

Stormwater Evaluation Report

Prepared for
City of Davis
September 2017



WEST YOST

ASSOCIATES
Consulting Engineers

011-10-17-55

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Prepared for

City of Davis

Project No. 011-10-17-55



Project Manager: Kristen Whatley, PE

9/5/17

QA/QC Review: Doug Moore, PE

9/5/17

Carlsbad

2173 Salk Avenue, Suite 250
Carlsbad, CA 92008
(760) 795-0365

Davis

2020 Research Park Drive, Suite 100
Davis, CA 95618
(530) 756-5905

Eugene

1650 W 11th Ave. Suite 1-A
Eugene, OR 97402
(541) 431-1280

Irvine

6 Venture, Suite 290
Irvine, CA 92618
(949) 517-9060

Pleasanton

6800 Koll Center Parkway, Suite 150
Pleasanton, CA 94566
(925) 426-2580

Portland

4949 Meadows Road, Suite 125
Lake Oswego, OR 97035
(503) 451-4500

Sacramento

2725 Riverside Boulevard, Suite 5
Sacramento, CA 95818
(916) 504-4915

Santa Rosa

2235 Mercury Way, Suite 105
Santa Rosa, CA 95407
(707) 543-8506

Sunnyvale

1250 Oakmead Parkway, Suite 210
Sunnyvale, CA 94085
(408) 451-8453

Walnut Creek

1777 Botelho Drive, Suite 240
Walnut Creek, CA 94596
(925) 949-5800

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List of Acronyms and Abbreviations

CCTV	Closed Circuit Television
CIP	Capital Improvement Project
City	City of Davis
CMMS	Computerized Maintenance and Management System
CWEA	California Water Environment Association
DI	Drainage Inlets
FTE	Full-Time Equivalent
GIS	Geographic information system
HP	Horsepower
O&M	Operations & Maintenance
PLC	Programmable Logic Controllers
RTU	Remote Telemetry Units
SCADA	Supervisory Control and Data Acquisition
SDS	Storm Drainage Pump Station
SOP	Standards Operating Procedures
KPIs	Key Performance Indicators
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

In order to move the City of Davis’ (City) Stormwater Division of the Public Works Department from largely reactive operations to a more proactive, preventative program, City management staff requested this evaluation of current Stormwater Division operations. This Report summarizes current staffing and operation and maintenance (O&M) practices, provides a benchmarking summary of similar and best management agencies, and recommends stormwater program improvements.

1.1 Purpose

West Yost reviewed several reference documents related to stormwater department operations and maintenance activities and interviewed O&M staff to gather the information needed to assess current O&M protocols. Several recommendations have been identified based on our O&M review and assessment. West Yost was also tasked with assessing the adequacy of the current O&M staffing levels. The staffing level assessment and recommendations are based on the duties of current staff, a comparison with similar size stormwater utilities, and on the ability of staff to perform additional tasks recommended for the O&M program.

This report includes the following:

- A summary of the O&M reviews and findings.
- A review and assessment of current maintenance procedures for several infrastructure types and recommended modifications and/or additions to those procedures to meet best practices and/or the City’s desired level of service.
- An assessment of O&M staffing levels needed to meet the City’s desired level of service. Staffing recommendations are compared against staffing levels within existing utilities of a similar size with varying degrees of maintenance needs.

1.2 Available Workhour Assumptions

This evaluation analyzes the City’s work order and payroll records and makes recommendations for staffing levels based on the assumed annual work hours available from each full-time equivalent (FTE) employee shown in Table 1. Timesheet data provided by the City from 2011 through 2014 also showed that the average number of hours recorded for each full-time Storm Division employee during that timeframe was 1,504 hours per year, which validates this assumption.

Description	Work Days per Year	Work Hours per Year
52 Weeks/Year x 5 Workdays per Week	260	2,080
Holidays	-12	-96
Vacations	-20	-160
Sick Days	-15	-120
Compensatory Time	-5	-40
Training	-20	-160
Total Available per FTE	188	1,504

1.3 Information Sources

The following sources of information were used during this evaluation:

- City of Davis Public Works Department Adopted Budget 2015-16
- City of Davis Stormwater Management Plan, September 2006
- Stormwater Asset Inventory
- Drainage Area Map, January 2015
- City of Davis Lift Station Assessment and Inventory Report, February 2015
- City of Davis Wastewater Collections Division O&M Manuals
- City of Davis Current and Potential Stormwater Division Staff Job Descriptions
- City of Davis Public Works Standby Schedule, February 2017
- City of Davis Public Works Organization Chart, August 2016
- City of Davis Stormwater Division Asset Management Data, October 2016
- City of Davis Stormwater Division Work Order Summary, February 2014 to February 2017
- City of Davis Budget Data, 2012-2017
- El Macero Pump Station Run Time Hours, 2012-2016
- City of Davis Work Order Detail Report, 12/29/2016-3/22/2017
- City of Davis Task Summary by Category Report, 3/23/2017
- City of Davis Non-Stormwater Division Hours, 2012-2016

1.4 Stormwater System Description

The City of Davis stormwater system is divided into eleven (11) tributary basins that are located within the Davis City Limits. The drainage basins are delineated in the service area map located in Appendix A.

The City stormwater conveyance system is comprised of approximately 92 miles of storm drain pipe, 0.5 miles of force main, 33 miles of storm drain laterals, 1,850 maintenance holes, 160 drainage inlets, and 8 siphon structures, as summarized in Table 2.

Asset	Quantity
Storm Drains	92 miles
Drainage Inlets	2,870
Storm Drain Laterals	33 miles
Maintenance Holes	1,850
Drainage Channels	16.7 miles
Detention Ponds	6 (65+ acres)
Drainage Pump Stations	9 (7.5 to 750 HP)
Bike Tunnel Sump Pumps	10 (4 HP each)
Force Mains	0.5 miles
Siphon Structures	8
Access Roads	15 miles

According to the City’s asset inventory records, 18 percent of the City’s storm drain assets were installed before 1960 and are reaching the end of their expected service lives, as summarized in Table 3.

Year Installed	% of Total Length
2000 to Present	6.6
1980 to 1999	30.2
1960 to 1979	45.8
1940 to 1959	11.5
1920 to 1939	1.9
1900 to 1919	3.9
Total	100

Stormwater flows by gravity into four City detention ponds, one detention basin, and one drainage pond, as summarized in Table 4.

Tributary Pump Station	Name	Pond/Basin Area, Acres
SDS#1	West Area Detention Pond	31.0
SDS#2	North Area Detention Pond	15.0
SDS#4	Core Area Detention Pond	11.8
SDS#7	Sutter Detention Basin	3.9
SDS#8	Evergreen Detention Pond	2.5
SDS#9	Cannery Drainage Pond	unknown
	Stonegate Retention Pond	18

Nine (9) stormwater drainage pump stations (SDS) lift stormwater from the ponds and basin into several main drainage channels. The drainage channels include the following:

- Covell Channel
- John Jones Channel
- F Street Channel
- Channel A
- Lincoln Highway Channel
- Putah Creek Channel
- Mace Ranch Park Channel
- El Macero Channel
- Chiles Swale Chanel

These channels are tributary to the Willow Slough Bypass or the Yolo Basin Wetlands, Davis site, which is located east of the City of Davis. The Willow Slough Bypass also receives runoff from agricultural lands to the north of the City of Davis. The Yolo bypass is the main receiving water body for stormwater collected throughout the City of Davis. The City has approximately 15 miles of access roads that are used to gain access to ponds and drainage channels for on-going maintenance tasks.

The SDSs are numbered 1 through 9, and are summarized in Table 5.

Name	Location	Date Constructed	Approximate Age, years	Pump Size
SDS#1	2700 W. Covell Boulevard	1980	37	2 - 25HP
SDS#2	3131 F Street	1980	37	1 - 40HP
SDS#3	1999 H Street	1948	69	2 - 200HP, 2 - 318HP
SDS#4	1919 Second Street	1987	30	2 - 30HP, 1-3 HP
SDS#5	One mile south of I-80	1948	69	2 - 250HP, 1 - 40HP
SDS#6	100 Olive Drive	1924	93	1 - 7.5HP
SDS#7	3003 John Jones Road	2002	15	2 - 14HP
SDS#8	1500 W. Covell	1997	20	1 - 7.5HP, 3 - 30HP
SDS#9	Cannery	2015	2	4 - 25HP, 3 - 60HP

SDS#1 and SDS #2 pump from their associated detention ponds which are used for wild life habitat in addition to stormwater detention. This use effects both the design parameters of the pump stations and overall detention basin storage capacity, which is discussed later in this report. SDS#4 pumps from an associated detention pond which is also used as a dog park. The dog park is closed when a storm event occurs to allow the pond to be used for stormwater storage.

In addition to the drainage pump stations, the City has ten (10) bike tunnel sump pumps that lift stormwater from the tunnels to nearby conveyance systems. Each bike tunnel sump pump station is equipped with a single four horsepower (HP) pump. The bike tunnel pump stations were built between 1989 and 1998 and have been in service for 19 to 28 years.

2.0 STORMWATER DIVISION EVALUATION

This section summarizes the City's current Stormwater Division O&M activities.

2.1 Maintenance

The purpose of the maintenance program is to ensure that stormwater system facilities, assets, and equipment are properly functioning to maximize system reliability, to ensure assets meet or exceed their expected service life, and to ensure that repairs can be performed in a scheduled manner avoiding extra costs and disruptions caused by unexpected failure.

The current maintenance activities are described based on interviews with staff and review of existing maintenance logs from 2014 to 2017. The City O&M staff are currently performing regular maintenance on many types of stormwater infrastructure. The maintenance review includes the assessment of current maintenance tasks for several infrastructure types and aspects, which include the following:

- Drainage pump station maintenance (pumps and generators);
- Conveyance system cleaning and condition assessment;
- Maintenance hole cleaning, repair, and replacement;
- Drainage inlet and siphon cleaning;
- Channel maintenance;
- Basin and pond maintenance;
- Access road and grounds maintenance; and
- Computerized Maintenance and Management System (CMMS).

Recommended modifications and/or additions to the current procedures are made to meet best practices and/or recommended regulatory guidelines. Detailed assessments and recommendations are given below for each infrastructure type or aspect.

2.1.1 Labor Hour Records

The City provided a summary of the labor hours recorded for each labor task category in work orders for the three-year period from February 14, 2014 through February 14, 2017, which is provided as Total Labor Hours in Table 6. Note that for this time period, there are labor hours without work orders, and only a portion of the total labor hours are recorded in work orders.

Note that according to Table 6, the average hours per year recorded in Lucity™ work orders for stormwater maintenance over the last three years is equal to 2,540 hours or a full-time employee equivalent of 1.69 people (per the available workhour assumptions in Table 1). Since Storm Division staffing levels have been between three and four FTE's during this same time period, Table 6 shows that roughly half of the available workhours are recorded in Lucity™ work orders.

Table 6. Maintenance Task Labor Hour and Work Order Summary (2/14/2014 to 2/14/2017)

Task Category	Total Labor Hours	Average Hours per Year	Percent of Total Labor Hours	No. of Work Orders	Percent of Total No. of Work Orders
SDS#1-4, 6-8	2,012	671	26.4	98	40.5
Drainage Channels	2016	672	26.5	38	15.7
Drainage Inlets	1,858	619	24.4	35	14.5
EM SDS05	648	216	8.5	13	5.4
Ponds/Basins	313	104	4.1	8	3.3
Bike Path Pump Stations	249	83	3.3	41	16.9
Drainage Maintenance Holes	160	53	2.1	2	0.8
Drainage Main	160	53	2.1	1	0.4
Street Segment	70	23	0.9	-	-
Customer Services	44	15	0.6	5	2.1
Stormwater Collection	40	13	0.5	-	-
WWTP Assistance	19	6	0.2	-	-
Parks Assistance	11	4	0.1	1	0.4
Water Assistance	8	3	0.1	-	-
Signs	5	2	0.1	-	-
WW Collections Assistance	5	2	0.1	-	-
EI Macero Drainage	4	1	0.1	-	-
Total	7,621	2,540	100	242	100
Annual FTE (1,504 hours/year)		1.69			

2.1.2 Drainage Pump Station Maintenance

Current SDS maintenance tasks and frequencies are summarized in Table 7, and are based on O&M and asset inventory data provided by City stormwater staff.

According to the City’s 2014-2016 work order records (see Table 3), City drainage pump station maintenance accounted for approximately 26 percent of the total stormwater division O&M staff labor hours and up to 35 percent of the total stormwater division hours when the EI Macero SDS#5 is included.

The City conveyance system includes 9 drainage pump stations. Each drainage pump station has operation and maintenance data specific to the pump station that is used as a guide to the facilities O&M activities. Generally, the staff visit the pump stations on a daily to weekly basis to inspect equipment and station operations unless a higher priority task is required elsewhere. Alarms are currently tested quarterly at each SDS.

Most pump stations can be monitored remotely via the telemetry/SCADA system. The City’s SCADA/Utility Controls Technician has access to the telemetry/SCADA system. At SDS#3, the on-site standby generator is activated by an automatic transfer switch in the case of a loss of power.

2.1.3 Bike Tunnel Maintenance

Bike tunnel maintenance consists of inspections, pump maintenance and quarterly cleaning of the wet well. Each bike tunnel pump station is inspected for vandalism, control panel lights are inspected, pump readings are recorded, inlet grates are cleaned, wet well is cleaned and the pump is run to ensure operability.

Staff use standard equipment, where possible, to increase the efficiency of repairs and accessibility of spare parts. All but one of the bike tunnel drainage pumps are the same manufacturer and model.

2.1.4 Conveyance System Cleaning and Condition Assessment

Staff reported that consistent cleaning, inspections, closed circuit television (CCTV) of the conveyance system are not being conducted due to a lack of staff resources and outdated CCTV equipment. CCTV provides a video of pipe condition from within the pipe that is used to conduct pipe condition assessments. Storm drain pipes need to be cleaned prior to CCTV. Staff has access to a hydro cleaning truck that is shared with the wastewater collections division. Staff will need proper training to operate the hydro cleaning truck and CCTV equipment.

O&M staff would like perform cleaning, CCTV, and inspection of approximately 1,000 feet of storm drain pipe per week. With approximately 92 miles of storm drainage pipe in the City's system, it would take approximately 9 years to complete a full system inspection. This does not include an additional 33 miles of storm drain laterals and force main which would require another 3 years. Staff estimated that less than 1 percent of the entire stormwater system has been cleaned in the last 3 years. The minimal hydro cleaning that has been completed was done by outside contractors due to a lack of staff time. The hydro-cleaning crew production expectations in the current City O&M manual states an annual mainline cleaning goal of 4,000 to 5,300 feet per day but does not specify if this is for sewers and/or storm drains.

2.1.5 Maintenance Hole Cleaning, Repair, and Replacement

Maintenance hole inspection is typically accomplished during the routine hydro-cleaning operation. According to staff, only a small portion of the stormwater system is being hydro cleaned due to a lack of resources. Therefore, the maintenance holes are not being regularly maintained. The location and maintenance of storm drain maintenance holes and pipe should be tracked using CMMS software utilizing geographic information system (GIS) capabilities for future reference. According to the City's O&M Manual, maintenance holes are inspected for the following conditions:

- Maintenance hole high or low
- Grout missing around joints
- Exposed rebar
- Hydrogen sulfide damage
- Old maintenance hole bricks missing
- Infiltration around barrel joints
- Objects present that might restrict flow
- Check frame and lid for cracks

Table 7. Drainage Pump Station Maintenance Task

Task	Task Frequency	SDS #1	SDS #2	SDS #3	SDS #4	SDS #5	SDS #6	SDS #7	SDS #8
Read and Record Hour Readings	Weekly	X	X	X	X	X	X	X	X
Check station for vandalism	Weekly	X	X		X	X	X		X
Flush line and drainage inlet	Weekly between October- April						X		
Test run pump(s)	Bi-weekly	X	X	X	X	X	X	X	X
Exercise all valves	Bi-weekly				X			X	X
Check bar screen during winter months	Bi-weekly between November-May	X							
Exercise wheel valve	Bi-weekly	X							
Check sump pump operation	Bi-weekly					X			
Clean inside of building	Bi-weekly			X		X			
Exercise hoist	Bi-weekly					X	X		
Check fire extinguishers	Monthly			X					
Test station alarms	Quarterly	X	X	X	X	X		X	X
Inspect and clean wet well	Quarterly			X			X	X	
Record pond level staff gauge and controller reading	Quarterly	X	X		X			X	X
Check control panel light indicators	Quarterly	X	X	X					X
Test area light	Quarterly	X							
Test control panel and pump indicator lights	Quarterly				X				
Check discharge flapper gates	Quarterly					X	X		X
Check anti-siphon valves	Quarterly					X			
Check water in engines	Quarterly			X					
Check fuel tank and order fuel when level reaches 500 gallons	Quarterly			X					
Check battery cables for corrosion	Quarterly			X					
Test power failure alarm	Quarterly			X					
Check engine solenoids	Quarterly			X					
Drain regulators in back of bubbler control panel	Quarterly			X					
Purge bubbler and check rotameter	Quarterly			X					
Check air pressure	Quarterly			X					
Start dehumidifier when exhaust fan no longer keep walls dry	Quarterly			X					
Check engine clutches	Quarterly			X					
Check engine heater	Quarterly			X					
Log completed tasks in log book	Quarterly			X					
Check engine water, add corrosion control chemical	Quarterly			X					
Check fuel lines and engine water lines for leaks	Quarterly			X					
Test emergency shutdown systems on all engines	Quarterly			X					
Check motor oil and add oil	As Needed	X	X	X	X	X			
Check dripper pot and add oil	As Needed	X	X	X	X	X			
Keep area clean. Wash down area	As Needed	X	X		X	X	X		X
Check and clean bar screens	As Needed		X	X		X	X		
Change out pesticide traps	As Needed	X	X		X	X	X	X	X
Inspect inlet and outlet discharge line and clear out lines	As Needed							X	
Clean trash rack	As Needed								X
Clean equipment	As Needed			X					

According to a City work order summary for a three-year timeframe (February 2014 to 2017) only 160 labor hours were dedicated to drainage maintenance holes. Detailed January 2017 work order reports indicate three labor hours for replacing maintenance hole lids that were removed during storm events.

