned, the City of Petaluma, and more specifically, the Payran area, has experienced significant flooding events on the average of once every five years over the past three decades. The damage caused by these flood events has a significant impact on the local economy (i.e. damages to home and property, City infrastructure, and local businesses).

The flooding of 1982 caused estimated damages of $28 million, the highest monetary level of damage sustained by the City in its history until the New Year's Eve flood event of 2005. Total damages for this event were estimated at $56 million. The 1986 flood

caused a reported $1 million in damages, and in 1998 an estimated $6 million of damage was assessed.

4. Floodplain Management Goals

The TAC reviewed and discussed existing goals from the 2001 and 2010 FMP's as well as new goals within this 2015 update. Below is a list of the 2010 goals and implementation status as well as a list of new goals developed by the TAC. The new goals were discussed with the public at the August 19, 2015 public meeting for their review and input. The primary goal of the City's floodplain management program is to continue efforts to minimize threat to life and property from flooding.

Existing Goals from the 2010 FMP:

- Goal: Increase community outreach efforts to local development community by sponsoring floodplain management workshops in conjunction with the State National Flood Insurance Program coordinator.

  Status: The City and Federal Emergency Management Agency held several floodplain management and mapping related workshops over the past five years as part of the flood insurance rate map update process.

- Goal: Continue to train new and update existing City Planning, Building and Public Works staff on NFIP, CRS and City floodplain management requirements.

  Status: The City's floodplain administrator attended two, week long floodplain management and community rating system training courses at the Emergency Management Institute in Emmittsburg, Maryland, since the last FMP update, as well as participated in local and regional floodplain management workshops and presentations.

- Goal: Continue annual stream and creek channel maintenance in accordance with established City, Sonoma County Water Agency and other regulatory requirements.

  Status: The City has worked with the County of Sonoma and the Sonoma County Water Agency, particularly after the recent December 11, 2014 flood event, to clear channels and creeks of debris, sediment and overgrown vegetation, within the limits of current environmental permits. The City is working on creating a City-wide environmental document to submit to permitting agencies that allows expanded channel and creek maintenance. The City anticipates receiving permit approval within fiscal year 2015-2016.

- Goal: Secure funding and complete the remaining Petaluma River Flood Control project. The project is currently scheduled to be completed by November of 2015.

Status: Federal funding was allocated and construction is currently underway on the remaining portions of the project. Construction is expected to be complete in November 2015.

- Goal: Obtain certification from the Army Corp of Engineers for the flood wall and flood control project; complete acceptance of the project by the City.

  Status: The City will submit the necessary paperwork to the Army Corps of Engineers to request the flood wall certification upon completion of the project.

- Goal: Pursue certification of existing levees that protect the City's waste water treatment plant and wetlands.

  Status: There is minimal impact to property or structures as a result of the de-accreditation of the existing levees in the southern portion of Petaluma. However, the City will continue to explore the accreditation process and opportunities with FEMA.

- Goal: Complete the City's XP-SWMM model and be cooperating technical partner with FEMA and the SCWA.

  Status: The City has completed the XP-SWMM storm water model. The model data was used, in conjunction with FEMA, to update the City's flood insurance rate maps.

- Goal: Update the City's Flood Insurance Rate Maps once the flood control project is complete and certified by the Army Corp of Engineers.

  Status: The City will submit a Letter of Map Revision to FEMA upon completion of the flood control project.

- Goal: Pursue obtaining an A99 designation, from FEMA, for the Payran area until new FIRM maps are issued.

  Status: The City submitted an application for an A99 flood zone determination in a portion of the Payran residential area in 2013. On June 20, 2014, a letter of Map Revision designating this area as an A99 flood zone became effective.

- Goal: Pursue the acquisition of McNear Peninsula as open space and natural and beneficial areas.

Status: The City has not yet pursued acquisition of the McNear Peninsula. This will remain as an on-going goal.

- Goal: Implement General Plan 2025 policies regarding Petaluma River Corridor terracing to accommodate a 100-year storm event, to all extent practicable.

  Status: The City has acquired property in the Denman Flats area near Industrial Avenue and secured funding for the purposes of creating flood terracing. Construction is expected to occur in 2016. The City continues to require development projects along the Petaluma River Corridor to provide flood terracing per General Plan policies.

- Goal: Coordinate the City's PH II Storm Water Management Plan update with requirements of the NFIP, CRS and the City floodplain ordinance.

  Status: In 2013, the City entered into an updated Phase II storm water permit with the State Water Resources Control Board. Part of the permit requirements requires the City to update portions of its storm water management plan over a five year period. The City continues to update this plan in accordance with the terms of the State permit.

- Goal: Coordinate flood control and maintenance projects with the Zone 2A Flood Advisory Committee.

  Status: The City continues to coordinate Zone 2A flood control projects.

- Goal: Convert the City's benchmark system from NGVD 1929 to NAVD 1988 to be consistent with the new FIRMS.

  Status: The City has not yet converted the NGVD1929 system to NAVD1988. A funding source needs to be identified for this project. In the meantime, surveyors and engineers use a datum conversion factor as necessary.

- Goal: Work with the Army Corp of Engineers to dredge the Petaluma River channel within the new flood control project area to preserve flood design capacity.

  Status: $500,000 of Federal funding has been allocated for environmental analysis and pre-permitting activities for dredging the Petaluma River. Approximately eight million dollars of additional funding is required to complete the dredging work. City and legislative staff are exploring additional funding opportunities for this work.

- Goal: Monitor and update the City's stream level gauge system and expand as needed to maximize the use and effectiveness of the data in the operation of the Flood Alert System.

  Status: The City is in the process of adding nine additional stream gauges to its existing system as well as updating its flood alert software system to "Flood Alert 2.0"

- Goal: Encourage local, State and Federal agencies to fund stream maintenance programs; pursue grants for increasing flow capacity in conjunction with stream enhancement projects.

  Status: This is an on-going goal to work with agencies to identify future grants and funding opportunities.

- Goal: Work with the Fire Department to update the telephone information hotline and notification system. Establish a more effective distribution system, such as a mailer in the City water bill, notifying residents of who to call for flood information.

  Status: The City now uses Nixle, the on-line notification system for emergency alerts including flooding and road closures. The City also uses social media to send public messaging as well update its website. The City maintains a telephone system for providing emergency information and continues to use utility bills as a means to send public information.

- Goal: Continue to pursue and develop higher regulatory standards for design year flood event standards. The current standard, which was created by FEMA and is used within the City of Petaluma, is the 100-year flooding event.

  Status: The City continues to use the one percent storm, commonly known as the 100-year event, as the design storm standard.

5. Review of Floodplain Management Activities

A community chooses to undertake floodplain management activities both to ensure the safety and well-being of their citizens, as well as to reduce the occurrence and damages from flooding. The activities that the City of Petaluma has implemented are both structural, and non-structural in nature. This section details the activities that have been identified and reviewed as part of the Floodplain Management Plan update process. The reason(s) why they are or are not recommended for action are also presented.

5.1 Preventive Activities

Preventive activities are considered those that keep flood problems from getting worse. The City of Petaluma already participates in a number of preventive activities, which include:

- Preservation of open space and natural and beneficial features per General Plan 2025 Policies 4-P-1 through 4-P-4;
- Established a 200 foot setback on both sides of the Petaluma River per General Plan 2025 policy 8-P-30;
- Mitigation requirements per General Plan 2025 policy 8-P-37;
- Zero net fill policy per General Plan 2025 policy 8-P-33A;
- Maintaining freeboard requirements;
- Drainage system maintenance;
- Maintaining building code and staffing; and
- Storm water management regulations;

The following are additional activities that were considered and evaluated by the TAC members in the previous FMP and re-evaluated and updated as appropriate in this document:

Prohibit Residential Development on First Floors General Plan 2025 policy 8-P-37(H) states that residential development shall be prohibited on the first floor of new structures within the regulatory floodplain after remapping of the FEMA floodway/floodplain.

Surface Water Management Master Plan The City of Petaluma has completed its General Plan 2025 update. One of the tasks of the work effort was to develop a Surface Water Master Plan, which in part addresses the hydrology and drainage of the Petaluma watershed and how it affects hydraulic conditions in the Petaluma River within the City's boundaries. The Plan includes technical appendices related to surface water management including calibration of the new XP-SWMM surface water model. This model will evaluate flood mitigation and sustainability alternatives, including surface water detention or retention, and other structural and non-structural conveyance facilities. The results of the study have been

incorporated into the General Plan 2025, and has enabled the City to develop and adopt new general plan policies and regulations for new development or redevelopment within City limits as well as to work with Sonoma County Water Agency through the Zone 2A Committee to address regulations for new construction in the Petaluma River watershed. City staff worked with FEMA staff, utilizing the new XP-SWMM storm water model to update the Flood Insurance Rate Maps in 2014, which included the Petaluma River flood control project structural improvements. City staff will continue to use the XP-SWMM model for planning surface water master plan updates as well as update the model as necessary to reflect current conditions.

Lower threshold for substantial improvements The City currently maintains a 50% threshold for substantial improvements, which meets the minimum requirements of the National Flood Insurance Program, to properties in the floodplain.

Protection of critical facilities The TAC committee considered the preventive action of prohibiting new critical facilities from the 500-year floodplain and/or requiring new and substantially improved critical facilities to be protected from damage and loss of access as a result of the 500-year flood. These activities were determined to be infeasible due to the severe limitations they would place on infill development and commercial activity and because of the expense of required retrofitting for such facilities.

Low Density Zoning The TAC members briefly reviewed the basic requirements of this activity. The City's new General Plan has established new land use designations, which includes development intensities, for all properties with its influence. The plan creates a 400-foot wide "River Plan Corridor" land use classification which requires preservation of natural and beneficial functions, open space preservation, development setbacks, and allows for peak storm water flows. Also, since the City of Petaluma is fairly developed at this point in time, low density zoning, as defined by the CRS Program is not feasible in the floodplain. The General Plan prohibits first floor residential uses in the floodplain, which would be inconsistent with allowing low density residential development.

Public Maintenance of Required Facilities The City continues to require that Homeowner Associations (HOAs) or other private maintenance entities inspect and clean drainage facilities on private developments. However, the City does not inspect the facilities with its own crews. It was decided that it would be difficult to justify the additional City funding necessary to hire additional staff to perform such inspections. The City has the ability to enforce its storm water ordinance through an established code enforcement program. Also, the City and Sonoma County Water Agency do perform routine inspections and maintenance of open channel and piped storm drain systems within their respective jurisdictions. The

City's new General Plan includes policies, 8-P-35(A, E and G), that requires storm water system inspection and maintenance. Additionally, the General Plan contains policy 8-P-35(H) which is to advise property owners to ensure maintenance of privately owned creeks as well as facilitate necessary regulatory permitting and design standards for such maintenance. Other agencies within the City of Petaluma watershed, such as the County of Sonoma, SCWA and Southern Sonoma County Resource Conservation District have established creek maintenance and enhancement plans for their respective jurisdictions. Typical maintenance activities include removal of non native species and clearing of overgrown vegetation. All maintenance work is subject to regulatory agency permitting requirements.

The City's Public Works and Utilities Department maintains a creek stewardship program to facilitate increased resident participation and responsibility for maintaining privately owned creek corridors in a manner capable of conveying flood flows while preserving riparian habitat values.

5.2 Property Protection Activities

Property protection activities that have been conducted in the past by the City of Petaluma include:

- Removal of two residential structures from the special flood hazard area. These structures were located at 529 Madison Street, which is owned by Clover-Stornetta Farms.
- Acquisition / relocation of 11 other properties within the floodplain.
- Requiring elevation certificates for any new floor area built or substantial improvements to properties in the floodplain and;
- Participating in the CRS program to reduce the insurance premiums for floodplain residents.
- The City has incorporated elevation certificate data into a computer format using the software available from FEMA.

As part of this FMP update, the TAC discussed the following activities, which were identified in the 2001 and 2010 FMP's for property protection and agreed to continue to pursue as appropriate:

Removing Structures from the Floodway The Water Resources element of the new General Plan includes policy 8-P-29(D) which states that the City shall develop a plan and identify funding opportunities to acquire and relocate existing structures within the regulatory floodway. The City has an adopted Multi Hazard Mitigation Grant Plan, through the Association for Bay Area Governments, which enables the City to qualify for Flood Mitigation Assistance and Pre-Disaster Mitigation funding.

Flood Proofing Program The City continues to provide flood proofing information to interested parties. Subsequent to the New Year's Eve flood in 2005, City staff worked with one local commercial property owner on providing building flood proofing measures. The improvements have been completed. In 2011, the City required the new Petaluma Health Center at 1179 North McDowell Boulevard to install a commercial flood proofing system as part of its facility upgrade. A publicly funded flood proofing program would be a very expensive undertaking, given an estimated cost of $50,000 per structure with approximately 800 properties that are presently located in the floodplain. This activity is not financially feasible at this time. However, the City remains committed to pursuing future grant and other funding opportunities.

Maintaining Elevation Certificates for post-FIRM Buildings The City has records of elevation certificates dating back to 1991 when it first joined the CRS Program. The City does not have records of elevation certificates that date back to the first FIRM in 1983.

Maintaining Elevation Certificates for all pre-FIRM Buildings The City has no records of elevation certificates for structures built before the first FIRM was issued by FEMA. This activity would require substantial staff and monetary efforts to perform, and the TAC decided to not pursue this activity at this time.

5.3 Natural Resource Protection Activities

To protect the natural areas and natural functions of the floodplain, the City of Petaluma has conducted the following activities:

- Protection of approximately 150 acres of wetlands in the Petaluma Marsh;
- Regulatory constraints on development in natural or riparian areas;
- Erosion and sediment control; and
- Storm water pollution control.

The following activities were reviewed by the TAC members:

Additional regulations for natural and beneficial functions The TAC committee discussed and evaluated prohibiting certain activities in the floodplain that may be hazardous to public health or water quality; new regulations requiring floodplain development to minimize disruption to stream channels; and developing a Habitat Conservation Plan, which would lead to adoption of appropriate regulations. These issues have been addressed by the City's General Plan 2025, which includes several new policies and programs in the natural environment and water resources elements to provide additional protection of existing waterways and

sensitive habitat areas. Additionally, the City's storm water ordinance contains several code sections that prohibit discharges in the floodplain area.

Best Management Practices The City currently participates in the State of California's general National Pollution Discharge Elimination System (NPDES) permit for all construction activity that results in soil disturbance of at least five acres of total land area. Additionally, the City created a Storm Water Management Plan in 2003 in accordance with the requirements of the Phase II Environmental Protection Agency surface water quality order. The plan includes best management practices for construction and municipal operations. This permit was updated in 2013. The City is in the process of implementing updated storm water management programs as required by the new permit.

5.4 Emergency Services Measures

The City's Fire Department has developed and regularly updates its standard procedures for a flood emergency response. Existing elements of the flood-warning program include:

- A computerized Flood Alert System comprised of numerous stream gages to enhance the City's ability to provide timely emergency flood response and evacuation warning to residents in flood prone areas (see Table 2 and Figure 4).
- Emergency Operations Plan (EOP) (last updated March 2007). The City plans to update its EOP within the next two years.
- Sonoma County operational area Emergency Operations Plan (last updated December 2014)
- Emergency warning dissemination;
- Critical facilities planning; and
- Participation in the State of California's dam safety program

5.5 Structural Projects

The City has been working on the Petaluma River Flood Control Project in a joint effort with the Army Corps of Engineers for over fifteen years. The project includes channel widening, floodwalls along Washington Creek and the Petaluma River, a concrete transition weir, two new pump stations, replacement of the Payran Street Bridge and the Lakeville Street Bridge, creation of a U-shaped channel along one reach of the river, and replacement of one railroad bridge and the removal of a second railroad bridge. The project is substantially complete with the remaining work scheduled for completion in November of 2015.

The City continually completes improvements to its local storm drain system through the 5-year Capital Improvement Program (CIP) and maintenance that is updated on an annual

basis. Recent improvements include inspecting and cleaning/repairing culverts, pipes and catch basins each fall, prior to the onset of the rainy season.

Committee members also reviewed the proposed flood management projects in the City's CIP for the next several years. These will be described in greater detail in the Action Plan.

5.6 Public Information Activities

Since the beginning of its membership in the CRS Program, the City of Petaluma has been conducting a variety of public outreach activities addressing flood awareness and education, and floodplain management. Some examples of ongoing activities are:

- Maintaining elevation certificates on post-FIRM and all new buildings in the floodplain;
- Providing map information and flood insurance purchase requirements to all inquirers;
- Mailing an annual brochure/newsletter to all residents in the floodplain providing floodplain management education and information;
- Compliance with State law on flood hazard disclosure for real estate transactions;
- Maintaining a flood protection library; and
- Providing site-specific flood and flood-related data for property owners.

During the FMP process, some additional public outreach activities were evaluated and discussed by the technical advisory committee. They include:

Outreach to the entire community The City currently sends an annual newsletter to the residents in the floodplain as well as the entire community. This City will continue to participate in this activity. The City partners with the local waste hauler, Petaluma Refuse and Recycling, to mail flyers that include flood information to the entire community, with waste bills.

Additional Outreach Projects with Public Information Program Strategy
Approximately 13 percent of the floodplain residents responded to the floodplain questionnaire that was mailed out by the City as part of the FMP update process. The input received from the questionnaires assisted City staff in preparation of this FMP update. The responses in the questionnaire were fairly mixed. Approximately half of those that responded agree that most of the City is adequately protected from flooding with 25% disagreeing and 25% neutral. In general however, most of those that responded indicated that flooding is still a very serious threat to lives and safety, and to the economic well-being and transportation facilities of this area. This is one reason why the City of Petaluma

will continue its efforts in floodplain management including participation in the NFIP and CRS programs.

Expanding hazard disclosure in the City of Petaluma The City currently distributes annual outreach letters to real estate agents and lenders with information regarding the hazards of flooding. In 2010, City staff met with the Northbay Association of Realtors to discuss modifications to the City's annual outreach letter based on updated California disclosure laws. Staff agreed to make changes and will continue to distribute the letter on an annual basis as part of the CRS program.

Additional Floodplain Management Training for City Staff The TAC members are aware of several training programs that are offered by FEMA through its Emergency Management Institute. A representative from the City's Public Works and Utilities Department has attended the Community Rating System course and the advanced floodplain management concepts course. Additionally, Public Works staff has attended local flood insurance program courses sponsored by the State NFIP office. Staff will continue to pursue further educational opportunities as required.

Additional Map Data Through its Geographic Information System (GIS) the City has developed a highly accurate digital base map for use in all of its mapping activities. This base includes streets, property lines, corporate limits and other relevant base information. A number of digital map overlays have been created to improve access to and quality of the flood data within the City. The City continues to maintain the following items in its GIS system:

- Locations of buildings in the floodplain;
- Overlays of the February 2014 and December 2008 Flood Insurance Rate Maps including the floodway and 100-year floodplain boundaries;
- Updated color aerial photography from 2011;
- Zoning designation, including the Petaluma River Corridor;
- Utility (storm drain) locations.
- Links to record drawings including storm drain plans.

Additionally, the City has utilized the XP-SWMM software to develop a state of the art storm water model. The model data includes the latest available information, including the Petaluma River flood control project, and was used by the City and FEMA for the revised Flood Insurance Rate Maps for the City of Petaluma.

Maintenance of Elevation Reference Marks To date, the City has not formally initiated a maintenance policy for the permanent monuments, or elevation

reference marks that are located throughout the City. The TAC members evaluated undertaking this effort to assist surveyors in finding the markers and ensuring the markers' accuracy. Committee members agreed that the maintenance of the existing elevation reference marks in the City can be performed by City staff. Staff is currently working on a project that will convert the City's datum from National Geodetic Vertical Datum 1929 to North American Vertical Datum 1988 (NAVD88). The conversion is necessary to be consistent with the NAVD88 datum used on the Flood Insurance Rate Maps.

6. Floodplain Management Action Plan

Based on the development of floodplain management goals (Section 4), the feedback obtained from the citizens at the public meeting, and the review of potential floodplain management activities as detailed in Section 5, the Technical Advisory Committee has prepared a Floodplain Management Action Plan to be implemented over the next five years. This section provides details of the various activities that will continue, or have been approved as part of the updated Floodplain Management Plan process. Activities from each of the six primary floodplain management categories, i.e. preventive; property protection; natural resource protection; emergency services; structural projects; and public information are presented herein.

6.1 Preventive Activities

The TAC members recommend that the City of Petaluma continues to perform its ongoing preventive activities, which include:

6.1.1 Open Space Preservation The City will continue its efforts to keep vacant floodplain lands open and pursue additional open space acquisition opportunities pursuant to General Plan 2025 policies. Timetable: ongoing; Budget: staff time (operating budget)

6.1.2 Higher Regulatory Standards The City will continue its activities to enforce standards that provide more flood protection than that of the NFIP's minimum requirements. These activities include:

- Implement policies and program of the City's General Plan 2025.
- Requiring 2 feet of freeboard for first floor elevations above the base flood elevation per General Plan 2025 Policy 8-P-37F;
- Foundation protection;
- Requiring post construction elevation certificates for new structures, additions and substantial improvements to structures in the floodplain;
- Requiring zero net fill on all new developments in the floodplain per General Plan 2025 policies;
- Adhering to additional federal and/or state-mandated regulatory standards; and
- Maintaining adequate staffing in the City's Building Division to continue enforcing building codes for new construction and improvements in the floodplain and throughout the City.

