KING CITY
CALIFORNIA

FINAL

Wastewater Treatment FACILITIES PLAN

September 2017

carollo

WASTEWATER TREATMENT FACILITIES PLAN

September 2017

FINAL

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KING CITY

WASTEWATER TREATMENT FACILITIES PLAN

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LIST OF ABBREVIATIONS

40 CFR 503	40 CFR Part 503 Standards for the Use and Disposal of Sewage Sludge
AACE International	Association for the Advancement of Cost Engineering International
AAF	Average Annual Flow
AB	Assembly Bill
ac	acre
ADC	Alternative Daily Cover
ADF	Average Daily Flow
ADMMF	Average Daily Maximum Month Flow
AFY	acre-feet per year
APLR	Annual Pollutant Loading Rate
ATCM	Airborne Toxic Control Measure
Basin Plan	Water Quality Control Plan for the Central Coastal Basin
Basin Plans	Water Quality Control Plans
BFE	Base Flood Elevation
BOD_5	5-day Biochemical Oxygen Demand
BPTC	Best Practicable Treatment or Control
CAA	Clean Air Act
CAG 45	ConAgra 45
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CAS	Conventional Activated Sludge
CCL	Ceiling Concentration Limit
CCR	California Code of Regulations
CDFA	California Department of Food and Agriculture
CEC	Contaminants of Emerging Concern
Central Coast Regional Board	Central Coast Regional Water Quality Control Board

CEQA	California Environmental Quality Act
CFU	Colony Forming Units
CI	Compression-Ignition
City	King City
CO	Carbon Monoxide
CPLR	Cumulative Pollutant Loading Rate
Cu ft	cubic foot (feet)
CWA	Clean Water Act
CWEA	California Water Environment Association
DAFT	Dissolved Air Flotation Thickener
DBP	Disinfection Byproducts
DDW	Division of Drinking Water
EDC	Endocrine-Disrupting Chemicals
EI&C	Electrical, Instrumentation, and Control
EPA	Environmental Protection Agency
EQ	Exceptional Quality
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FTE	Full-time Equivalents
g/bhp-hr	gram per brake horsepower per hour
gpm/sq ft	gallons per minute per square foot
GHG	Greenhouse Gas
GBT	Gravity Belt Thickener
GWDR	General Waste Discharge Requirements
GT	Gravity Thickener
HC	Hydrocarbon
hp	horsepower
IRWM	Integrated Regional Water Management
MBR	Membrane Bioreactor

MBUAPCD	Monterey Bay Unified Air Pollution Control District
MDDF	maximum daily diurnal flow
mg/L	milligrams per liter
mg-min/L	milligram-minutes per liter
mgd	million gallons per day
mJ/cm^2	millijoules per square centimeter
mL/L	milliliter per liter
MLE	Modified Ludzack-Ettinger
MLR	Mixed Liquor Return
MLSS	Mixed Liquor Suspended Solids
MMR	Monthly Monitoring Reports
MRWPCA	Monterey Regional Water Pollution Control Agency
MPN	Most Probable Number
NFIP	National Flood Insurance Program
NH_3	Ammonia-N
NMHC+NOx	Non-Methane Hydrocarbon plus Nitrogen Oxide
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NTU	nephelometric turbidity unit
NWRI	National Water Research Institute
O&M	Operations and Maintenance
Panel	Science Advisory Panel
Panel Report	"Monitoring Strategies for Chemicals of Emerging Concern in Recycled Water Recommendations of a Science Advisory Panel"
PBDE	Polybrominated Diphenyl Ethers
PCL	Pollutant Concentration Limit
PFRP	Processes to Further Reduce Pathogens
PFU	Plaque Forming Unit
PHF	Peak Hour Flow

PM	Particulate Matter
POP	Persistent Organic Pollutants
ppd	pounds per day
PPCP	Pharmaceuticals and Personal Care Products
PSRP	Processes to Significantly Reduce Pathogens
RAS	Return Activated Sludge
RDT	Rotary Drum Thickener
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SGMA	State Groundwater Management Act
SIP	State Implementation Plan
SNMP	Salt and Nutrient Management Plans
SRF	State Revolving Fund
SRT	Sludge Retention Time
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
Title 22	Title 22, Division 4, Chapter 3 of the California Administrative Code
TSS	Total Suspended Solids
UV	Ultraviolet
UVT	Ultraviolet Transmittance
WAS	Waste Activated Sludge
WDR	Waste Discharge Requirements
WQ	Water Quality
WWTP	Wastewater Treatment Plant
yd^3	cubic yards
yr	year

Chapter 1

EXECUTIVE SUMMARY

1.1 INTRODUCTION

The King City (City) Wastewater Treatment Plant (WWTP) is located in the Salinas Valley of Monterey County, California along the Salinas River and serves a population of approximately 12,900. The WWTP was constructed in 1970 and underwent capacity expansions in 1982, 1991, and 2010. The last facility plan update was completed in 2007. Since then, the City has identified several drivers leading to this current facility plan. These drivers include the following:

- The City's desire to produce tertiary-treated effluent meeting Title 22 unrestricted reuse requirements.
- The City's desire to sell land adjacent to the treatment facility.
- Additional plant capacity required to accommodate anticipated growth in the City.
- Potential for change in current permit requirements (i.e., updates to the City's Waste Discharge Requirements [WDR] by the Central Coast Regional Water Quality Control Board [Central Coast Regional Board]).
- Increasing difficulty meeting existing treatment objectives and anticipated permit requirements with existing pond-based system.
- Need to repair/rehabilitate aging infrastructure.
- Ongoing maintenance needs of the existing pond system including removing accumulated biosolids and inert solids that could cause an internal load.
- Potential for future regulations on nutrients, including ammonia and nitrate.
- Future climate change and flooding concerns.

This facility plan summarizes the facility's current and future regulatory requirements, evaluates the facility's current and future flows and loads, provides alternatives for future effluent reuse and disposal, and recommends alternatives for a future tertiary treatment facility that will produce Title 22 unrestricted reuse-quality water. The basis of evaluation for future needs is over a 20-year planning horizon.

The facility consists of domestic treatment and disposal as well as an industrial disposal-only system. The domestic treatment facility has a design capacity of 1.2 million gallons per day (mgd) and consists of a headworks, seven (7) treatment ponds, an effluent disposal pump station and force main, and six (6) spray irrigation fields for disposal of treated effluent. The WWTP operates under a domestic WDR regulated by the Central Coast Regional Board and disposes of treated domestic wastewater on domestic sprayfields. The City monitors industrial wastewater discharge from one facility, ConAgra 45 (CAG 45),

under a separate WDR. Currently, CAG 45 is a cogeneration facility with very little to no influent loading in the waste stream and with no plans to return to agricultural processing. The City has directed Carollo to exclude the CAG 45 facility from this facility plan analysis. Should CAG 45 return to agricultural or industrial processes in the future, pretreatment of the effluent would be required before accepting it into the domestic wastewater treatment plant.