2.1.6 Drainage Inlet Cleaning

The City has 2,870 drainage inlets (DI's) that require annual maintenance to clear trash, remove large obstructions, and conduct visual condition inspections. In 2016, public works staff spent approximately 260 hours inspecting 96 percent of the total drainage inlets, and cleaning 28 percent, which resulted in the removal of 538 pounds of trash and 150 pounds of concrete block and/or rocks. During storm events, DI's can become clogged with debris which can cause stormwater to back-up and create flooding conditions. Therefore, during storm events staff spend considerable resources clearing out debris from DI's to allow for proper drainage to occur. These are not planned tasks and, therefore, are considered corrective versus preventative. Additional staff time and resources should be allocated for potential storm events and their associated corrective maintenance tasks.

2.1.7 Siphon Cleaning

The City has eight siphon locations that require regular maintenance. Each siphon is inspected and cleaned annually.

2.1.8 Channel Maintenance

Open channels are either natural or concrete lined channels that convey stormwater or run-off. These channels must be maintained to prevent localized flooding by draining stormwater. Open channel maintenance consists of mowing slopes and flats and clearing vegetation and debris from channels annually during the summer months. The core area is flushed annually in September. Staff indicated that channel cleaning efforts utilize 50 percent to 70 percent of staff labor resources between April and September. Some channels are not being regularly cleared due to limited staff resources. Staff are required to clear several open channels that are located outside the City limits which also creates a drain on existing staff resources. Staff recommended that several of these channels be concrete lined or piped to eliminate the need for on-going maintenance. Outside contractors are used for spraying channels, maintaining major trees, beaver eradication, and to address environmental concerns.

Staff reported that the El Macero Channel has not been cleared due to several coordination complexities. Staff needs to coordinate with the Fish and Wildlife due to regulatory requirements associated with the garter snake and beavers. Staff needs to coordinate with Kinder Morgan regarding an existing hazardous materials pipeline that crosses the channel. The El Macero Channel also has issues with improper grading and sediment buildup at SDS#5.

Prior to performing channel maintenance staff must ensure that homeless encampments are cleared from the area. Staff gets as-needed support from the police department in clearing these encampments.

Staff is concerned about a potential new city regulation that would ban the use of Round-up, a chemical used in weed abatement. This regulation would make maintaining channels more difficult.

2.1.9 Detention Basin and Pond Maintenance

Detention basins and ponds are designed to hold, infiltrate and/or slowly release stormwater. Quarterly maintenance activities currently include:

- Mowing/weed eating,
- Chemical herbicide treatments,
- Maintenance of slopes/fire breaks,
- Trees and brush trimming,
- Clearing inlets/outfalls,
- Clearing trash/debris,
- Grading access roads,
- Repairing gate/fence, and
- Inspecting/repairing signage.

Staff is currently maintaining most basins and ponds, except the North Area and West Area ponds that are being utilized for wildlife habitat. These ponds cannot be drained to remove accumulated sediment and vegetation.

2.1.10 Access Road and Grounds Maintenance

Access roads are used to bring in equipment to perform maintenance activities in the channels and at various ponds and basins. These roads must also be maintained to ensure access by necessary maintenance vehicles and equipment. Staff indicate that, due to a lack of staffing, access roads along channels are not being consistently maintained. A detailed City work order in January 2017 indicates a significant staff effort (approximately 176 staff hours) was required to repair access road erosion that had occurred on a channel access road. If the access road had failed it may have created a channel blockage.

2.2 Operations

2.2.1 System Capacity

SDS#1 and SDS #2 pump from their associated detention ponds which are used for wildlife habitat in addition to stormwater detention. The drainage pump stations were designed to pump stormwater based on the full capacity of the detention basins. The detention basins must have a specific volume of water at all times to provide wildlife habitat, and therefore has a reduced storage capacity from the original design. In addition, detention basin maintenance (vegetation and sediment removal) cannot be performed because the basins always have water in them, thus further reducing their storage capacity. The existing detention basin storage capacity that is being used for wildlife should be replaced in-kind and the design of SDS#1 and SDS #2 should be reassessed to determine if pumping design parameters have changed due to design criteria changes. If capacity issues are not addressed they may pose flooding risks in the areas adjacent to and directly upstream of the basins.

SDS#3 is the largest drainage station in the City's stormwater system representing two-thirds of the City's entire pumping capacity. According to the condition assessment indicated that even with all four pumps running the station is unable to keep up with 100-year flow requirements. Staff have confirmed this assessment and believe the station requires additional pumping capacity. The condition assessment states "A failure at this station in even a relatively minor event could cause significant flood damage."

SDS#5 is the second largest drainage station, and is also reported to be under capacity. According to the condition assessment, "the station was only capable of discharging the equivalent of a 10-year discharge event. This flow limitation is noted as acceptable because flooding from higher flows would be limited to agricultural lands and would not impact upstream urban areas." The assessment report refers to a 1992 report entitled "South Davis Storm Drainage Hydrologic and Hydraulic Evaluation" which estimated that only 55 percent of the flow at this station originated in urban areas of the City, with the remaining 45 percent of the flow originating in the agricultural areas between the City and the drainage station. Staff indicated that the electrical pumping cost at the SDS#5 ranges between \$8,000 and \$10,000 each month during the dry season due to continuous recirculation of agricultural run-off.

Due to the scale of the cost of maintaining these facilities serving drainage areas located outside of the city limits, it would likely benefit the City to conduct an ownership and maintenance responsibility assessment to identify potential cost sharing opportunities and/or maintenance responsibility relief. The liability assessment should attempt to quantify the agricultural irrigation impacts to downstream facilities, and attempt to develop a regional plan for tailwater reuse and disposal.

2.2.2 SCADA Monitoring

SCADA is currently being monitored by the SCADA Control System Technician through existing drainage pump station Remote Telemetry Units (RTU's) and/or Programmable Logic Controllers (PLC's). The stormwater drainage pump stations with remote monitoring capabilities are currently monitored for flow, alarms, and high water levels. Only SDS#3 and #9 have full monitoring and remote control capability through the existing SCADA system. The other stormwater drainage pump stations (SDS#1, #2, #4, #5, #7, #8) require staff to physically go to the SDS site to make any control adjustments or trouble shoot issues. In addition, bike tunnel pump stations have no SCADA capabilities and must be monitored manually by staff to ensure they remain operational. Staff resources are utilized to make the necessary site visits.

It should ultimately be a goal for the City to add SCADA system control capabilities to the remaining stormwater drainage pump stations and the bike tunnel pump stations to improve the efficient use of staff resources. Remote monitoring and control capabilities allow for improved documentation of operational changes and provide an on-going record of these types of changes to on-call staff. Additionally, since the bike tunnel pump stations only have one pump at each station, there is no redundancy in the case of a pump failure. Pump failure quickly causes flooding and severely increases the risk to public safety – particularly at Pump Station 6, which is the Richards Boulevard underpass, which is also a major transportation and emergency evacuation route for the City. SCADA monitoring at these sites will notify staff of any equipment failures so that emergency response staff can be deployed.

The SCADA Control System Technician provided an estimated cost for adding remote control capability through system integration at approximately \$20,000 per SDS site based on 2015 estimates. This estimate may be low depending on whether installation and programming is included in this cost. SDS#6 will likely have a higher cost because it is not currently equipped with a modern PLC or RTU which is needed for SCADA system integration. Remote communication upgrades to SDS#6 are considered the most critical. Once SCADA integration is completed, existing staff resources can be refocused on other higher priority tasks.

2.3 Regulatory Compliance

Stormwater quality regulatory requirement compliance is overseen by the City's Environmental Resources Division. The Environmental Program Specialists within the division are responsible for compliance with stormwater quality regulatory requirements including compliance with the MS4 permit. Evaluating this program and its staffing is not within the scope of work for this evaluation.

2.4 Condition Assessment

HydroScience conducted a condition assessment of all the City's SDS's in 2015. The Lift Station Assessment and Inventory Report identified several improvements at SDS#3, #5, and #6. The remaining stations were reported as well maintained and in good condition but in need of electrical and control system upgrades. Staff report that none of the recommended improvements for SDS#3, #5, and #6 have been addressed to date. The assessment also indicated the structural integrity of the SDS#6 building may be compromised during a seismic event. The report also indicates "This station is the only stormwater drainage station equipped with diesel powered pumps. Diesel powered pumps do not lend themselves to backup power in the same manner that electrically powered pumps do (with a backup generator replacing the utility power supply in the event of a power failure). This leaves this station, the most important in the City's conveyance system, without a source of backup power. This represents a clear and significant risk to the City." HydroScience recommended replacing SDS#3 as soon as possible at an estimated construction cost of \$7 to \$10 million. When the diesel-powered pumps at SDS#3 are replaced with electric powered pump, a back-up generator should be installed to provide power during an electrical outage.

The assessment indicated SDS#5 electrical and control building has been subject to flooding. According to the HydroScience report, "To mitigate this issue, a metal plate was installed across the building door. This is an impediment to safe operation and should be removed and replaced with another means of flood protection as soon as possible." In addition, the assessment report states, "the open channel to drainage station has sediment issues which require significant effort for removal by the City's staff each year. Isolation gates could likely be engineered to help mitigate this issue and reduce the yearly cleaning efforts. Note that the sediment appears to originate from the agricultural areas between the City limits and the drain station." The assessment report recommended three possible alternatives, one of which was a relocation of the electrical control building and modifying the drainage channel to reduce the sediment buildup. The report estimated a construction cost of \$3 to \$5 million for this alternative.

The City's two largest capacity drainage pump stations, SDS#3 and SDS#5, are over 50 years old. Typically, the useful life of pump station equipment is limited to 20 to 30 years, with

good maintenance. Pump station structures typically have a useful life of 50 years¹. Thus, both of these drainage pump stations are well beyond their useful life.

SDS#6 is the City's oldest storm drainage station and has been in service for over 100 years. This station is also the smallest in capacity. The condition assessment recommended full replacement with an estimated construction cost of \$0.8 to \$3 million.

Staff indicate that there has been no condition assessment on the majority of the City's stormwater drainage piping. In 2015-16, City Engineering staff used an outside contractor to CCTV the sanitary sewer and storm sewers in the downtown core area of the City to identify repairs needed before paving projects commence.

Table 2 of the HydroScience report provides a breakdown of the City's drainage piping by year of installation. Approximately 67 percent of the City's drainage piping is over 38 years old and 18 percent is over 58 years old. Staff report that there have been no piping failures. Continued pipeline condition assessment is critical to understanding the scope and budget for pipeline replacements and/or repairs into the future. Without proper planning, failures will likely occur which can cause other consequences and increased costs due to emergency repairs.

2.5 Training

Staff reported that training is provided for all activities for each new staff when they are hired. The Collections System Technician provides training to new staff and staff from other divisions that are being cross-trained. In addition, tailgate training sessions are conducted prior to performing tasks to discuss safety issues. Training for necessary certifications are performed by outside vendors. Staff meetings are held weekly and during these meetings O&M manual procedures are reviewed as a training refresher.

2.6 Record Keeping

2.6.1 Standard Operating Procedures and Operation and Maintenance Manual

Staff provided their current O&M Manuals for review. The manuals document the fundamentals for most activities. Each binder included several standard operating procedures for various maintenance tasks.

Standard Operating procedures in the current O&M Manual include the following:

- Storm Drainage Station
 - Procedures for inspections, records documentation, and general maintenance items (2010)
 - Location on maps from the drainage atlas maps
 - Pump and motor nameplate data
 - Pump manufacturers data, maintenance, and troubleshooting recommendations (SDS#4)

¹ https://www3.epa.gov/npdes/pubs/in-plant_pump_station.pdf

- Pump operation level data (high and low water alarms, pump on, pump off)
- Pump operating modes (SDS#5)
- Pump assembly dimensions (plan and profile)
- Level and pressure sensor technical data
- Wet well inspection and cleaning procedure (SDS#3)
- Power outage emergency procedure (SDS#3, 2003)
- Air compressor manufacturers data, maintenance, and troubleshooting recommendations (SDS#3)
- Spill prevention control and countermeasure plan (SDS#3, 2005)
- PanelView User's Manual for PLC (SDS#3, 2003)
- Control strategy (SDS#3)
- Access easement information (SDS#6)
- Piping diagram (SDS#6)
- Float switch manufacturers data (SDS#6)
- PG&E information (2010)
- Pump controller manufacturers data and troubleshooting recommendations (SDS#8, 2001)
- Status sheet for documentation purposes
- Emergency operations procedures for extended power failure (2010)
- Training Record Form
- Standard specifications and drawings, January 1996 Edition
 - Sewer Systems
 - Storm Drainage Systems
 - Collections Crew Expectations (2004)
 - Sanitary Sewer Collections Lines (2004)
 - Public Information Handout – Sewer Lateral Maintenance Policy (2007)
- Collections Vehicle Inspection Guide
- Traffic Control Training (2002)
- Gas Detector User Manual (2001)
- North Davis Meadows Low Pressure Sewer System – Procedure for Emergency Repairs and/or Replacement Projects (2002)
- Equipment Maintenance Schedule Form
- Standard Guidelines for the Installation, Handling and Removal of Pneumatic Pipe Plugs (2002)
- General Information - Isolation of 42" and 48" Trunk Lines (2002)
- Equipment Needed for Isolation of 42" and 48" Trunk Lines (2002)
- Guidelines for New Connections on Existing Lines (2004)

- Wastewater Safety (2002)
- Criteria for Maintenance Worker II Wastewater Collection Division (2002)
- Wastewater Collections Department – Fundamental Guide (2002)
- Wastewater Collections Systems – Division of Responsibilities (2002)
- Wastewater Spill Report Form (2002)
- Hydraulic Cleaning Crew Meeting Agenda (2002)
- Utilities Crew Meeting Agenda (2002)
- Collections Crew Meeting Agenda (2002)
- Collections Crew Operations and Maintenance Manual (2004)
 - Sanitary and Storm Sewer System Responsibilities (2002)
 - Sanitary Sewer Responsibility Check – Trouble Shooting Procedures (2002)
 - USA Marking Guidelines (2002)
 - USA Location Request Format Form (2002)
 - USA North Suggested Marking Guidelines & the California One Call Law (2000)
 - Procedures for Utility Connections
 - Collections Connection Permit Form (2005)
 - Rules and Procedures for Entering Maintenance Holes and Confined Spaces (2002)
 - Confined Space Entry Procedures for Sewer Lift Stations 1, 3 and 4 (2002)
 - Sanitary Sewer Overflow Response Procedures (2007)
- Hydraulic Cleaning Crew Operations and Maintenance Manual (2003)
 - Hydro-Cleaning Crew Expectations (2004)
 - Sanitary\Storm Sewer Preventative Maintenance Responsibilities (2002)
 - General Instructions for: (2002)
 - Utility Maps
 - Catch Basin/Siphon Cleaning
 - Maintenance Hole Inspection
 - General Safety
 - Mainline Hydro-Cleaning Procedures
 - Preventative Maintenance Recording and Updating System (2002)
 - Drainage System Maintenance – Three Month Downtown Program Form (2009)
 - Storm Sewer Mapping Instructions (2002)
 - Operation/Maintenance Procedures for High Velocity Cleaners
 - Procedure for Replacing High Pressure Hose on High Velocity Cleaners (2006)
 - Operation and Maintenance of Hydro-Cleaning Truck (1988)
 - Operation and Maintenance of Combination Cleaning Truck
 - Hydro-Cleaning Log Sheet (2002)

- Sewer Main Maintenance Daily Report (2002)
- D.I. Cleaning Program Form (2007)
- Maintenance Hole Inspection Report (2002)
- Standard Manhole Details (1989)
- Backyard Easement Hydraulic Cleaning Procedure Survey/Safety (2002)
- North Davis Meadows Low Pressure Sewer System Maintenance Procedures (2002)
- North Davis Meadows Low Pressure Sewer System Preventative Maintenance Hydraulic Flushing Procedure (2002)
- Utility Crew Operations and Maintenance Manual (2004)
 - Utility Crew Expectations (2004)
 - Service Line Chemical Treatment Procedure (2002)
 - Integrated Pest Management Weed Abatement (2002)
 - Procedure for Herbicide Application (2002)
 - Record Keeping Procedures (2002)
 - Safety Precautions (2002)
 - Econ Portable Emergency Eye Wash Station (2002)
 - Integrated Pest Management – Weed Abatement Forms (2002)
 - Herbicide manufacturers data and MSDS information
 - Hazardous Materials Emergencies Contacts (2002)
 - T.V. Inspection
 - T.V. Inspection System Equipment Checklist (2002)
 - T.V. Inspection Daily Report Form (2002)
 - T.V. Inspection Report (2002)
 - User’s Manual for CCTV System (1994)
 - User’s Manual for Footage Display (1994)
 - Procedures for Locating Sanitary Sewer Service Clean-Outs
 - Confined Space (2002)
 - Confined Space Regulations (1994)
 - Lockout/Tagout Procedure (2001)
 - Chemical Distribution Record Form (2002)
 - Mainline/Lateral Stoppage Record Form (2002)

2.6.2 Computerized Maintenance Management System

The City of Davis is utilizing the CMMS software program Lucity™ to track basic system maintenance activities. Staff mentioned that there is an effort currently underway to get more training on Lucity™ for staff to fully utilize the software capabilities.