The timetable for these activities: ongoing; Budget: staff time (operating budget)

6.1.3 Storm Water Management City staff will continue enforcing City standards on storm water management, freeboard requirements for new buildings in AE zones, requiring local drainage plans for new developments, erosion and sediment control regulations, and water quality regulations for new construction. Timetable: ongoing; Budget: staff time (cost recovery through development fees).

6.1.4 Storm Water Management Planning and Regulation City staff will continue to enforce policies and implement requirements of the following storm water documents.

- Surface Water Management Element (Chapter 8) of the General Plan 2025.
- Phase II Storm Water Management Plan and subsequent updates.
- Storm Water Ordinance (Chapter 15.80 Petaluma Municipal Code).
- Updated Grading and Erosion Control Ordinance (Chapter 17.31, Petaluma Municipal Code).
- Petaluma River Watershed Drainage Master Plan.

Timetable: ongoing; Budget: staff time

6.1.5 Drainage System Maintenance City will continue maintaining the reaches of the Petaluma River and adjoining tributaries as well as culverts, catch basins and piped storm drain systems that fall within its jurisdiction for debris removal. Timetable: ongoing; Budget: O&M operating budget;

6.2 Property Protection Activities

The TAC members recommend that the City of Petaluma continues to perform its ongoing property protection activities, which include:

6.2.1 Acquisition/Relocation The City has successfully undertaken efforts to acquire/relocate 13 properties in the floodplain in the past. The City will continue to explore opportunities per General Plan 2025 Policy 8-P-37 (E), such as pre-disaster mitigation and flood mitigation assistance programs, to fund the acquisition/relocation of properties, especially in the repetitive loss areas of the floodplain. Timetable: ongoing; Budget: staff time (operating budget).

6.2.3 Elevation Certificates The City will continue to require post construction elevation certificates for all new and substantially improved properties in the floodplain. Timetable: ongoing; Budget: staff time (operating budget).

6.2.3 CRS Program The City will continue participating in the CRS Program to assist floodplain residents in minimizing flood damages, protecting their property, and reducing their insurance premiums. Timetable: ongoing; Budget: staff time (operating budget).

6.3 Natural Resource Protection Activities

The TAC members recommend that the City of Petaluma continues to perform its ongoing natural resource protection activities, which include:

6.3.1 Petaluma Marsh Protection and Enhancement The General Plan 2025 contains several goals, policies and programs to protect and enhance biological and natural resources within the urban growth boundary. Policies 4-P-1 through 4-P-4 state various protection and enhancement measures for the Petaluma River and its tributaries as well as wetlands and marsh areas. Timetable: ongoing; Budget: staff time (operating budget).

6.3.2 Development Constraints The City's Zoning Ordinance requires that where any removal or modification of native or riparian vegetation is required, such removal or modification may be permitted only after obtaining a development permit consisting of written approval from the Planning Director, provided that such proposed modifications have been found to be consistent with the General Plan. These constraints continue to be underscored as vital to the preservation of open space and agricultural areas in the General Plan 2025. Timetable: ongoing; Budget: staff time (operating budget).

6.3.3 Erosion and Sediment Control Flood prevention activities were discussed in Section 6.1, and included the City's storm water management activities (Item 6.1.3), which incorporate development regulations for erosion and sediment control. These regulations also play an important role in the preservation of natural and riparian channel sections along the Petaluma River and its tributaries. Timetable: ongoing; Budget: staff time (operating budget).

6.3.4 Stormwater Pollution Control The City created a Storm Water Management Plan in 2003 in accordance with the requirements of the Phase II Environmental Protection Agency surface water quality order. The plan includes best management practices for construction and municipal operations. City staff prepares annual reports on each year's accomplishments and presents that information to the San Francisco Bay Area Regional Water Quality Control Board. The permit was updated in 2013. The City is in the process of implementing required storm water management elements required as part of the new permit. Timetable: July 2013 – June 2018, Budget: staff time (operating budget).

6.3.4 Petaluma River Floodway Acquisition Implement the Phase III terracing project in the lower Denman reach, between the twin bridges at Petaluma Blvd. North and Corona Road. The purpose of this project is to increase floodplain capacity in this reach while reducing localized flooding. Timetable: property acquisition and design complete, construction to commence in spring/summer of 2016; Budget: $2,659,000; Source of funding: Sonoma County Water Agency Zone 2A, State Department of Water Resources Grant and participation from private property owners.

The City has identified other natural resource protection projects which are identified in the 5-year storm water CIP "Surface Water Projects FY 2015-2016, Localized Flooding Reduction Projects" list located in Appendix C of this FMP.

6.4 Emergency Services Measures

The City of Petaluma has expended significant effort in developing a sound and effective flood preparedness program as part of its Emergency Operations Plan. The TAC members unanimously approved continuing the following activities:

6.4.1 Flood Alert System The City of Petaluma will continue to maintain and update its computerized flood alert system for flood warnings. The City is in the process of adding nine additional stream gauges and upgrading to the newer "Flood Alert 2" system. Timetable: FY 2015/2016; Budget: $174,00 Zone 2A Funds, $5,000 City funds, $85,180 in Prop 84 Funds ,and $431,400 in uncommitted local funding.

6.4.2 Emergency Warning Dissemination System The City of Petaluma will continue to maintain and modify, as necessary, the means by which floodplain residents are notified of evacuation plans or other measures to be undertaken in the event of a flood. The City also now uses the Nixle on-line e-mail notification system to disseminate emergency warnings. Timetable: ongoing; Budget: staff time (operating budget).

6.4.3 Critical Facilities Planning The City of Petaluma will continue to maintain and update its information on critical facilities on an annual basis. In addition, names and telephone numbers of operators of all critical facilities in the floodplain will be updated annually. Timetable: ongoing; Budget: staff time (operating budget).

6.4.4 Dam Safety Program The City of Petaluma will continue participating in the State of California's dam safety program. Timetable: ongoing; Budget: staff time (operating budget).

6.5 Structural Projects

The City of Petaluma is involved in both channel modification and local storm drain improvement projects. As mentioned in Section 6.3 of this FMP update, the City has a 5-year CIP storm water program titled "Surface Water Projects FY 2015-2016 Localized Flooding Reduction Projects" list that identifies and prioritizes flood reduction projects, cost estimates, funding sources and timelines. This list is hereby incorporated as part of this FMP update. The following local storm drain improvement projects are a sample from the flooding reduction projects list and will continue as part of this Floodplain Management Plan.

6.5.1 Petaluma River Flood Control Project The City of Petaluma is committed to completing this joint effort with the Army Corps of Engineers to provide 100-year level of flood protection in the Payran area. Timetable: the remaining work includes installation of a short section of sheet pile channel wall upstream of Lakeville Street, excavation of the transition channel downstream of Lakeville Street and installation of rock rip-rap along the river bank downstream of the Payran Street Bridge; Approx. Budget: $3,147,000; Source of funding: Federal Funds; Schedule: Completion by November of 2015.

6.5.2 Local Storm Drain Improvements The City of Petaluma currently has a Capital Improvement Plan (CIP) through Fiscal Year 2020. There are 9 projects that have been identified to expand the drainage system and alleviate local flooding by re-contouring creeks to increase flow capacity, adding or improving inlets to existing pipelines or installing new pipes. Some of the detailed improvements include:

- Capri Creek (North McDowell to Maria Drive); Re-contour Capri Creek between North McDowell Boulevard and Maria Drive, along Sunrise Parkway to reduce out of bank flooding of private property. Timetable: Design 2015/2016, Construction 2016/2017; Budget: $1,100,000; Source of Funds: Storm Drain Mitigation Fees, Zone 2A Assessments, State grant.

- Phase III terracing project (lower Denman reach, between the twin bridges at Petaluma Blvd. North and Corona Road); The purpose of this projects is to increase floodplain capacity in this reach while reducing localized flooding. Timetable: Design complete, Construction 2016; Budget: $2,659,000; Source of funding: Sonoma County Water Agency Zone 2A, State Department of Water Resources Grant, open space grant.

- Kelly Creek (at Sunnyslope Avenue); Reconstruct confluence of Kelly Creek and utility lines at Sunnyslope Avenue and extend storm drain pipe to nearest storm drain system with sufficient capacity. Timetable: Design 2015/2016, Construction 2016/2017; Budget: $1,167,000; Source of Funds: Currently unfunded. Possible Storm Drain Mitigation Fees and Zone 2A Assessments.

- Washington Creek Repair and Enhancement; Bank repair and native riparian plantings on Washington Creek from North McDowell to Prince Park. Timetable: Design 2015/2016, Construction 2016; Budget: $175,000 for studies, no construction funding; Source of Funds: Zone 2A Assessments.

- Various Surface Water Projects; various project on Adobe Creek, Lynch Creek, Washing Creek and Willow Brook Creek. Timetable: 2016/2017, and 2018/2019; Budget: $2,464,000; Source of Funds: Not yet determined.

6.6 Public Information Activities

The public's response to the City's questionnaire mailed to all the residents and property owners in the floodplain indicated that residents in the City's floodplain wish to be better informed of flood protection activities and flood awareness issues. The TAC members committed to continuing the City's current outreach efforts and expanding them, as presented below:

6.6.1 Map Information and Flood Insurance Requirements The City will continue to provide map information and flood insurance purchase requirements as a service to all citizens who contact the City seeking such information. City staff will keep the maps updated and will continue to publicize the service. Timetable: ongoing; Budget: staff time (operating budget).

6.6.2 Annual Brochure / Newsletter The City has been mailing a flood awareness newsletter every year to residents in the floodplain as well as all residents within Petaluma. The City will continue this outreach. At the August 19, 2015 public meeting, City staff heard concerns from the public that the flood information sent in bill stuffers may not reach all residents because many now receive bills electronically. The TAC agreed that the City will examine this issue and ways to implement the necessary changes to improve the system. Timetable: ongoing; Budget: Operating budget will include additional funds to cover extra printing and postage.

6.6.3 Additional Outreach Strategy City staff will continue to develop, coordinate, and evaluate annual outreach activities in addition to the preparation and

mailing of the annual brochure. City staff will continue to assess the local hazard, discuss appropriate flood safety measures, develop an outreach activity to address a specific issue and establish the process that will be followed to implement and evaluate its effectiveness on an annual basis. Timetable: ongoing; Budget: Staff time plus costs for printing materials for display or distribution to City residents (operating budget).

6.6.4 Flood Hazard Disclosure The City of Petaluma will continue its compliance with state law on flood hazard disclosure for real estate transactions. Timetable: ongoing Budget: Staff time plus printing and mailing costs (operating budget).

6.6.5 Flood Protection Library The City will continue maintaining and updating a collection of pertinent flood protection materials at the City's public library. These documents will be entered into the library's card catalog to allow patrons easy access to publications related to flooding and flood protection. Timetable: ongoing; Budget: staff time (operating budget).

6.6.6 Additional Map Data The City already maintains a detailed GIS database including various layers of information that are pertinent to flood data and flood management. Additionally, the City has utilized the XP-SWMM software to develop a state of the art storm water model. The model data includes the latest available information, including the Petaluma River flood control project, which was used by the City and FEMA to create new Flood Insurance Rate Maps for Petaluma, effective February 19, 2014.

6.6.7 Elevation Reference Mark Maintenance The City will initiate exploration of a program to convert the vertical datum from National Geodetic Vertical Datum 1929 to North American Vertical Datum 1988. Timetable: Ongoing; Budget: staff time (operating budget).

7. Implementation and Evaluation

The Petaluma City Council voted to adopt the updated Floodplain Management Plan at their September 21, 2015 meeting.

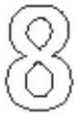
The City's CRS Coordinator will work with other city staff as well as current and future technical advisory committee members to monitor implementation of the floodplain management activities, review progress on an annual basis, and recommend revisions to the plan in an annual report. This report will be submitted to the Petaluma City Council, the Federal Emergency Management Agency, local newspapers, posted on the City's web site, and will be made available to the public.

Appendix

Appendix A Water Resources Element, Chapter 8, Petaluma General Plan 2025

Appendix B Natural Environment Element, Chapter 4, Petaluma General Plan 2025

Appendix C Surface Water Projects FY 2015/16, City of Petaluma



Water Resources

The Water Resources Element brings four components (Water Supply and Demand, Recycled Water, Wastewater, and Surface Water) of Petaluma's water systems to the forefront, equal in weight to the other elements, rather than obscured within an element covering a multitude of community facilities topics. As quoted by Mark Twain "Whiskey's for drinking, water's for fighting"; water has been the source of the most intensive part of the work effort of this Plan, and certainly much of the controversy and public discussion. The approach to the community's water resources, through direction from the City Council, has been to address water related issues holistically. Recognizing the scarcity of the resource and the need to use water in the most environmentally sensitive and responsible manner has resulted in an element that offers innovative solutions to meet the community's needs now and well into the future.

8.1 WATER SUPPLY AND DEMAND

INTRODUCTION

The Water Supply and Demand section of the Water Resources Element presents a plan for providing Petaluma's residents and businesses with a safe, reliable, and high quality source of water through 2025 and beyond, using a mix of imported water purchased from the Sonoma County Water Agency (SCWA), recycled water, water conservation and groundwater. A challenging and more complex environment requires development of a new approach towards water supply through the General Plan period. Modest population growth translates into water demands increasing from 3,600 million gallons per year (11,000 acre-feet per year) in the baseline year of 2002, to approximately 5,139 million gallons per year (15,775 acre-feet) in 2025. Regulatory and environmental issues have delayed the SCWA's expansion of its water transmission system. Consequently, projected demands will exceed the amount of water the SCWA can provide without expanding its water transmission system. Should the SCWA complete expansion of the water transmission system prior to 2025, the City may revisit this plan , particularly regarding the volume of tertiary recycled water provided for offset.

BACKGROUND & CONTEXT

Petaluma's water supply prior to 1961 was provided by local groundwater, supplemented by water from Lawler Reservoir and the Station #7 filter plant. Water quality concerns prompted the City to investigate alternate water supplies. On May 9, 1960, the City of Petaluma and the North Marin Water District entered into an agreement with the SCWA for the annual delivery of 4,500 acre-feet and 10,000 acre-feet of water, respectively. In response, the SCWA began construction of the Petaluma Aqueduct, which included a 16-1/2 mile long 24-inch and 33-inch diameter pipeline from Santa Rosa to Petaluma, a booster pumping plant, and a six million gallon reservoir near Lake Ralphine.

The Petaluma Aqueduct began operating in December 1961. The superior quality aqueduct water quickly became the City's primary source of water. The City continues to maintain and operate local wells to meet peak demands and emergency needs. Today, the Santa Rosa Aqueduct and the Russian River-Cotati Intertie carry Russian River water from SCWA diversion facilities located in the Wohler and Mirabel areas to Petaluma via the Petaluma Aqueduct. In addition, SCWA operates three groundwater wells in the Santa Rosa Plain that supplement the water supply from the Russian River. Treatment is provided by chemical addition for disinfection and corrosion control.

Petaluma's primary source of water continues to be Russian River water purchased from the SCWA. The SCWA supplies water to Petaluma and seven other water contractors under the Restructured Agreement For Water Supply. Under the Restructured Agreement, Petaluma's monthly water supply entitlement from the SCWA is an average-day maximum month supply of 21.8 mgd and an annual supply limit of 13,400 acre-feet per year (4,366 million gallons)[1]. The SCWA also supplies water to Petaluma and other water contractors under the Temporary Impairment Memorandum of Understanding (MOU). The MOU governs allocation of water during periods of Temporary Impairment. Under the MOU, Petaluma is obligated to use its best efforts to limit its demand on the Transmission System to 17.1 mgd. The MOU supersedes the Restructured Agreement. The City supplies approximately 68 percent residential and 32 percent non-residential customers, which include commercial, institutional, and industrial customers. In the baseline year of 2002, the City delivered more than 3,600 million gallons (11,000 acre-feet) of potable water to Petaluma's residents and businesses.

Water Rights And Supply

The State Water Resources Control Board (Board) is the agency with authority over water rights in California. California water rights permits often contain terms limiting rates of direct diversion and re-diversion. Direct diversion refers to water diverted directly from stream flows. Re-diversion refers to water that has first been diverted to storage in a reservoir, then released and diverted again (re-diverted) at a point downstream. The Agency operates its facilities under four (4) separate Board permits. The combined direct diversion and re-diversion under all four permits is limited to 75,000 acre-feet (24,400 million gallons) per year, with a maximum diversion rate of 180 cubic feet per second.

As reported in the SCWA's Water Supply Workshop Report (November 2004), the objective of the Water Project is to provide a safe, economical, and reliable water supply to meet the defined current and future water supply needs in the Agency's service area. The EIR

[1] Annual entitlement limits were not included in the water supply agreements prior to the 11th Amended Agreement.

Table 8.1-1: Existing and Projected Water Demands

Year	Total Annual Water Demand (MG)	Total Annual Water Demand (AF)	Average Daily Water Demand (MGD)	Maximum Day Water Demand (MGD)	Maximum Month Water Demand (MG)	Average Day Maximum Month (MGD)
2005	3,845	11,799	10.5	19.4	497	16.5
2010	4,364	13,391	12.0	22.0	564	18.8
2015	4,723	14,493	12.9	23.8	610	20.3
2020	4,898	15,031	13.4	24.7	633	21.1
2025	5,139	15,775	14.1	25.9	664	22.1

Table 8.1-2: Projected Total Water Use

Water Use	Water Demand Projection by 2025	SCWA Supply	Shortfall
Annual	5,139 million gallons	4,366 million gallons	773 million gallons
Average Day Maximum Month	22.1 mgd	17.1 mgd	5 mgd

will be designed to address the deficiencies identified by the Court of Appeals. As of February 2006, the SCWA estimates the EIR will be completed by October 2007.

Endangered Species Act

The National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) is the Federal Agency with authority to address Endangered Species Act (ESA) issues. NOAA Fisheries has listed Coho Salmon, Steelhead and Chinook Salmon as "threatened" in the Russian River under the ESA. There are two levels at which species are listed: threatened or endangered. An "endangered" species is one that is in danger of extinction throughout all, or a significant portion of its range. A "threatened" species is one that is likely to become endangered in the foreseeable future.

The SCWA submitted a Biological Assessment (BA) to NOAA Fisheries in 2004. The next step is for NOAA Fisheries to prepare its Biological Opinion (BO), which is a detailed report of their opinion as to whether or not the actions described in the BA are likely to jeopardize the continued existence of the listed species or result in the destruction or adverse modification of designated critical habitat.

WATER DEMAND

The City completed an analysis of water supply demands based on the Draft General Plan 2025 and compared them to the SCWA water supply. The City's existing water demands were assessed from City water meter records, water supply production values, and distribution system operation records for the baseline year of 2002. The projected annual water demands were then developed based on anticipated land use changes from the 2002 base year through buildout of the Draft General Plan 2025, based on the preferred land use plan considered by the City Council in November 2005[2]. The land use changes were divided into nine tiers of possible development projects, ranging from projects under construction, projects in formal review, and projected potential projects resulting from land uses identified in the Draft General Plan 2025. These tiered projects were allocated to five-year increments within the planning period to set the potential timing of the water demand in the system as illustrated in Table 8.1-1.

The maximum month and maximum daily water demand projections were based on an assessment of historic water demand conditions. The annual demands, maximum month demands, and maximum day demands for 10 years from 1994 to 2003 were reviewed to identify peaking factors associated with maximum month and maximum day demands in each year. The average maximum day peaking factor over the 10-year period was 1.84 times the average annual daily rate. The average maximum month peaking factor over the 10-year period was 1.55 times the average monthly

[2] The year 2002 was selected as the baseline because of the good correlation between water consumption data and available land use data for the year 2002.

demand. These 10-year average peaking factors were applied to the annual projections to obtain maximum month and maximum day projections.

Through build-out of the Draft General Plan 2025, Petaluma's total demand by 2025 is projected to be approximately 5,139 million gallons annually (15,775 acre-feet). Petaluma's current (2006) entitlement of 4,366 million gallons (13,400 acre-feet) per year from SCWA alone will not be sufficient to meet the growth projected through 2025. The analysis also shows that by 2025, the average day maximum month (ADMM) demand, or peak demand, will be 22.1 mgd, which exceeds the Temporary Impairment MOU limit of 17.1 mgd.[3] By 2025, this analysis indicates there will be an annual demand shortfall of 773 million gallons (2,371 acre-feet) per year and an ADMM demand shortfall of 5 mgd. The analysis further indicates that the shortfall in ADMM may begin occurring during peak demand periods as early as 2007 and the annual demand shortfall may begin occurring as early as 2010.[4] The projected demands are presented in Table 8.1-2.

[3] The Average Day Maximum Month, or ADMM, is the average daily flowrate for the month with the most water use.

[4] With Rooster Run using recycled water beginning in 2006, the shortfall in ADMM could occur in 2008, and an annual shortfall could occur in 2011.