This executive summary chapter provides a brief overview of key findings and recommendations of the facility plan. For more detailed information, the reader is directed to Chapters 2 through 5 of the facility plan.

1.2 CURRENT AND FUTURE REGULATORY REQUIREMENTS

The WWTP discharges are regulated by the Central Coast Regional Board under two WDRs last updated in 1991:

- WDR Order No. 91-05 for the City of King Domestic Wastewater Facility (Domestic), which was adopted on January 11, 1991.
- WDR Order No. 91-84 for the City of King Industrial Wastewater Facility (Industrial from CAG 45), which was adopted on September 13, 1991.

The receiving water limitations for effluent discharges to the domestic and industrial sprayfields are listed in Table 1.1. Any future updates to the WDRs would likely incorporate the recommendations and/or requirements from the latest versions of the Water Quality Control Plan for the Central Coastal Basin (Basin Plan), State Resolution 68-16 (Antidegradation Policy), and the California Water Code Division 7. The Basin Plan describes beneficial uses and water quality objectives for waters of the State and within the Central Coast Region. King City is part of the Salinas River hydrologic unit which may require additional nitrogen reduction requirements. The Antidegradation Policy protects the receiving waters of the treated wastewater, including both surface waters and groundwater, by ensuring minimal degradation of the waters occurs. In addition, the City may also need to include a mandatory pretreatment ordinance for any flows and loads accepted from future industrial and agricultural discharges. The City will need to evaluate the anticipated impact of any future industrial or agricultural effluent discharge and may require pretreatment of the effluent before allowing it to enter the wastewater treatment plant.

Table 1.1 Domestic and Industrial WWTP Effluent Discharge Requirements
Wastewater Treatment Facilities Plan
King City

Parameter	Domestic		Industrial	
	Monthly Average	Weekly Average	Monthly Average	Daily Maximum
Flow, mgd	1.2(1)	--	2.4(2) 1.0(3)	--
Settleable Solids, mL/L	0.8	1.2	1.0	5.0
Suspended Solids, mg/L	100	150	--	--
Total Suspended Solids Loading, ppd/ac	--	--	150(4)	200(4)
BOD_5, mg/L	100	150	1,200	1,300
BOD_5 Loading, ppd/ac	--	--	300(4)	400(4)
pH(5)	6.5 to 8.3	--	6.5 to 8.4	--
Total Dissolved Solids, mg/L	--	--	1,500	2,000
Boron, mg/L	--	--	--	1.0
Chromium (Total), mg/L	--	--	--	0.1
Copper, mg/L	--	--	--	0.2
Diethylethanolamine, mg/L	--	--	--	0.1
Zinc, mg/L	--	--	--	2.0
Nitrate, mg/L as N(6)	8	--	8	8
Sulfate, mg/L(6)	--	--	250	250
Chloride, mg/L(6)	--	--	250	250

Notes:
(1) WDR was last updated in 1991. The facility upgrade has since been completed, increasing the domestic effluent discharge capacity to a monthly mean of 1.2 mgd.
(2) On-season (May 1 through November 30).
(3) Off-season (December 1 through April 30).
(4) Maximum sprayfield loading rates.
(5) pH shall be within this range at all times.
(6) Discharge shall not cause concentrations in the downgradient groundwater to exceed these values.

In addition to the wastewater effluent discharge requirements, biosolids generated from the WWTP are subject to wastewater biosolids regulations. Currently, the solids collected from the wastewater settle and accumulate within the ponds, which must be dredged periodically to maintain the plant's capacity. Future upgrades and/or expansions to the plant will likely increase the amount of biosolids generated.

Biosolids are classified by the EPA's 40 CFR Part 503 Standards for the Use and Disposal of Sewage Sludge ("40 CFR 503") regulations as Class B or Class A, according to the level of pathogen reduction. Biosolids must also meet vector attraction and metal concentration limits.

The State of California does not directly regulate beneficial use of biosolids. The Regional Water Boards have the option of adopting the State's General Order for biosolids, while providing additional management requirements with no additional biosolids quality requirements. Also, California Department of Resources Recycling and Recovery (CalRecycle) and the California Department of Food and Agriculture (CDFA) have jurisdiction over certain aspects of organics management that could affect the future management of biosolids in the State.

Many counties in California have developed, or are developing, ordinances for biosolids land application. The stringency of these county regulations ranges from requirements for relatively high minimum insurance to the complete or partial banning of sludge land application. Currently, Monterey County allows land application of Class B biosolids on a case-by-case basis as approved by the County Director of Health. Should the City need to haul biosolids to another county for land application, potential nearby options include:

- Santa Clara, Alameda, and Santa Barbara Counties - no regulations or ordinances currently enacted.
- Kern County - Class B land application allowed with conditions met.
- Fresno, Kings, and San Luis Obispo Counties - current ban on Class B land application but land application of Class A EQ biosolids allowed.

Updates to these biosolids regulations may arise in the future. The use and disposal of biosolids is becoming progressively more difficult in California. Land application of biosolids is restricted by many California counties, and fewer landfills are accepting biosolids.

1.3 FLOW AND LOAD EVALUATION

1.3.1 Historical and Projected Flow Analysis

The flow and load evaluation for the WWTP included an evaluation of historical wastewater flows and loads as well as future flows and loads projected for the 20-year planning horizon.

Historical wastewater flows and loads were evaluated to understand daily and seasonal trends as well as variations due to drought and non-drought conditions. Current flows and loads were compared with design criteria of the existing facility to understand regulatory compliance history and to develop capacity needs. The flow and load projections were developed based on an analysis of available historical data provided by the City, current flow monitoring conducted as part of the Collection System Master Plan, and available

information related with future land use. Projections for flows and loads were ultimately used to size the treatment process elements.

The following flow definitions are used throughout this chapter:

- **Average Daily Flow (ADF):** ADF is the average flow during a one-day period. The WWTP monthly monitoring reports (MMRs) report ADF.
- **Average Annual Flow (AAF):** AAF flow is the average of the ADF values during a calendar year.
- **Average Day Maximum Month Flow (ADMMF):** ADMMF is the largest volume of flow anticipated to occur during either a continuous 30-day period or a calendar month. The WWTP MMRs report ADMMF.
- **Peak Hour Flow (PHF):** PHF is the largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Treatment plant facilities are typically sized for specific flow parameters, as shown in Table 1.2.