There remains an opportunity to gain efficiency and workflow benefits by integrating Lucity™ with the City’s storm system GIS and CCTV inspections, linking record drawings and O&M manuals, and to track work order information that provides more sophisticated workflow analytics to inform future business decisions. Access to historical work order data through CMMS allows

the user to assess work order completion goals, identify trends, better understand maintenance costs, and improve inventory control. The CMMS program can also be set to automatically generate preventative maintenance work orders and help optimize maintenance activities to potentially reduce repairs, expensive emergency costs, and equipment downtime.

2.6.3 Work Order Generation and Documentation

West Yost reviewed the 2017 work order detail reports as part of this evaluation. Work orders are currently being generated to address corrective tasks such as repairs identified through inspections, responses to complaints, and weather events. Each work order identifies labor resources, and material and equipment used to respond to and address the work order tasks. Work order detail reports indicate the following items:

- Category (used to track work completed for different types of infrastructure),
- Problem,
- Problem cause (if known),
- Main task needed to address the problem,
- Work request comments,
- Staff who created and assigned the work order,
- Address or location, and
- Start and completion dates and times.

Work orders are completed based on their priority. The highest priority work orders are based on addressing safety concerns.

Table 6 (in Section 2 above) summarizes the number of work orders recorded for each labor activity. It does not appear that preventative maintenance task work orders are being generated and tracked. The City's O&M manual includes the following tasks as Storm Sewer Preventative Maintenance Responsibilities:

- Annual Catch Basin/Siphon Cleaning Program,
- Annual Cleaning of Drainage Pump Station Sumps,
- Quarterly cleaning of Siphon (Core Area) Storm Sewer,
- Routine maintenance hole inspection,
- Routine records updating, and
- Emergency stoppages/wash-downs.

Implementation and tracking of a strong preventative maintenance program will maximize the useful life of all system facilities and minimize emergency conditions by performing system maintenance in a regularly scheduled and timely manner. A key component of a preventative maintenance and an asset management program is the implementation and regular use of a CMMS and asset management program. Most CMMS programs are GIS-based and provide asset

management tools used to perform inspection, monitoring, and condition assessment. These programs track maintenance work and create a database that includes maintenance information on system facilities such as: drainage inlets, storm drains, pump stations, and detention ponds. Implementation of a CMMS program requires the development of an inventory of all system assets. The program uses the inventory of assets and historical maintenance and repair data to generate preventative work orders for field staff to perform.

Full implementation of the program will allow the City to:

- Inventory/track all assets by ID number and physical address;
- Track labor, material, and associated maintenance costs;
- Incorporate Manufacturers maintenance recommendations for mechanical and electrical equipment;
- Record and document the maintenance history for each piece of equipment;
- Plan and schedule work by individual assets or group assets;
- Generate work orders for scheduled preventative maintenance;
- Forecast repairs and replacement part needs; and
- Project budgetary information.

Until the existing CMMS program can be fully utilized, the Collections System Supervisor should prepare a schedule of preventative maintenance tasks with instructions to complete them. Instructions may include specifications for fuels, lubricants, filters, and other items related to specific equipment. The manufacturer's maintenance recommendations for equipment specific O&M manuals should be incorporated into the schedule of preventative maintenance tasks. The Collections System Supervisor will be responsible to ensure that the program tasks are being completed and that timely updates to the schedule are incorporated.

2.7 Key Performance Indicators

Storm Division key performance indicators (KPIs) appear to be tracked as individual specific goals set for each year, which can vary from year to year. The City's Public Works Department's 2015/16 Annual Budget listed the following operation and maintenance-related Stormwater performance measures:

- Complete a video inspection of the City's stormwater mains;
- Complete hydro-jetting of the entire stormwater piping system;
- Three miles of stormwater main lines were inspected and hydro cleaned;
- Performed inspection, cleaning, and repairs of 2,700 storm drain inlets;
- Maintained 15 miles of stormwater channel;
- Maintained and cleaned 5 drainage ponds;

- Cleaned and inspected 6 stormwater detention ponds and 15 miles of drainage channels; and
- Maintained seven roads (1 mile) of maintenance access roads.

The operation and maintenance measures listed above are general and sometimes overlapping, and not specific enough to help staff track progress and show marked changes or improvements from year to year. Additionally, the goals of completing hydro-jetting and video inspection of all stormwater mains appears to be a long-term goal to be accomplished over several years; while in reality, three miles of stormwater mains were hydro cleaned and inspected in fiscal year 2015/16. Note that at the rate of three miles of pipe cleaned and inspected per year, it would take 30 years to clean the entire 92 miles of stormwater mains. The City will need to reassess these measures based on their current staffing resources, and employ additional staff and/or use outside contractors to increase annual cleaning and CCTV production rates in order to accomplish the current measures.

3.0 STAFFING ASSESSMENT

The City has requested a staffing analysis on the estimated work needs and the appropriate levels of staffing. A current organization chart is provided as Appendix B. Our assessment and recommendations are described in the sections below.

3.1 Current O&M Staffing Summary

Current stormwater O&M staff is made up of three permanent occupied positions and two potential/open positions. The occupied positions include a Collections System Supervisor, Collections System Technician, and a Public Works Maintenance Worker II.

Several of the current stormwater O&M staff provide assistance to other public works departments for tasks such as traffic control and sewer system O&M tasks. Other public works department staff assist the stormwater O&M staff during storm events and to complete annual maintenance tasks. According to interviews with current staff, the sharing of staff resources between the public works departments is mutually beneficial, yet not always equal in overall staff time resources. Drainage pump station electrical and instrumentation work is completed by wastewater treatment plant O&M staff. The stormwater staff share administrative support with other divisions in the public works department. When administrative support is not available, O&M staff must complete administrative tasks which can take them away from O&M field tasks.

In addition, and on an annual basis, the City hires temporary laborers to support permanent staff. The current permanent and temporary staff responsibilities are described in detail for each position below, which are based on current job descriptions provided by the City.

3.1.1 Collections System Supervisor

The Collections System Supervisor position has many responsibilities with the main responsibility being planning, coordinating, supervising and overseeing the work completed by the permanent and temporary staff. Additional responsibilities include the following duties:

- Provide technical staff assistance;
- Train, assign, and evaluate personnel;
- Review personnel work;
- Materials selection;
- Estimating materials and labor costs for jobs;
- Ensure needed supplies, materials, and equipment are on-hand;
- Record daily labor, material, and equipment costs;
- Maintain work related records;
- Ensure compliance of maintenance tasks with appropriate laws, rules, and regulations;
- Respond to inquiries and complaints regarding field maintenance operations;
- Inspect new installations and repair work;

- Participate in the development of new systems and equipment;
- Assist in developing, administering, and monitoring project budgets;
- Identification of maintenance repair needs and recommend corrective actions;
- Review plans and specifications;
- Participate in stand-by program;
- Coordinate emergency and special assignments with other City departments and divisions, and with outside agencies and companies; and
- Build and maintain positive working relationships with co-workers, other city employees, and the public using principals of good customer service.

3.1.2 Collections System Technician

Under the direction of the Collections System Supervisor, the Collections System Technician is a lead worker that provides a wide variety of skilled and semi-skilled maintenance, construction, and repair work. Additional responsibilities include the following duties:

- Lead field crew, train and assist supervisor in evaluating personnel;
- Operate and train personnel in the safe and proper operation of a wide variety of maintenance and construction equipment;
- Receive assignments and assist in the planning and layout of the work crew and scheduling and assigning specific duties to crew personnel;
- Review the work of assigned personnel;
- Participate in work of crews engaged in maintenance, construction, and repair work;
- Assist supervisor in selecting materials and estimating material and labor costs for jobs assigned;
- Ensure needed supplies, materials, and equipment are on hand;
- Record daily labor, material, and equipment costs;
- Maintain work related records;
- Perform more difficult work in the general O&M of the City sewer system and storm drains;
- Operate and check the operation of sanitary/storm sewer facilities, pumps, motors, valves, filters, programmable controllers, auxiliary engines and related equipment;
- Perform utility connection inspections, underground service alert markings, sanitary and storm drain responsibility checks;
- Respond to sanitary and storm sewer overflows and flooding problems;
- Setup sampling and flow monitoring equipment and collect samples;
- Install and repair underground pipes and remove blockages from sewer and storm drain lines;

- Perform sewer maintenance duties;
- Operate maintenance equipment and tools;
- Utilize proper safety precautions related to all work performed;
- Read and interpret maps of underground sewer and drainage systems;
- Participate in maintenance hole repairs, sewer line rodding, installation, and repairs on collection pipelines;
- Participate in standby program as required; and
- Build and maintain positive working relationships with co-workers, other city employees, and the public using principals of good customer service.

3.1.3 Public Works Maintenance Worker II

Under the direction of the Collections System Supervisor and Technician, the Public Works Maintenance Worker II provides a variety of semi-skilled and skilled tasks in the construction, maintenance, and repair of streets, signs, sewers, storm drains, and related public works facilities. Additional responsibilities include the following duties:

- Operate light and moderately heavy power driven equipment;
- Install and repair underground pipes and remove blockages from sewer and storm drain lines;
- Exercise valves and replace mainline valves;
- Test and install pipes; assist in maintaining and testing valves;
- Set up traffic safety devices and barricades;
- Perform sewer maintenance duties;
- Operate construction and maintenance equipment and tools;
- Perform street maintenance duties;
- Utilize proper safety precautions related to all work performed;
- Read and interpret maps of underground sewer and drainage systems;
- Maintain storm drains and ditches including removal of brush, trees, and weeds;
- Assist in maintaining drainage pump stations and sewer lift stations;
- Perform emergency street, sewer, storm drain or other Public Works maintenance work as required;
- Participate in standby program as required; and
- Build and maintain positive working relationships with co-workers, other city employees, and the public using principals of good customer service.

3.1.4 Collections System Worker (Potential Position)

Under the direction of the Collections System Supervisor, the Collections System Worker provides a variety of semi-skilled and skilled tasks in the construction, maintenance and repair of streets, signs, sewers, storm drains, and related public works facilities. Additional responsibilities include the following duties:

- Operate light and moderately heavy power driven equipment;
- Install and repair underground pipes and remove blockages from sewer and storm drain lines;
- Set up traffic safety devices and barricades;
- Perform sewer maintenance duties;
- Perform routine preventative maintenance on equipment;
- Perform street maintenance duties;
- Operate construction and maintenance equipment and tools;
- Utilize proper safety precautions related to all work performed;
- Read and interpret maps of underground sewer and drainage systems;
- Maintain storm drains and ditches including removal of brush, trees, and weeds;
- Assist in maintaining drainage pump stations and sewer lift stations;
- Maintain inventory of supplies;
- Perform emergency street, sewer, storm drain or other public works maintenance work as required;
- Assist in maintaining drainage pump stations and sewer lift stations;
- Operate and check the operation of sanitary/storm sewer facilities, pumps, motors, valves, filters, programmable controllers, auxiliary engines and related equipment;
- Perform utility connection inspections, underground service alert markings, sanitary and storm drain responsibility checks;
- Respond to sanitary and storm sewer overflows and flooding problems;
- Setup sampling and flow monitoring equipment and collect samples;
- Perform street maintenance duties;
- Participate in standby program as required; and
- Build and maintain positive working relationships with co-workers, other city employees, and the public using principals of good customer service.

3.1.5 Public Works Maintenance Worker I (Potential Position)

Under the direction of the Public Works Crew Supervisor, the Public Works Maintenance Worker provides a variety of semi-skilled and skilled tasks in the construction, maintenance and repair of streets, signs, sewers, storm drains, and related public works facilities. Additional responsibilities include the following duties:

- Operate light and moderately heavy power driven equipment;
- Install and repair underground pipes and remove blockages from sewer and storm drain lines;
- Exercise valves and replace mainline valves;
- Test and install pipes; assist in maintaining and testing valves;
- Set up traffic safety devices and barricades;
- Perform sewer maintenance duties;
- Perform routine preventative maintenance on equipment;
- Maintain wells;
- Maintain and repair fire hydrants;
- Operate construction and maintenance equipment and tools;
- Perform street maintenance duties;
- Utilize proper safety precautions related to all work performed;
- Read and interpret maps of underground sewer and drainage systems;
- Maintain storm drains and ditches including removal of brush, trees, and weeds;
- Assist in maintaining drainage pump stations and sewer lift stations;
- Paint traffic markings on streets, crosswalks, parking lots, and curbs;
- Manufacture and install traffic signs and remove old signs;
- Design and manufacture special signs for municipal facilities;
- Maintain inventory of traffic related supplies;
- Spread asphalt in patching and repairing streets;
- Respond to hazardous material incidents;
- Perform emergency street, sewer, storm drain or other public works maintenance work as required;
- Participate in standby program as required; and
- Build and maintain positive working relationships with co-workers, other city employees, and the public using principals of good customer service.

3.1.6 Temporary Staff

The temporary staff are responsible assisting the permanent staff in addressing work orders and completing preventative maintenance duties including controlling vegetation.

Temporary staff are hired through CalOpps, a public employment job board owned and operated by public agencies. Temporary employees are allowed to work a maximum of 1,000 hours in a fiscal year before CalPERS benefits must be provided. This time restriction limits the responsibilities these workers can take on due to the fact that they will not be long-term employees. In addition, each new temporary employee requires training, which is time taken from permanent staff duties. The current temporary staff lack certification which limits the types of work tasks they can perform. For example, temporary staff cannot operate large equipment, enter confined spaces, or conduct traffic control due to specialized training, certification, and insurance requirements.

3.1.7 After-Hours

The City has on-call staffing requirements for staff reporting to emergency calls during non-working hours. Currently the sewer, transportation, stormwater, and potable water staff share these responsibilities. The on-call requirement shift extends over one week. During this week, the on-call staff member must be available to respond to emergency calls and/or system alarms within an hour of the call. Once the staff member assesses the emergency condition they will call additional staff needed to address the condition. A public works on-call staffing schedule is prepared each month with current contact information for each division.

3.2 Labor Hour Analysis

The City provided timesheet data for the Public Works Department for 2011 through 2016, which indicated the number of hours worked by each employee in each division of public works. Figure 1 shows the seasonal pattern of the number of hours worked on Storm Division work over the six-year period. As shown on Figure 1, the 2015 and 2016 timesheet data had inconsistent information, which was found to be due to the use of a new City payroll software that was not tracking data consistently with past years. Therefore, 2015 and 2016 timesheet data is not included in this analysis, but provided only for reference.