Table 8.1-3: Current and Projected Annual Water Supply

Annual Supply Conditions	*Total Annual Water Supply in Million Gallons*				
	2005	*2010*	*2015*	*2020*	*2025*
SCWA	3,845	4,055	4,212	4,240	4,364
Recycled Water	0	217	331	431	464
Water Conservation	0	91	180	228	250
Groundwater	0	0	0	0	61
Total Supply Sources	3,845	4,363	4,723	4,899	5,139
Annual Supply Conditions	*Total Annual Water Supply in Acre-Feet*				
SCWA	11,799	12,443	12,923	13,009	13,397
Recycled Water	0	667	1,017	1,322	1,425
Water Conservation	0	280	553	700	767
Groundwater	0	0	0	0	186
Total Supply Sources	11,799	13,391	14,493	15,031	15,775

Source – Dodson Engineers, 2006

Table 8.1-4: Current and Projected Maximum Month Water Supply

ADMM Supply Conditions	*Average Daily Flow During Maximum Month in Million Gallons per Day*				
	2005	*2010*	*2015*	*2020*	*2025*
SCWA	16.5	16.8	16.9	16.6	16.7
Recycled Water	0.0	1.5	2.5	3.4	3.6
Water Conservation	0.0	0.5	0.9	1.1	1.3
Groundwater	0.0	0.0	0.0	0.0	0.5
Total Supply Sources ADMM	16.5	18.8	20.3	21.1	22.1

Source – Dodson Engineers, 2006

WATER SUPPLY

The Water Supply and Demand Analysis Report is a long-term plan that increases the use of recycled water, expands the water conservation program, and includes the moderate use of groundwater to meet increasing potable water demands, until such time as the SCWA is able to expand its water transmission system. These opportunities translate into viable water supply options that were evaluated by the City with the goal of identifying the appropriate mix of water supply that allow the City to meet its long-term water supply needs. The planned mix of water supply sources to meet projected annual and maximum month water demands are illustrated in Tables 8.1-3 and 8.1-4 respectively.

RECYCLED WATER

Water recycling is the treatment and management of municipal, industrial, or agricultural wastewater to produce water that can be reused for beneficial uses, and offset demands for drinking water supplies (potable water). Water recycling provides an additional source of water that can be used for purposes such as irrigation or environmental restoration. While historically, the City of Petaluma has used recycled water primarily for agricultural irrigation, the City now has an opportunity to use recycled water as a water supply that can offset current and future potable water demands. For additional information see the Water Supply and Demand Analysis Report (Dodson 2006).

The City is constructing the Ellis Creek Water Recycling Facility (WRF), expected to come on line in 2009. The facility will produce tertiary recycled water in accordance with California Department of Health Services (DHS) Title 22 requirements for unrestricted use. Allowable irrigation uses for tertiary recycled water include parks and playgrounds, schoolyards, residential landscaping, unrestricted access golf courses, food crops, and other uses permitted by the DHS through the California Code of Regulations.

Table 8.1-5: Summary Tertiary Recycled Water Customers

Customer Type	*Total ADMM Flowrate (mgd)*	*Number of Customers/Sites*
Golf Course	1.0	2
Open Space	0.2	3
Park	1.3	37
School	1.0	19
Turf	0.1	1
Total	3.6	62

The recycled water program consists of a least cost combination of tertiary and secondary treatment scenarios that, in combination, distribute all recycled water from the City's Ellis Creek Water Recycling Facility during the period of restricted discharge into the Petaluma River, provide system flexibility, and create sufficient potable use offset. Potable offset is defined as current potable water use that is replaced by tertiary water use.

The Ellis Creek Water Recycling Facility, nearing completion, will provide tertiary recycled water to offset potable demand.

The Water Resources Plan calls for a phased approach to further implement the use of recycled water throughout the City of Petaluma. The first customer is the Rooster Run Golf Course which uses approximately 138 MG/ year of water for irrigation of 126 acres. Since the Rooster Run Golf Course can be supplied with secondary recycled water by the existing recycled water system, the backbone pipeline was designed and built to be in use by summer 2006. The pipeline will temporarily connect to the existing secondary recycled water system to serve Rooster Run Golf Course until the tertiary system goes online in Year 2009. A summary of the type of customers and potable offset demands are summarized in Table 8.1-5.

The tertiary recycled water distribution system will eventually be expanded to serve irrigation needs in all four quadrants of the City. Service to these areas will require significant capital improvements including a new pipeline distribution system, two 1.0 MG reservoirs, pump station and eventually an increase in the tertiary treatment capacity of the Ellis Creek WRF. The system would be expanded incrementally through 2025.

WATER CONSERVATION

The City's water conservation program focuses on thirteen best management practices (BMPs) or water demand management measures. The City utilizes water conservation BMPs as a method to reduce water demands, thereby reducing water supply need for the City.

The City is a member of the California Urban Water Conservation Council (CUWCC). The CUWCC was created to assist in increasing water conservation statewide, under a Memorandum of Understanding (MOU). As signatory to the MOU, the City has pledged their good faith effort towards implementing BMPs identified in the CUWCC MOU Regarding Urban Water Conservation. The City signed the CUWCC MOU on January 31, 2002, and submits annual BMP reports to the CUWCC in accordance with the MOU. The MOU requires that a water utility implement only the BMPs that are economically feasible. If a BMP is not economically feasible, the utility may request an economic exemption for the BMP. The City has not requested economic exemption from any of the BMPs at this time.

Table 8.1-6 includes the CUWCC BMPs currently performed by the City. The CUWCC BMP 10, Wholesale Agency Assistance Programs, does not apply to the City since the City does not wholesale water to another entity.

The City's continued implementation of the thirteen water conservation BMPs will provide water use reductions throughout the planning period. However, to increase water conservation in the future to meet projected water demands, seven additional BMPs will be implemented and are listed in Table 8.1-7. The additional BMP program is scheduled to start in 2008.

The new water conservation measures will supplement the City's existing water conservation program, and will be phased in over the years 2008 – 2025. The new measures are projected to boost annual savings by approximately 250 million gallons, and reduce peak day demands by 1.28 mgd. The estimated total cost is $8.3 million[5]. In October 2005, the City began work on a Water Conservation Plan to identify potential water conservation measures and programs that are beyond the scope of the BMPs. This effort will conclude in Fall 2006, and will include a program for additional water conservation savings.

The proposed water conservation program, combined with the proposed recycled water program, will save a total of 714 million gallons of potable water annually, and reduce peak day demands by 4.85 mgd. The remaining potable water shortfall through build-out of the Draft General Plan 2025 of 59 million gallons annually and a peak day demand of 0.15 mgd may need to be met through the measured use of groundwater.

GROUNDWATER

The City intends to use groundwater primarily for standby or emergency conditions and will meet all normal demands from surface water (SCWA), recycled water, and conservation in the near term (Dodson Engineers, 2006). The City's intent is to continue to provide minimum month average day demands from its well supply as a short-term emergency, drought, or SCWA supply containment source of water. Following past practices, groundwater use may be utilized during the planning period to meet peak water demands in the summer months. In 2006 the City had six active wells and nine inactive wells. Groundwater will also serve as a water supply if SCWA deliveries are curtailed.

At the end of the planning period in years 2024 and 2025, the water supply available to the City from SCWA, in combination with recycled water and water

5 Present worth, 2006 dollars.

Table 8.1-6: City Water Conservation Best Management Practices

Best Management Practices, BMP
BMP 01:Water Survey Programs for Single-Family and Multi-Family Residential Customers
BMP 02:Residential Plumbing Retrofit
BMP 03:System Water Audits, Leak Detection, and Repair
BMP 04:Metering with Commodity Rates for all New Connections and Retrofit of Existing
BMP 05:Large Landscape Conservation Programs and Incentives
BMP 06:High-Efficiency Washing Machine Rebate Programs
BMP 07:Public Education Programs
BMP 08:School Education Programs
BMP 09:Conservation Programs for Commercial, Industrial, and Institutional Accounts
BMP 10:Wholesale Agency Assistance Programs
BMP 11:Conservation Pricing
BMP 12:Conservation Coordinator
BMP 13:Water Waste Prohibition
BMP 14:Residential and Commercial Ultra Low Flow Toilet (ULFT) Replacement Programs

Table 8.1-7: Additional City Water Conservation Best Management Practices

Measure	*Description*
Recirculating Hot Water System for New Developments	Require all new single family and multi family housing units to have a recirculating hot water system installed. This includes a recirculation pump and insulated hot water pipes. An alternative may allow a tankless, instant hot water system.
High Efficiency Toilet Installation	Provide free contractor installation of high efficiency toilets, either dual flush (6/3 liter) or 4 liters-per-flush toilets.
Rain Sensors	Provide sensors to customers for their automatic irrigation system (controller). Users install sensors themselves.
Landscape Education Training	Combination of three types of training classes: (1) Xeriscape, (2) Homeowner Irrigation, and (3) Promotion of water efficient plants.
ET Controller Rebates	Provide rebates for purchase of weather adjusting (ET) irrigation controllers to customers. Users install controllers themselves.
Landscape Requirements	Establish and enforce new landscape requirements for new non-single family landscaping.
Commercial Urinal Rebates	Selectively provide rebates to businesses to convert to efficient (0.5 gallons/flush) or waterless urinals subject to high use, such as restaurants, theaters, schools, etc.

conservation may not be sufficient to meet annual or maximum month demands. This assumes buildout of the General Plan, which may or may not occur by 2025 based on market, growth management, and interim policies. The potential shortfall is estimated at 186 acre-feet per year, which is available by pumping approximately four of the existing wells. A combination of existing wells delivering an average of 0.5 MGD over the course of the four summer months would satisfy the annual supplemental supply condition of 186 acre-feet (60.75 million gallons). Existing well stations will be rehabilitated and individual wellhead treatment will be provided to meet water quality standards in place at that time. These flow rates are significantly below the City's historic groundwater pumping levels.

The groundwater would also continue to be used to supplement the maximum month demands. Combining SCWA water, recycled water and water conservation as described above leaves a peak day demand shortfall of

about 0.15 MGD at the end of the planning period. This peak demand can be met by the 0.5 MGD pumping of groundwater to meet annual demands during this period, reducing the surface water deliveries to less than the maximum month limit. This would provide additional flexibility and reliability in meeting maximum daily demands with either surface water or groundwater during the month.

Additional opportunities for water conservation, beyond those provided above, could be evaluated for applicability such as permitting gray water systems, composting toilets, drywells for drinking fountains; or other best management practices developed in the future. Any service or system connected or receiving service from the municipal source must be in full compliance with public health and safety regulations.

GOAL 8-G-1: Water Supply and Demand

Provide a safe, reliable, high-quality, economical and sustainable source of water to meet the community's needs.

Policies and Programs:

8-P-1 Optimize the use of imported water from the SCWA to provide adequate water for present and future uses.

A. Prepare, implement, and maintain long-term, comprehensive water supply plans and options in cooperation with the appropriate state and federal agencies, regional authorities, water utilities, and local governments.

B. Support regional efforts towards ensuring that imported water is reliable, cost-effective, and is of high quality.

8-P-2 Continue to work to maintain water supply agreements with SCWA to ensure adequate potable water.

8-P-3 Work with the Sonoma County Water Agency on the South Transmission System Project to develop the parallel aqueduct along the City's preferred eastside alignment in order to improve reliability of water supplies.

8-P-4 The City shall routinely assess its ability to meet demand for potable water.

A. The City shall continue to monitor the demand for water for projected growth against actual use, and ensure that adequate water supply is in place prior to, or in conjunction with, project entitlements.

B. The City planning staff will discuss water supply with the developer for each new development early in the planning process and inform Water Resources staff of upcoming demands as provided by the applicant.

C. The City shall maintain a tiered development record to monitor pending and projected developments to allow a reasonable forecast of projected water demand.

D. The City shall upgrade utility billing software as necessary to provide the ability to efficiently track and project water demand trends including, but not limited to, the following parameters.

- Land use categories
- Customer classifications

8-P-5 Develop alternative sources of water to supplement imported supply.

A. Expand the use of recycled water to offset potable demand.

B. Expand water conservation to further improve the efficient use of potable water.

C. Continue to use groundwater to meet emergency needs.

8-P-6 The City shall utilize the Water Demand and Supply Analysis Report, June 2006 and any amendments thereto, for monitoring, assessing and improving the City's municipal water supply.

A. Require implementation of adopted Water Master Plan through conditions of approval for all public and private development.

8-P-7 Limit the provision of potable water service to lands within the Urban Growth Boundary with the exception of the provisions outlined in the Urban Growth Boundary measure and incorporated into Chapter 2 Land Use, Growth Management, and the Built Environment.

Goal 8-G-2: Water Supply and Demand

Continue to maintain a high level of customer service and satisfaction.

Policies and Programs:

8-P-8 Provide timely responses to customer service requests and improve educational opportunities.

A. Implement monthly utility billing.

B. Convert to an automated meter reading system (AMR).

C. Provide additional information to customers on their water use through utility billing and new technology, such as web-based service programs. Additional information shall include amount of water used by tier for the current billing period, charge for each tier, amount of water used for wastewater charge during the current billing period, and recent water use history.

D. Expand community service programs such as:

- Conducting customer statistical analyses.
- Conducting consumer surveys.
- Providing customer leak detection services.
- Participating in the Business Water Project by the Business Environmental Alliance.
- Developing a community recognition program that recognizes efforts to implement Best Management Practices.

Goal 8-G-3: Recycled Water

Maximize the use of recycled water as a potable water offset to manage water demands, and meet regulatory requirements for wastewater discharge.

Policies and Programs:

8-P-9 Provide tertiary recycled water for irrigation of parks, playfields, schools, golf courses and other landscape areas to reduce potable water demand.

A. Expand the Ellis Creek Water Recycling Facility to provide tertiary and secondary recycled water as outlined in the Recycled Water Master Plan.

B. Operate and maintain the Ellis Creek Water Recycling Facility to produce recycled water to meet or exceed current regulatory standards.

8-P-10 The City may require the use of recycled water through the City development review process.

A. New development may be required to install a separate recycled water system as deemed necessary and appropriate by the City to offset potable demand.

B. Evaluate where the most appropriate potable water offset improvements can be implemented.

C. Determine the appropriate means of potable offset. Individual project systems may be required in addition to City-required improvements and/or fees relating to the recycled water offset system.

8-P-11 The City may continue to work with agricultural users to reuse secondary recycled water. In addition, the City may purchase land as a backup reuse site, if deemed necessary and appropriate to meet system needs.

8-P-12 Provide water of adequate quality and quantity to meet customer needs. The City, at its' sole discretion, during the environmental review and entitlement process, will determine whether a given customer's supply will be potable water, tertiary recycled water, secondary recycled water, groundwater, or a combination of these.

8-P-13 Work to convert existing potable water customers identified under the City's Recycled Water Master Plan to tertiary recycled water as infrastructure and water supply becomes available.

A. Require implementation of adopted Recycled Water Program improvements through conditions of approval for all public and private development.

Goal 8-G-4: Wastewater

Manage the wastewater collection and treatment system to address 100 percent capture and treatment of the City's wastewater in an economically and ecologically sound manner.

Policies and Programs:

8-P-14 The water recycling facility shall be operated and maintained in compliance with all State and Federal permit requirements.

8-P-15 Capacity of the water recycling facility shall be maintained, and expanded as necessary, to keep pace with the city's growth.

A. Require implementation of adopted Water Recycling Facility master Plan and distribution program improvements through conditions of approval for all public and private development.

8-P-16 Comply with the current Statewide General Waste Discharge Requirements concerning the operation and maintenance of the City's sanitary sewer collection system.

A. Perform condition assessment of existing facilities.

B. Survey facilities and maintain current system maps.

C. Perform regular cleaning and inspection to help eliminate sanitary sewer overflows.

D. Fund collection system infrastructure replacement on a 100-year life cycle.

E. Regularly update the sanitary sewer flow model and make improvements necessary to support development.

8-P-17 Maintain and expand public access and educational opportunities at the Ellis Creek Water Recycling Facility.

Goal 8-G-5: Water Conservation

Maximize water conservation measures to improve water use efficiency and reduce overall water demand.

Policies and Programs:

8-P-18 Reduce potable water demand through conservation measures.

A. Implement the Water Conservation Plan that incorporates conservation measures beyond the Best Management Practices developed by the California Urban Water Conservation Council.

B. Continue to expand the application of Water Conservation Best Management Practices.

C. Implement the City's Water Drought Contingency Plan to assist citizens in reducing water use during periods of water shortages and emergencies.

D. Revise the City's Landscape Ordinance to encourage, or as appropriate require, the use of water-efficient landscaping.

E. Regularly update regulations, codes and agreements to implement water conservation and discourage wasteful use of water.

F. Enforce conservation measures that eliminate or penalize wasteful uses of water.

Goal 8-G-6: Groundwater Supply

Preserve and maintain the City's groundwater resources.

Policies and Programs:

8-P-19 Ensure adequate water supply during emergency situations by developing potential groundwater resources and aquifer storage capacity, combined with management of surface water, to meet overall emergency water supply objectives. The City's groundwater resources shall be preserved to meet emergency needs and to offset peak demands.

A. The City will develop additional wells to supply the average minimum month water demand.

B. Work cooperatively with the County of Sonoma to protect and preserve Petaluma groundwater resources, including the preservation and enhancement of significant recharge areas within the watershed.

C. Evaluate the need and feasibility of developing limited wellhead treatment facilities to insure water quality requirements.

D. Preserve oak woodlands, upland native grassland, and wetland areas identified as contributing to groundwater recharge; at a minimum for areas identified within the Groundwater Feasibility Study, Technical Memo 4, dated February 2004 (Technical Appendix Volume 4).

8-P-20 Manage groundwater as a valuable and limited shared resource by protecting potential groundwater recharge areas and stream sides from urban encroachment within the Petaluma watershed.

See, at a minimum, those areas defined as possible recharge areas set forth in Technical Appendix Volume 4, Groundwater Feasibility Study, 2004, or revisions thereto.

A. Control construction of impervious surfaces in groundwater recharge areas. Potential recharge area protection measures at sites in groundwater recharge areas include, but are not limited to:

- Restrict coverage by impervious materials;
- Limit building or parking footprints;
- Require construction of percolation ponds on site.
- Require surface drainage swales

B. Urge the County when reviewing development applications, to examine the combined impacts of new septic tanks placed in proximity to wells and the ability to maintain adequate protection of groundwater resources. The County should examine the cumulative impacts of the allowed development densities in the West Petaluma Specific Plan area and compare the results to established water quality standards. Test wells should be required prior to issuing any building permits.

8-P-21 Protect groundwater quality from surface contamination by requiring 100 foot sanitary seals on all new municipal water supply wells.

8.2 PETALUMA'S WATER DISTRIBUTION SYSTEM

The major water distribution facilities owned and operated by the City consist of approximately 200 miles of pipeline, ten treated water reservoirs which provide 13 million gallons of storage, and eight booster pump stations. The City's existing water distribution system is divided into five pressure zones. Zones 1, 2, and 4 are supplied by turnouts along the Petaluma Aqueduct. The higher elevation areas which comprise Zones 3 and 5 are supplied by booster stations that draw water from Zone 2. Transmission mains are mostly 10 and 12 inches in diameter, although pipes with diameters of up to 16 inches exist as well as pipe diameters as small as 4-inch diameter pipe. Most of the distribution mains are 6 to 10 inches in diameter. The Water Distribution System Master Plan (July 2006) provides a comprehensive evaluation of existing and projected system improvements. The City maintains a groundwater supply system which is reserved for standby or emergency situations, and to provide peak day demands that cannot be met through SCWA water.

Petaluma's water conservation program, established in 1998, has been and continues to be effective in promoting permanent water savings. The program now accounts for approximately 66 million gallons of potable water savings each year, primarily through implementation of the California Water Urban Conservation Council's Best Management Practices.

Paula Lane Reservoir.

Goal 8-G-7: Water Distribution

Continue to invest in the City's storage and distribution system to insure reliable delivery of high quality water to meet daily and emergency needs.

Policies and Programs:

8-P-22 Invest in the maintenance, repair and replacement of the water utility infrastructure.

A. Fund pipeline infrastructure replacement based on a 100-year life cycle.

8-P-23 Provide storage facilities to serve twice the average daily water demand.

A. Design and construct additional storage facilities as necessary.

8-P-24 Water quality shall be maintained to meet local, State, and Federal standards.

A. Maintain water storage reservoir coatings on a 20-year life cycle

B. Continue to perform routine directional water main flushing and testing.

8-P-25 Work with SCWA to provide and improve emergency measures to ensure adequate water, storage and distribution during supply interruptions.

8-P-26 Encourage continued development of the City's water supply and distribution system to meet established system pressure and fire flow standards (including reservoirs, mains, and hydrants).

A. The City will implement water distribution improvements identified in the Water Distribution System Master Plan to provide design pressure and flows to each part of the City's water distribution system.

8-P-27 Maintain existing and future water supply, storage, treatment and distribution facilities with minimal or no adverse impact to the environment.

8.3 SURFACE WATER MANAGEMENT

INTRODUCTION – EXISTING CONDITIONS (2006)

The Petaluma River watershed includes an area of approximately 146 square miles. The City lies within the watershed along the Petaluma River and is located approximately 12 miles north of San Pablo Bay. The City constitutes 13.6 square miles with approximately 16.1 square miles within the Urban Growth Boundary. The City's surface water drainage system includes the Petaluma River, open creek channels, conduits, culverts, bridge openings, detention ponds, and control structures such as weirs. At locations throughout the City, these elements act to convey storm water runoff toward the Petaluma River and eventually to San Pablo Bay.