Table 1.2 Basis of WWTP Sizing
Wastewater Treatment Facilities Plan
King City

Flow Parameter	Element
ADMMF, mgd	• Secondary Treatment Processes • Chemical Storage Facilities • Solids Handling Facilities
PHF, mgd	• Influent Pump Station • Headworks (bar screens and grit removal) • Secondary Clarifiers • Tertiary Filtration • Disinfection • Effluent Pump Station

Historical average daily flows from January 2008 through October 2016 from King City were analyzed and plotted separately for non-drought years (2008 through 2011, Figure 1.1) and drought years (2012 through 2016, Figure 1.2). Non-drought years generally indicated a higher AAF than drought years likely due to water conservation efforts during drought years. Non-drought years generally experienced an increase in flow and loads during the dry weather months (March to October) compared to the wet weather months likely due to the increased farmworker population during the agriculturally-intensive months.

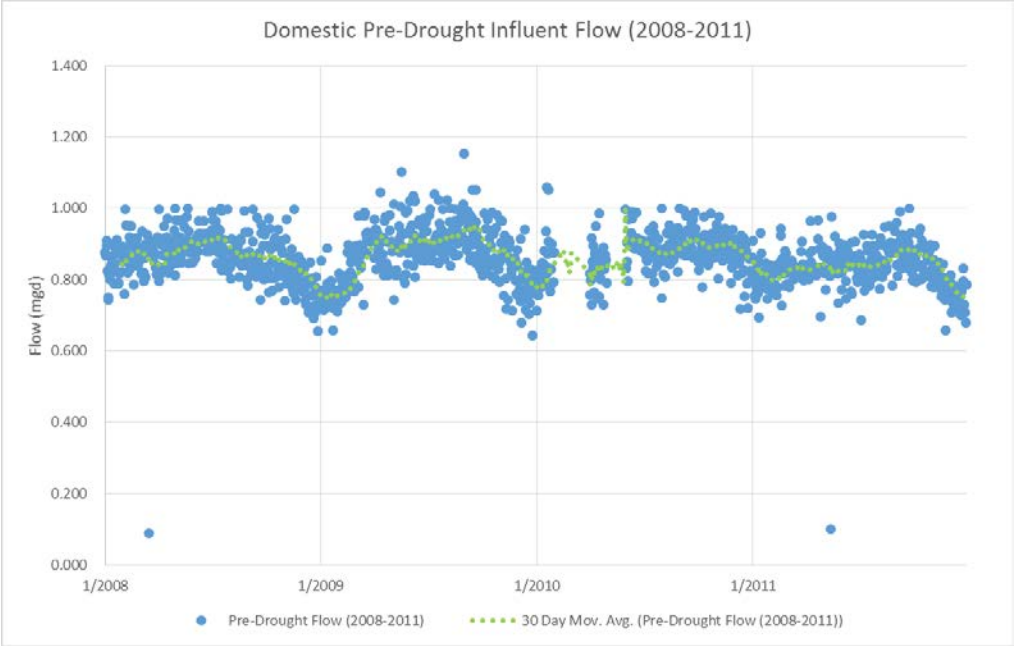

Figure 1.1 Domestic Pre-Drought Influent Flow (2008-2011)

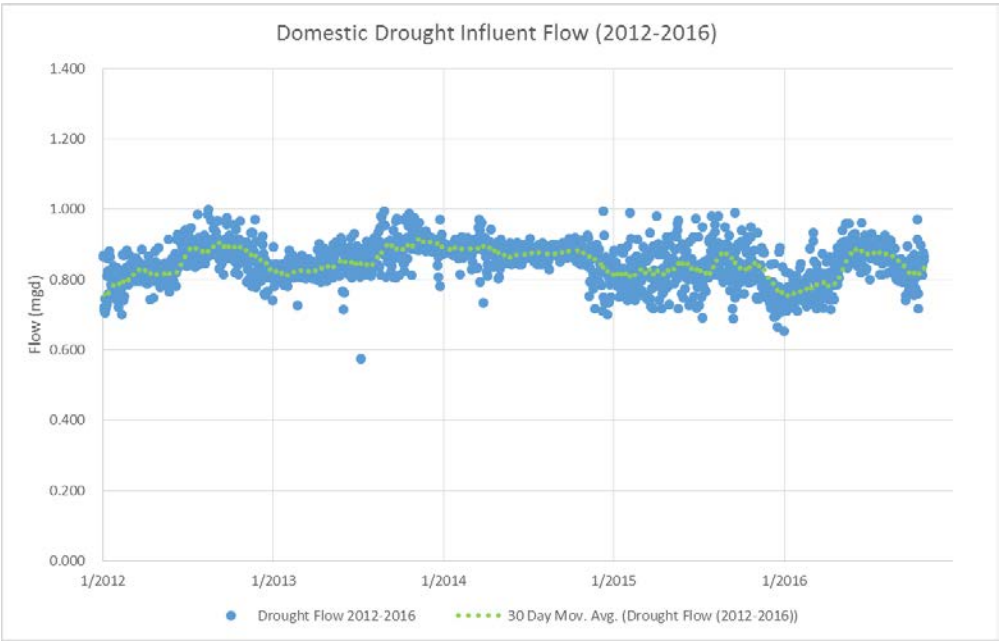

Figure 1.2 Domestic Drought Influent Flow (2012-2016)

Table 1.3 summarizes the historical flows from the monthly monitoring report data from 2008 to 2016.

Table 1.3 Historical Flow Analysis
Wastewater Treatment Facilities Plan
King City

Year	AAF, mgd	ADMMF, mgd	ADMMF/AAF Peaking Factor
2008	0.86	0.94	1.10
2009	0.87	0.98	1.13
2010	0.88	0.95	1.08
2011	0.83	0.91	1.09
2012	0.85	0.92	1.08
2013	0.86	0.93	1.07
2014	0.87	0.91	1.04
2015	0.83	0.91	1.10
2016	0.83	0.90	1.09
Non-Drought(2008-2011) Average	0.86	0.95	1.10
Drought(2012-2016) Average	0.85	0.91	1.08

As a comparison to historical flows, an analysis of potable water consumption data and GIS analysis of land use acreage was conducted. The ADMMF was calculated from flow projections and land use data and compared with water consumption data obtained from the 2015 Cal Water Urban Water Management Plan. Table 1.4 presents the data from that analysis.

Table 1.4 Water Consumption Data and Land Use Analysis
Wastewater Treatment Facilities Plan
King City

Land Use Type	Acreage	Wastewater Flow Factor, gpd/ac	Wastewater Flow, mgd
Single Family	327	1,200	0.39
Multi Family	59	2,000	0.12
Commercial	103	750	0.08
Industrial	342	550	0.19
Institutional/Governmental	144	600	0.08
Total	**975**	**-**	**0.86**

Flow projections were developed starting from current ADMMF and anticipated community growth information based on current and future land use information from a variety of historical and recent sources. Table 1.5 summarizes the analysis of flow projection by growth area. A 10-percent contingency has been included after the subtotal.