Figure 1 also shows the average of years 2011 through 2014, which were relatively consistent with each other. It was expected that the Storm Division would require more labor hours in the wet weather months (October through April) than in the dry weather months. But rather than a weather season trend, Figure 1 shows a trend of less stormwater division staff hours in the wet months due to increased staff hours by both Transportation Division and temporary stormwater staff in the dry months to prepare for the wet months. The dry season maintenance work also depletes the budget for temporary staff, therefore, during the winter months stormwater staff have less overall manpower available. Note that Figure 1 only summarizes Storm Division staff hours, and that outside division staff hours that may have been dedicated to stormwater work are not shown (see Figure 2 for a summary of the total hours worked by all departments).

The timesheet data was also analyzed on an annual basis to find the interdepartmental patterns of work performed by non-Storm Division staff on stormwater work and the amount of work performed by Storm Division staff outside of stormwater work. Figure 2 shows that from 2011 to 2014 (2015 and 2016 data was inconsistent and is provided only for reference), the total number of hours required by the Storm Division was approximately four FTE's, or 6,020 hours per year. Figure 2 also shows that interdepartmental assistance from the Water, Wastewater, and Transportation divisions doubles the time spent on stormwater work by Storm Division staff, and significantly outweighs the time spent by Storm Division staff on non-stormwater work - indicating a clear staffing shortage in the Storm Division.

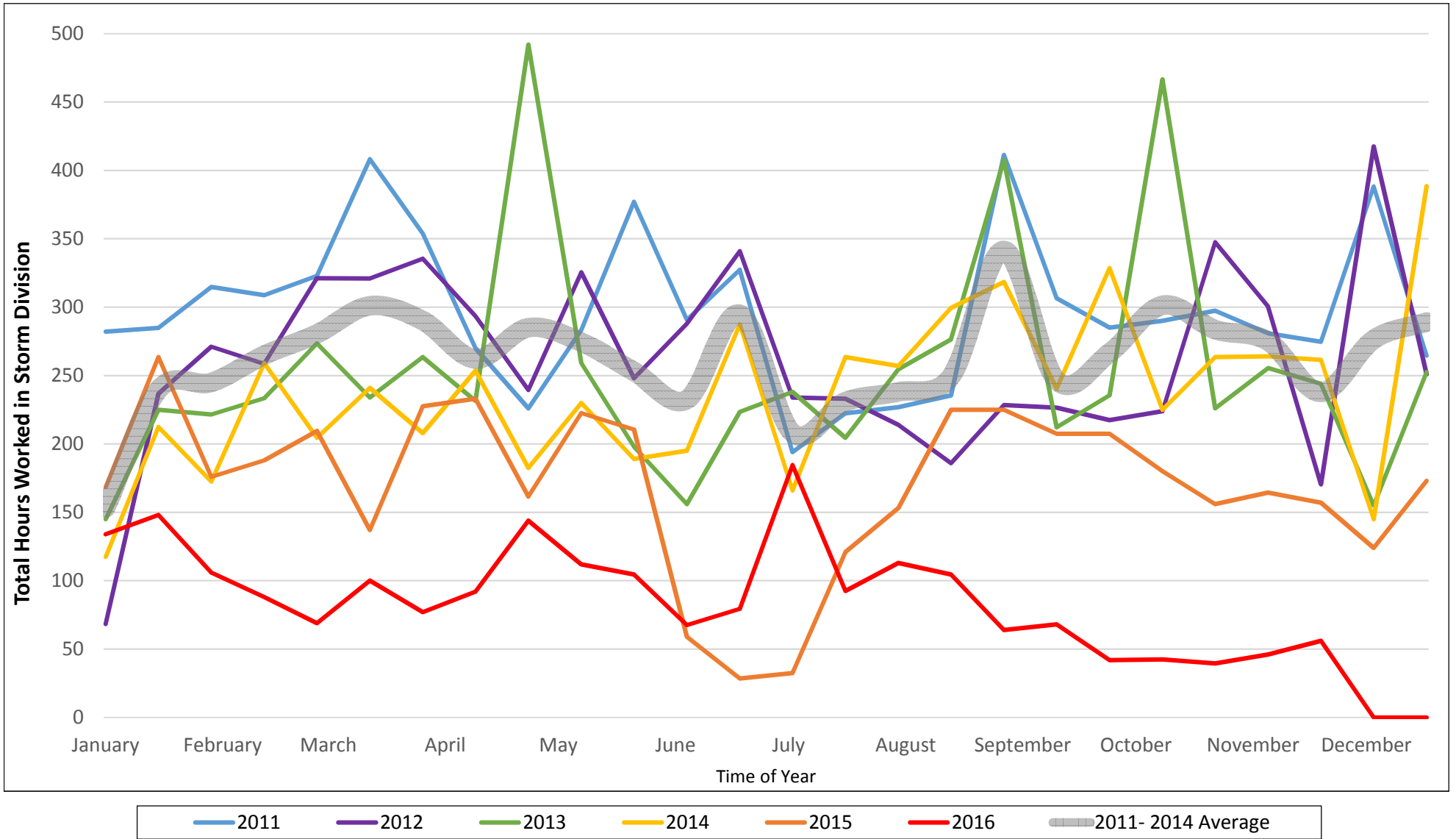
Figure 2 also shows annual rainfall totals, which do not appear to influence the number of hours worked on stormwater work in a given year.

3.3 Staffing Evaluation

In some instances, the task responsibilities described in the current job descriptions are repetitive and lack a clear delineation of task responsibility. For example, if two staff members have the same tasks in their job description, then it is unclear which staff member is ultimately responsible for task performance. A better approach would be to have a lead staff person whom is responsible and a back-up person identified in the absence of the lead staff person. The Collections System Technician has many duplicate task responsibilities to the direct supervisor, the Conveyance System Supervisor. Consequently, it can be difficult to determine who is truly accountable for these duties and to determine if the proposed workload is appropriate for the position. West Yost recommends indicating which tasks are performed as a back-up to the lead staff member assigned to the task. Based on staff interviews, it appears that the Collections System Technician regularly performs the tasks that also fall under the Conveyance System Supervisor job description. The Conveyance System Supervisor job description also lacks a focus on identifying, advancing and implementing larger repair and preventative maintenance projects.

According to the current job descriptions, each of the currently occupied positions have California Water Environment Association (CWEA) certification requirements. West Yost confirmed the current CWEA certifications with a publicly available certification database. Current staff meet the minimum certification requirements except for the Conveyance System Supervisor, which is required to have a Grade III Conveyance System Maintenance Certificate and currently holds a Grade II Conveyance System Maintenance Certificate.

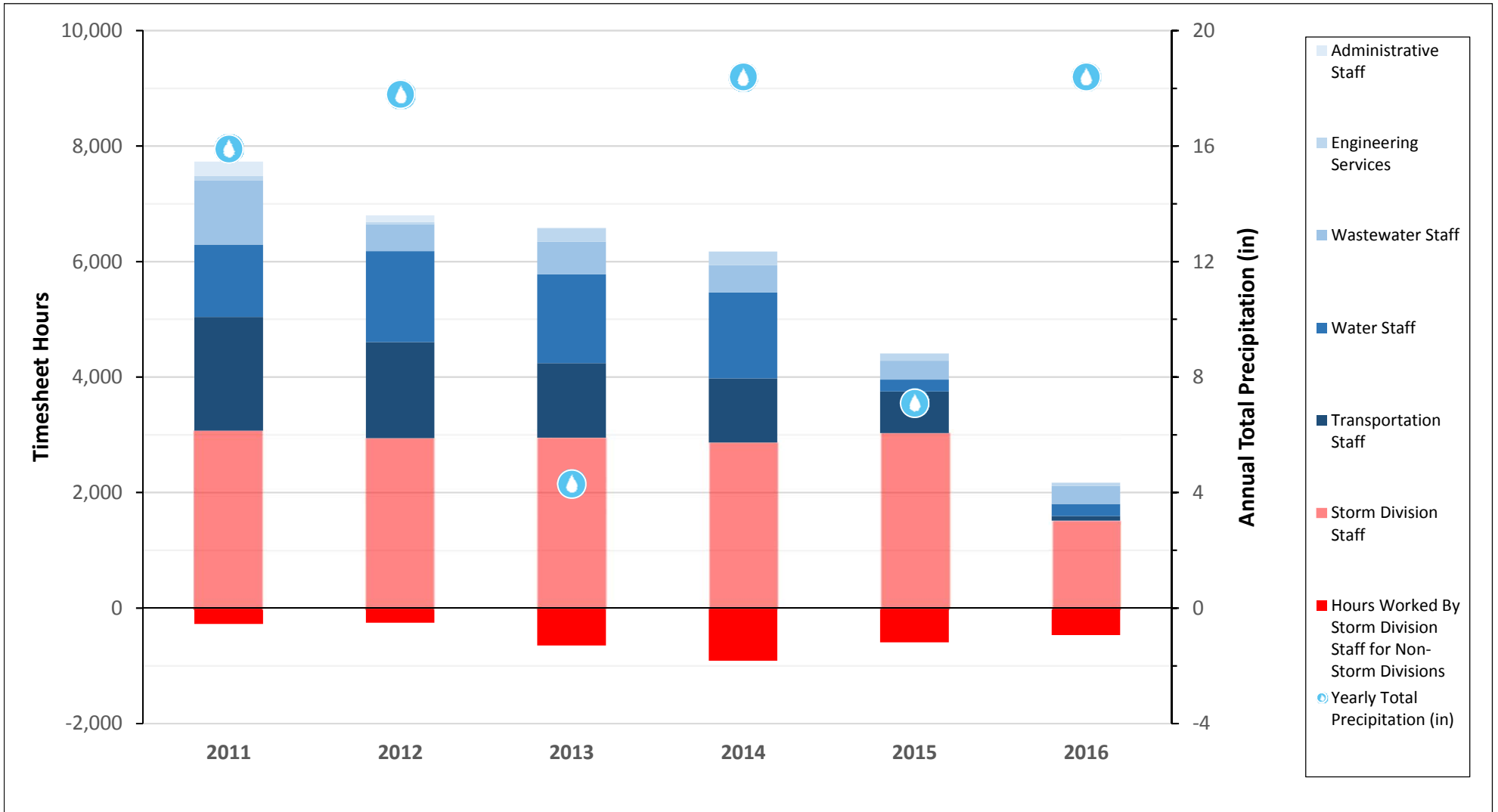
Discussions with City O&M staff and review of O&M information indicate that there is a shortage of staffing needed to complete day-to-day operations and complete preventative maintenance tasks. There is also turnover of temporary staff that requires training of new staff. The City currently only has staffing to perform the day-to-day operations, corrective maintenance needs, and some preventative maintenance tasks. City staff noted that not all preventative maintenance tasks are being performed due to shortage of staff.



Note:
The 2015 and 2016 timesheet data has incomplete/inconsistent information due to the use of new City payroll software.



Figure 1
Seasonal Pattern of Storm Division Work
City of Davis
Stormwater Evaluation



Note:
The 2015 and 2016 timesheet data has incomplete/inconsistent information due to the use of new City payroll software.



Figure 2
Annual Hours Worked in Storm Division
City of Davis Stormwater Evaluation

4.0 BENCHMARKING DATA SUMMARY

West Yost contacted other stormwater agencies to discuss how they implement their stormwater programs. The sections below describe the programs of six agencies of a similar service population to the City, plus two large, proactive stormwater agencies. The results of the benchmark data gathering are included in detailed call logs in Appendix C, and are summarized in Table 8. The six organizations are of comparable size and are valuable for their small staff management strategies. The larger agencies lend experience with best management practices for stormwater facility maintenance frequencies and ideal supervisor to worker organizational arrangements. The experiences of each agency are unique, given that each have different hydrologic conditions, land use characteristics, geographic constraints, and infrastructure conditions. However, each had implemented different practices that could be applied to the City's system for improvement of the current staffing. Some management strategies include:

- Use of contractors for specific maintenance tasks, such as pipe flushing;
- Staffing more full time workers and fewer seasonal and management staff (suggested ratio of 5 maintenance staff per 1 field supervisor);
- Regular review and reprioritization of maintenance activities;
- Sharing of staff from other Divisions/Departments during wet-weather events; and
- Regular inspection and maintenance of stormwater facilities to reduce unplanned maintenance demands.

4.1 City of Hanford

West Yost spoke with Mike Consenza, Utilities Superintendent for the City of Hanford. The Utilities Department Stormwater Division maintains the City's stormwater facilities including 57 miles of pipe, 1 mile of channels, and 30 pump stations.

The Stormwater Division was created last year and was split from a joint division with sewer staff. Previously there were 7 maintenance workers and 1 foreman in this joint stormwater/sewer division. The Stormwater Division currently has 1 foreman and 3 maintenance workers, although they hope to add an additional 4 or 5 maintenance workers to the team. The Stormwater Division can request sewer/water division maintenance staff support as needed. Staff from other Divisions was frequently used in the past wet-weather season (3 to 4 times per month).

Maintenance activities are primarily focused on the 250 acres of ponding basins: spraying weeds, mowing, disking, scarify basins for percolation, removing trees, repairing the 21 miles of fence line, removing graffiti, and weekly inspection of the basins. Pump stations are visually inspected weekly, during which the pump is operated. The Stormwater Division does not have a proactive flushing program for the pipelines - the City has the equipment to flush the pipelines but do not have the staff to complete the work. Overall, the City estimates that 80 percent of staff time is spent on scheduled maintenance and 20 percent on reactive maintenance, such as repairing fences or clearing drains.

Table 8. Summary of Benchmarking Results

Agency	System Description and Annual Budget	Staffing	Key Performance Indicators (KPIs) and Goals for O&M Activities	O&M Frequencies	References for Preventative versus Reactive Maintenance
City of Davis	<ul style="list-style-type: none"> Stormwater pipe – 93 miles Channels – 16.7 miles Drainage area – 10 square miles Pump stations – 9 Service population 65,000 Annual O&M budget: \$1.6M 	<ul style="list-style-type: none"> 1 Supervisor 1 Lead worker 1 Worker 2 Seasonal Workers 	<ul style="list-style-type: none"> Performed inspection, cleaning, and repairs of 2,700 storm drain inlets; Maintained 15 miles of stormwater channel; Maintained and cleaned 5 drainage ponds; Cleaned and inspected 6 stormwater detention ponds and 15 miles of drainage channels; and Maintained 7 roads (1 mile) of maintenance access roads. 	<ul style="list-style-type: none"> Inspect drainage inlets twice per year Clean siphons annually Channel and basin clearing annually Hydro-flush/CCTV storm drains as needed Pump stations checked weekly, maintained quarterly 	<ul style="list-style-type: none"> Proactive pump station maintenance 96% of drainage inlets inspected (28% cleaned) in 2016. 8 siphons cleaned annually Less than 1% of the storm drain system cleaned in the last 3 years Some channels and access roads are not being regularly maintained due to limited staff resources.
City of Hanford	<ul style="list-style-type: none"> Stormwater pipe – 57 miles Channels – 1 mile (one channel) Pump stations – 30 Drainage area – 17 square miles Service population – 59,338 Annual O&M budget: \$790,000 	<ul style="list-style-type: none"> Stormwater Division was created last year 1 foreman and 3 maintenance workers Would like to double number of staff members this year. 	<ul style="list-style-type: none"> Maintenance activities are primarily focused on the 250 acres of ponding basins: spraying weeds, mowing, disking, whipping basins for percolation, removing trees, repairing the 21 miles of fence line, removing graffiti Weekly inspection of the basins Pump stations are visually inspected weekly Currently no proactive flushing program for the pipelines - City has the equipment but do not have enough staff to complete the work. 	<ul style="list-style-type: none"> Don't have planned flushing of system – will start to do this because of requirements of new permits Pump stations – visual inspection at least once a week (inspect telemetry, control panels, oil) Start and stop every pump station once a week 	<ul style="list-style-type: none"> 80% scheduled maintenance 20% reactive to issues (fence repair, clogged drain) May shift depending on amount of rain
City of Madera	<ul style="list-style-type: none"> Pump stations - (unknown) Drainage area – 26 square miles Service population – 64,000 Annual O&M budget - \$720,000 	<ul style="list-style-type: none"> Streets Division manages the City's stormwater facilities including pipelines, basins, and pump stations. No dedicated stormwater staff, stormwater is a sub-function of the Streets Division. Streets Division is 27 people, 5-6 are typically utilized during a storm event Usually use 5-6 people to perform maintenance on basins, but up to 10 if they are doing multiple basins in a day 	<ul style="list-style-type: none"> Maintenance activities include annual basin maintenance (clearing vegetation and reprofiling) and seasonal inlet/culvert maintenance (clearing leaves and vacuuming debris). Pipelines not flushed regularly – vacuum out drain inlets and cross culverts seasonally, but not every inlet or culvert is done 	<ul style="list-style-type: none"> No set schedule for maintenance of pump stations – City is working on asset management for sewer and water, stormwater is next Two lift stations are used regularly; the others are hardly ever used and not regularly inspected or maintained 	<ul style="list-style-type: none"> Estimated 95% preventative work Estimated 5% reactive to an issue
City of Manteca	<ul style="list-style-type: none"> Stormwater Pipe – 170 miles Pump stations - 36 Service Population – 75,000-80,000 Annual O&M budget: \$487,000 	<ul style="list-style-type: none"> Stormwater maintenance staff includes 10 maintenance staff led by the Collections Supervisor and WWTP Superintendent. 	<ul style="list-style-type: none"> Maintenance staff are conducting a visual inspection of all outfalls and pump stations to identify and fix maintenance issues and determine where illicit discharges may occur. 	<ul style="list-style-type: none"> Pipelines are not on a regular flushing or maintenance program Drainage channel maintenance is completed by the South San Joaquin Irrigation District. 	<ul style="list-style-type: none"> Reactive maintenance program, but becoming more proactive because of inspections performed as part of the MS4 permit
City of Napa	<ul style="list-style-type: none"> Stormwater pipe – 152 miles Channels – 4-6 miles Pump stations – 1 Drainage area – 14,500 acres Service population – 78,000 Annual O&M budget: \$1.4M 	<ul style="list-style-type: none"> 2 to 4 O&M staff members 2 engineers for design and construction of storm drain/sewer/water projects 12 maintenance workers that do stormwater work 	<ul style="list-style-type: none"> 4-6 miles of channels maintained annually 	<ul style="list-style-type: none"> Planned maintenance includes annual inspection and clearing of 114 drainage inlets and biennial channel maintenance 	<p>Not provided</p>
City of Rocklin	<ul style="list-style-type: none"> 467 Outlet structures Service population – 60,000 Annual O&M budget: (unknown) 	<ul style="list-style-type: none"> No designated stormwater crew Streets Division – 5 full time, 5 to 6 part-time seasonal staff City is currently working on an annual budget that would increase funds for stormwater maintenance. 	<ul style="list-style-type: none"> Flush pipes as needed (by private contractor) Annual creek/channel maintenance including clearing outlets, trash removal, tree removal, and spraying for weeds. Annual open space vegetation removal using goats. 	<ul style="list-style-type: none"> Annual maintenance of creeks coordinated by Fish and Wildlife. No maintenance on detention basins. 	<ul style="list-style-type: none"> Most of the maintenance activities are reactive, due to budgetary constraints. The City's stormwater infrastructure is nearing the end of its useful life. Pipes are lined on an emergency basis to extend their useful life. Much of the system's corrugated metal pipe is failing.