The topography of the area also plays an important role in surface drainage. The City is located in a broad bowl, bounded by the Sonoma Mountains to the east and a range of low hills to the west. The ground surface elevation in the City varies from essentially sea level in the area around the Petaluma River to approximately 400 feet above sea level in the hills within the City limits.

CHARACTER OF SURFACE WATER DRAINAGE SYSTEM

The hills that surround the City drain via numerous creeks and streams that make their way through the City on their way to the Petaluma River. Drainage ways that convey these flows have been modified as the area around the Petaluma River has developed. At many locations within the City these creeks and streams have been converted to buried conduits. The addition of impervious areas within the City has also changed the local hydrology. Runoff conveyed over paved streets, parking lots, and rooftops into open channels or pipes that carry flows to the Petaluma River will reach the River more quickly, generally creating higher peak flows than runoff conveyed through natural streams or through native vegetation.

Important characteristics to consider when analyzing a surface drainage system include the climatic conditions of the local area; the most important climatic characteristic is precipitation, which generates runoff.

Open/Natural Channels/ Biological Resources

Approximately 10.85 miles (57,300 linear feet) of open channels and natural creeks exist within the City of Petaluma. The Petaluma River separately consists of approximately 7.14 miles (37,700 feet) of channel inside the City limits. The riverbank composition varies greatly as the River meanders through the City. An inventory of this environment was undertaken in 2002 to include natural waterways, piped sections, biotechnical and bioengineered banks, riprap banks, floodwalls, and structures (see Biological Resources Review, TM3, GP EIR Appendix).

Preservation and enhancement of the natural channels offers an excellent opportunity to improve the flood conveyance capacity and enhance habitat values. Utilizing and implementing the River Access and Enhancement Plan (1986), setting aside the Petaluma River Corridor, and utilizing the Restoration, Design and Management Guidelines for maintenance activities will ensure the protection of the natural environment while meeting the flood flow capacity needs for the Petaluma Watershed Basin.

Existing physical and natural constraints may limit the ability to achieve containment of the 100-year design storm within the Petaluma River Corridor. The intent is to maximize the carrying capacity of the river corridor while reducing depths within the surrounding floodplain to the greatest extent possible. Implementation of the River Access and Enhancement Plan establishes and/or enhances the river corridor primarily through the introduction of flood terraces and low-flow channels, along with habitat restoration and associated vegetation management. The flood-terraces and low-flow channels are envisioned to be sized and situated for compatibility with the existing topography and describable landscape features, while still allowing for future adjacent development where appropriate. Under the 1% (100-year) design flow conditions, the flood terraces are expected to vary in width up to 200' from centerline in order to provide the desired beneficial effects on hydraulic capacity, floodwater elevation, and water quality improvement.

Engineered/Piped System

The City's piped storm water drainage system ranges in size from less than 6 inches to greater than 6 feet in diameter. A total of approximately 4,480 pipe segments exist in the City (2006). Of these pipe segments, approximately 3,260 are less than 24 inches in diameter and approximately 1,220 are 24 inches in diameter or larger (a pipe segment is defined as any pipe originating

and terminating at a manhole, catch basin or open channel). There are also approximately 70 locations within the City where open channel flows are conveyed under roadways via bridges or culverts.

Flows / Capacity

Floods in the Petaluma River Basin are normally of short duration, lasting 3 to 4 days, or less. Tributaries of the Petaluma River can begin to rise within hours after a heavy storm event has begun if antecedent soil moisture content is already high. Typically floods occur between December and March.

Flooding has taken place in the City, to the extent that at least some street flooding occurs, on average once per year over the past twenty or so years. Recent significant flooding events (meaning street and property flooding) have occurred in Petaluma in 1982, 1983, 1986, 1995, 1996, 1998, and 2005. The largest flood of record in the City of Petaluma occurred from January 3 through 5, 1982. A significant flood event occurred on December 30-31, 2005, over-taxing both piped and open channel systems.

Including the Petaluma River, there are approximately 18 miles of channels that have been studied in detail by the Federal Emergency Management Agency (FEMA) within the City. Based on the historic records of flood events and the detail to which streams have been studied and floodplains delineated within the City by FEMA, it is clear that flooding is a significant problem.

The City has put forth significant effort to address its flooding problems. Evidence of this is the City's involvement in the National Flood Insurance Program (NFIP) Community Rating System (CRS). Community participation in the CRS is voluntary. There are 10 CRS classes based on a point system that assigns a rating: Class 1 requires the most credit points and gives the greatest premium reduction; Class 10 receives no premium reduction. A minimum of 500 points is required to receive a CRS classification of Class 9. A table describing activities and their point values is included in Appendix D of this memorandum (FEMA, 1999). Petaluma is currently rated as Class 5.

The City of Petaluma maintains a NWS Automated Local Evaluation in Real Time (ALERT) emergency flood warning system which provides real-time water level conditions for the Petaluma River and Willow Brook Creek during flood events. The ALERT system consists of nine precipitation gages distributed throughout the watershed and eight river stage gages. Alarms are triggered if either the water surface elevation exceeds the set point or if the rate of rise exceeds the set rate for a particular gaging station location. Members of the Department of Water Resources and Conservation maintenance crews are paged when the trigger values are reached.

Surface Water Modeling/Floodway Mapping

The City utilizes a surface water management model (XP-SWMM) as a tool to provide hydrologic and hydraulic solutions for the Petaluma watershed. Future use of the model will include evaluation of changes to the watershed and conveyance system and the effects of those changes, model or simulate modifications or improvements to test their effectiveness or impacts, project review, verification of applicant submitted watershed impact reports, and prioritization of City capital improvement projects. The XP-SWMM model will also be used for the remapping of the regulatory Floodway and Floodplain through the Federal Emergency Management Agency (FEMA), when additional work is concluded to allow the remapping process to proceed. Until that remapping occurs, the 1989 FEMA Flood Insurance Rate Maps (FIRMs) will remain as the City's regulatory means to delineate the Floodway and Floodplain. The creation of the Petaluma River Corridor (PRC) within this General Plan provides for designating the area of concern for preservation of habitat and flood conveyance improvements.

Water Quality

The United States Environmental Protection Agency's (EPA) Clean Water Act regulates discharge from storm drain systems in order to reduce surface water pollutants and improve water quality. The Phase II National Pollutant Discharge Elimination System (NPDES) rule, adopted by the EPA and administered by the San Francisco Bay Regional Water Quality Control Board, requires operators of small municipal separate storm sewer systems to obtain a NPDES permit and implement programs and activities to reduce pollutants in storm water runoff. The City of Petaluma, as an operator of a municipal storm drain system prepared a Storm Water Management Plan and began implementation of this Plan in March 2003, in order to comply with the Phase II NPDES requirements. The Plan acts as the City's permit, describing actions that include best management practices, measurable goals, and timetables for implementation six minimum control measures, as

follows:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Storm Water Management
- Pollution Prevention for Municipal Operations

Implementation of the Plan, as it relates to existing and future land uses, including the development of a dedicated funding mechanism, is necessary to ensure water quality is protected and improved through the planning period.

OPERATIONS & MAINTENANCE

Responsibility for maintenance of the open channels within the City is shared between the City and SCWA. SCWA has also previously been involved in planning efforts and produced the Petaluma River Watershed Master Drainage Plan, which was completed in 1986, updated in 2003 and is still used today as a guide for development of channel improvement projects within the watershed.

The open channels within the City range from heavily vegetated, as in the case of the Petaluma River downstream of the Corona Road Bridge, to concrete lined channels, as in the case of portions of East Washington Creek. Maintenance of these channels historically included clearing vegetation from the bottom of the natural channels by SCWA with heavy equipment to maintain hydraulic capacity. SCWA discontinued that practice in 1987 at the request of the California Department of Fish and Game (DFG). As a result of this reduction of in-channel maintenance work, hydraulic capacity has been reduced as the channels become choked with vegetation and debris, thereby exacerbating flooding problems. The change in maintenance practices for open channels has undoubtedly resulted in reductions in the conveyance capacities of those channels. There are numerous locations where the amount of vegetation in the main channel is as dense as that in the overbank areas. As proposed development and habitat enhancement projects continue, this change in character of the open channels will need to be addressed to ensure that the current true hydraulic capacity of these conveyances is taken into account for future planning, design and implementation.

Current City of Petaluma standards for storm drainage are as follows:

- 10-year storm - The entire area needs to drain into a pipe.
- 25-year storm - Runoff can pond in streets.
- 100-year storm (FEMA BFE) - Needs to stay out of habitable areas (finished floors must be above 100-year flood level). The 100-year storm is 6 inches of rainfall in 24 hours.
- Designated areas (upstream of Payran Street bridge) - Floors need to be 2 feet above 100-year flood. (Approach is similar to FEMA requirements.)
- There is an option to provide detention storage to offset increased runoff.

The City adopted a Storm Water Management Program on March 3, 2003 as part of its application for a National Pollution Discharge Elimination System (NPDES) Storm Water Phase II Permit. The City's application was accepted by the San Francisco Bay Regional Water Quality Control Board; therefore the City now operates under the Statewide General Stormwater Permit.

The City also maintains Storm Drain Design and Construction Standards and Specifications. These include guidance for design and construction of manholes, catch basins, sidewalk underdrains and other items appurtenant to storm drainage systems. The Restoration Design and Management Guidelines for the Petaluma River Watershed is to provide reference information, procedures and guidelines for the integrated management and maintenance of stream corridors and flood control channels within the Petaluma River Watershed. The goal of the document was to provide a reference document for those involved in day-to-day maintenance and management (Questa, 1996). In Volume I, "Restoration and Revegetation Design", vegetation, wildlife, and revegetation techniques within the Petaluma Watershed are described and an assessment and inventory of those resources is presented. Volume II, "Management for Stream Corridors", predominantly concentrates on riparian vegetation including landscape maintenance practices and streambank stabilization guidelines.

Dredging. Currently, the USACE dredges the Petaluma River from the head of the navigable waters located at

The Turning Basin in downtown Petaluma, on a four year cycle. The tonnage of commercial products moved on the River is the USACE method for determining if dredging for navigation is economically justified. Recreational use of the river, which is significant, is not a part of the Corps economic justification criteria. In the future, as property values increase, some industries may relocate away from the riverfront, thereby reducing the annual commercial shipping tonnage. Without industrial shipping there may not be enough justification for continued navigation maintenance dredging on the Petaluma River. If navigation channel maintenance dredging were discontinued, this would negatively impact the hydraulic capacity of the new Payran flood control project as sediment accumulates without periodic removal. The locations where dredging spoils are placed on the shore require periodic maintenance work to prevent erosion of the banks. Alternative funding, through the creation of an Assessment District, should be pursued to guarantee dredging is performed, in perpetuity.

CAPITAL IMPROVEMENT PROGRAM / RESTORATION

Sonoma County Zone 2-A funds pay for some storm water capital improvement projects within the City. The Southern Sonoma County Resource Conservation District, (RCD) the local component of the Natural Resources Conservation Service of the U.S. Department of Agriculture (USDA) also conducts small watershed restoration projects in the Petaluma watershed. The Petaluma Watershed Enhancement Plan is the guiding document for RCD's activities within the watershed. Completed in 1999 by the RCD, the enhancement plan did not use the 1986 SCWA master plan as a starting point, and is significantly different in nature. The following four goals are identified in the enhancement plan:

1. Goal A- Establish a local watershed council for residents and other organizations to fund and coordinate watershed enhancement activities and keep one another informed.
2. Goal B- Improve water quality and groundwater recharge in the Petaluma Watershed with the ultimate purpose of removing the Petaluma River from the RWQCB impaired water body list 303d.
3. Goal C- Support the viability of agriculture in the community.
4. Goal D- Conserve and enhance existing wildlife habitat.

A Surface Water Operation and Maintenance Plan (SWOMP) has been developed as a part of an overall Surface Water Master Plan. The SWOMP describes the requirements for personnel, equipment, materials and other budget expenditure estimates necessary to properly maintain the surface water system (System) and meet the requirements of the U.S. Environmental Protection Agency Storm Water Phase II Final Rule. Benefits beyond providing storm water conveyance systems will also be gained from the City's SWOMP. Improvements can be expected in overall water quality within the system and to downstream areas. Proper design of stream channels combined with the improved maintenance activities can also result in better protection of riparian habitats, provide necessary facilities for preservation of fish and other aquatic species, provide for recreational and groundwater recharge opportunities.

See Also Chapter 4: The Natural Environment for discussion on the Petaluma River, natural environs and preservation/restoration goals and policies.

Goal 8-G-8: Surface Water Management

Provide surface drainage and flood protection facilities to meet the community's needs of reducing flood hazards and potential property damage.

Policies and Programs:

8-P-28 The area upstream of the Corps weir, and below the confluence of Willow Brook Creek with the Petaluma River, located within the 1989 FEMA floodplain (and any amendments thereto) and adjacent to the Petaluma River, shall include a Petaluma River Corridor (PRC) set aside for the design and construction of a flood terrace system to allow the River to accommodate a 100-year storm event within a modified River channel, to the extent feasible given existing physical and natural constraints.

A. The Water Resources and Conservation Department shall work with the Community Development Department to insure the PRC is implemented.

B. Maintenance, in perpetuity, of the PRC and applicable flood terrace, storm water flow capacity, environmental habitat and public access improvements shall be maintained,

through a funding mechanism approved by the City.

8-P-29 The City of Petaluma, SCWA, Sonoma County and other responsible agencies shall be encouraged to work together in order to create and adopt a flood management plan, or plan amendment to the Petaluma River Watershed Master Drainage Plan (SCWA, June 2003), for the Petaluma River watershed implementing the following regional surface water solutions; or a reasonable segment thereof:

A. Establish a Petaluma River and creek corridor setback for the design and construction of a flood terrace system to allow the Petaluma River (Corona and Denman Reaches), along with Willow Brook, Marin, and Liberty Creeks to accommodate a 1% (100-year) storm event within a modified channel section to the extent possible given existing natural and physical constraints.

B. Work with Sonoma County to create interim development standards for that setback area until such time as studies are concluded and approved by Sonoma County, the SCWA, the City of Petaluma, and other responsible agencies. Thereafter all lands affected shall set aside the necessary river and/or creek corridor areas and, as development occurs, shall undertake the identified surface water containment enhancement improvements to accommodate improvements envisioned in Program A, above. The following components, at a minimum, shall be included in the interim development standards called for above:

- Compliance with No Net Fill.
- Elevation of finished floor at least two feet above Base Flood Elevation (BFE).
- Construction of a flood terrace in the setback area to convey the 1% (100-year) design storm, to the extent possible, in accordance with City and SCWA requirements.
- Payment of an hydraulic/hydrology model update fee for evaluating the proposed project, the cumulative impacts and the related mitigations, to the regional surface water conveyance system.
- Payment of a proportionate share of regional flood reduction mitigation costs.

C. The City will work with the County to ensure that zero net fill policies are enforced within the unincorporated area for areas within the regulatory floodplain of the Petaluma River and its tributaries.

D. Working with Sonoma County, the City shall develop a plan and identify funding opportunities to acquire and remove existing structures within the regulatory floodway of the Petaluma River and its tributaries. The Plan shall be updated as needed to maintain consistency with changes in regulatory mapping of the floodway.

E. Participate with the County in implementation of the regional components of the Petaluma River Watershed Master Drainage Plan (SCWA, June 2003), Petaluma River Floodplain Management Plan (City of Petaluma, October 2001, Petaluma River Access and Enhancement Plan (City of Petaluma, May 1006, Sonoma County General Plan 2020 (Public Safety Element) and the City of Petaluma General Plan 2025.

8-P-30 Within a 200' setback from centerline of the Petaluma River, within the UGB, no additional development shall be permitted on lands within that 400' wide corridor, given natural and physical constraints, unless the proposed development fully complies with the interim development standards as defined in 8-P-29 B, until such time as the study referred to in Policy 8-P-29-B is concluded and approved by the SCWA and City of Petaluma. Thereafter all lands affected shall set aside the necessary river and/or creek corridor areas and, as development occurs, shall undertake the identified surface water containment enhancement improvements.

A. The watershed model, XP-SWMM or updates thereto, shall be maintained, in cooperation between the City and SCWA, to assist in the evaluation of development proposals and in the design of regional watershed improvements to reduce flood elevations.

B. Proposed development applications may be charged a model update fee to cover costs associated with evaluating a specific proposal for project specific and cumulative impacts to the regional surface water system.

C. On-site and off-site improvements, deemed necessary by the City of Petaluma, to reduce the surface water impacts associated with a specific development proposal shall be designed, constructed, and maintained in perpetuity at the cost of the development associated with said impacts.

8-P-31 In accordance with the studies undertaken for the Corps Flood Protection Project, existing areas subject to periodic surface water inundation and containment, within the Corona and Denman Reaches (Lynch Creek confluence with the Petaluma River upstream to the Old Redwood Highway over-crossing of Willow Brook Creek), shall be preserved and enhanced where feasible to reduce localized flooding.

A. The Department of Water Resources and Conservation shall work with the SCWA and the Community Development Department to insure the protection afforded by the Payran Corps Flood Protection Project is not compromised by proposed development.

B. Continue to work with SCWA for the on-going efforts to maintain or improve historic channel capacity for flood waters.

8-P-32 Areas within the Petaluma watershed, outside of the City of Petaluma, which are subject to periodic surface water inundation and containment, should not be modified in any manner to reduce the historic storage characteristics and capacity.

A. Department of Water Resources & Conservation shall work with Sonoma County, SCWA, and other responsible agencies to preserve and expand detention basin capacity within the Petaluma River watershed and maintain or reduce peak discharge volumes from Willow Brook, Marin, Liberty and Lichau Creeks.

B. The City shall work with the County of Sonoma to establish a zero net fill policy for detention basins and areas within the regulatory floodplain within the Petaluma River watershed in order to preserve and enhance basin capacity and to ensure no detrimental impact to downstream flows, including the increase in peak discharge volumes in the downstream areas.

8-P-33 The City shall continue to implement mandatory zero-net fill upstream of the Payran transition weir, and when appropriate utilize zero-net runoff, to assess site-specific impacts and identification of mitigations.

A. The Development Code shall be amended to include the dirt, existing or fill, between the regulatory 100-year flood elevation and the required minimum elevation for the first finished floor in the calculation of zero-net fill displacement or placement. Any project within an area subject to inundation in a 1% (100-year) storm event shall include site specific analysis of impacts and identification of mitigations.

8-P-34 Utilizing XP-SWMM, the City shall diligently pursue the remapping and updating of the regulatory Floodway and Floodplain, through the Corps of Engineers.

Goal 8-G-9: Surface Water Management:

Preserve the design conveyance capacity of the surface water drainage system.

Policies and Programs:

8-P-35 Protect private and public properties and capital investments including those designed to minimize flooding potential.

A. Work with SCWA, regulatory agencies, and/or property owners, as appropriate given maintenance authority, to insure maintenance of the engineered channels, natural creeks, and enclosed surface water system.

B. Support continuation of Zone 2A parcel tax for funding regional surface water improvements.

C. Work with regulatory and advisory agencies to facilitate preservation and environmental enhancement of the natural corridor for species of importance and native to the area.

D. Promote public education and stewardship of the riparian corridors.

E. Work with the U.S. Army Corps of Engineers to dredge the river channel downstream of the transition weir to maintain the 100-year design conveyance capacity and navigable channel.

F. Initiate the formation of an Assessment District, or other funding mechanism, to ensure periodic dredging occurs and the dredge materials disposal site is maintained.

G. The City shall continue to inspect and maintain the conveyance capacity of open channels and the piped system within our authority.

H. The City shall facilitate and advise property owners to ensure the maintenance of privately owned creeks and channels (e.g. Kelly Creek). Assistance may include facilitation of regulatory permitting and design standards.

I. Continue to evaluate, and take appropriate action, to monitor and maintain the adequacy,

safety, and strength of existing berms and levees and other flood protection/reduction facilities.

J. The Development Code shall require the identification of any disposal site for excavated soil and require that any disposal be located outside the regulatory floodplain within the Planning Referral Area.

K. Monitor changes in tide elevations and related effects on Petaluma River tidal levels over time in order to determine if there is a trend that increases the level of Mean Higher High Water, as determined by the Corps of Engineer.

- Assess the effect of any such trend or changes on habitable structures in the regulatory floodplain.

L. Require flood protection of new or significantly remodeled first floor habitable structures within the regulatory floodplain.

M. Continue to monitor precipitation data in order to maintain current data in the XP-SWMM model.

N. Improve the data available for the XP-SWMM model. Add stream level gages at the following locations:

- Petaluma River at Petaluma Blvd. (southbound bridge)
- Petaluma River at the railroad trestle bridge downstream of Corona Creek
- Corona Creek at McDowell Blvd.
- Capri Creek at McDowell Blvd.
- Adobe Creek at Lakeville Road
- Lynch Creek at Maria Dr.
- Lynch Creek at McDowell Blvd. or HWY 101 (northbound)
- Washington Creek at McDowell Blvd. or HWY 101 (northbound)
- East Washington Creek at Washington St.
- Petaluma River at HWY 101 (southbound bridge)

8-P-36 Require development on sites greater than 1/4 acre in size to demonstrate no net increase in peak day stormwater runoff, to the extent deemed practical and feasible.