Table 1.5 Flow Projection by Growth Area
Wastewater Treatment Facilities Plan
King City

Growth Area	Number of Dwelling Units, con	Flow Factor, gal/con-d	Aerial Analysis, acre	Generation Factor, gpd/acre	Anticipated Flow, mgd
Current AAF, mgd	-	-	-	-	0.86
In-Fill Development	396	190	120	1,170	0.21
Creek Bridge(1)	170	185	-	-	0.03
Mills Ranch	368	185	-	-	0.07
Downtown Addition	650	185	-	-	0.12
New Commercial	-	-	35.3	750	0.03
Undeveloped Industrial	-	-	155	1,000	0.16
Lone Oak	-	-	-	-	-
Little Bear CSD, existing(2)	569	140	-	-	0.08
Proposed Annexations	Beyond 20-yr Planning Horizon				
Little Bear CSD, future/planned(3)	Beyond 20-yr Planning Horizon				
				Subtotal	1.56 mgd
				Contingency	10 percent
				PROJECTED AAF	**1.72 mgd**

Notes:
(1) Includes Arboleda.
(2) Only existing flows from Pine Canyon and Royal Estates (including septic and will-serve) are included in this estimate.
(3) Future/planned flows from Pine Canyon, Royal Estates, Morisoli, and Lot 71 are beyond the 20-year planning horizon of this Facility Plan.

A PHF was estimated based on routing two design storms through the collection system model developed for the 2017 Collection System Master Plan. Estimated peak flows were determined based on routing a design storm based on both a January 18, 2010 wet weather event rainfall distribution curve and a Soil Conservation Service (SCS) Type 1 rainfall distribution curve. The total rainfall for both storms was 3 inches, which corresponds to a 10-year, 24-hour storm for the City. For the January 2010 event, an estimated PHF of 2.9 mgd was produced. For the SCS Type 1 event, an estimated PHF of 3.9 mgd was produced. Hence, the more conservative PHF of 3.9 mgd will be used for development of the peaking factor. The projected design flows are summarized in Table 1.6.

Table 1.6 Projected Design Flows Wastewater Treatment Facilities Plan King City			
Flow Parameter	**Current Flows, mgd**	**Design Peaking Factor (From AAF)**	**Anticipated 20-year Design Flows, mgd**
AAF, mgd	0.86(1)	-	1.72(2)
ADMMF, mgd	0.98(3)	1.13(4)	2.00(5)
PHF, mgd	3.90(6)	4.53(7)	7.80(8)

Notes:
(1) From GIS land use analysis.
(2) From Table 1.5. Includes 10% contingency.
(3) Maximum historical ADMMF from 2008 to 2016, occurring in 2009.
(4) Maximum peaking factor from 2008 to 2016, occurring in 2009.
(5) Rounded up from 1.94.
(6) Equivalent to a 10-year, 24-hour storm for King City routed through a SCS Type 1 curve.
(7) Current PHF divided by current AAF.
(8) Rounded up from 7.79.

1.3.2 Loads Analysis

Analysis of influent 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and ammonia as nitrogen (NH_3) concentrations are typically used to evaluate the capacity of existing facilities and for sizing new secondary treatment processes. The City's WWTP, however, is not required to monitor influent domestic wastewater constituents and, therefore, has no data on record for most wastewater constituents. Only effluent constituents, including effluent BOD_5 and TSS, are reported. The most recent WWTP design criteria from the 2010 Domestic WWTP and Disposal Facility Improvements Project will be used as the preliminary design criteria for this analysis. The 2010 project anticipated influent BOD_5 loading to be 3,133 pounds per day (ppd) and TSS to be 2,662 ppd (Carollo, 2010). The 2010 design loads and the future 20-year ADMMF were used to develop the future load projections for sizing the new secondary treatment process alternatives. Table 1.7 summarizes the 2010 and future 20-year design criteria.

Table 1.7 Treatment Plant Design Loads Wastewater Treatment Facilities Plan King City			
Parameter	**2010 Design Criteria(1)**	**Equivalent Concentration at ADMMF, mg/L**	**20-yr Design Criteria**
ADMMF, mgd	1.2	-	2.0(2)
Influent BOD_5, ppd	3,133	313	5,221(3)
Influent TSS, ppd	2,662	266	4,437(3)

Notes:
(1) From 2010 Domestic Wastewater Treatment and Disposal Facilities Improvements Project (Carollo Engineers).
(2) Rounded up from 1.94 mgd.
(3) Calculated from equivalent concentration derived from 2010 Design Criteria.

1.3.3 Influent Wastewater Sampling

In addition to the preliminary design criteria developed from 2010 design loads, influent wastewater sampling is recommended to establish a baseline for influent wastewater characteristics and to refine the 20-year design criteria. An initial 2-week sampling plan was developed and sampling was conducted between April 22, 2017 through April 28, 2017 and May 11, 2017 through May 17, 2017 to coincide with anticipated peak annual dry weather flows and peak loads generated during the agricultural season. The samples were collected and analyzed by Monterey Bay Analytical Services, who currently analyze City data for regulatory reporting.

Summary tables of the recommended sampling plan and the sampling results from this initial 2-week sampling period are included in Chapter 3. The results suggest a higher average BOD, TSS, and Total Kjeldahl Nitrogen loading than was initially assumed using 2010 design criteria. To further refine the design criteria for preliminary design, additional monitoring of BOD, TSS, and nitrogen species is recommended during the 2017 dry weather agricultural season (e.g., two weeks in July and two weeks in September) and to continue on a quarterly basis until preliminary design.

1.4 EFFLUENT REUSE AND DISPOSAL

The City would like to consider effluent reuse and disposal using urban irrigation and/or agricultural irrigation when recycled water demand exists and seasonal land disposal (i.e., sprayfields or percolation ponds) when recycled water demand does not exist. Alternatives considered would need to incorporate the current and future (anticipated) regulatory landscape, including recent State policies regarding the drought, the State Groundwater Management Act (SGMA), and salt and nutrient management planning.

In California, both the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCB) have regulatory authority over projects using recycled water. The SWRCB administers statewide water rights, water pollution control, and water quality functions, while RWQCBs conduct planning, permitting, and enforcement activities. This project lies within the jurisdiction of the Central Coast Regional Board (Region 3). The Central Coast Regional Board has authority to issue WDRs and/or water reclamation requirements to the recycled water supplier, the recycled water user, or both. In lieu of the WDR and water reclamation requirements, the Central Coast Regional Board has authority to issue Master Reclamation Permits to a supplier and/or distributor of recycled water, and this option appears to be more common.