Table 8. Summary of Benchmarking Results

Agency	System Description and Annual Budget	Staffing	Key Performance Indicators (KPIs) and Goals for O&M Activities	O&M Frequencies	References for Preventative versus Reactive Maintenance
City of Turlock	<ul style="list-style-type: none"> Stormwater pipe – 133 miles Channels – Approx. 110 miles Lift/Pump stations – 40 Service population – 72,000 Annual O&M budget: \$1.3M 	<ul style="list-style-type: none"> Maintenance Division staff dedicated to stormwater maintenance range from 6 to 16, depending on needs. During storm events, the full 16-person staff is needed to respond to issues. 	Not provided	<ul style="list-style-type: none"> Preventative maintenance activities include weekly mowing of basins and weekly inspection of the pump stations. 	Not provided
County of Orange	<ul style="list-style-type: none"> Stormwater pipe – 740 miles Channels – 350 miles Pump stations – 7 Drainage area – 789 square miles Service Population – 3.1 million 	Not provided	<ul style="list-style-type: none"> Visual inspection of channels Inspection of reinforced concrete boxes and pipes 36-inches and larger, conducted by confined space personnel entry Visual inspection and cleaning of catch basins Trash/debris removal Inspection of channel subdrain vaults Trash debris boom maintenance Urban runoff diversion inspection Ocean outlet cleaning Flap gate/slucicegate inspection Pump station trash rack cleaning Herbicide treatment and rodent control Channel sediment removal Basin sediment removal 	<ul style="list-style-type: none"> Weekly Pump exercise Monthly Pump station maintenance and debris cleaning Annual Dam inspection Maintenance activities that occur twice per year are typically conducted just before and just after the storm season. Completed as needed – CCTV inspection of storm drain laterals, fence maintenance, access road maintenance, channel weep hole cleaning, graffiti cleanup, homeless encampment cleanup, corrugated metal pipe maintenance, and insect control. 	Not provided
County of San Bernardino	<ul style="list-style-type: none"> Drainage area - 20,000 square miles The Flood Control District only maintains regional facilities – channels, basins, etc. Each member City is responsible for maintaining their own system to the point at which it connects to the County's channels. 	<ul style="list-style-type: none"> 263 staff, which are assigned to one of three regions. Each region has a Regional Superintendent. Remote transportation yards (13) and 4 flood yards throughout the County staffed at various levels – each has supervisor (large yards also have lower level supervisor) and different numbers of field staff. Staff is shared between flood control and transportation, as needed. 	<ul style="list-style-type: none"> Main KPI for department is the Roadside Pavement Condition Index (PCI) – they have at a set PCI and assign resources as needed to complete activities to maintain the goal PCI. Goals for stormwater are to have the facilities ready to accept winter flows before they begin. Primary basins are empty and able to accept full design capacity. Channels are cleared if needed. Since much of the work is based on severity of the seasons, it is difficult to establish many KPIs. 	<ul style="list-style-type: none"> Channel Maintenance – Trash and shopping carts are cleared as needed. Channel vegetation removal is performed by District staff and weed spraying is performed by the County Agriculture Department. Weeds sprayed annually. Each member City is responsible for the maintenance of their systems, including the pipelines up to the point of connection to the County's channels. Currently considering getting a maintenance management system. Current system allows charges by activity code, but doesn't facilitate planned maintenance scheduling. 	<ul style="list-style-type: none"> Most of the stormwater activities are reactionary, due to the unpredictability and changes in needs in any given year. The Division creates a CIP list annually. Large projects/reconstructions are sent out to contractors, but minor projects are done in house. The activities (planned and unplanned) are regularly reviewed and reprioritized. Priorities may change depending on the season. There is always more to be done than can be done.

4.2 City of Madera

West Yost spoke with Dave Randall, Public Works Director for the City of Madera. The Public Works Department Streets Division manages the City's stormwater facilities including pipelines, basins, and pump stations. The Streets Division includes 27 staff, of which 5 to 6 are typically dedicated to stormwater maintenance, although up to 10 staff may be used for basin maintenance.

Maintenance activities include annual basin maintenance (clearing vegetation and reprofiling) and seasonal inlet/culvert maintenance (clearing leaves and vacuuming debris). The major pump stations facilities are maintained, but minor facilities with low use are not regularly maintained. Pipelines are not on a routine flushing program. The City is currently developing an asset management program for the sewer and water facilities, and will develop a program, including regular maintenance schedules, for the storm facilities next.

4.3 City of Manteca

West Yost spoke with Harfateh Grewal, Assistant Engineer for the City of Manteca Stormwater Department. The Stormwater maintenance staff include 10 maintenance staff led by the Collections Supervisor and Wastewater Treatment Plant (WWTP) Superintendent. Maintenance is largely preventative, due to inspection required by their MS4 NPDES permit. The maintenance staff are conducting a visual inspection of all outfall and pump stations to identify and fix maintenance issues and determine where illicit discharges may occur. Pipelines are not on a regular flushing or maintenance program. Drainage channel maintenance is completed by the South San Joaquin Irrigation District.

4.4 City of Turlock

West Yost spoke with Fallon Martin, Municipal Services Analyst for the City of Turlock. The Public Facilities Maintenance Division is responsible for maintaining the City's stormwater facilities including: 133 miles of pipelines, 110 miles of channels, and 40 pump stations. Maintenance Division staff dedicated to stormwater maintenance range from 6 to 16, depending on needs. During storm events, the full 16-person staff is needed to respond to issues. Preventative maintenance activities include weekly mowing of basins and weekly inspection of the pump stations.

4.5 City of Napa

West Yost spoke with Gerardo Mendez, Stormwater Coordinator for the City of Napa. The Stormwater Department maintains the City's stormwater facilities including: 152 miles of pipes, 5 miles of channels, and 1 lift station. The maintenance staff is comprised of 12 workers that may also do paving or concrete work. Planned maintenance includes annual inspection and clearing of 114 drainage inlets and biennial channel maintenance.

4.6 City of Rocklin

West Yost spoke with Rick Lawrence, Streets Supervisor for the City of Rocklin. The Streets Division is responsible for the stormwater facilities maintenance, although there is not a designated stormwater crew. The Division has five full time staff, and typically 5 to 6 part-time seasonal staff. The following maintenance activities are conducted on the stormwater facilities:

- Flush pipes as needed (by private contractor);
- Annual creek/channel maintenance including clearing outlets, trash removal, tree removal, and spraying for weeds; and
- Annual open space vegetation removal using goats.

Most of the maintenance activities are reactive, due to budgetary constraints. The City's stormwater infrastructure is nearing the end of its useful life. Pipes are lined on an emergency basis to extend their useful life. Much of the system's corrugated metal pipe is failing. The City is currently working on an annual budget that would increase funds for stormwater maintenance.

4.7 County of Orange

West Yost spoke with Richard Boon, Stormwater Program Chief for the Orange County Department of Public Works. The Stormwater Program manages the major stormwater facilities for the unincorporated areas of Orange County, as well as the 34 member-cities. These stormwater facilities include 740 miles of storm drain pipes, 7 pump stations, and 350 miles of channels.

The Operations and Maintenance Division created and follow maintenance activities, as documented in the comprehensive *Flood Control Channel Routine Maintenance Plan* report. This report documents the following maintenance activities and frequencies:

- Visual inspection of channels (twice per year);
- Inspection of reinforced concrete boxes and pipes 36-inches and larger, conducted by confined space personnel entry (once every two years);
- Visual inspection and cleaning of catch basins (three times per year);
- Trash/debris removal (twice per year);
- Vegetation clearing (twice per year);
- Inspection of channel subdrain vaults (once every three years);
- Trash debris boom maintenance (twice per year – before storm season and after);
- Urban runoff diversion inspection (once per week);
- Ocean outlet cleaning (twice per year – before storm season and after);
- Flap gate/sluiceway inspection (once per year);
- Pump exercise (once per week);
- Pump station maintenance and debris cleaning (once per month);
- Dam inspection (one per year);
- Pump station trash rack cleaning (twice per year);
- Herbicide treatment (pre-emergent annually, post-emergent three times per year);

- Rodent control (four times per year);
- Channel sediment removal (when height reaches 1-ft above design grade); and
- Basin sediment removal (when over 25 percent of design capacity).

Maintenance activities that occur twice per year are typically conducted just before and just after the storm season.

The following activities are completed on an as-needed basis as issues occur:

- CCTV inspection of storm drain laterals,
- Fence maintenance,
- Access road maintenance,
- Channel weep hole cleaning,
- Graffiti cleanup,
- Homeless encampment cleanup,
- Corrugated metal pipe maintenance, and
- Insect control.

4.8 County of San Bernardino

West Yost spoke with Brendon Biggs, Deputy Director of Public Works Operations for San Bernardino County. The Public Works Operations Department staff are responsible for the maintenance of the County's flood control and transportation facilities. Regional flood control facilities include channels and basins, and member cities maintain their own system up to the point of connection to the County channel.

Staff are assigned to one of 3 regions, and further assigned to remote yards throughout the County. Each Region has a Superintendent and each yard has one or two Supervisors, depending on size. Staffing of each yard is typically between 3 to 20 people. Typically, the ratio to field workers/operators to supervisors is approximately 5 to 1 (see the organizational chart included as Appendix D). Staff are shared between flood control and transportation, as needed.

Most of the stormwater activities are reactionary, due to the unpredictability and changes in needs in any given year. In a wet year, there may be significant storm damage done to roads, bridges, and other infrastructure that the staff will need to focus on. There may be fires, flash floods, or drought that affect maintenance needs. The Division creates a capital improvement project (CIP) list annually. Large CIP projects/reconstructions are sent out to contractors, but minor projects are completed in-house. There is always more work to be done than the staff have time to complete, so maintenance activities (planned and unplanned) are continuously reviewed and reprioritized. Priorities may change depending on the season.

5.0 RECOMMENDATIONS FOR PROGRAM MODIFICATIONS AND IMPROVEMENTS

This section describes suggestions for improvements to the City's existing stormwater operation and maintenance division.

5.1 Maintenance Frequencies

Existing and recommended modifications to the City's current maintenance schedules are listed in Table 9. Recommended frequencies are increased or remain the same as the existing goals for many maintenance tasks. For example, where the current frequency goal is adequate to maintain the system the recommended frequency remained unchanged. In general, frequencies were increased for tasks that may have a greater impact on the system if not completed and for tasks that can identify maintenance issues such as inspections. Recommended frequencies were decreased from existing goals for certain tasks to allow staff more time resources to address tasks that have not been consistently completed. Staff will need to evaluate performance and make any necessary adjustments to recommended frequencies after implementation of recommended goals and additional staffing.

5.2 Staffing Level Recommendations

In order to meet the recommended maintenance schedules in Table 9, the recommended staffing modifications are:

- Convert two temporary staff to one full-time entry-level worker position to improve efficiency and technical ability of this existing staff resource, and lesson the training burden on full-time staff.
- Add one new lead Collection System Technician position to maximize the flexibility of crew sizes to meet the maintenance tasks at hand. Adding a second Collection System Technician will allow the Storm Division to operate in the following crew formations:
 - Two (2) two-worker crews (each with one Collection System Technician, and one worker)
 - One (1) three-worker crew (for high-traffic, confined-space, or labor-intensive tasks), and one (1) one-worker crew (one technician for USA markings, service call response, etc.)
 - For days when one crew member is unavailable because of illness, vacation, training, or inter-departmental help: one (1) three-worker crew (maximizing crew cross-training efforts and/or completing intensive tasks)
- Consider one supervisor position per five field crew members.
- Adjust the tracking parameters in the new payroll software to allow continued tracking of historic labor hours.

Table 9. Recommended Preventative Maintenance Schedules

Activity	Existing Frequency Goal	Recommended Frequency
Channels		
Clear Debris and Trash	Annually	Biennially (every two years)
Visual Inspection	Annually	Biennially (twice a year)
Herbicide Treatment (Pre-emergent)	<i>None</i>	Annually
Herbicide Treatment (Post-emergent)	Annually	Biennially
Rodent Control	<i>None</i>	Quarterly
Clear Outlets and Inlets	Annually	<i>No change</i>
Regrade Slopes	Annually	Biennially
Pipes, Maintenance Holes and Inlets		
CCTV Inspection of Pipes (including laterals)	None	Every 5 years
Hydro-jet Pipes and Maintenance Holes	Annually	Every 5 years
Flush Siphons	Quarterly	Biennially
Basins and Ponds		
Visual Inspection and Vegetation Clearing	Quarterly	Annually
Trash/Debris Removal	Quarterly	Annually
Herbicide Treatment (Pre-emergent)	<i>None</i>	Annually
Herbicide Treatment (Post-emergent)	Quarterly	<i>No change</i>
Inspect Inlets	Annually	<i>No change</i>
Clear Inlets/Outfalls	Annually	<i>No change</i>
Stormwater Pump Stations		
Pump Exercise	Monthly	Monthly
Station Maintenance -Record Readings -Check Motor Oil -Check Dripper Pot -Exercise Pump -Check for Vandalism -Check Bar Screens -Check Panel Lights -Test Area Lighting -Exercise Discharge Valve -Check Pest Traps -Test Station Alarms	Quarterly	Monthly
Bike Tunnel Pumps		
Station Maintenance -Record Readings -Exercise Pump -Check for Vandalism -Clear Area / Wash Down -Inspect Wet Well -Inspect Inlet Grates -Check Panel Lights	Monthly	<i>No change</i>
General		
Grade access roads	Quarterly	Annually
Inspect Fencing	Quarterly	<i>No change</i>
Inspect Signage	Quarterly	<i>No change</i>
Trim Trees	Quarterly	Annually

5.3 Maintenance Recommendations

The following provides the top priority maintenance recommendations for the stormwater system based on limited staff resources.