8-P-37. No new inhabited structure or development shall be permitted within that portion of properties containing areas of water depths exceeding one foot as illustrated in Figure 8-2, unless mitigation and/or on-site or off-site improvements are constructed to reduce the 100-year flood depth to less than one foot.

A. The City shall maintain a 2-D model of the Petaluma River within the City of Petaluma and continue to work with SCWA to achieve a 2-D model for the Petaluma Watershed.

B. Utilizing the 2-D model, the City of Petaluma will work with SCWA to identify, design, fund, and construct regional solutions to minimize the flooding impacts associated with historic and increasing out-of-bank flows which occur from increasing storm flow and velocity from out-of-City areas into the City.

C. Working with Sonoma County, the City will continue to ensure that zero net fill policies are enforced within the unincorporated area for areas encumbered by the regulatory floodplain of the Petaluma River.

D. Utilizing an approved modeling tool, the City shall diligently pursue the remapping of the regulatory Floodway and Floodplain, through the Corps of Engineers, following the completion of the Payran Reach Corps project.

E. Working with Sonoma County, the City shall develop a plan and identify funding opportunities to acquire and move, relocate, or demolish housing, which remain located within the regulatory Floodway, once remapping occurs.

F. Until remapping of the regulatory floodplain occurs, new residential development in the 100-year flood boundary area as illustrated in Figure 8-1, with depths of less than one foot of water during a 100-year storm event will be required to elevate the lowest floor two feet (2') above the BFE as determined by the City 2-D model.

G. New non-residential development in the 100-year flood boundary area, identified in Figure 8-1, with less than one foot of water depth during a 100-year storm event will be required to provide flood protection at least 1 foot above the BFE, or elevate the lowest floor two feet above the BFE.

H. Residential development shall be prohibited on the first floor of new structures within the regulatory floodplain after remapping of the FEMA floodway/floodplain.

I. After remapping the City should pursue acquisition of properties in the regulatory Floodway and seek funding

for implementation of surface water improvements and riparian habitat enhancements.

J. Consider development of a program whereby projects may acquire property(ies) and construct planned flood terracing and/or detention/retention facilities as mitigation for surface water impacts. The result of the improvements must result in an improvement to the pre-project conditions by way of a net reduction in storm water elevations and downstream flows.

Goal 8-G-10: Water Quality

Reduce pollutant load in surface water runoff, thereby improving water quality within the Petaluma River and its tributaries.

Policies and Programs:

8-P-38 All development activities shall be constructed and maintained in accordance with Phase 2 National Pollutant Discharge Elimination System (NPDES) permit requirements.

A. The Water Resources and Conservation Department shall review, and have the authority to conditionally approve, all development permits to insure compliance with NPDES Phase 2 requirements.

B. Maintain, update as needed, and implement the City's Storm Water Management Plan to retain a current storm water discharge permit with the California Regional Water Quality Control Board.

C. A funding mechanism, such as a storm water utility fee, shall be implemented by the City to insure a dedicated source of funds is available for all surface water drainage system maintenance and improvement needs.

Goal 8-G-11: Sustainable Site Planning

Improve natural hydrologic functions and water quality through sustainable site planning.

Policies and Programs:

8-P-39 Consider, to the extent practicable, requiring sustainable site design practices as outlined in the 'Sustainable Site Planning' text box contained herein.

Sustainable Site Planning

Sustainable site planning practices—sometimes also referred to as Low-Impact Design (or LID)—are designed to maintain or restore the natural hydrologic functions on a site with the goal of reducing the impact of development. The goal is to structure the development of a site—through arrangements of buildings, roads, parking areas, site features, and storm water management plans—to detain, filter, treat and reduce runoff, and reduce urban heat island impacts. By reducing water pollution and increasing groundwater recharge, sustainable site design helps to improve the quality of receiving surface waters and to stabilize the flow rates of nearby streams, potentially minimizing flooding impacts and benefiting wildlife habitats.

Sustainable site design exploits every surface in the infrastructure—natural and hardscape—to perform a beneficial hydrologic function. The surfaces are used to retain, detain, store, change the timing of, or filter runoff in a number of different configurations and combinations through techniques including[1] (see Water Resources Element for additional guidance and policies):

- Reduce imperviousness by limiting building footprint, and using permeable paving or landscaping to break up expanses of impervious surfaces.
- Cluster development on sites to minimize disturbance.
- Use canopy trees to absorb rainwater and slow water flow.
- Direct runoff into or across vegetated areas to help filter runoff and encourage groundwater recharge.
- Preserve, or design into the infrastructure, naturally vegetated areas that are in close proximity to parking areas, buildings, and other impervious expanses in order to slow runoff, filter out pollutants, and facilitate infiltration.
- Reduce street widths for internal circulation.
- Remove curbs and gutters from streets, parking areas, and parking islands, where appropriate, to allow storm water sheet flow into vegetated areas.
- Use devices such as bioretention cells, vegetated swales, infiltration trenches, and dry wells to increase storage volume and facilitate infiltration.
- Grade to encourage sheet flow and lengthen flow paths to increase the runoff travel time in order to reduce the peak flow rate.
- Disconnect impervious areas from the storm drain network and maintain natural drainage divides to keep flow paths dispersed.
- Disconnect roof downspouts and direct storm water into vegetated areas or into water collection devices.
- Install cisterns or sub-surface retention facilities to capture rainwater for use in irrigation and non-potable uses.
- Install "eco-roofs" (vegetated or garden roofs).
- Use native plants (or adaptable species) to establish an adaptable and low maintenance landscape that requires less irrigation and are appropriate for the climatic conditions.
- Use naturally occurring bio-chemical processes in plants located in tree box filters, swales, and planter boxes.
- Divert water away and disconnect from the storm drain using correctional drainage techniques

1. Modified and adapted from www.wbdg.org

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4
The Natural Environment

Petaluma is a city defined by the natural environment. The aquatic and riparian resources along the Petaluma River; the rich, ecologically diverse plant and wildlife communities; the area's precious water and air resources; and productive open space resources—contribute greatly to the city's quality of life. Protection, restoration, and enhancement of the natural environment are intrinsic components of fostering sustainability.

This element outlines policies related to the river, biological resources, air quality, energy, and solid waste. Detailed background information about the natural environment in Petaluma is provided in the *Biological Resources Review* (Appendix F-3, Volume 4 of Technical Appendices).

4.1 BIOLOGY AND NATURAL RESOURCES

THE RIVER ENVIRONS

The significance of the Petaluma River lies in its roles as a natural habitat, a carrier of storm waters, a centerpiece of urban identity and local history, a recreation resource, as well as a water-borne commercial/industrial transportation corridor. Today, the river is navigable from its mouth at San Pablo Bay to the Turning Basin in downtown Petaluma.

The river is also part of an ecological system that runs from the hills to the San Pablo Bay, linking fresh water with tidal zones. Urban development, however, has caused the degradation of the most significant natural resources within the Urban Growth Boundary (UGB)—the aquatic and riparian resources found along the river and its tributaries. Conserving and restoring the river's ecological system is essential to maintaining Petaluma's place-based character.

Aquatic and Riparian Resources

Aquatic resources in the Planning Area include the Petaluma River and its tributaries, vernal pools and seasonal wetlands, northern coastal salt marshes, coastal brackish marshes, and freshwater marshes. Riparian habitats are found in proximity to these aquatic areas, and act as a transition from the upland communities, providing habitat and cover for many species of aquatic and semi-aquatic animals. The General Plan seeks to protect these aquatic and riparian habitats as they play a crucial role in the preservation of sensitive species in the area, including the Chinook salmon and the Western Pond Turtle.

Petaluma River Access and Enhancement Plan

As mentioned in Chapter 1: Introduction, the 1996 Petaluma River Access and Enhancement Plan (the River Plan) describes the community's vision for the Petaluma River, including riverfront uses, activities, and developments. A central feature of the River Plan is the integration of the natural and built environment, recognizing that development and public access along the river must be balanced with protection of the few remaining natural areas located along this corridor. Equal in priority are the goals and policies of the Surface Water portion of the Water Resources Element, which identifies the need to preserve an adequate setback from the river to accommodate peak storm flows.

Incremental implementation of the River Plan has been underway since it was completed and this General Plan enhances its status as an integral part of the General Plan implementation. Since 1996, trail segments have been installed, land has been purchased as riverfront open space, flood reduction, habitat enhancement, and restoration projects have been completed. Design of new pedestrian improvements continues to be planned and constructed, riverfront properties have been developed, and funding for additional projects continues. The General Plan incorporates the River Plan as a proven effective tool for use by the City and property owners alike in achieving the goals set forth by the community.

VEGETATION

While the river environs contain areas of tremendous plant and wildlife diversity, there are other parts of the Planning Area that exhibit unique and valuable biological characteristics. A brief description of the Planning Area's common vegetation communities is provided below, followed by an identification of sensitive species and habitats that warrant additional protection and management strategies to preserve their features.

Vegetation types within the Planning Area—as described in Holland's Preliminary Descriptions of Terrestrial Natural Communities of California—may generally be classified into eight categories:

1. *Urban*. Includes ornamental landscaping, non-native

The Petaluma River, the city's largest waterway, meanders through the center of the city.

grass and weed associations in vacant lots (usually referred to as ruderal vegetation), and scattered agricultural crop and orchard plantings.

2. *Rural/agricultural.* Includes low-density residential/commercial areas, as well as row crops, orchards, and ruderal vegetation. A variety of agricultural products are grown in the Planning Area, including tomatoes, asparagus, corn, squash, walnuts, apricots, apples, cherries, and grapes.

3. *Grassland/oak savannah.* Non-native grassland vegetation occurs in the western and southern portions of the Planning Area while oak savannah occurs in the western portions. In many areas, severe levels of grazing have reduced these plant coverings to the extent that bare ground is visible.

4. *Fresh emergent wetlands.* These wetlands are among the most productive wildlife habitats in California. Fresh emergent wetland habitats occur in association with terrestrial habitats or aquatic habitats including Riverine, Lacustrine, and Wet Meadows.

5. *Vernal pools/seasonal wetlands.* These temporary ponds create a unique microclimate, which supports an assemblage of plants and wildlife. Vernal pools in the Planning Area are associated with the grassland and oak savannah communities. The California Department of Fish and Game (CDFG) classifies vernal pools and seasonal wetlands as a sensitive habitat.

6. *Riparian.* The Planning Area contains bands of riparian habitat along the Petaluma River and its tributaries.

7. *Northern coastal salt marsh.* These wetlands contain highly productive, herbaceous perennial plants up to 4 feet in height. The salt marsh wetlands located in the lower reaches of the Petaluma River are important habitat for sensitive species such as the salt marsh harvest mouse, California clapper rail, and California black rail.

8. *Brackish water marsh.* Found adjacent to coastal salt marshes, these marshes differ in that they are made brackish from freshwater input. Species composition is characterized as being intermediate between salt marsh wetland and freshwater marsh wetland communities, consisting of elements from both communities. As a result, the brackish marsh wetlands are located in the lower reaches of the Petaluma River and are important habitat for sensitive species also found in the coastal salt marshes.

SENSITIVE SPECIES AND HABITATS

Sensitive or special status species are those plant and animal species that are designated by Federal or State regulatory agencies as needing protection due to rarity or threats to their existence. Sensitive habitats are those areas in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in the ecosystem. Sensitive habitat areas within the Planning Area include vernal pools, northern coastal salt marshes, and coastal brackish marshes.

Special status species that have moderate to known occurrence within the Petaluma Planning Area are listed in Table 3.8-1 of the Final Environmental Impact Report.

Petaluma's river, creeks, and marshes offer a diverse biological and wetlands habitat for numerous species.

Open space areas like Shollenberger Park are an important component of Petaluma's natural environment.

GOAL 4-G-1: Biology & Natural Resources

Protect and enhance biological and natural resources within the UGB.

Policies and Programs:

4-P-1 Protect and enhance the Petaluma River and its tributaries through a comprehensive river management strategy of the following programs:

A. Fully adopt and incorporate the Goals, Objectives, Policies and Programs of the Petaluma River Access and Enhancement Plan as an integral part of the General Plan 2025. Implement the Petaluma River Access and Enhancement Plan including expanded improvements identified through project specific environmental assessment.

B. Institute and maintain public access to and along the entire length (on one or both sides), of the river while ensuring that natural resources and river dependent industry are protected.

C. Require design review to address the relationship and stewardship of that project to the river or creek for any development on sites with frontage along the river and creeks.

D. Create setbacks for all tributaries to the Petaluma River extending a minimum of 50 feet outward from the top of each bank, with extended buffers where significant habitat areas, vernal pools, or wetlands exist. Development shall not occur within this setback, except as part of greenway enhancement (for example, trails and bikeways). Where there is degradation within the zone, restoration of the natural creek channels and riparian vegetation is mandatory at time of adjacent development.

E. Facilitate compliance with Phase II standards of the National Pollutant Discharge Elimination System (NPDES) to improve the water quality and aesthetics of the river and creeks.

F. Work with the State Lands Commission, State Department of Fish and Game, the Sonoma County Water Agency, and other jurisdictional agencies on preservation/enhancement of the Petaluma River as a component of reviewing major development along the River.

G. Expand the planting and retention of trees along the upper banks of the river and creeks to reduce ambient water temperature and shade out invasive, non-native species.

H. Revise the Development Code to include:

- Standards for the four management zones that run the entire length of the river: 1) Restoration Zone, 2) Buffer Zone, 3) Preservation Zone, and 4) River Oriented Development Zone. These standards shall be based on the River Plan's text and sections A-A through O-O as augmented by the cross-section needs identified through the XP-SWMM analyses;
- Design review requirements as articulated in the River Plan for any development on sites with frontage along the river or within 300 ft. of the river;
- The use of transfer of development rights (TDR) from portions adjacent to the river to elsewhere on the parcel by allowing property owners an increase in residential densities or in allowable Floor-to-Area-Ratio (FAR) and/or smaller/clustered lots to compensate for the loss of development opportunity on land within the Restoration, Buffer, or Preservation zones of the River Plan. The overall development potential on a site shall be consistent with the General Plan. TDRs shall not be applied to lands within the Floodway as there is no development potential within the Floodway.

I. Develop a consistent design for site furniture, a wayfinding system, and educational signage in the PRC and along the creeks and tributaries leading to it to heighten the recognition and value of the river and its ecosystem.

J. Utilize the Parks and Recreation, Water Resources & Conservation, Public Works departments, property owners (e.g. Landscape Assessment Districts) and/or other appropriate public agencies (e.g. Sonoma County Water Agency) to manage the long term operations, maintenance responsibilities, and stormwater capacity associated with the river and tributary greenways.

K. Prohibit placement of impervious surfaces in the Floodway (i.e. Parking lots, roadways, etc.) with the exception of pathways and emergency access improvements.

L. Continue to implement, where appropriate, flood terrace improvements to reduce localized flooding in concert with habitat enhancement projects.

M. Cooperate with State and Federal agencies to address and/or eradicate issues and environmental problems associated with

possible infestation of the midden crab into the Petaluma River and adjacent tributaries.

4-P-2 Conserve wildlife ecosystems and sensitive habitat areas in the following order of protection preference: 1) avoidance, 2) on-site mitigation, and 3) off-site mitigation.

A. Utilize Technical Memorandum 3: Biological Resources Review as a baseline document, expanding to address project specific impacts.

4-P-3 Protect special status species and supporting habitats within Petaluma, including species that are State or Federal listed as endangered, threatened, or rare.

A. As part of the development review process, site-specific biological resource assessments may be required to consider the impacts on riparian and aquatic resources and the habitats they provide for invertebrates, fish, amphibians, reptiles, birds, mammals, and plants. If development is located outside these ecologically sensitive regions, no site-specific assessment of biological resources may be necessary. Appropriate mitigation measures to reduce impacts to sensitive habitats and special status species shall be imposed on a project-by-project basis according to Petaluma's environmental review process.

B. Permit mitigation banking as a conditional use in all land use designations along the Petaluma River and its tributaries.

GOAL 4-G-2: Biology & Natural Resources

Promote resource protection within the Petaluma Watershed to conserve grassland habitats, oak woodlands, and other natural resources that are found in areas between the UGB and the Planning Area boundary.

Policies and Programs:

See also Chapter 8: Water Resources.

4-P-4 Continue to support rural land use designations and Agricultural Best Management Practices within the Sonoma County General Plan.

A. Coordinate with Sonoma County's Agricultural Preservation and Open Space District, Permit and Resource Management Department, and Water Agency to protect riparian corridors and critical biological habitats as well as to reduce cumulative impacts on sensitive watershed areas outside of the city limits.

B. Work with County, State and federal agencies to ensure that development within the Planning Referral Area does not substantially affect State or federally listed rare, endangered, or threatened species or their habitats. Require assessments of biological resources prior to approval of any development in or within 300 feet of ecologically sensitive areas.

4-P-5 Support wetland mitigation and oak woodlands restoration in the unincorporated areas outside the UGB.

4.2 AIR QUALITY

In addition to being a regional issue of significance, air quality is vital to the overall health of the environment and the attractiveness of any locality. The Petaluma Valley enjoys generally good air quality largely due to its link with the Petaluma Gap (the region from the Estero Lowlands to the San Pablo Bay) and its low population density.

Mobile sources, including trains, boats, planes, and on- and off-road vehicles, present the greatest threat to air quality in Petaluma, as well as the region. Highway 101 and its interchanges are the most significant cause of elevated ozone levels in the area. Wood burning and other outdoor burning during late fall and winter is another source of air pollutants (primarily particulates and carbon monoxide). However, the prevailing wind assists in providing Petaluma with good air quality as there are no significant pollution sources upwind of Petaluma, and pollutant loads tend to be carried to the southeast away from the most developed areas.[1] While air pollution potential is low, Petaluma's role in the cumulative regional air quality must be addressed.

SAN FRANCISCO BAY AREA AIR BASIN

The City of Petaluma is located within the nine-county San Francisco Bay Area Air Basin. The air quality within the Bay Area Air Basin is influenced by a wide range of emissions sources—such as dense population centers, heavy vehicular traffic, and industry.

Under the Federal Clean Air Act, the U.S. Environmental

[1] City of Petaluma, Department of Community Development, *River Oaks/Petaluma Outlet Village Master Plan Draft Environmental Impact Report*, March 1990.

Protection Agency (EPA) can classify an air basin or a portion thereof, as either in "attainment" or "non-attainment." This classification is based on whether or not the basin meets national ambient air quality standards. Likewise, a basin is classified under the California Clean Air Act with respect to the achievement of State ambient air quality standards. The Bay Area is considered in "attainment" for all of the national standards. It is considered in "non attainment" for State standards for ozone and suspended particulate matter (PM-10 and PM 2.5, but is "unclassifiable" with regard to visibility-reducing particles[2]).

CRITERIA AIR POLLUTANTS

Federal, State, and local laws and regulations are the basis for controlling air pollution. The federal Clean Air Act requires the EPA to identify National Ambient Air Quality Standards. The EPA has established national standards for six criteria air pollutants, including ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), suspended particulate matter, and lead (Pb). In addition, the California Clean Air Act sets State standards for ambient air quality that are more stringent than the corresponding national standards. This legislation also sets standards for sulfates, hydrogen sulfide, and vinyl chloride, pollutants for which no national standards have been set.

At the regional and local levels, the Bay Area Air Quality Management District (BAAQMD) is primarily responsible for planning, implementing, and enforcing the federal and State ambient standards in the Bay Area. The BAAQMD operates a nearby air quality monitoring station in Downtown Santa Rosa at 5th Street, approximately 15 miles north of Petaluma. According to station measurements, no violations of federal or state standards for carbon monoxide occurred from 1996-2004 in the area, and ozone levels exceeded the State standard only twice. Occasional violations of particulate matter standards are a result of combustion, construction, grading, demolition, agricultural activities, and motor vehicles; however, the number of days when violations occurred is significantly lower than in previous years, especially the 1980s.

TOXIC AIR CONTAMINANTS

Unlike criteria air pollutants, ambient air quality standards have not been established for toxic air contaminants (TACs). These pollutants are typically carcinogens, mutagens, or reproductive toxins. Regulation of toxic air contaminants is achieved through federal and State controls on individual sources.[3]

The preferred technique for reducing toxic air emissions is source reduction, and as part of a local control strategy in the Bay Area, all applications for new stationary sources are reviewed to ensure compliance with required emission controls and limits. BAAQMD maintains an inventory of stationary sources of toxic air contaminants that emit TACs above certain threshold quantities in the Bay Area. There are currently 11 such sources listed within Petaluma, six of which are dry cleaners.

Hazardous Air Pollutants (HAPs) are emitted by any source that burns fuel (other than hydrogen). There are a wide variety of Federal and State controls on TACs and HAPs that apply to mobile and stationary sources.