The primary regulation governing recycled water use is published in Title 22, Division 4, Chapter 3 of the California Administrative Code (Title 22). Title 22 regulations define four categories of recycled water determined by the treatment level and effluent turbidity and disinfection levels. In order to be used for agricultural spray irrigation of food crops or landscape irrigation, the City's recycled water treatment facilities would be required to meet the requirements for tertiary disinfected recycled water, which is the highest level of treatment defined by the State and allows for unrestricted reuse in virtually all recycled water applications. Domestic wastewater requires biological (secondary) treatment, filtration, and disinfection to Title 22 effluent limits before it can be considered tertiary recycled water. All of the treatment processes evaluated in this report have been accepted by the State as being capable of meeting the Title 22 regulatory requirements. Title 22 and typically the Master Reclamation Permit describe recycled water producer, distributor, and user responsibilities including permitting, inspection, training, and reporting requirements.

1.4.1 WWTP Permit Compliance History

The existing domestic effluent discharge requirements have not changed since 1991. However, since the original plant design, the regulatory climate and enforcement world has significantly changed. The regulatory climate today is increasingly stringent. Occasional permit non-compliance is no longer acceptable to the SWRCB, environmental conservation groups, or the general public. The existing WWTP relies on a pond-based treatment system for primary and secondary treatment. The system has served the City well over several decades but has a number of drawbacks: there is not sufficient room to further expand the ponds for additional treatment capacity and facultative pond performance is inherently affected by the weather (temperature, wind, and precipitation). Despite the City’s efforts to improve secondary treatment performance, ongoing permit exceedances of plant effluent limits for BOD and TSS support the need for increased secondary treatment capacity beyond the capacity of the existing ponds.

Nutrients such as nitrogen in the form of ammonia, nitrates, or total nitrogen have been identified as concerns in the Basin Plan. Other permittees in the Central Coast Region (e.g., City of Soledad) have received more restrictive limits for nitrogen in their recent permit. Nutrient management in the form of nitrogen reduction is also a priority of the Basin Plan

with the recommendation that future facility expansions include a means for nitrogen reduction.

During the March 29, 2017 meeting with Carollo, the City, and the Central Coast Regional Board to discuss the Facility Plan, the Central Coast Regional Board indicated that while the domestic and industrial WDRs are not currently being updated, significantly more stringent secondary effluent limits for BOD, TSS, ammonia, and nitrate can be expected in the future. It was discussed that future secondary effluent BOD and TSS limits of 30 mg/L each and a future total nitrogen secondary effluent limit at or lower than 10 mg/L can be reasonably expected. The Central Coast Regional Board also indicated that sprayfield effluent disposal is a nitrogen reduction strategy that will continue to be encouraged for the Salinas River Basin. Other effluent disposal methods such as percolation ponds will need to be further evaluated (such as considering groundwater levels), but may be allowed by the Central Coast Regional Board. The Central Coast Regional Board also confirmed that sprayfield or percolation pond effluent disposal would most likely not require disinfection as currently operated.

In the future, the City would like the new facility to produce tertiary effluent for reuse. The anticipated water reuse demands will be evaluated by Carollo as a separate project in conjunction with Cal Water, who provides potable water service in the City. Any recycled water produced by the City would require coordination and partnership with Cal Water because of the existing "anti-paralleling statute" (California Public Utilities Code, Chapter 8.5 Section 1501) that prohibits duplication of service within the service area of any public or private water utility without approval or payment for loss of revenue and use of facilities.

Approximately 1.7 mgd of effluent will need to be reused or disposed of on an average annual basis. Effluent disposal alternatives need to be considered for periods with little to no recycled water demands. In addition to recycled water demand, the two recommended alternatives for additional effluent disposal are sprayfields and percolation ponds. Further discussion with the Central Coast Regional Board is needed to determine the effluent quality (e.g., undisinfected or disinfected secondary or tertiary effluent) required for the effluent disposal alternatives.

Because the current sprayfields lack sufficient capacity to dispose of the entire 1.7 mgd effluent flow during periods without recycled water demands, alternatives of sprayfields, percolation ponds, and lined storage ponds must be added or combined to make a complete reuse/disposal project.

The summary of the effluent reuse and disposal alternatives evaluated using the results of individual water balances is shown in Table 1.8. The construction cost of each effluent reuse and disposal alternative is shown in Table 1.9.

Table 1.8 Initial Screening of Effluent Reuse and Disposal Options
Wastewater Treatment Facilities Plan
King City

Alternative	Existing Sprayfield Area, (ac)	New Sprayfield Area, (ac)	New Percolation Pond Area(1), (ac)	New Storage Pond Area(1), (ac)	Agricultural Irrigation, (ac)
1	54(2)	0	23(3)	0	0
2	Not Used	0	74(4)(5)	0	0
3	54(6)	0	23(7)	10	575
4(8)	54(2)	20	0	0	0
5	Not Used	0	0	61(4)(9)	575

Notes:

(1) Bottom pond area (effective percolation area) required is shown. Approximately 20 percent additional top pond area is required to account for sloped pond walls and berms.
(2) Domestic sprayfields in use year-round.
(3) 23 acres is available by converting Ponds 1A, 1B, 3, and 5. Pond 4 can be taken out of service.
(4) 33 acres is available by converting Ponds 1A, 1B, 3, 4, and 5.
(5) An additional 41 acres of percolation pond bottom area is required (approximately 50 acres of top pond area).
(6) Domestic sprayfields only in use during non-irrigation season.
(7) 23 acres is available by converting Ponds 1A, 1B, 3, and 5. Pond 4 will be converted to recycled water storage.
(8) Pond 3, pond bottom area of 4.5 acres, will be kept in service with the existing clay liner intact and used for storage of treated secondary effluent.
(9) An additional 27 acres of lined storage pond bottom area is required (approximately 33 acres of top pond area).

Table 1.9 Cost of Effluent Reuse and Disposal Options
Wastewater Treatment Facilities Plan
King City

Alternative	Capital Construction Cost(1)	Recycled Water Production, AFY
1	$2,510,000	0
2	$7,000,000	0
3	$3,450,000	891
4	$2,050,000	0
5	$9,720,000	1,773

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30% estimating contingency. See Appendix C for capital cost for water balance alternatives.

1.5 TREATMENT ALTERNATIVES ANALYSIS

Identification of treatment alternatives is needed to address the BOD_5 and TSS capacity shortfall and to treat the water to Title 22 unrestricted reuse-quality. Alternatives for each treatment process were developed and evaluated based on economic and non-economic factors. With this analysis in conjunction with input from the City, a recommended preliminary tertiary treatment facility was developed along with preliminary construction costs and a preliminary site plan.

1.5.1 Summary of Common Improvements Needed

Based on the age of the existing facilities and the drivers and objectives for the future WWTP, the majority of the existing treatment facilities must be replaced. There are several required common processes to all alternatives.

Septage Receiving Station: The City desires a new septage receiving station, which can be a source of revenue for the City and would provide a service to the surrounding communities.