5.3.1 Drainage Pump Station Maintenance

West Yost recommends the generator at SDS#9 be tested and serviced monthly to ensure automatic operational functionality. Testing frequency should also comply with air quality permit requirements. In addition, generator fuel level is currently being observed and maintained based on use. All pump station equipment should be maintained according to manufacturer's recommendations. West Yost recommends all equipment maintenance should be documented for historical reference and warranty conditions. Documentation should include records of the following:

- Oil levels, lubrication;
- Suction and discharge pressures;
- Pump motor run hours;
- Number of pump stops and starts;
- Station flow Power usage and cost;
- Testing results; and
- Motor current draw

West Yost recommends daily drive-by visual inspections of these facilities continue during wet weather months, and that O&M Manual and manufacturers recommendations be followed for maintenance activities. Mechanical and electrical equipment repairs are currently performed by wastewater treatment plant staff and transportation staff, respectively, who have the appropriate skill sets to perform this specialized type of work. Large drainage pump station repairs, such as a pump replacement or rebuild, should be completed through an engineering CIP.

In the long-term, West Yost recommends pump capacity and efficiency be measured with pump tests. The pump tests should be compared to the original factory settings to determine if losses in pump capacity and efficiency will cause pumps to be targeted for repair and/or replacement due to wear. West Yost recommends pumps with horsepower's greater than 25 HP, be monitored for heat, vibration, and noise every 3-5 years to identify any changes that could be occurring and reducing overall pump service life. Large pumps and motors should be tested for heat and vibration through thermography and vibration analysis. These tests are used to identify pump issues that may reduce the overall life of a pump. Thermal imaging can identify issues with grease and oil or worn pump bearings. Vibration testing can identify issues with bearings and/or shaft and motor alignment. Motor resistance testing can also identify motor winding insulation health. These types of tests are considered preventative maintenance items to extend the life and efficiency of pumping equipment.

5.3.2 Conveyance System Cleaning and Condition Assessment

Periodic storm drain system cleaning removes accumulated sediment, trash, and other possible obstructions and pollutants. Routine cleaning reduces the amount of trash and debris that will eventually reach receiving waters. Without routine cleaning, clogging and/or a reduction in overall pipe capacity may occur, which can increase the risk of flooding. Priority should be given to older pipes, recurring problem spots, and pipes with flat slopes that do not flush sediment and debris well.

Since approximately 20 percent of the storm drain system has passed its expected useful life, and another 40 percent of the system is not far behind, it will be proactive for the City to inspect the condition of the piping system before failures start systematically occurring. CCTV inspection will establish a baseline condition for storm drain system, and allow the City to schedule and prioritize future cleaning and rehabilitation work. Best management practices are to inspect aging underground piping systems using a condition rating system on a five-year cycle to monitor the progress of structural defects over time. However, CCTV inspection can require expensive equipment, require skilled training, and be labor-intensive. It also requires that each pipe be hydro-cleaned ahead of the CCTV inspection crew to remove debris and cobwebs that hide structural and maintenance defects and/or prohibit the CCTV camera from traveling through the pipe. Given the current Storm Division staffing limitations, adding a large internal CCTV program does not appear feasible now, but would remain a good, long-term goal for the Division. In the meantime, it is recommended that within the next two years, the City hire outside CCTV contractors (who will hydro-clean each pipe first, then conduct a condition assessment) to inspect the storm drain assets that were installed on or before 1960 (approximately 18 percent of the system), along with any large-diameter and/or critical pipes. This will give the City short-term maintenance and repair/replacement programs that can jump-start the development of a long-term proactive program.

5.3.3 Maintenance Hole Cleaning, Repair, and Replacement

Since the City is currently not cleaning the entire system on a fixed-frequency, maintenance holes are also not being accessed regularly. It's important to access maintenance holes on a regular basis to maintain their accessibility and monitor any problems. Maintenance hole access can be lost when covers get mistakenly paved or built over, so it's important to locate and access manholes on a five to ten-year cycle – and after every street paving project. The cleaning and CCTV work recommended above will facilitate the access of approximately 20 percent of the maintenance holes, so it is recommended that the City develop a tracking system to ensure that over the next seven to ten years, all the maintenance holes get accessed. The condition of each manhole is equally as important as the condition of the pipelines to prevent flooding. Visual inspection (NASCCO MACP Level 1 inspections) of the manhole structure from the ground surface does not require confined-space entry, and is recommended at the time each manhole is accessed. Photographs should be taken of any observations for the facilitation of repairs and for historic condition records.

5.3.4 Detention Basin and Pond Maintenance

West Yost recommends annual inspection of these facilities at a minimum. Inspections and maintenance tasks should include:

- Removal and disposal of litter and dead vegetation;
- Accumulated sediment, oil and any other pollutants;
- Evidence of settlement or sinkholes;
- Evidence of rodent holes in dams or berms and removal of rodents;
- Identify any slope erosion and repair eroded slopes when rills form;
- Inspect sediment trap;
- Inspection after storm events for infiltration;
- Removal of trees and weeds that are growing within the pond, on side slopes/berms, or within the emergency overflow area. It is recommended that the City use outside contractors for drainage pond dredging as needed to increase pond capacity;
- Remove sediment to 10 percent of the designed ponds depth during summer months;
- Maintain vegetation (mow and weed trim to match surrounding area); and
- Identify and remove any pollutant sources.

5.3.5 Access Road and Grounds Maintenance

West Yost recommends inspecting access roads and grounds on an annual basis when the facilities they service are inspected and/or maintained. Maintenance activities include the removal of litter, vegetation management, and erosion control. In addition, fences and gates should be periodically inspected to ensure access is being restricted.

5.3.6 Standard Operating Procedures and Operation and Maintenance Manual

Many of the existing O&M manuals, forms, and Standards Operating Procedures (SOP's) apply to the wastewater collection system and/or are outdated (over 10 years old) and need to be updated to reflect current requirements, methods, and equipment. O&M Manuals and SOP's should be reviewed at least once every two years, and updated as necessary. Staff indicate that the current manuals are not detailed enough for a new staff member to pick up and use without additional training required.

Because of the current staffing limitations, it is recommended that the Storm Division seek consultant support to work with staff to update the SOP's. For budgetary purposes, the City can plan for an average consultant cost of \$3,200 to \$3,500 to update maintenance SOPs.

Existing O&M guidance should be supplemented with procedures or information that address the following topics:

- Customer complaint response protocol and record keeping;
- Start-up, shut-down, sequencing and adjustment procedures for mechanical equipment;
- Detailed preventative maintenance procedures for mechanical equipment;
- Description of valve positions related to various operational scenarios;
- Types and amounts of lubricants for mechanical equipment;
- List of replacement parts to be kept on hand for each piece of mechanical equipment;
- Any environmental factors which may affect operation;
- Manufacturer recommended O&M procedures;
- Common operating problems and solutions;
- How changes to normal operation should be addressed;
- Alternative operating procedures such as operations when equipment is out of service; and
- Current manufacturer contact information.

5.3.7 Computerized Maintenance Management System

It is recommended that the Storm Division fully utilize the Lucity™ software capabilities to improve data collection of labor hours and increase work order task designations. Work order instructions may include specifications for fuels, lubricants, filters, and other items related to specific equipment. The manufacturer's maintenance recommendations for equipment-specific O&M manuals should be incorporated into the schedule of preventative maintenance tasks. The Collections System Supervisor will be responsible to ensure that work orders are being issued and completed, and that timely work order action codes, notes, and labor hours are incorporated.

It's also recommended that the Storm Division implement a work order prioritization system. Below are several example categories which could be used to prioritize work orders:

- **Emergency** – Catastrophic failure has or is about to occur which may be a hazard to the public, eminent flood risk, or may be dangerous to personnel. Work must be performed immediately. Around the clock work and outside contractors may need to be authorized.
- **Urgent** – Failure that could affect the flooding, personnel health, or a repair that can greatly improve the system. Generally, applies to equipment with no back up. Overtime and outside contractors may need to be authorized.
- **Important** – May adversely affect or damage equipment or infrastructure. Work should be planned within two weeks, if possible.
- **Routine** – Desirable to repair, but not threatening equipment or flooding potential. Complete the work preferably within 4 weeks.

- **Contingency** – Will extend the life of equipment, will reduce cost of operation, and will improve the system. Routine work should be scheduled according to workload, as fill-in for the end of the day or on days when no work has a higher priority. Complete the work preferably within 8 weeks.

5.3.8 Key Performance Indicators

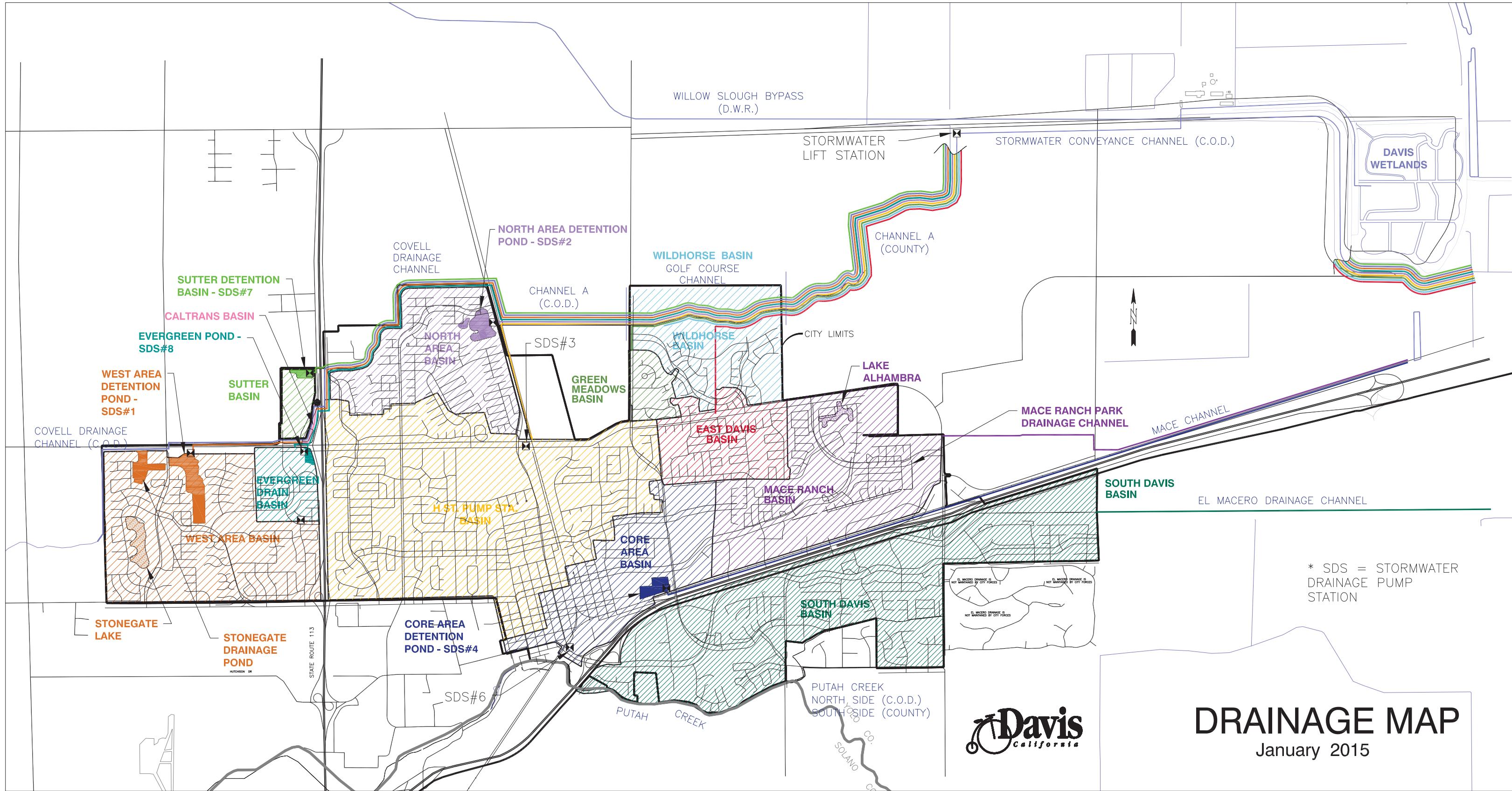
It is recommended that performance of maintenance be measured and evaluated using KPIs that are consistent from year to year, showing improvements and progress over time. Typically, KPIs are expressed numerically. The following are common KPIs for stormwater programs:

- Quantity of detention pond and channel inspections and cleanings per month/year,
- Pipe cleaning/video inspection rates per year (recommended as contract labor),
- Percentage of preventative work orders completed on schedule, and
- Number of staff hours on preventative vs. corrective work orders.

Target values will need to be established for each KPI to evaluate performance indicators on a regular basis. It is recommended that these KPIs be reported to management monthly, and summarized in an annual Storm Division report to City Council. Reporting provides accountability on the Division's goals, and helps communicate challenges with management and elected officials.

APPENDIX A

Drainage Areas



DRAINAGE MAP

January 2015

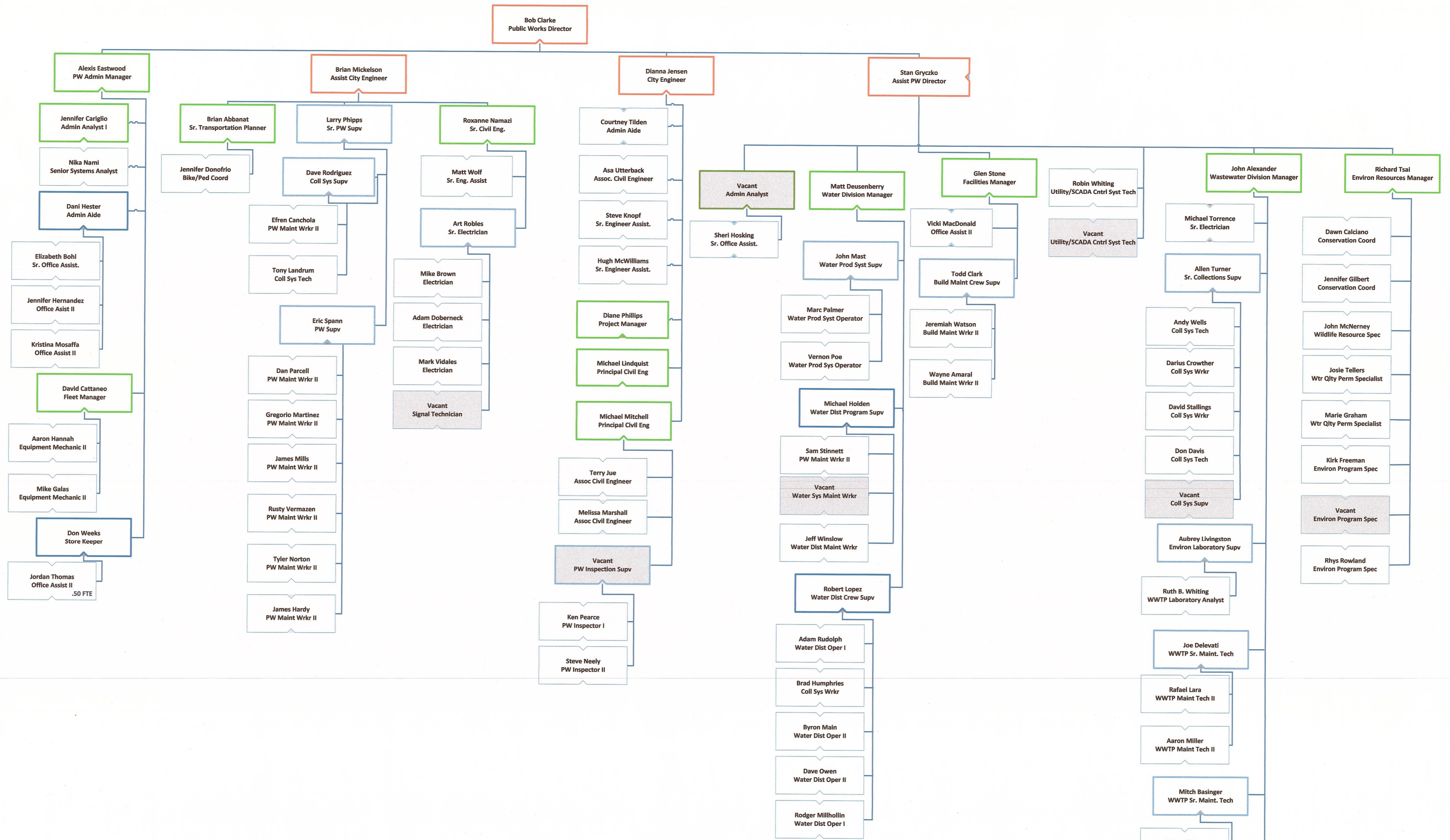
* SDS = STORMWATER DRAINAGE PUMP STATION