Sensitive Receptors

The BAAQMD defines sensitive receptors as "facilities or land uses that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly and people with illnesses. Examples include schools, hospitals and residential areas."[4] Heightened sensitivity may be caused by health problems, proximity to the emissions source, and duration of exposure to air pollutants. Sensitive receptors in Petaluma include approximately 20 elementary schools, two junior high schools, seven high schools, one hospital and several convalescent homes. Any residence can also be considered a sensitive receptor.

Recognizing those sensitive members of the community are also likely to be at parks and in or around any residential area, all residential structures could also be deemed sensitive.

[2] http://www.arb.ca.gov/desig/adm/adm.htm

[3] Federal environmental laws refer to "hazardous air pollutants" and California environmental laws refer to "toxic air contaminants."

[4] Bay Area Air Quality Management District, Bay Area '97 Clean Air Plan and Triennial Assessment, December 17, 1997.

GOAL 4-G-3: Air Quality

Improve air quality and meet all Federal and State ambient air quality standards and goals by reducing the generation of air pollutants from stationary and mobile sources.

Policies and Programs:

4-P-6 Improve air quality through required planting of trees along streets and within park and urban separators, and retaining tree and plant resources along the river and creek corridors.

A. Require planting of trees for every significant tree removed at a project site. Replacement planting may occur on the project site or on a publicly owned area, with long-term maintenance assured.

- Encourage the use of trees which provide biogenic benefits to air quality and are suitable to the local environment.
- Establish ratio and size of replacement trees as part of the development code update.

4-P-7 Reduce motor vehicle related air pollution.

A. Enforce land use and transportation strategies described in Chapter 1: Land Use and Chapter 5: Mobility that promote use of alternatives to the automobile for transportation, including walking, bicycling, bus transit, and carpooling.

Motor vehicles, regulations of whose emissions by local agencies is preempted by State law, are the major source of criteria air pollutants in the Bay Area Air Basin, accounting for the vast majority of carbon monoxide and particulate matter and over a quarter of the reactive oxygen gas and nitrogen dioxide in the region. Increased use of transit and carpooling, coupled with land use and circulation patterns that promote walking and bicycling, can lead to a decrease in daily trips, less emissions, and improved air quality.

4-P-8 Support, where feasible, the development of alternative fuel stations.

4-P-9 Require a percentage of parking spaces in large parking lots or garages to provide electrical vehicle charging facilities.

4-P-10 Require electric vehicle charging and alternative fuel facilities at all new and remodeled gas stations.

Highway 101 and its interchanges are the most significant causes of elevated ozone levels in the area.

4-P-11 Promote ride-sharing and car-sharing programs.

4-P-12 Prohibit new drive-thru food and service facilities with the exception of vehicle serving businesses, such as car wash and oil/lube, and limit expansion of the drive-thru components of existing facilities which increase idling vehicles.

- Discretionary approvals for such facilities shall include provisions which decrease or eliminate idling vehicles, to the extent feasible and practical.

4-P-13 Require development of traffic roundabouts, where feasible, as an alternative to a traffic signal, to reduce idling vehicles.

4-P-14 Develop and integrate Intelligent Transportation Technologies, as applicable, into Petaluma's transportation system.

4-P-15 Improve air quality by reducing emissions from stationary point sources of air pollution (e.g. equipment at commercial and industrial facilities) and stationary area sources (e.g. wood-burning fireplaces & gas powered lawn mowers) which cumulatively emit large quantities of emissions.

A. Continue to work with the Bay Area Air Quality Management District to achieve emissions reductions for non attainment pollutants; including carbon monoxide, ozone, and PM-10, by implementation of air pollution control measures as required by State and federal

statutes.

The BAAQMD's CEQA Guidelines should be used as the foundation for the City's review of air quality impacts under CEQA.

B. Continue to use Petaluma's development review process and the California Environmental Quality Act (CEQA) regulations to evaluate and mitigate the local and cumulative effects of new development on air quality.

C. Continue to require development projects to abide by the standard construction dust abatement measures included in BAAQMD's CEQA Guidelines.

These measures would reduce exhaust and particulate emissions from construction and grading activities.

D. Reduce emissions from residential and commercial uses by requiring the following:

- Use of high efficiency heating and other appliances, such as cooking equipment, refrigerators, and furnaces, and low NOx water heaters in new and existing residential units;
- Compliance with or exceed requirements of CCR Title 24 for new residential and commercial buildings;
- Incorporation of passive solar building design and landscaping conducive to passive solar energy use for both residential and commercial uses, i.e., building orientation in a south to southeast direction, encourage planting of deciduous trees on west sides of structures, landscaping with drought resistant species, and use of groundcovers rather than pavement to reduce heat reflection;
- Encourage the use of battery-powered, electric, or other similar equipment that does not impact local air quality for non-residential maintenance activities;
- Provide natural gas hookups to fireplaces or require residential use of EPA-certified wood stoves, pellet stoves, or fireplace inserts.

Current building code standards generally ban the installation of open-hearth, wood-burning fireplaces and wood stoves in new construction. It does, however, allow for the use of low-polluting wood stoves and inserts in fireplaces approved by the federal Environmental Protection Agency, as well as fireplaces fueled by natural gas.

4-P-16 To reduce combustion emissions during construction and demolition phases, the contractor of future individual projects shall encourage the inclusion in construction contracts of the following requirements or measures shown to be equally effective:

- Maintain construction equipment engines in good condition and in proper tune per manufacturer's specification for the duration of construction;
- Minimize idling time of construction-related equipment, including heavy-duty equipment, motor vehicles, and portable equipment;
- Use alternative fuel construction equipment (i.e., compressed natural gas, liquid petroleum gas, and unleaded gasoline);
- Use add-on control devices such as diesel oxidation catalysts or particulate filters;
- Use diesel equipment that meets the ARB's 2000 or newer certification standard for off-road heavy-duty diesel engines;
- Phase construction of the project;
- Limit the hours of operation of heavy duty equipment.

4-P-17 To avoid potential health effects and citizen complaints that may be caused by sources of odors, dust from agricultural uses, or toxic air contaminants the following measures may be considered:

- Locate new stationary sources of air pollutants, such as industrial facilities, at sufficient distances away from residential areas and facilities that serve sensitive receptors to avoid significant impacts caused by odors, dust, and toxic air contaminants.
- Include buffer zones within new residential and sensitive receptor site plans to separate those uses from potential sources of odors, dust from agricultural uses, and stationary sources of toxic air contaminants.

4.3 ENERGY

Like almost every community in California, Petaluma uses electricity, natural gas, and petroleum-based fuels as its primary sources of energy. In California, approximately 54 percent of the State's entire energy supply is made up of petroleum-based fuels. Natural gas makes up 33 percent of the energy supply, and 13 percent comes from electricity. Petroleum-based fuels, or transportation fuels,

and natural gas are considered primary sources because they are readily available.

Reduced energy use in housing, commercial structures, public facilities, and transportation helps maintain local economic vitality and reduces the need for new infrastructure to deliver energy to the city. The energy shortages faced by the State and the threatened rolling blackouts in the summer of 2001 as well as the high gasoline prices in summer 2005, underscore the importance of conserving energy resources. Better use of materials, insulation, and increased harnessing of solar incidence in building design reduces demand on natural gas and heating products. Transportation measures that facilitate pedestrian use and bicycling reduce dependence on petroleum. Together, these steps will lead to a more reliable, sustainable, economic energy future.

GOAL 4-G-4: Energy

Reduce reliance on non-renewable energy sources in existing and new development.

Policies and Programs:

Energy policies supporting alternative and efficient transportation systems, reduction of energy consumption in buildings by means of appropriate design and orientation are identified in Section 3.3: Sustainable Building and Chapter 5: Mobility. Residential energy efficiency is addressed in Chapter 11: Housing Element.

4-P-18 Develop and adopt local energy standards that would result in less energy consumption than standards set by the California Energy Commission's (CEC) Title 24 or updates thereto.

The State of California addresses energy conservation through Title 24 "Energy Efficiency Standards for Residential and Nonresidential Buildings." Whereas Title 24 applies to new buildings, much of the City west of Highway 101 was developed prior to 1953 and there is a tremendous opportunity to encourage greater energy efficiency in Petaluma's older structures. Energy-efficient air conditioners, high-efficiency lighting and glass, automatic controls for lighting, photocell dimming, higher insulation levels, and reflective rooftops are examples of standards that could reduce energy consumption in new and existing buildings.

A. Identify and implement energy conservation measures that are appropriate for public buildings and facilities, such as:

- Schedule energy efficiency "tune-ups" of existing buildings and facilities.
- Institute a lights-out-at-night policy in all public buildings where feasible.
- Continue to retrofit older lighting fixtures in City facilities until all buildings have been upgraded.
- Where new traffic signals or crosswalk signals are installed, or existing signals are upgraded, continue to use LED bulbs or other equivalent efficient technology that may develop.
- Evaluate the possibility of decreasing the average daily time streets lights are on.
- Periodically evaluate the efficiency of potable and sewer pumping facilities and identify measures to improve pumping efficiency.
- Encourage the County of Sonoma to upgrade existing, inefficient facilities which serve Petaluma (e.g. potable water pumping facilities).

B. Identify energy conservation measures appropriate for retrofitting existing structures. Work with local energy utility to encourage incentive program for retrofitting. Consider the use of alternative transportation fuels among City-owned vehicles and the Petaluma Transit system to reduce dependence on petroleum-based fuels and improve local air quality. Continue to replace traditional fuel vehicles in the City's fleet with alternative fuel vehicles and/or zero/low emission vehicles, as appropriate. When selecting alternative fuel vehicles consider the "full cycle" of emissions for the different fuel types.

In 2002, the City of Petaluma adopted a Clean City Fleets resolution. The Clean Fleets Program, sponsored by the American Lung Association, directs local government staff to purchase the cleanest vehicle available for municipal fleets.

C. Investigate and implement alternative sources of renewable power to supply City facilities, such as solar water heating at the Petaluma Swim Center, cogeneration at the Ellis Creek Water Recycling Facility, and solar photovoltaics on City-owned buildings.

4-P-19 Encourage use and development of renewable or nontraditional sources of energy.

A. Participate in state and local efforts to develop appropriate policies and review procedures for the institution of renewable energy

sources such as solar, wind, geothermal, and hydroelectric power.

One such effort began in August 2005, when the City adopted a resolution requiring developers of residential projects of 5 or more units to wire all units for future photo voltaic arrays.

In addition, the State's Emerging Renewables Buydown Program provides rebates to consumers who install qualifying energy systems, such as photo voltaic, wind turbines, and fuel cells. As of July 2005, nearly 80 participants from within Petaluma have been involved with the program through the use of solar energy systems.

B. Implement green building code to allow use of alternative building materials and methods.

C. Work with the Petaluma Area Chamber of Commerce and PG&E in encouraging local businesses to undertake energy audits and implement energy reduction improvements.

D. Consider the feasibility of requiring a percentage of new development to meet 50% of their energy needs from fossil fuel alternatives (e.g. solar panels, etc.).

4-P-20 Continue to participate in undergrounding of public utility lines; whenever appropriate, require conversion of overhead lines to underground in conjunction with public and private projects.

4.4 SOLID WASTE

Solid waste transfer and disposal facilities are owned and operated by the Sonoma County Department of Transportation and Public Works, which also helps maintain the Countywide Integrated Waste Management Plan (CoIWMP) jointly with the Sonoma County Waste Management Agency (SCWMA).

At this time, the County owns and operates one landfill and owns and contracts the operation of five transfer stations that provide service to its residents. The Central Landfill, located within the Central Disposal Site, and the Sonoma Transfer station service Petaluma. In 2001, the Central Landfill was expanded to provide sufficient capacity for solid waste disposal through 2015. There is, however, the possibility of expanding the facility and postponing its closure further into the future. An analysis done by Sonoma County recommends siting a new landfill in the County once the Central Landfill has reached capacity. In 2001, Petaluma disposed approximately 56,000 tons of solid waste at this site, representing about 11 percent of the total waste disposed at the Central Landfill.

As of January 2006, the private hauler Green Waste Recovery is responsible for the city's solid waste pickup and disposal. Under various options for waste disposal, Petaluma's waste could go to landfills in Novato, Hollister, Suisun City, or Dixon.

RECYCLING

The Integrated Waste Management Act requires local governments to prepare and implement plans to achieve 50 percent waste reduction in 2000. Sonoma County and individual city recycling and composting programs resulted in a 40 percent diversion rate for the County as a whole in 2000. The 50 percent diversion goal has been extended for the County and a 70 percent goal for 2015 has already been approved by the SCWMA. The County's Source Reduction and Recycling Element (SRRE) documents how source reduction, recycling, composting, and public education will contribute to the diversion of solid wastes from landfills.

Petaluma has two drop-off/buyback centers, two 20/20 buyback centers, single-family residential curbside recycling, as well as commercial recycling. The curbside recycling program, operated under Green Waste, provides a single-stream bin system. In addition, yard waste collection services are provided on a weekly basis.

The South Petaluma Recycling Center, located on Petaluma Boulevard South, offers free drop-off service for most recyclables.

Petaluma contributed 8,681 tons of recyclable waste (13 percent of the County's 64,596 tons) and 18,846 tons of composting waste (16 percent of the county's 115,000 tons) in 2000. The city's percentage of participation in County recycling slightly outweighed its proportion of population, at 12 percent of the County's total.

GOAL 4-G-5: Solid Waste

Meet Petaluma's solid waste disposal needs while maximizing opportunities for waste reduction, reuse, and recycling, in compliance with the California Integrated Waste Management Act of 1989.

Policies and Programs:

See also Section 10.3: Hazardous Waste Management for policies relating to Hazardous Waste storage and disposal.

4-P-21 Reduce solid waste and increase reduction, reuse and/or recycling, in compliance with the Countywide Integrated Waste Management Plan (ColWMP).

A. Work with Sonoma County to identify environmental and economical means to meet the need for solid waste disposal.

B. Require new or remodeled residential and all non-residential development to incorporate sufficient, attractive, and convenient interior and exterior storage areas for recyclables and green waste.

C. Continue to encourage waste reduction and recycling at home and in businesses through public education programs, such as informational handouts, on recycling, yard waste, wood waste, and hazardous waste collection.

D. Develop a residential and commercial food waste composting program.

E. Purchase goods containing recycled materials for City use.

F. Continue to cooperate, require, and/or support the operation of resource recovery facilities by the City waste hauler and the disposal site operators.

G. Investigate and replace bottled water in City offices with alternate source of drinking water.

H. Ensure that all public facilities have adequate and accessible depositories for recyclables.

4-P-22 Require future waste contract negotiations to include the following:

A. Disposal of City waste products at a site with the least potential for environmental impacts.

B. Discussion on resource recovery services for Petaluma waste.

C. The identification of recycling and waste stream diversion goals.

D. Hazardous waste collection.

4.5 GREENHOUSE GAS EMISSIONS

Petaluma seeks to evaluate and lessen the impact of greenhouse gas emissions by reducing emissions, conserving resources and implementing the goals, policies and programs outlined in the General Plan 2025.

GLOBAL

Climate change is a shift in the average weather patterns observed on earth, which can be measured by such variables as temperature, wind patterns, storms and precipitation. The temperature on earth is regulated by what is commonly known as the "greenhouse effect." Naturally occurring greenhouse gases in the atmosphere, including carbon dioxide, methane, nitrous oxides, and water vapor, absorb heat from the earth's surface and radiate it back to the surface.

Human activities result in emissions of four principal greenhouse gases: carbon dioxide, methane, nitrous oxide, and halocarbons (fluorine, chlorine and bromine). Of all human activities, the burning of fossil fuels is the largest contributor in overall greenhouse gas emissions, releasing carbon dioxide gas into the atmosphere.[5]

The resulting increases in greenhouse gas emissions from human activities are leading to higher concentrations and a change in composition of the atmosphere. For instance, the concentration of CO2 in the atmosphere has risen about 30 percent since the late 1800s (National Assessment Synthesis Team [NAST], 2001).[6] Many sources and models indicate that temperatures on earth are currently warming and will continue to warm at unprecedented levels. The global mean surface temperature has increased

5 Intergovernmental Panel on Climate Change, Fourth Assessment Report (IPCC 4th), 2007, Working Group (WG) I, Frequently Asked Question 2.1, How do Human Activities Contribute to Climate Change and How Do They Compare with Natural Influences?

6 Climate Action Team, 2006, Climate Action Team Report to Governor Schwarzenegger and the Legislature, March.

by 1.1° F since the 19th century (IPCC Synthesis report, 2001), and the 10 warmest years of the last century all occurred within the last 15 years.[5]

The many effects of Greenhouse Gas Emissions are still being researched and are not fully known, but are expected to include increased temperatures which would: reduce snowpack, a primary source of drinking water; exacerbate air quality problems and adversely impact human health by increasing heat stress and related deaths; increase the incidence of infectious disease, asthma and respiratory health problems; cause sea levels to rise, threatening urban and natural coastlands; increase pests and pathogens; and cause variations in crop quality and yields.

This section of the General Plan is focused on the reduction of greenhouse gas emissions. To the extent that Petaluma is affected by global warming, for example rises in sea level, the issues are addressed in the Water Resources Element.

STATE OF CALIFORNIA

In California, the majority of human activity greenhouse gas emissions can be broken down into four sectors: transportation, industrial, electrical power, and agriculture/forestry. The largest source is from the transportation sector.[5]

In 2005, Governor Schwarzenegger issued Executive Order S-02-05, calling for statewide reductions to 2000 levels by 2010, 1990 levels by 2020 and to 80 percent below 1990 levels by 2050. The Executive Order also called for the creation of a state "Climate Action Team", which would report to the Governor every two years on both progress toward meeting the targets and effects of Greenhouse Gas Emissions on the state.

In the Fall of 2006, the Governor signed Assembly Bill 32 (AB32), the "Global Warming Solutions Act of 2006," committing the State of California to reducing greenhouse gas emissions to 1990 levels by 2020. The statute requires the California Air Resources Board (CARB) to track emissions through mandatory reporting, determine what 1990 emissions were, set annual emissions limits that will result in meeting the target, and identify a list of discrete early actions that directly address greenhouse gas emissions, are regulatory, and can be enforced by January 1, 2010.

CITY OF PETALUMA

Municipal Greenhouse Gas Emissions

On August 5th, 2002, the City Council adopted Resolution 2002-117 committing to participate in the Cities for Climate Protection. By doing so the City committed to:

- Taking a leadership role in promoting public awareness about the causes and impacts of Greenhouse Gas Emissions.
- Undertaking the Cities for Climate Protection program's five milestones to reduce greenhouse gas and air pollution emissions throughout the community by:

  1. Conducting a greenhouse gas emissions inventory and forecast to determine the source and quantity of GHG emissions.

  2. Establishing a greenhouse gas emissions reduction target.

  3. Developing an action plan with both existing and future actions to meet the greenhouse gas reduction target.

  4. Implementing the action plan.

  5. Monitoring to review progress.

In 2005 the City completed steps 1 and 2. On July 18, 2005 the City passed Resolution 2005-118, "Resolution to Establish GHG Emission Reduction Target(s) for the City of Petaluma". Resolution 2005-118 established greenhouse gas emissions reduction targets of 25% below 1990 levels by 2015 for community emissions and 20% below 2000 levels by 2010 for municipal operations. The City's reduction targets are more stringent than those passed by the State. The City is currently working on Step 3, development of the action plan for municipal emissions.

Also, the City signed the U.S. Mayors Climate Protection Agreement calling for participating cities to meet or surpass the Kyoto Protocol targets, and the resolutions above do surpass the Kyoto targets.

Since 2005 the City has implemented, or is in the process of implementing, many programs to reach the municipal operations goal. These include: a major lighting retrofit at City Hall, the Police Department and the Lucchesi Community Center; replacement of four traditional fuel fleet vehicles with one zero emission electric vehicle and three hybrid vehicles; retrofit of nine "off-road" vehicles (dump trucks, vacuum trucks, etc) to

Table 4.5-1: Petaluma Community-wide 1990 and 2005 Greenhouse Gas Emissions and Projected Emissions for 2025

	1990				2005				2025			
	Electricity (kWh)	Natural Gas (Therms)	CO_2e Emissions (tons)	Percent of Total	Electricity (kWh)	Natural Gas (Therms)	CO_2e Emissions (tons)	Percent of Total	Electricity (kWh)	Natural Gas (Therms)	CO_2e Emissions (tons)	Percent of Total
Buildings	335,233,026	9,083,718	172,200	40%	455,792,623	12,245,736	237,400	39%	554,183,117	15,572,117	292,800	40%
Municipal Services - Water & Sewer	6,184,009	209	2,100	0%	6,786,555	209	2,400	0%	10,146,879	6,000	3,600	1%
	Population	Waste Generated (tons)			Population	Waste Generated (tons)			Population	Waste Generated (tons)		
Solid Waste	43,200	49,567	22,500	5%	57,085	29,144	12,500	2%	72,707	37,178	15,900	2%
		Vehicle Miles Traveled				Vehicle Miles Traveled				Vehicle Miles Traveled		
Transportation		305,992,640	238,100	55%		544,710,305	368,100	59%		662,392,145	409,200	57%
TOTAL			434,900	100%			610,400	100%			721,600	100%
Percent Increase							2.7% increase per year from 1990 to 2005				0.9% increase per year from 2005 to 2025	

Notes: Columns may not add due to rounding.

comply with the California Air Resources Board lower vehicle emission regulations[7]; replacement of 99 percent of the incandescent traffic lights with LED lights; and replacement of three of nine 1989 diesel buses with four, 2007 Gillig models, which are equipped with clean burning diesel engines that meet the 2010 CARB regulations. As standard procedure, the Public Works Maintenance & Operations staff replaces older lighting fixtures with energy efficient units, as the original fixtures burn out.