Headworks: The headworks capacity must be increased to handle the design PHF of 7.8 mgd. Due to the age and condition of the existing headworks, all structural and mechanical components need to be replaced. A new headworks would include new Parshall flumes, 1/4-inch spacing mechanical bar screens, a vortex grit chamber with grit pumping and grit classifier, and new influent pump station with submersible pumps.

Flow Splitter Structure: A new flow splitter structure is proposed to follow the influent pump station to evenly distribute the flow to the new secondary treatment process.

Effluent Disposal (Irrigation) Pump Station: The existing irrigation pump station is assumed to be reused in this Facility Plan. During preliminary design, the pump station will be further evaluated for recommended improvements.

1.5.2 Identification of Secondary Treatment Options

Identification of secondary treatment options is needed to address the current and future treatment objectives and permit compliance requirements. A preliminary screening of new secondary treatment options was conducted, and those deemed feasible were further discussed with the City.

There are several treatment processes that can be used to provide additional secondary treatment capacity, either alone or in combination with other processes, in order to achieve desired effluent water quality. Table 1.10 provides a list of secondary treatment processes that are commonly considered, along with the constituents they most commonly remove.

Table 1.10 Secondary Processes Meeting Permit Discharge Requirements Wastewater Treatment Facilities Plan King City			
	Ability To Remove		
Process	Organics (BOD)(1)	Ammonia(2)	Total Nitrogen(2)
Suspended Growth			
Activated Sludge	✓	✓	✓
Attached Growth			
Trickling Filters (1-Stage)	✓		
Nitrifying Trickling Filters		✓	
Denitrification Filters			✓
Land Based Systems			
Ponds (Aerated)	✓	Summer only	

Notes:
(1) Current permit discharge requirement.
(2) Anticipated future permit discharge requirement.

Of the options considered, Carollo recommends a suspended growth, activated sludge process for the various reasons indicated in Table 1.11 and the following sections.

Table 1.11 Initial Screening of Secondary Treatment Options
Wastewater Treatment Facilities Plan
King City

Treatment Option	Adds BOD Capacity	Removes Ammonia	Improves Final UVT(1)	Reliable	Move Forward
Additional Ponds	Yes	Summer only	No	Maybe	No - Does not meet WQ objectives
Trickling Filter	Yes	Only if 2-stage	No	Yes	No
Activated Sludge	Yes	Yes	Yes	Yes	Yes

Notes:
(1) Ultraviolet Transmittance (UVT) is an important design criteria for the UV disinfection alternative as discussed in the Tertiary Treatment section of this chapter and Chapter 5.

Additional ponds could provide increased BOD and TSS removal, however, a pond system would have difficulty providing year-round ammonia and total nitrogen removal and meeting secondary effluent quality needed to support downstream processes producing Title 22 unrestricted reuse-quality tertiary effluent. The ponds would also require more land that the City desires to sell, making ponds an inviable option.

Trickling filters would also have difficulty removing ammonia and total nitrogen unless more than one stage is installed. They have unique operation and maintenance (O&M) requirements. Trickling filters are prone to intermittent high effluent TSS due to sloughing,

which makes them poor processes to include upstream of ultraviolet (UV) disinfection. They are also prone to attracting snails that strip the attached biological growth from the media, which require additional operational expenses to control. For these reasons, Carollo does not recommend trickling filters or any other attached growth process for the City.

Activated sludge processes provide reliable, year-round BOD, ammonia, and total nitrogen removal and provide the most flexibility for meeting increasingly stringent discharge requirements. The main disadvantage of these processes is they typically have a high O&M cost due to process aeration air demand. Carollo recommends moving forward with the activated sludge options and further defining these process alternatives. During a meeting with the City, the City agreed to move forward with an activated sludge option, which was further narrowed down to conventional activated sludge (CAS) using a Modified Ludzack-Ettinger (MLE) process, oxidation ditches, and membrane bioreactors (MBR).

The CAS with MLE option is a common, proven technology that is widely used to reliably remove organics, ammonia, and total nitrogen, and is easily expanded or modified to increase the overall capacity or improve the process. However, compared to oxidation ditches, this process is more operationally complex and requires additional maintenance associated with equipment used. It would also require periodic shutdowns to clean, replace, and repair equipment.

The oxidation ditch option, compared to the CAS with MLE and the MBR options, is simpler to operate, requires less maintenance, and provides a higher degree of reliability in handling shock loads and avoiding upsets. However, oxidation ditches require a larger footprint and slightly increased aeration costs due to the decreased efficiency of mechanical aeration compared to the diffused aeration used with the CAS with MLE and MBR options.

The MBR option requires the smallest footprint and can produce high quality effluent for reuse applications without the need for additional filtration processes downstream. However, MBRs require finer screening pretreatment and the membranes must be cleaned periodically with chemicals to mitigate fouling. There is also an increased energy cost associated with the additional aeration and pumping requirements.

1.5.3 Identification of Tertiary Treatment Options

Identification of tertiary treatment options is needed to address the future facility objectives and permit compliance requirements. All of the tertiary filtration and disinfection processes evaluated for this project have been accepted by the State as being capable of meeting the Title 22 requirements. Two filtration options (cloth media disk filters and continuous backwash filters) and two disinfection options (UV and chlorination) were considered. The tertiary treatment options were sized using the maximum daily diurnal flow (MDDF) instead of PHF to reduce the overall size of the facilities. On the rare occasion flow exceeds the MDDF, the flow will bypass the tertiary treatment processes and discharge directly to the sprayfields or percolation ponds.

Cloth media disk filters have a small footprint and require minimal energy and operator attention. However, they have the potential for media clogging and scaling, affecting operational run time as well as O&M time and labor.

Continuous backwash filters continuously clean the media through use of an airlift pipe and sand washer and therefore do not require backwash holding basins, waste backwash holding basins, or backwash pumps, which significantly reduces filter construction cost and increases ease of operation. However, these filters require an air compressor which increases the power cost.

UV disinfection is a physical process rather than a chemical process, therefore, no chemicals are used to disinfect the water and no disinfection residual is created that could negatively impact the receiving water. UV disinfection also typically requires a smaller footprint than sodium hypochlorite disinfection. However, UV uses more power than chlorination and has increased O&M related with equipment replacement and cleaning. There are also additional safety considerations associated with exposure to UV light and mercury release from lamp bulbs if damaged.

Sodium hypochlorite disinfection (chlorination) is a proven, reliable process, would require minimal operator attention, and can maintain a disinfectant residual within the distribution system to prevent biological growth within the pipes. However, the chlorine contact basins would require cleaning, reliance on chemical deliveries, and chemical feed and chemical mixer/injector equipment maintenance. Sodium hypochlorite could also generate disinfection byproducts (DBPs), degrade and become less effective in sunlight, and generate sodium which could impact recycled water quality. Chlorine is highly corrosive and toxic in all forms, and thus storage, shipping, and handling requires additional safety and O&M considerations.