EL MACERO DRAINAGE IS NOT MAINTAINED BY CITY FORCES

EL MACERO DRAINAGE IS NOT MAINTAINED BY CITY FORCES

APPENDIX B

Public Works Org Chart



Regular Full Time 93.5
 Vacant Positions 6.0
 Total Staff (FTE's) 99.5



City of Davis Public Works Department

APPENDIX C

Benchmarking

City of Handford
Mike Consenza, Utilities Superintendent, 559-585-2550
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
<p>Miles of stormwater pipe – 57 miles</p> <p>Miles of channels – 1 mile (one channel)</p> <p>Acres of tributary area – 17 square miles (basically the city limits)</p> <p>Number of lift stations – 30 total; 15 – off street pumping; 15 – pumps in ponding basins (turned on during off peak rain events to make room in the system depending on needs)</p> <p>Service Population – 59,338</p>
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
<p>Division split last year into separate sewer and storm drain division (were 8 employees, 7 maintenance and 1 foreman).</p> <p>New standalone stormwater division includes 1 foreman, 3 maintenance workers. Not enough people. Will be asking for 4 or 5 more maintenance workers in the future.</p> <p>Stormwater has the option to have sewer/water division maintenance staff come to help out – this year they have utilized staff from other divisions frequently (3 or 4 times a month during the rainy season)</p> <p>Department has a utilities supervisor that oversees daily field operations of water and storm drain operations in the field</p>
Key Performance Indicators (KPI) and Goals for O&M Activities (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
<p>Miles flushed per year – no proactive flushing at all. City has the equipment, but does not have enough people to do the work.</p> <p>Number of service calls – 1 a week in the rainy season, maybe 2 if there are bad rainstorms</p> <p>250 acres of ponding basins – Maintenance includes spraying weeds, mowing, discing, whipping the basins for percolation, removing trees, inspecting/repairing 21 miles of fence line, spraying fence line, removing graffiti.</p> <p>Inspect fence lines and ponding basins weekly – 1 staff person does this on Wednesdays</p>
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
<p>Don't have planned flushing of system – will start to do this because of requirements of new permits</p> <p>Pump stations – visual inspection at least once a week (inspect telemetry, control panels, oil)</p> <p>Start and stop every pump station once a week</p>
Resources for Preventative Maintenance versus Reactive Maintenance (Try to get a sense of how much time is spent doing scheduled activities versus time spent responding to issues)
<p>80% scheduled maintenance</p> <p>20% reactive to issues (fence repair, clogged drain)</p> <p>May shift depending on amount of rain</p>
Additional Information (Ask if there is anything else that we should know about the Agency's O&M Staff and Activities)
Will probably try to double staff this year

City of Madera
Dave Randall, Public Works Director, 559-661-5461
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
<p>Mile of pipes –</p> <p>Miles of channels – no channels</p> <p>Acres of tributary area – 26 square miles</p> <p>Number of life stations -</p> <p>Service population – 64,000</p>
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
<p>No dedicated stormwater staff, instead stormwater is a subfunction of the Streets Division. Streets Division is 27 people, 5-6 are typically utilized during a storm event</p> <p>Dry and wet season staff are the same</p> <p>Usually use 5-6 people to perform maintenance on basins, but up to 10 if they are doing multiple basins in a day</p>
Key Performance Indicators (KPI) and Goals for O&M Activities (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
<p>No hard metrics tracked by the department</p> <p>Maintain every basin annually – to clean up vegetation and reprofile if there has been erosion</p> <p>Pipelines not flushed regularly – vacuum out drain inlets and cross culverts seasonally, but not every inlet or culvert is done</p> <p>Leaf pickup throughout the city (paid for by solid waste funds)</p> <p>Only get service calls when there is very heavy rain and streets become flooded</p>
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
<p>Facilities division has electricians and they help with maintenance of motors, controllers at pump stations</p> <p>No set schedule for maintenance of pump stations – City is working on asset management for sewer and water, stormwater is next</p> <p>Two lift stations are used regularly; the others are hardly ever used and not regularly inspected or maintained</p>
Resources for Preventative Maintenance versus Reactive Maintenance (Try to get a sense of how much time is spent doing scheduled activities versus time spent responding to issues)
<p>Most of work is preventative (leaf pickup, clearing culverts and inlets, basin maintenance) maybe 5% of time is reactive to issues</p> <p>Work orders are not used, so time use is difficult to track with precision</p>
Additional Information (Ask if there is anything else that we should know about the Agency's O&M Staff and Activities)
<p>Issue of stormwater quality is becoming more of an issue and they are starting to look into ways to address that</p> <p>Looking into installation of pervious surfaces to replace impervious surfaces</p>

City of Manteca
Harfateh Grewal, Assistant Engineer – Stormwater, 209-456-8429
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
Miles of pipe – Miles of channel – Acres of tributary area – Basins - Lift stations – Service population – 75,000-80,000
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
1 crew for sewer and storm collections systems. Crew is based at WWTP and includes about 10 maintenance staff members led by the WWTP superintendent and Collections Supervisor Haven't had to ask other departments for help
Key Performance Indicators (KPI) and Goals for O&M Activities (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
Does not think there is a flushing schedule for pipelines As part of NPDES permit, they are surveying outfalls and pump stations to identify areas where illicit discharges may take place and also areas that need maintenance attention Service calls – 3-5 per month, only received 2 in the month of February (clogged storm drain inlet, pump issues, illicit discharges are typical issues)
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
Have an agreement with South San Joaquin Irrigation District to assist with drainage channel maintenance
Resources for Preventative Maintenance versus Reactive Maintenance (Try to get a sense of how much time is spent doing scheduled activities versus time spent responding to issues)
Have more of a reactive maintenance program, but have lately been becoming more proactive because of the inspections they are performing as part of their MS4 permit Didn't see a big uptick in stormwater issues this winter with big storms
Additional Information (Ask if there is anything else that we should know about the Agency's O&M Staff and Activities)

City of Napa
Gerardo Mendez, Stormwater Coordinator, 707-257-9520 Karl Ono, Operations Engineer, 707-257-9407
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
Miles of pipe – 152 miles Miles of channel – unknown, lots of surface drainage is comingled with the County (Napa County Flood Control District), shared responsibility for maintenance, typically alternate years for maintenance. Approximately 4-6 miles. Acres of tributary area – 14,500 acres Lift stations – 1 Service population – 78,000
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
MS4 permit compliance, phase 2 – 2 to 4 staff members. \$30,000 dollars O&M – 2 engineers for design and construction of storm drain/sewer/water projects, crew of 12 maintenance (could be paving, concrete crew, no dedicated crew) that do stormwater work 114 DI that are inspected and maintained annually as part of permits
Key Performance Indicators (KPI) and Goals for O&M Activities (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
4-6 miles maintained annually
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
Resources for Preventative Maintenance versus Reactive Maintenance (Try to get a sense of how much time is spent doing scheduled activities versus time spent responding to issues)
Additional Information (Ask if there is anything else that we should know about the Agency's O&M Staff and Activities)

City of Rocklin
Rick Lawrence, Streets Supervisor, 916-625-5500
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
Miles of pipe – Miles of channel – Acres of tributary area – Lift stations – none Service population – 467 outlet structures
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
Not a large in house facility – staff of five full time, hire five to six part time seasonal staff members Maintain SOS, storm drain lines, creeks and open space areas, drainage outlets Contract with private vendor – Vactor service – utilized heavily for cleaning services Just purchase their own Vactor truck Broke city into thirds Streets division does all maintenance, doesn't have a team just dedicated to storm.
Key Performance Indicators (KPI) and Goals for O&M Activities (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
Clean SOS 1/3 – each one every three years Pipes flushed – done by need, as plugged or dirty systems are found, cleaned by contractor Have a lot of corrugated metal pipe that is reaching the end of its life Doing a lot of pipelining – based on funding, but pretty much on an emergency basis Trying to get more money from City County, getting an annual budget Annual maintenance of creeks – August 15 – October 15 dedicated to creek maintenance, walk the entire system, identify trees that need to be removed, trash removal. Clear all outlets. Spray for weeds at outlets. Coordinated through Fish and Wildlife. Basins are pretty maintenance free – basins are closed as needed Detention basins serve as water quality controllers Grazing program – goats and sheep graze on open space areas, going into 4 th or 5 th year. Also, helps with fire prevention Few service calls
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
Just use slide gates for detention basins
Resources for Preventative Maintenance versus Reactive Maintenance (Try to get a sense of how much time is spent doing scheduled activities versus time spent responding to issues)
Reactive because of budget issues Try to remain proactive
Additional Information (Ask if there is anything else that we should know about the Agency's O&M Staff and Activities)
Biggest threat is corrugated metal pipes

City of Turlock
Fallon Martin, Municipal Services Analyst, 209-668-5590, famartin@turlock.ca.us
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
Miles of stormwater pipelines in system: 133 +/- Miles of stormwater channels in system: 110 +/- Total tributary area (acres or square miles): Same as the City +/- Number of lift/pump stations: 40 Service population: 72,000 +/-
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
Total number of staff dedicated to stormwater operations minimum of 6 and maximum of 16 Is cross-departmental help provided for wet weather events? Yes, Public Facilities Maintenance Is seasonal help provided during wet weather? No
Key Performance Indicators (KPI) and Goals for O&M Activities , (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
How often is vegetation cleared from basins? Mowed weekly How often are pump stations inspected and maintained? Weekly Approximately how much time is spent working on schedule maintenance activities and how much time is spent responding to issues? Storm events = 16 staff members at 8 hours/day
Resources for Preventative Maintenance versus Reactive Maintenance (Try to get a sense of how much time is spent doing scheduled activities versus time spent responding to issues)
Additional Information (Ask if there is anything else that we should know about the Agency's O&M Staff and Activities)

Orange County Public Works – Stormwater Program
Richard Boon, Stormwater Program Chief, 714-955-0670, richard.boon@ocpw.ocgov.com
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
<p>Service population 3.1 million Area 789 square miles (incorporated areas and the limits of 34 cities) 740 miles of storm drains 350 miles of channels</p>
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask about field crew organization, such as number of staff per crew and number of crews per supervisor. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
(see attached organizational chart)
Key Performance Indicators (KPI) and Goals for O&M Activities (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
None
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
<p>Visual inspection of channels (twice per year – before storm season and after); CSE inspection of reinforced concrete boxes and pipes 36” and larger (once every 2 years); visual inspection and cleaning of catch basins (3 times per year); trash/debris removal (twice per year); Clear vegetation (twice per year); Channel subdrain vault inspection (once every 3 years); trash debris boom maintenance (twice per year – before storm season and after); diversion inspection (once per week); ocean outlet cleaning (twice per year – before storm season and after); Flapgate/slucigate inspection (once per year); pump exercise (once per week); station maintenance (once per month/year); dam inspection (one per year); pump station trash rack cleaning (twice per year); herbicide treatment (pre-emergent annually, post-emergent three times per year); rodent control (four times per year);</p> <p>As-needed: CCTV inspection of storm drain laterals, fence maintenance, access road maintenance, channel weephole cleaning, graffiti cleanup, homeless encampment cleanup; CMP maintenance; insect control; channel sediment removal (when height reaches 1-ft above design grade); basin sediment removal (when over 25% capacity)</p>
Resources for Preventative Maintenance versus Reactive Maintenance (i.e., how much time is spent doing scheduled activities versus time spent responding to issues)
No response
Additional Information (Ask if there is anything else that we should know about the Agency’s O&M Staff and Activities)
None

County of San Bernardino Flood Control
Eloy Ruvalcaba, Environmental Management Division, eruvalcaba@dpw.sbcounty.gov Brendon Biggs, Deputy Director of Public Works - Operations, bbiggs@dpw.sbcounty.gov
Description of Facilities & System Map (i.e., miles of stormwater pipes, miles of channels, acres of tributary area, numbers of lift/pump stations, service population)
The District boundary covers approximately 20,000 square miles. The Flood Control District only maintains regional facilities – channels, basins, etc. Each member City is responsible for maintaining their own system to the point at which it connects to the County’s channels.
Organizational Chart (Identify stormwater operations and maintenance staff – differentiate between field staff and management staff. Ask if cross-departmental or seasonal help is provided for wet-weather events.)
263 staff under Brendon, which are assigned to one of 3 regions. Each region has a Regional Superintendent. Remote transportation yards (13) and 4 flood yards throughout the County staffed at various levels – each has supervisor (large yards also have lower level supervisor) and different numbers of field staff. Staff is shared between flood control and transportation, as needed.
Key Performance Indicators (KPI) and Goals for O&M Activities (e.g., miles of pipe flushed per year, miles of channels maintained, number of service calls)
Main KPI for department is the Roadside Pavement Condition Index (PCI) – they have at a set PCI and assign resources as needed to complete activities to maintain the goal PCI. Goals for stormwater are to have the facilities ready to accept winter flows before they begin. Primary basins are empty and able to accept full design capacity. Channels are cleared if needed. Since much of the work depends on the severity of the seasons, it would be difficult to establish many KPIs. For example, the miles of snow plowed per year would be zero if there is no snowfall.
O&M Activity Frequencies (e.g., flush system every 5 years, annual visual inspection and maintenance of pump stations, annual vegetation clearing from basins)
Channel Maintenance – Trash and shopping carts are cleared as needed, and need is determined by calls from the public or by flood control staff when they are on patrol checking on the facilities. The channel vegetation removal is performed by District staff and the weed spraying is performed by the County Agriculture Department. Weeds are sprayed annually. Maintenance of channels is often hindered by the ability to get environmental permits issued. The County is currently working on a general system-wide permit to speed up activities (no individual permit needed for each activity. The County will establish separate mitigation areas to offset all activities.) Each member City is responsible for the maintenance of their systems, including the pipelines up to the point of connection to the County’s channels.
Resources for Preventative Maintenance versus Reactive Maintenance (Try to get a sense of how much time is spent doing scheduled activities versus time spent responding to issues)
Most of the stormwater activities are reactionary, due to the unpredictability and changes in needs in any given year. In a wet year, there may be significant damage done to roads, bridges, and other infrastructure due to storms that the staff will need to focus on. There may be fires, flash floods, or drought that affect maintenance needs. The Division creates a CIP list annually. Large projects/reconstructions are sent out to contractors, but minor projects are done in house. The activities (planned and unplanned) are regularly reviewed and reprioritized. Priorities may change depending on the season. There is always more to be done than can be done.
Additional Information (Ask if there is anything else that we should know about the Agency’s O&M Staff and Activities)
Currently looking into getting a maintenance management system. Current system allows charges by activity code, but doesn’t facilitate planned maintenance scheduling. The County had an equipment consultant last year assess if they had the right amount and type of equipment. They have different needs than a city or most other counties, being the largest county in the US. Their equipment has to be multi-functional (plow snow in winter, grade desert roads in summer).

APPENDIX D

San Bernardino DPW Operations Org Chart

PC 920 (66780)
73315 STAFF ANALYST *VACANT*

09058 EQUIP PARTS SPECIALIST EILEEN LEWIS

DEPUTY DIRECTOR,
OPERATIONS
PC 520 (66720)
85125 CH PUB WKS ENGR BRENDON BIGGS

CUSTOMER SERVICE / DISPATCH
PC 520 (66720)
05637 SECRETARY II SANTA STRATTON
RADIO ROOM CLERK
02931 OFFICE ASSISTANT III STEPHANIE HERNANDEZ
83268 PSE/RADIO ROOM LORENA REYES

RISK MANAGEMENT
XXXXX SAFETY SPECIALIST DAVID NEUMANN

EAST VALLEY/MOUNTAIN REGION
PC 521 (66720)
02145 PUB WKS OP SPT ANGEL H. LEMUS

DESERT REGION
PC 522 (66720)
04789 PUB WKS OP SPT ROBERT EVANS

PERMITS/OPERATIONS SUPPORT
PC 920 (66780)
04319 PUB WKS ENGR IV MELISSA WALKER

WEST VALLEY REGION
PC 920 (66780)
02290 PUB WKS OP SPT SCOTT RYAN
10028 OFFICE ASSIST III SHIRLEY KOCH
88664 CON ARBORIST CHRISTOPHER DANYOW
89841 ARBORIST *VACANT*

FLOOD CONTROL SUPPORT CREW
PC 924 (66782)

77586 PUB WKS OP SPV MATT DURAN
07532 MNT/CONST SPV II *VACANT*
02520 EQUIP OPR III ROBERT SILVA
06934 EQUIP OPR III GREG ROBERG
02541 EQUIP OPR III *VACANT*
06943 EQUIP OPR III MICHAEL FAVREAU
03873 EQUIP OPR II LEONARD CHAVEZ
03864 EQUIP OPR II DEAN COCHRANE
03881 EQUIP OPR II GREG GRIFFITH
03880 EQUIP OPR II JOHN AFFLECK
02575 EQUIP OPR I JORGE JIMENEZ
03673 EQUIP OPR I LISANDRO SOLIS
03683 EQUIP OPR I IGNACIO NAVA
03514 MNT/CONST WKR II JAIME OCEGUEDA
03656 MNT/CONST WKR II *VACANT*
03499 MNT/CONST WKR I *VACANT*
03506 MNT/CONST WKR I JAMIE VASQUEZ
04867 PESTICIDE APPL RONNIE CHAVEZ, SR.