The Green Team, a Council sanctioned group composed of City staff members and interested citizens, was formed to analyze City procedures and processes to identify areas of improvement, educate staff and the community, and sponsor the Going Green Expo.

The City is currently preparing a Climate Action Plan (CAP) for its municipal activities per Resolution 2002-117. The purpose of the municipal CAP is to identify and prioritize programs, projects, and procedural policies that will help the City achieve the municipal greenhouse gas emission goals of Resolution 2005-118.

7 California Environmental Protection Agency, Air Resources Board, November 1998, EV II – Amendments to California's Low-emission Vehicle Regulations.

Community Greenhouse Gas Emissions

As stated above, Resolution 2005-118 established greenhouse gas emissions reduction targets of 25% below 1990 levels by 2015 for community emissions. The primary sources of community greenhouse gas emissions in Petaluma are identified in Table 4.1-1 on the following page. In summary, residential and commercial buildings are responsible for about 40 percent; transportation is responsible for about 55 to 59 percent; and municipal services and solid waste management account for about 2 to 5 percent of emissions.

Emissions have grown from about 434,900 tons in 1990 at about 10.1 tons per person to 610,400 tons in 2005 at about 10.7 tons per person. Without benefit of the policies in the General Plan, emissions in 2025 are estimated to be 721,600 tons at about 9.9 tons per person. Although emissions would continue to increase, the rate of increase is expected to slow in the future based on implementation of the General Plan policies and State measures.

Throughout this General Plan, many far-reaching goals and policies are identified to promote the vision

for Petaluma's long-range physical and economic development and resource conservation. These policies, in such key areas as land use, conservation, systems efficiency, safety, mobility and housing, serve a dual purpose to implement the City's long-range goals and also require that growth occurs in ways that reduce the City's contribution of greenhouse gas emissions, see the following chapters:

1. Land Use, Growth Management and the Built Environment
2. Community Design, Character, and Green Building
5. Mobility
6. Recreation, Music, Parks, & the Arts
7. Community Facilities, Services, and Education
8. Water Resources
9. Economic Health and Fiscal Sustainability.

Goal 4-G-6: Greenhouse Gas Emissions

Reduce the contribution to greenhouse gases from existing sources and minimize the contribution of greenhouse gases from new construction and sources.

Policies and Programs:

4-P-23 **Fund and/or designate a Green Program Manager to oversee implementation of all Greenhouse Gas Emissions policies and programs identified in the Greenhouse Gas Emissions section as well as the City's Climate Action Plan. The policies and programs will need to be reviewed and updated periodically as new information, regulatory standards, and technologies develop. A report shall be provided to the City Council biannually, reporting on the status of the City's efforts to reduce green house gases, and recommendations for any changes that are deemed necessary.**

4-P-24 **Comply with AB 32 and its governing regulations to the full extent of the City's jurisdictional authority.**

4-P-25 **To the full extent of the City's jurisdictional authority, implement any additional adopted State legislative or regulatory standards, policies and practices designed to reduce greenhouse gas emissions, as those measures are developed.**

4-P-26 **Implement all measures identified in the municipal Climate Action Plan to meet the municipal target set in Resolution 2005-118 (20% below 2000 levels by 2010).**

4-P-27 **The City shall prepare a Community Climate Action Plan to identify and prioritize programs, projects, and procedural policies that will help the City achieve the community greenhouse gas emission goals of Resolution 2005-118 (25% below 1990 levels by 2015).**

4-P-28 **Prepare a feasibility report for the City of Petaluma forming a Community Choice Aggregation (through AB 117, permits any city or county to aggregate the electric loads of residents, businesses and municipal facilities to facilitate the purchase and sale of electrical energy) as a way of supplying renewable energy to the community.**

4-P-29 **Train appropriate City staff on new technology and look for opportunities to improve energy efficiency in public facilities.**

4-P-30 **Continue to monitor new technology and innovative sustainable design practices for applicability to insure future development minimizes or eliminates the use of fossil fuel and GHG-emitting energy consumption.**

4-P-31 **Provide information and tips on reducing greenhouse gas emissions to the community.**

A. Advertise "Green Tip" in the local newspaper.
B. Work with utilities to offer Green Tips with the utility bills.
C. Continue sponsoring Petaluma's green programs, including, but not limited to, the Going Green Expo.
D. Create a program of on-going community education.
E. Support the efforts of the Sonoma Green Business Program.

4-P-32 **Develop and implement a municipal Environmentally Preferable Purchasing Program.**

4-P-33 **Investigate the feasibility of developing a City sponsored program to subsidize or assist home-owners in purchasing solar water heating or passive solar systems, or other forms of renewable energy, through low-interest loans or property tax assessments.**

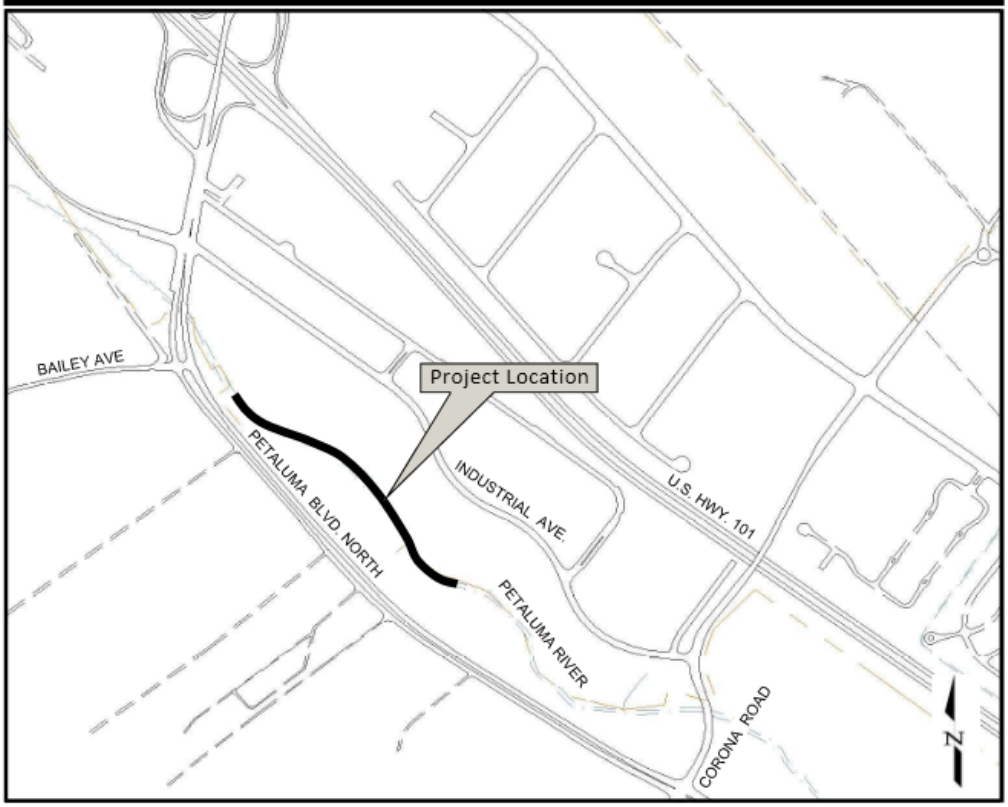
SURFACE WATER PROJECTS
FY 2015-2016

SURFACE WATER CAPITAL IMPROVEMENT PROGRAM BUDGET FY 15-16
PROJECT SUMMARY
Fund 3160.31600

PROJECTS (dollars in $000)		Actual Life to Date thru 6/30/14	Estimate FY 14-15	Budget FY 15-16	PROJECTED FY 16-17	PROJECTED FY 17-18	PROJECTED FY 18-19	PROJECTED FY 19-20	Total Estimate
C00500208	River Plan - Denman Reach Phase 3	$ 761	$ 402	$ 1,496	$ -	$ -	$ -	$ -	$ 2,659
C16301307	Petaluma River Flood Control	344	3	2,800	-	-	-	-	3,147
C16301413	Capri Creek Re-Contouring & Terracing	9	22	100	969	-	-	-	1,100
C16301415	Surface Water Projects	4	-	-	1,230	-	1,230	-	2,464
C00500705	Lakeville Channel Improvements	20	-	10	-	-	-	-	30
C00500308	Stream And Precipitation Gauges	62	10	107	-	-	-	-	179
C16301414	Kelly Creek Modifications	-	5	52	1,110	-	-	-	1,167
C16301417	Washington Creek Repair & Enhancement	-	20	155	-	-	-	-	175
C16301518	Old Corona Road Water Quality Mitigation Project	-	22	131	772	12	12	-	949
	TOTAL	$ 1,200	$ 484	$ 4,851	$ 4,081	$ 12	$ 1,242	$ -	$ 11,870

SOURCES (dollars in $000)									
	Storm Drainage Impact Fees	$ 375	$ 57	$ 744	$ (131)	$ -	$ -	$ -	$ 1,045
	State Grants	660	355	-	825	-	-	-	1,840
	SCWA Zone 2A Assessments	62	82	1,337	1,254	-	-	-	2,735
	Dept of Water Resources Grant	-	-	993	-	-	-	-	993
	Open Space Grant	-	-	50	-	-	-	-	50
	Army Corp of Engineers	-	-	1,820	-	-	-	-	1,820
	Undetermined	-	-	-	2,133	12	1,242	-	3,387
	TOTAL	$ 1,097	$ 494	$ 4,944	$ 4,081	$ 12	$ 1,242	$ -	$ 11,870

RIVER PLAN—DENMAN REACH PHASE 3 SURFACE WATER



CIP-82

DRAFT

Project Title: **Denman Reach Phase 3** **C00500208**

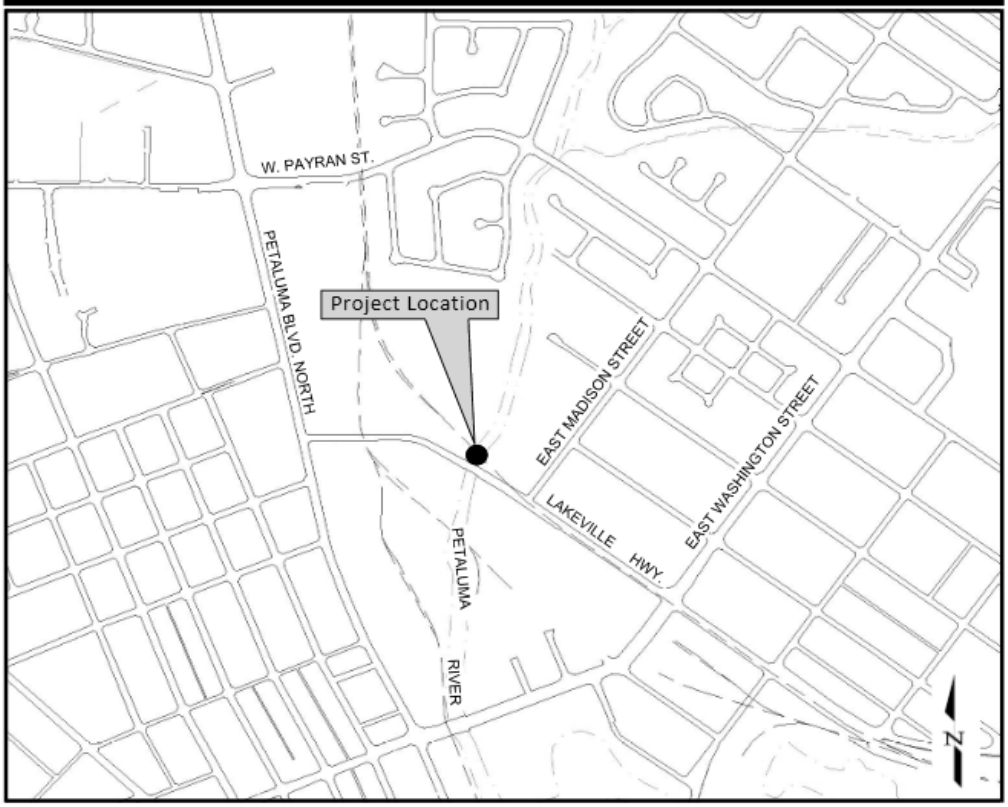
PROJECT PURPOSE AND DESCRIPTION

This project is located along the Petaluma River, upstream of Corona Road within the Denman Reach. The project consists of acquiring properties and obtaining temporary construction and permanent trail easements to allow the excavation of a longitudinal bench along the low-flow channel of the river. The objective is to create a flood terrace and restore the wetland and upland habitat areas upstream of the previously constructed Phase 1 and 2 projects. This will stabilize the existing incised river channel and unstable bank areas, improve hydraulic function, and reduce localized flood levels currently impacting adjacent development in the City and unincorporated areas.

FINANCIAL OVERVIEW

C00500208	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental		40	40	25					65
Land & Easements	673	200	873	192					1,065
Design	36	150	186	8					194
Legal Services	2	2	4	1					5
Administration			-						-
Construction Contracts			-	1,056					1,056
Construction Mgmt	24		24	78					102
Salaries and Benefits	23		23						23
Contingency			-	100					100
CIP Overheads	3	10	13	36					49
TOTAL USES	$ 761	$ 402	$ 1,163	$ 1,496	$ -	$ -	$ -	$ -	$ 2,659
SOURCES (dollars in $000)									
Storm Drainage Impact Fees	8		8	81					89
State Grants	660	355	1,015						1,015
SCWA Zone 2A Assessments		47	47	465					512
Dept of Water Resources Grant			-	993					993
Open Space Grant			-	50					50
TOTAL FUNDS	$ 668	$ 402	$ 1,070	$ 1,589	$ -	$ -	$ -	$ -	$ 2,659

PETALUMA RIVER FLOOD CONTROL SURFACE WATER



DRAFT

CIP-84

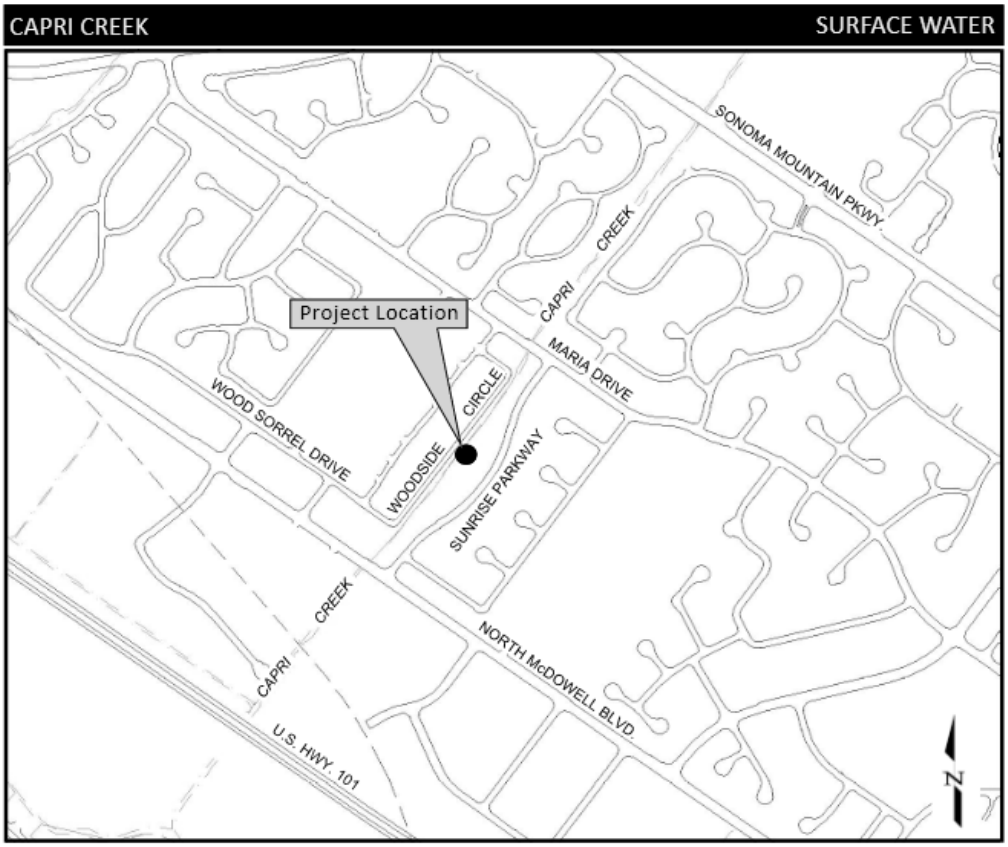
Project Title: Petaluma River Flood Control **C16301307**

PROJECT PURPOSE AND DESCRIPTION

This project completes the U.S. Corps of Engineers Petaluma River Flood Control Project within the Payran Reach. This work includes approximately 100 ft. of sheet pile flood wall extension to the SMART bridge abutment, embankment and storm drain outfall repair, and sheet pile cap repair. Projected costs represent only the City's 35% cost share of the proposed project. Construction drawings are complete and the project is expected to be ready to bid in late spring 2015, pending funding by the Corps.

FINANCIAL OVERVIEW

C16301307	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental			-						-
Land & Easements	2		2						2
Design		3	3						3
Legal Services			-						-
Administration	327		327						327
Construction Contracts			-	2,780					2,780
Construction Mgmt			-	20					20
Salaries and Benefits	7		7						7
Contingency			-						-
CIP Overheads	8		8						8
TOTAL USES	$ 344	$ 3	$ 347	$ 2,800	$ -	$ -	$ -	$ -	$ 3,147
SOURCES (dollars in $000)									
Storm Drainage Impact Fees	336	11	347	490					837
SCWA Zone 2A Assessments			-	490					490
Army Corps of Engineers			-	1,820					1,820
TOTAL FUNDS	$ 336	$ 11	$ 347	$ 2,800	$ -	$ -	$ -	$ -	$ 3,147


CAPRI CREEK
SURFACE WATER
Project Location
SONOMA MOUNTAIN PKWY.
CAPRI CREEK
MARIA DRIVE
WOOD SORREL DRIVE
CIRCLE
WOODSIDE
SUNRISE PARKWAY
CAPRI CREEK
NORTH McDOWELL BLVD.
U.S. HWY. 101
N

CIP-86

Project Title: Capri Creek Re-contouring and Terracing **C16301413**

PROJECT PURPOSE AND DESCRIPTION

The project will improve channel hydraulic capacity to reduce out of bank flooding and ease of maintenance. The creek will be re-contoured west of Maria Dr. to better define low flow channel, create a flood terrace and a sediment/debris removal basin at the downstream inlet. . Additionally in-stream habitat structures and plantings of native trees and shrubs will be added along the newly defined riparian corridor. The project will be funded largely through a State grant and Zone 2A funding with additional supplemental funding from Storm Drainage Impact fees.

FINANCIAL OVERVIEW

C16301413	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental			-						-
Land & Easements			-						-
Design	2	20	22	19	2				43
Legal Services		2	2						2
Administration			-						-
Construction Contracts			-	64	875				939
Construction Mgmt			-	15	68				83
Salaries and Benefits	6		6						6
Contingency			-						-
CIP Overheads	1		1	2	24				27
TOTAL USES	$ 9	$ 22	$ 31	$ 100	$ 969	$ -	$ -	$ -	$ 1,100
SOURCES (dollars in $000)									
Storm Drainage Impact Fees	9	22	31	27					58
State Grants			-		825				825
SCWA Zone 2A Assessments			-	73	144				217
TOTAL FUNDS	$ 9	$ 22	$ 31	$ 100	$ 969	$ -	$ -	$ -	$ 1,100

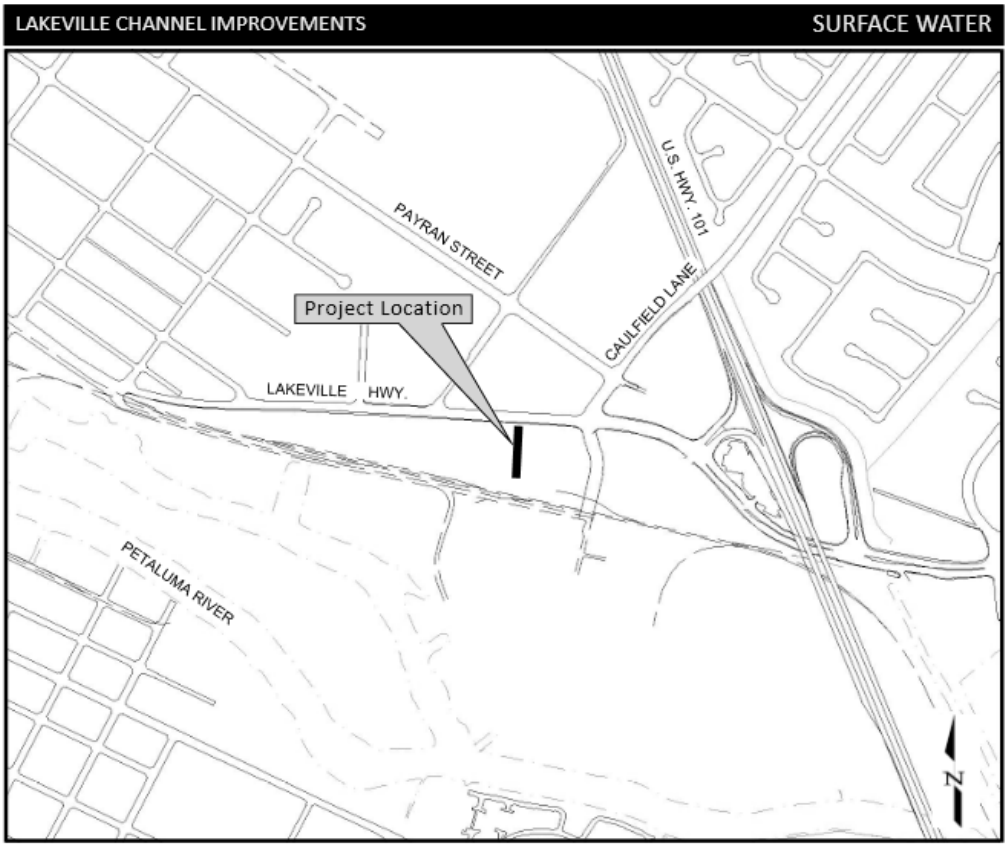
Project Title: Surface Water Projects **C16301415**

PROJECT PURPOSE AND DESCRIPTION

A five-year surface water project list has been developed to prioritize future capital projects. Likely future projects include creation of sediment basins on Adobe Creek, minor localized flood improvements within neighborhoods, developing a stewardship program and improving creekside trails on Adobe Creek, Lynch Creek, and Washington Creek, bank stabilization on Lynch and Washington Creeks, detention/retention ponds for Willowbrook Creek, and feasibility studies for increased retention pond sites.