1.5.4 Identification of Solids Treatment Options

Identification of solids treatment options is needed to address the regulatory objectives for biosolids. Any of these treatment options deemed feasible were further discussed and evaluated with the City.

Solids collected in the existing treatment system currently accumulate in the pond system and are periodically dredged and removed. With the proposed new facility, the majority of the solids generated will be waste activated sludge (WAS) generated from the secondary treatment process. An additional but smaller source of solids will be generated by the filter backwash. Several solids treatment and handling processes can be used to thicken, stabilize, and dewater wastewater sludge. The need for thickening, stabilization, and/or dewatering is dependent on which secondary treatment option is chosen. As shown in Table 1.12, for WAS produced by CAS with MLE, oxidation ditch, or MBR, there are several treatment processes that can be used for thickening, stabilization, and dewatering.

Table 1.12 Solids Treatment Options Wastewater Treatment Facilities Plan King City			
Secondary Treatment Alternative	**Solids Treatment Step Required**		
	Thickening	**Stabilization**	**Dewatering**
CAS With MLE	✓	✓	✓
Oxidation Ditch(1)			✓
MBR	✓	✓	✓

Notes:

(1) WAS generated by the 25-day solids retention time in the oxidation ditch is anticipated to comply with the pathogen reduction and vector attraction reduction requirements of the 40 CFR 503 biosolids regulations.

Thickening options include gravity belt thickeners (GBT) and rotary drum thickeners (RDT). Stabilization options include aerobic digestion and solids lagoons. Dewatering options include sludge drying beds and screw presses.

GBTs are a reliable and relatively low-maintenance process with low energy consumption. However, they produce emissions of solids, liquids, corrosive gases, and odor that may be an O&M concern for plant staff.

RDTs are self-contained processes, unlike the GBTs, therefore emissions are not an issue. They typically also have a smaller footprint and require less operator attention.

Aerobic digesters, compared to solids lagoons, have an increased process control capability, reduced facility footprint, and reduced potential for odors. However, they have increased power costs and maintenance.

Solids lagoons are reliable, easy to operate, and require little energy. However, they require a significant amount of land area, have increased potential for odors, and require periodic dredging of accumulated solids.

Sludge drying beds require minimal operator attention and are easily maintained. However, they require a significant amount of land area for drying the sludge as well as for the stockpiling of dried sludge. Operational impacts due to wet weather, including runoff, need to be considered. Drying beds also have an increased potential for odors.

Screw presses require minimal operator attention, little power, can be operated on a 24-hour schedule, and are self-contained resulting in little to no potential for odors. The dewatered sludge can also be loaded into a hopper and directly onto a hauling truck.

1.6 OPTIONS FOR OVERALL TERTIARY FACILITY AND RECOMMENDED ALTERNATIVE

A workshop was held with the City on March 30, 2017 to discuss potential treatment options, non-economic considerations associated with each treatment process, and planning-level comparative life-cycle cost estimates for each treatment option. Based on the range of options evaluated, Carollo presented two overall tertiary facility configurations for the City to consider. These two potential configurations for the overall tertiary facility (based on the secondary treatment option) are shown in Table 1.13.

Table 1.13 Recommended Configurations for Overall Tertiary Facility
Wastewater Treatment Facilities Plan
King City

Alternative	Liquid Treatment			Biosolids Treatment		
	Secondary Treatment	Filtration	Disinfection	Thickening	Stabilization	Dewatering
1	Oxidation Ditch with Secondary Clarifiers	Continuous Backwash Filter	UV	N/A	N/A	Screw Press
2	MBR	N/A	UV	Rotary Drum Thickener	Aerobic Digester	Screw Press

Based on feedback obtained from the March 30, 2017 workshop, the City prefers Alternative No. 1: headworks, oxidation ditch, secondary clarifier, continuous backwash filter, UV, and screw press. A preliminary facility site plan is shown in Figure 1.3 and a preliminary hydraulic profile for the proposed facility is shown in Figure 1.4. Given that the construction costs for Alternatives Nos. 1 and 2 are similar, the decision to move forward with Alternative No. 1 was made on a qualitative basis and from input from the City. Alternative No. 1 is further parsed into Buildout and Phasing options for both Secondary Treatment only and full Tertiary Treatment to represent four options for Capital Improvements Program implementation. The recommended number of unit processes for the Buildout and Phasing options are detailed in Table 1.14, with capital construction costs and O&M costs outlined in Table 1.15, Table 1.16, Table 1.17, and Table 1.18.

LEGEND

1. Headworks
2. Oxidation Ditches
3. RAS/WAS Pump Station
4. Secondary Clarifiers
5. Continuous Backwash Filters
6. UV Disinfection
7. Irrigation Pump Station (Existing)
8. Screw Press