TRANSPORTATION SUPPORT CREW
PC 524 (66781)

05425 MNT/CONST SPV II RICHARD DIXON
03537 MNT/CONST SPV I JOHN HUTCHISON
02509 EQUIP OPR III STEVE ANDREWS
02542 EQUIP OPR III MIKE WILSON
03835 EQUIP OPR II STUART GRIFFEY
03844 EQUIP OPR II FIDEL GONZALEZ
03877 EQUIP OPR II MIKE TURPIN
03850 EQUIP OPR II JASON COOK
03730 EQUIP OPR I VINCENT HELMS
03731 EQUIP OPR I DAVID GUTIERREZ
74011 EQUIP OPR II DAVID GARCIA

CRESTLINE - YARD 7
PC 507 (66745)

01728 PUB WKS OP SPV JESS SALDANA
83568 MNT/CONST SPV I BRENT JOHNSON
02518 EQUIP OPR III RYAN ETHRIDGE
03690 EQUIP OPR II DAN DOWELL
03692 EQUIP OPR II ADRIAN ASENCIO
03704 EQUIP OPR II RON CHALFANT
03472 MNT/CONST WKR II RUSSELL DAVIS
03660 MNT/CONST WKR II EBARISTO RAMIREZ
71990 EQUIP OPR II ANTHONY GREEN

BLUE JAY - YARD 8
PC 508 (66746)

01724 PUB WKS OP SPV LAMAR ALLMAN
00854 MNT/CONST SPV II CORY NELSON
02514 EQUIP OPR III ANDY DUCHATEAU
02517 EQUIP OPR III JOHN DECADENA
71994 EQUIP OPR III JOSEPH ROBERTSON
71993 EQUIP OPR II PETE KATTERHAGEN
03693 EQUIP OPR II *VACANT*
03695 EQUIP OPR II ERIK HOLMES
03698 EQUIP OPR II THOMAS LEONE
03852 EQUIP OPR II MICHAEL SOTELO
XXXXX EQUIP OPR II BRIAN GRUBER
03867 MNT/CONST WKR II LUIS FARAGOZA
00843 MNT/CONST WKR II DAMIEN CONTRERAS

BIG BEAR - YARD 9
PC 509 (66747)

01730 PUB WKS OP SPV DEAN SAYLOR
83567 MNT/CONST SPV I DAVID DORADO
02523 EQUIP OPR III JESUS DIAZ
03699 EQUIP OPR II DARREN PALMER
03703 EQUIP OPR II RICHARD RODRIGUEZ
03705 EQUIP OPR II ROBERT ANDERSON
03470 MNT/CONST WKR II WAYNE HIGGINS
00838 MNT/CONST WKR II BRANDON STEWART

ZONE 3 YUCAIPA
ZONE 5 MOUNTAIN
ZONE 6 LOW DESERT
PC 923 (66786)

00865 MNT/CONST SPV II MICHAEL FISHER
03534 MNT/CONST SPV I JOE GOMEZ
02549 EQUIP OPR III PETE HOLLOWAY
80972 EQUIP OPR II DOUGLAS DURBIN
03687 EQUIP OPR I RODNEY MILTON
02556 MNT/CONST WKR II JOHN DREW
03489 MNT/CONST WKR I TAYLOR GOMEZ
*SR C.C. A. LEMUS

BIG RIVER - YARD 2
PC 502 (66767)

02595 MNT/CONST SPV II KEVIN CANEPA
03868 EQUIP OPR II *ERIC RONK
03721 EQUIP OPR I MIKE WILLIAMS

JOSHUA TREE - YARD 10
PC 510 (66768)

01731 PUB WKS OP SPV PHIL CARDOZO
00862 MNT/CONST SUP II KEVIN J. ADDISON
02527 EQUIP OPR III RANDY WILSON
03855 EQUIP OPR II ROBERT JOHNSON
03862 EQUIP OPR II JEFF BEHRENS
03712 EQUIP OPR I TED DUMAS JR.
03713 EQUIP OPR I *VACANT*
03711 EQUIP OPR I MATTHEW ALVARADO
03836 MNT/CONST WKR II ARTHUR WATSON
03465 MNT/CONST WKR I STEVEN DOMSKIE
88965 EQUIP OPR III DAVID HOPKINS (TEMP)

BALDY MESA - YARD 11
PC 511 (66761)

01732 PUB WKS OP SPV ROY MONTRY
00855 MNT/CONST SPV II FRANK OPICE
02538 EQUIP OPR III KENNETH EMBREY
02546 EQUIP OPR III JAMES PFIFFER
83565 EQUIP OPR II ANTHONY FREEMAN
02529 EQUIP OPR II FRED REQUA
03700 EQUIP OPR II THOMAS JARVIS
82761 EQUIP OPR II GRANT ATTAWAY
01132 EQUIP OPR I EDWARD JASSO, JR
03674 EQUIP OPR I ROBERT WILSON
07223 EQUIP OPR I *VACANT*
07224 EQUIP OPR I ED REBHAN, JR.
03485 MNT/CONST WKR II ZANE BOWER
81509 EQUIP OPR II ULYSSES SHANK
71978 EQUIP OPR II SAMUEL CANALES JR.

BARSTOW - YARD 12
PC 512 (66762)

01733 PUB WKS OP SPV WILLIAM LITTLE
00849 MNT/CONST SPV II ANTHONY MONTANO
02531 EQUIP OPR III ROBERT BYRKETT
83566 EQUIP OPR III VINCENT RUSSO
02532 EQUIP OPR III RICHARD MORGAN
03859 EQUIP OPR II LEWIS LAWSON
03872 EQUIP OPR II KEVIN LANG
03670 EQUIP OPR I *VACANT*
03706 EQUIP OPR I JUSTIN BROOKS
03715 EQUIP OPR I JOE BONETPELS, JR.
03717 EQUIP OPR I *VACANT*
03719 EQUIP OPR I BAULIO BIRRUETA
03847 MNT/CONST WKR II ARNOLD CRUZ

ZONE 4 BALDY MESA
ZONE 6 HIGH DESERT
PC 926 (66787)

00867 MNT/CONST SPV II SHANE COCHRANE
06917 EQUIP OPR III ED REBHAN, SR.
77587 EQUIP OPR II GEORGE CAMPBELL
03845 MNT/CONST WKR II JEREMY SHANK
03493 MNT/CONST WKR I JOEL HESTER

TRONA - YARD 13
PC 513 (66763)

00848 MNT/CONST SPV II DAVID CHRISTOPH
03860 EQUIP OPR II *ERIC RONK
03696 MNT/CONST WKR II PATRICK MARCOTTE
*SR TO W. LITTLE AND A. MONTANO

NEEDLES - YARD 15
PC 515 (66766)

01734 PUB WKS OP SPV DON TOY
00859 MNT/CONST SPV II DELVIN HOLMES
02533 EQUIP OPR III GARY GREGOR
03861 EQUIP OPR II JACK SMITH
03708 EQUIP OPR I LARRY MERICAL
03723 EQUIP OPR I JOSEPH PUHM

APPLE VALLEY - YARD 16
PC 516 (66764)

01735 PUB WKS OP SPV CRAIG SHERMAN
00856 MNT/CONST SPV II JOSEPH BONETPELS
02530 EQUIP OPR III CODY CESSNA
02535 EQUIP OPR III *HOWARD BOWERS
03863 EQUIP OPR II SHANE STOGORMAN
01131 EQUIP OPR II KYLE RILEY
03725 EQUIP OPR I MARC GEIST
03726 EQUIP OPR I JAMES SURRITT
03728 EQUIP OPR I PAUL BARAGONA
03729 EQUIP OPR I *VACANT*
06671 MNT/CONST WKR II ANTHONY PEREZ
03468 MNT/CONST WKR I *VACANT*

CRACK FILL CREW
PC 527 (66762)

83682 EQUIP OPR I *VACANT*
73310 MNT/CONST WKR II KENNETH BIRD
73311 MNT/CONST WKR I *VACANT*
73312 MNT/CONST WKR I TROY PETTIBONE
73313 MNT/CONST WKR I DAN RAWLINSOON
83569 MNT/CONST WKR I DANNY THOMPSON

PERMITS/OPERATIONS SUPPORT
PC 920 (66780)

05645 SECRETARY I LA SHON BROWN
84729 OFFICE ASSISTANT III NATALIE LOPEZ
88777 OFFICE ASSISTANT II DANIELA POWELL
81357 OFFICE ASSISTANT II ALYSHA SAVALA
93714 PSE DAKOTA CORTEZ
94760 PSE VANESSA VAZQUEZ
83261 PSE *VACANT*

PROPERTY MANAGEMENT SECTION
PC 920 (66780)
04403 ENGR TECH V BRENDA HARTMANN
05321 ENGR TECH IV BRAD MECHAM
10603 ENGR TECH IV SAM McDONALD

OPERATIONS SUPPORT SECTION
PC 920 (66780)
XXXXX PUB WKS ENGR III *VACANT*
12035 PUB WKS ENGR II ROBERT AGUIRRE
89842 ENGR TECH III TRICIA READ

PC 558 (66711)
09860 PUB WKS ENGR II MINH-THU HO

FLOOD CONTROL PERMITS SECTION
PC 927 (66712)
00352 PUB WKS ENGR III MOHAMMAD ALI
05325 ENGR TECH V MARTY MISH
05319 ENGR TECH IV LAWRENCE BROCK
10602 ENGR TECH IV MATTHEW CORTEZ
02104 ENGR TECH IV RICHARD MENDOZA
07082 ENGR TECH IV STACY SERRANO

TRANSPORTATION PERMIT SECTION
PC 558 (66711)
00355 PUB WKS ENGR III MICHAEL TRUETT
04353 OFFICE ASSISTANT III TRISH URIBE
03739 ENGR TECH V SYLVIA GOMEZ
04388 ENGR TECH IV DON BOWEN
05304 ENGR TECH IV DENNIS BRHEL
83677 ENGR TECH IV GERALD STONE
05305 ENGR TECH IV KRIS CARIOU

PERMITS/OPERATIONS SUPPORT
PC 920 (66780)

05645 SECRETARY I LA SHON BROWN
84729 OFFICE ASSISTANT III NATALIE LOPEZ
88777 OFFICE ASSISTANT II DANIELA POWELL
81357 OFFICE ASSISTANT II ALYSHA SAVALA
93714 PSE DAKOTA CORTEZ
94760 PSE VANESSA VAZQUEZ
83261 PSE *VACANT*

PROPERTY MANAGEMENT SECTION
PC 920 (66780)
04403 ENGR TECH V BRENDA HARTMANN
05321 ENGR TECH IV BRAD MECHAM
10603 ENGR TECH IV SAM McDONALD

OPERATIONS SUPPORT SECTION
PC 920 (66780)
XXXXX PUB WKS ENGR III *VACANT*
12035 PUB WKS ENGR II ROBERT AGUIRRE
89842 ENGR TECH III TRICIA READ

PC 558 (66711)
09860 PUB WKS ENGR II MINH-THU HO

FLOOD CONTROL PERMITS SECTION
PC 927 (66712)
00352 PUB WKS ENGR III MOHAMMAD ALI
05325 ENGR TECH V MARTY MISH
05319 ENGR TECH IV LAWRENCE BROCK
10602 ENGR TECH IV MATTHEW CORTEZ
02104 ENGR TECH IV RICHARD MENDOZA
07082 ENGR TECH IV STACY SERRANO

TRANSPORTATION PERMIT SECTION
PC 558 (66711)
00355 PUB WKS ENGR III MICHAEL TRUETT
04353 OFFICE ASSISTANT III TRISH URIBE
03739 ENGR TECH V SYLVIA GOMEZ
04388 ENGR TECH IV DON BOWEN
05304 ENGR TECH IV DENNIS BRHEL
83677 ENGR TECH IV GERALD STONE
05305 ENGR TECH IV KRIS CARIOU

FLOOD CONTROL/SUPPORT CREW
PC 921 (66784)
07501 PUB WKS OP SPV TYSON FRISTOM

ZONE 2 SAN BERNARDINO YARD
PC 922 (66785)
00863 MNT/CONST SPV II BRIAN KLOEPFER
06853 MNT/CONST SPV I TONY TRONCOSO
02548 EQUIP OPR III ROBERT MACIAS
02543 EQUIP OPR III CAREY STOCKTON
06944 EQUIP OPR III CLINT WAUGH
03875 EQUIP OPR III JUAN ARJONA
03842 EQUIP OPR II DAVID LOMAX
03680 EQUIP OPR I MICHAEL McCLELLAN
06757 MNT/CONST WKR II ERIC VASQUEZ
03492 MNT/CONST WKR I RYAN HAIGLER
03508 MNT/CONST WKR I *VACANT*
03513 MNT/CONST WKR I MARCUS MILLER

ZONE 1 RANCHO CUCAMONGA YARD
PC 921 (66784)
00864 MNT/CONST SPV II ROBBIE CLARK, JR.
00866 MNT/CONST SPV I BRANDON CALDERON
02539 EQUIP OPR III JUAN GALLARDO
02544 EQUIP OPR III GUILLERMO SANDOVAL
03875 EQUIP OPR III JUAN ARJONA
06933 EQUIP OPR I MANU 'ATU TAMITA
06935 EQUIP OPR I MATTHEW SOMMERVILLE
03664 EQUIP OPR I ANDREW GARCIA
03486 MNT/CONST WKR II HENRY NORIEGA
03507 MNT/CONST WKR II CHRIS SCHIERHOLD
03517 MNT/CONST WKR II MATTHEW ACEVES
03488 MNT/CONST WKR I MICHAEL WESTER
03500 MNT/CONST WKR I JULIAN TARULA
03501 MNT/CONST WKR I RONALD CHAVEZ, JR.

CRACK FILL CREW
PC 506 (66744)
75577 MNT/CONST WKR II M. GABLE
75579 MNT/CONST WKR I *VACANT*
83884 MNT/CONST WKR I TONY SALKELD
75580 MNT/CONST WKR I *VACANT*
75581 MNT/CONST WKR I *VACANT*

EAST VALLEY - YARD 5
PC 505 (66743)
01729 PUB WKS OP SPV MIKE HODGE
00851 MNT/CONST SPV II ANDY WATTS
00852 MNT/CONST SPV II RODNEY REIMANN
02515 EQUIP OPR III *DARRELL PERRY
02551 EQUIP OPR III *RUBEN ALDERETE
03848 EQUIP OPR II ROBBIE CLARK, SR.
03865 EQUIP OPR II MICHAEL CRUZ
02540 EQUIP OPR II JESS SLAYMAN
03676 EQUIP OPR I ANDREW DE LA ROSA
03675 EQUIP OPR I MARIO GANTT
03678 EQUIP OPR I JAIME RIVERA
03684 EQUIP OPR I PAUL TROY
03685 EQUIP OPR I ALEX ESTRADA
03734 EQUIP OPR I JOSHUA SHOFFEITT
03482 MNT/CONST WKR II CARLOS TENORIO
02537 MNT/CONST WKR II MIKE LOFTIN
02469 MNT/CONST WKR I JOHN BASHOR
71982 EQUIP OPR II DUANE CARNAHAN
74004 EQUIP OPR II IVAN CONDIT

*INCLUDE ON SERVICE REQUESTS

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TRAFFIC OPERATIONS SECTION
PC 525 (66783)

03679 PUB WKS OP SPV ROBERT VASQUEZ
05424 MNT/CONST SPV II ROBERTO LUCERO
13945 MNT/CONST SPV II DAVID MELLOR
13944 EQUIP OPR III ERIC HOLLEY
03876 EQUIP OPR II MARCO SHEHAB
00833 MNT/CONST WKR II RONNIE RODRIGUEZ
00836 MNT/CONST WKR II STEVEN VALLEZ
00837 MNT/CONST WKR II DAVID QUIROZ
00839 MNT/CONST WKR II *VACANT*
00840 MNT/CONST WKR II KEVIN GALLARETA
00841 MNT/CONST WKR II MARTYN MORALES
01133 MNT/CONST WKR II DANNY MORENO
03463 MNT/CONST WKR II MANUEL MONTIEL
03471 MNT/CONST WKR II DAVID GIRDENIS
03480 MNT/CONST WKR II MICHAEL GONZALES
10032 MNT/CONST WKR II RICK PEDROSA
10033 MNT/CONST WKR II MARK MORAN
81751 MNT/CONST WKR I CHRIS CONTRERAS
75578 MNT/CONST WKR I FRANCISCO CHILSON

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