FINANCIAL OVERVIEW

C16301415	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental			-						-
Land & Easements			-						-
Design			-		15		15		30
Legal Services			-						-
Administration			-						-
Construction Contracts			-		1,000		1,000		2,000
Construction Mgmt			-		115		115		230
Salaries and Benefits	4		4						4
Contingency			-		100		100		200
CIP Overheads			-						-
TOTAL USES	$ 4	$ -	$ 4	$ -	$ 1,230	$ -	$ 1,230	$ -	$ 2,464
SOURCES (dollars in $000)									
Storm Drainage Impact Fees	2	2	4						4
Undetermined			-		1,230		1,230		2,460
TOTAL FUNDS	$ 2	$ 2	$ 4	$ -	$ 1,230	$ -	$ 1,230	$ -	$ 2,464


LAKEVILLE CHANNEL IMPROVEMENTS
SURFACE WATER
PAYRAN STREET
U.S. HWY. 101
CAULFIELD LANE
Project Location
LAKEVILLE HWY.
PETALUMA RIVER
N

CIP-90

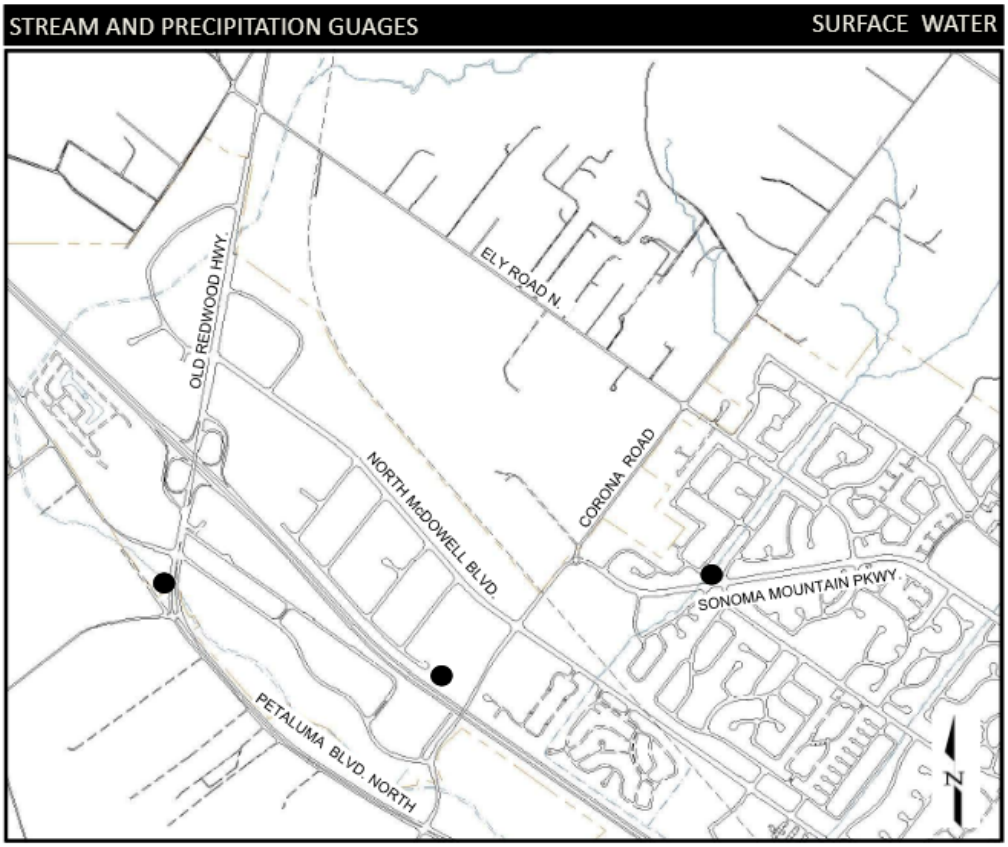
Project Title: Lakeville Channel Improvements **C00500705**

PROJECT PURPOSE AND DESCRIPTION

The City currently owns and maintains an open drainage ditch at 960 Lakeville Street. The ditch conveys storm water runoff from Lakeville Street and the surrounding area into an adjacent channel. Maintaining adequate flow capacity of this ditch is exacerbated by the growth of cattails. Staff will study options to improve flow. The potential environmental impacts of this proposed project have been determined, and mitigation alternatives need to be evaluated in order to proceed with construction.

FINANCIAL OVERVIEW

C00500705	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental	19		19						19
Land & Easements			-						-
Design			-	10					10
Legal Services			-						-
Administration			-						-
Construction Contracts			-						-
Construction Mgmt			-						-
Salaries and Benefits			-						-
Contingency			-						-
CIP Overheads	1		1						1
TOTAL USES	$ 20	$ -	$ 20	$ 10	$ -	$ -	$ -	$ -	$ 30
SOURCES (dollars in $000)									
Storm Drainage Impact Fees	20		20	10					30
TOTAL FUNDS	$ 20	$ -	$ 20	$ 10	$ -	$ -	$ -	$ -	$ 30


STREAM AND PRECIPITATION GUAGES
SURFACE WATER
ELY ROAD N.
OLD REDWOOD HWY.
NORTH McDOWELL BLVD.
CORONA ROAD
SONOMA MOUNTAIN PKWY.
PETALUMA BLVD. NORTH
N
PROJECT LOCATIONS

DRAFT

CIP-92

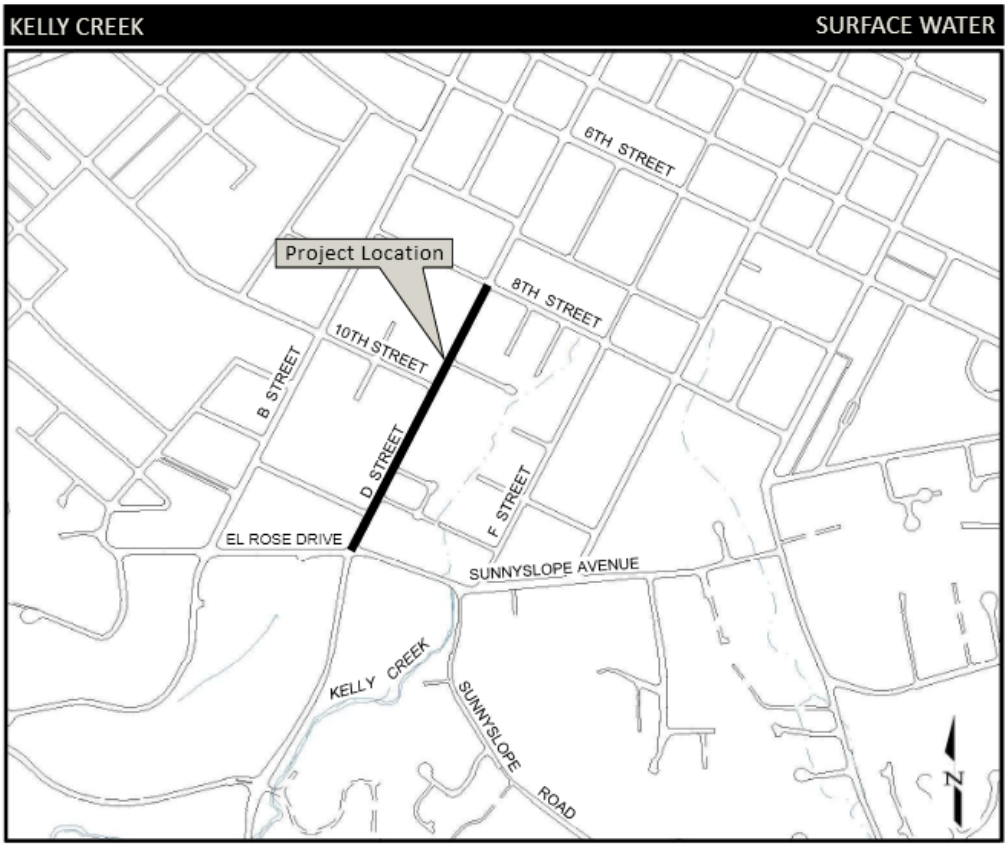
Project Title: Stream and Precipitation Gauges **C00500308**

PROJECT PURPOSE AND DESCRIPTION

This project is located throughout the Petaluma River watershed within the City limits, as well as unincorporated Sonoma County. The project consists of the installation of ten additional gauges to measure and record stream depth and precipitation. The purpose is to obtain additional data necessary to evaluate surface water runoff and flooding in the watershed. These gauges will also augment the existing gauges used for City flood response activities. This project has been approved for funding by SCWA Zone 2A.

FINANCIAL OVERVIEW

C00500308	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental			-						-
Land & Easements			-						-
Design		10	10						10
Legal Services			-						-
Administration			-						-
Construction Contracts	55		55	89					144
Construction Mgmt			-	11					11
Salaries and Benefits	6		6						6
Contingency			-	3					3
CIP Overheads	1		1	4					5
TOTAL USES	$ 62	$ 10	$ 72	$ 107	$ -	$ -	$ -	$ -	$ 179
SOURCES (dollars in $000)									
Storm Drainage Impact Fees			-	5					5
SCWA Zone 2A Assessments	62	10	72	102					174
TOTAL FUNDS	$ 62	$ 10	$ 72	$ 107	$ -	$ -	$ -	$ -	$ 179


KELLY CREEK
SURFACE WATER
6TH STREET
Project Location
8TH STREET
10TH STREET
B STREET
D STREET
F STREET
EL ROSE DRIVE
SUNNYSLOPE AVENUE
KELLY CREEK
SUNNYSLOPE ROAD
N

CIP-94

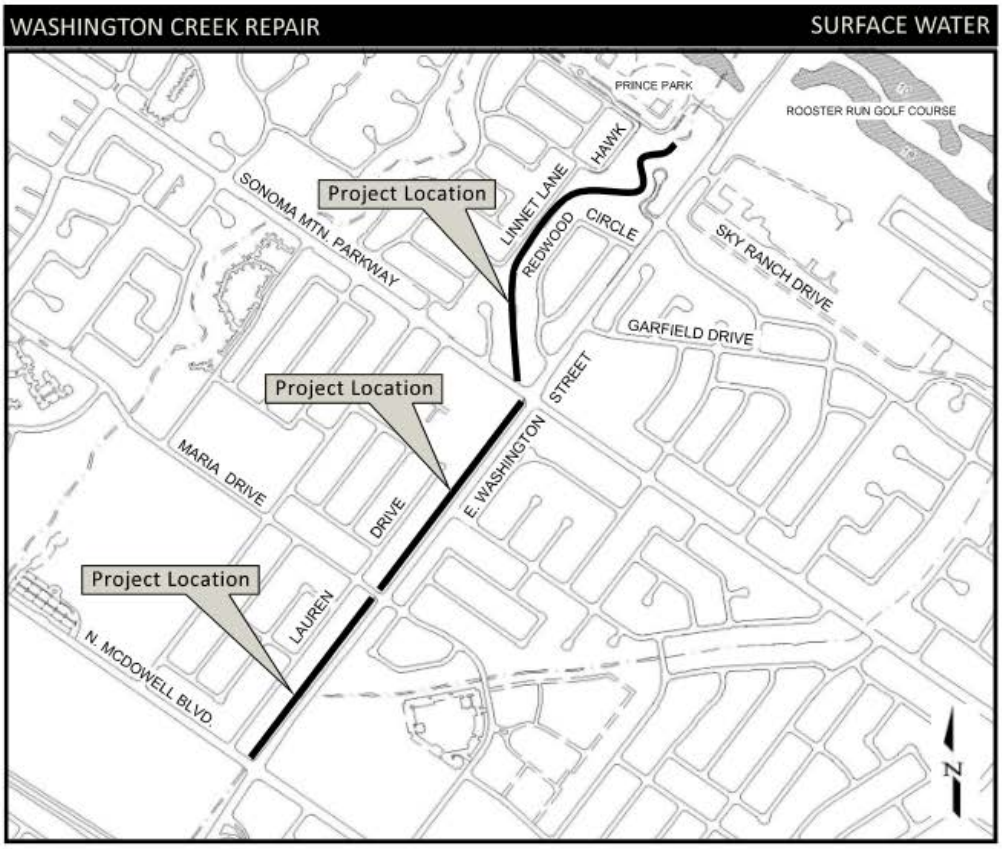
Project Title: Kelly Creek Modifications **C16301414**

PROJECT PURPOSE AND DESCRIPTION

The project will redirect culvert flow to a new storm drain line in D Street and reconnect the natural flow from Kelly Creek at Sunnyslope back into the Kelly Creek natural channel. The first phase of work is to assess current conditions and existing capacity in the storm drain system to determine the project scope. The second phase is construction. The schedule will be based on priority and available funding. Initial funding for preliminary analysis and engineering will be Zone 2A assessments. Staff is seeking funds for construction.

FINANCIAL OVERVIEW

C16301414	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental		5	5						5
Land & Easements			-						-
Design			-	52					52
Legal Services			-						-
Administration			-						-
Construction Contracts			-		900				900
Construction Mgmt			-		90				90
Salaries and Benefits			-						-
Contingency			-		90				90
CIP Overheads			-		30				30
TOTAL USES	$ -	$ 5	$ 5	$ 52	$ 1,110	$ -	$ -	$ -	$ 1,167
SOURCES (dollars in $000)									
SCWA Zone 2A Assessments		5	5	52	1,110				1,167
TOTAL FUNDS	$ -	$ 5	$ 5	$ 52	$ 1,110	$ -	$ -	$ -	$ 1,167


WASHINGTON CREEK REPAIR
SURFACE WATER
PRINCE PARK
ROOSTER RUN GOLF COURSE
HAWK
LINNET LANE
REDWOOD CIRCLE
SONOMA MTN. PARKWAY
Project Location
SKY RANCH DRIVE
GARFIELD DRIVE
STREET
E. WASHINGTON
Project Location
MARIA DRIVE
DRIVE
Project Location
LAUREN
N. MCDOWELL BLVD.
N

CIP-96

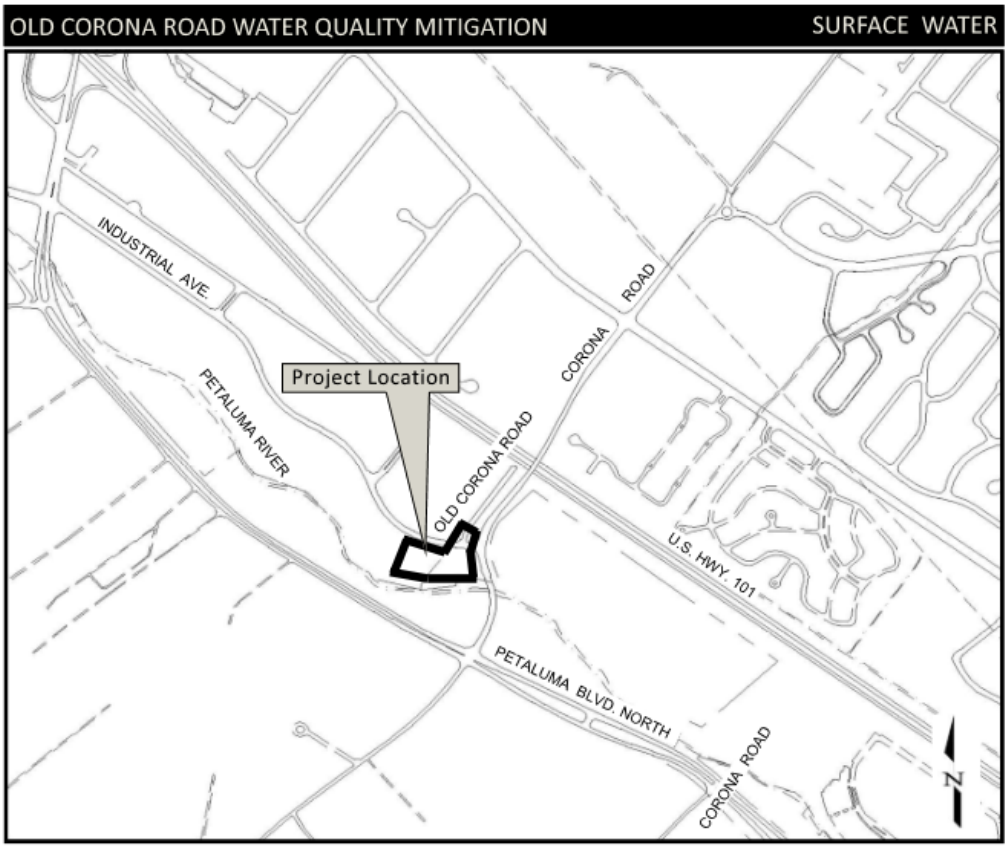
Project Title: Washington Creek Repair & Enhancement **C16301417**

PROJECT PURPOSE AND DESCRIPTION

The project includes bank repair and native riparian plantings on Washington Creek starting at N. McDowell Blvd. meandering upstream through subdivisions to Prince Park. Environmental analysis, permitting and design are scheduled for 2015 with construction in 2016.

FINANCIAL OVERVIEW

C16301417	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental		20	20						20
Land & Easements			-						-
Design			-	25					25
Legal Services			-						-
Administration			-						-
Construction Contracts			-	125					125
Construction Mgmt			-	5					5
Salaries and Benefits			-						-
Contingency			-						-
CIP Overheads			-						-
TOTAL USES	$ -	$ 20	$ 20	$ 155	$ -	$ -	$ -	$ -	$ 175
SOURCES (dollars in $000)									
SCWA Zone 2A Assessments		20	20	155					175
TOTAL FUNDS	$ -	$ 20	$ 20	$ 155	$ -	$ -	$ -	$ -	$ 175


OLD CORONA ROAD WATER QUALITY MITIGATION
SURFACE WATER
INDUSTRIAL AVE.
PETALUMA RIVER
Project Location
OLD CORONA ROAD
CORONA ROAD
U.S. HWY. 101
PETALUMA BLVD. NORTH
CORONA ROAD
N

CIP-98

Project Title: Old Corona Road Water Quality Mitigation **C16301518**

PROJECT PURPOSE AND DESCRIPTION

This project will improve the water filtration and carrying capacity of an existing roadside open ditch adjacent to Old Corona Road. The ditch receives surface water flows from Highway 101 for a distance of 550 linear feet and approximately 25-30' in width. At the downstream end of the roadside open ditch the low flow will be diverted to two bio-retention basins for further water quality improvement prior to discharge to the Petaluma River.

FINANCIAL OVERVIEW

C16301518	Expenses and Funds Received			BUDGET					
					PROJECTED				
USES (dollars in $000)	Actual Life to Date thru 6/30/14	Estimate FY 2015	Estimate Life to Date thru 6/30/15	Proposed FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	Total Project Estimate
Planning/Environmental	-	20	20	22	-				42
Land & Easements			-	30					30
Design			-	74					74
Legal Services		2	2	5					7
Administration			-						-
Construction Contracts			-		672	7	7		686
Construction Mgmt			-		100	5	5		110
Salaries and Benefits	-		-						-
Contingency			-						-
CIP Overheads			-						-
TOTAL USES	$ -	$ 22	$ 22	$ 131	$ 772	$ 12	$ 12	$ -	$ 949
SOURCES (dollars in $000)									
Storm Drainage Impact Fees		22	22	131	(131)				22
Undetermined			-		903	12	12		927
TOTAL FUNDS	$ -	$ 22	$ 22	$ 131	$ 772	$ 12	$ 12	$ -	$ 949