N

0 150

Scale in Feet

PRELIMINARY
TERTIARY FACILITY SITE PLAN

FIGURE 1.3

KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

carollo

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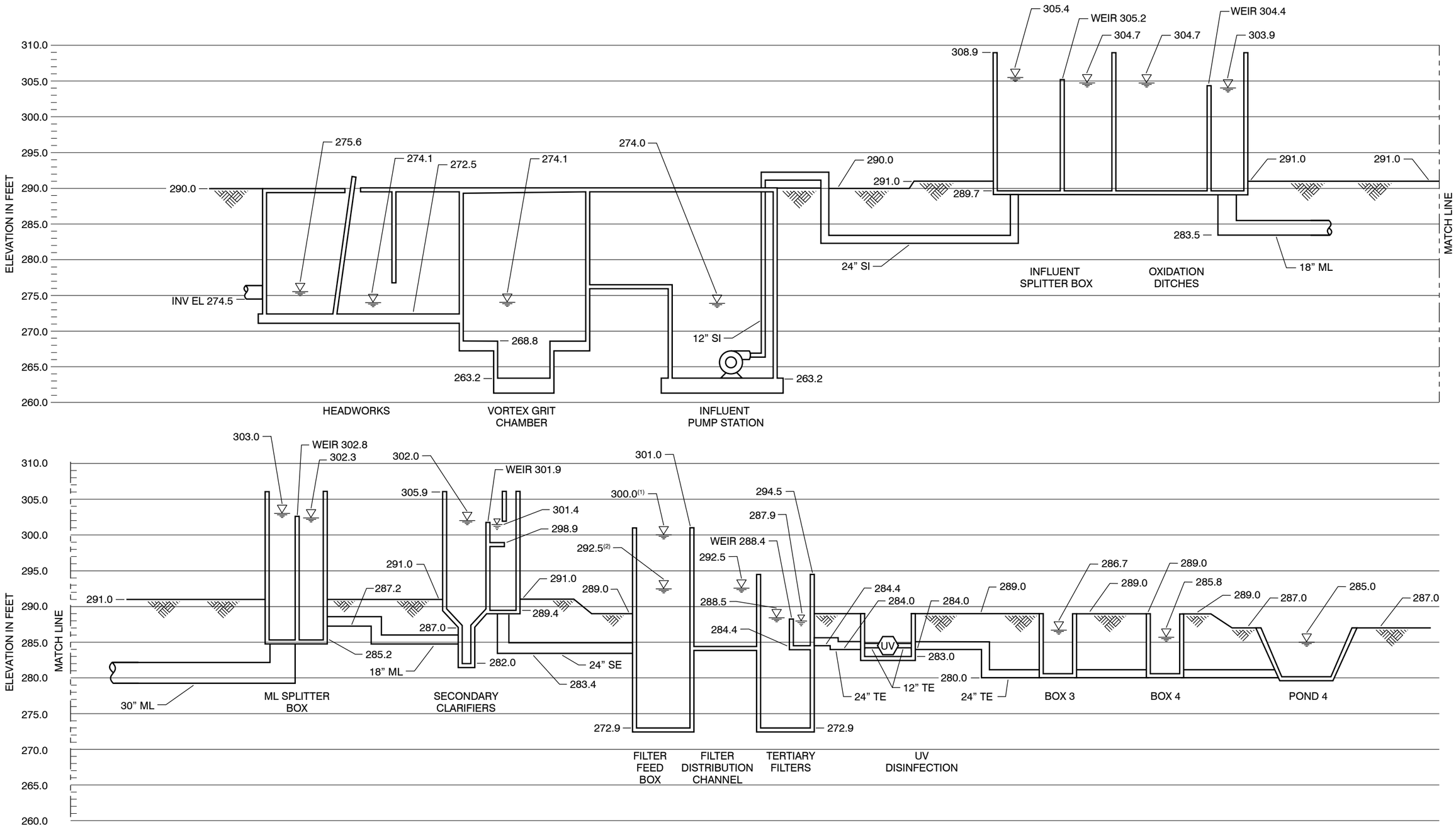

NOTES:

1. WATER SURFACE ELEVATION AT PHF 7.8 MGD.
2. WATER SURFACE ELEVATION AT MDDF 3.2 MGD.

PRELIMINARY HYDRAULIC PROFILE

FIGURE 1.4

KING CITY

WASTEWATER TREATMENT FACILITIES PLAN

carollo

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Table 1.14 Number of Process Units for the Recommended Alternative
Wastewater Treatment Facilities Plan
King City

Process	Tertiary Treatment			Secondary Treatment		
	Buildout	Phase 1	Phase 2	Buildout	Phase 1	Phase 2
Headworks	1	1	-	1	1	-
Oxidation Ditch	3	2	1	3	2	1
Secondary Clarifier	3+1	2+1	1	3+1	2+1	1
Continuous Backwash Filter	10+2	6+2	4	-	-	-
UV	3+1	2+1	1	-	-	-
Screw Press	1+1	1+1	-	1+1	1+1	-

Table 1.15 Cost of Tertiary Treatment Facility at Buildout
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost(1)(2)	Total Annual O&M Cost(3)	Present Worth of 20-yr O&M Cost(4)	Present Worth of 20-yr Life Cycle Cost(5)
Headworks	$7,670,000	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$24,120,000	$207,400	$2,854,000	$26,974,000
Continuous Backwash Filter	$13,000,000	$46,200	$636,000	$13,636,000
UV	$4,700,000	$103,300	$1,422,000	$6,122,000
Screw Press	$3,720,000	$229,600	$3,160,000	$6,880,000
Labor	-	$500,000	$6,881,000	$6,881,000
Total(6)	**$53,210,000**	**$1,125,500**	**$15,490,000**	**$68,700,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix H for capital cost item details for each element.
(2) Buildout escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-year life cycle cost = capital construction cost + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

Table 1.16 Cost of Tertiary Treatment Facility Phased
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost, Phase 1[(1)(2)]	Capital Construction Cost, Phase 2[(1)(2)]	Total Annual O&M Cost[(3)]	Present Worth of 20-yr O&M Cost[(4)]	Present Worth of 20-yr Life Cycle Cost[(5)]
Headworks	$7,670,000	-	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$7,570,000	$207,400	$2,854,000	$27,584,000
Continuous Backwash Filter	$8,690,000	$4,680,000	$46,200	$636,000	$14,006,000
UV	$3,530,000	$1,270,000	$103,300	$1,422,000	$6,222,000
Screw Press	$3,720,000	-	$229,600	$3,160,000	$6,880,000
Labor	-	-	$500,000	$6,881,000	$6,881,000
Total[(6)]	**$40,770,000**	**$13,520,000**	**$1,125,500**	**$15,490,000**	**$69,780,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020. Phase 2 escalation to midpoint of construction occurs January 1, 2023.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-yr life cycle cost = capital construction cost, phase 1 + capital construction cost, phase 2 + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

Table 1.17 Cost of Secondary Treatment Facility at Buildout
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost[(1)(2)]	Total Annual O&M Cost[(3)]	Present Worth of 20-yr O&M Cost[(4)]	Present Worth of 20-yr Life Cycle Cost[(5)]
Headworks	$7,670,000	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$24,120,000	$207,400	$2,854,000	$26,974,000
Screw Press	$3,720,000	$229,600	$3,160,000	$6,880,000
Labor	-	$300,000	$4,129,000	$4,129,000
Total[(6)]	**$35,510,000**	**$776,000**	**$10,680,000**	**$46,190,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix H for capital cost item details for each element.
(2) Buildout escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-year life cycle cost = capital construction cost + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

Table 1.18 Cost of Secondary Treatment Facility Phased Wastewater Treatment Facilities Plan King City					
Process	**Capital Construction Cost, Phase 1(1)(2)**	**Capital Construction Cost, Phase 2(1)(2)**	**Total Annual O&M Cost(3)**	**Present Worth of 20-yr O&M Cost(4)**	**Present Worth of 20-yr Life Cycle Cost(5)**
Headworks	$7,670,000	-	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$7,570,000	$207,400	$2,854,000	$27,584,000
Screw Press	$3,720,000	-	$229,600	$3,160,000	$6,880,000
Labor	-	-	$300,000	$4,129,000	$4,129,000
Total(6)	**$28,550,000**	**$7,570,000**	**$776,000**	**$10,680,000**	**$46,800,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020. Phase 2 escalation to midpoint of construction occurs January 1, 2023.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-yr life cycle cost = capital construction cost, phase 1 + capital construction cost, phase 2 + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

1.6.1 Cost Saving Alternative for Overall Tertiary Facility

Although the tertiary filtration alternative originally preferred by the City is continuous backwash filtration, an option to reduce overall facility costs was considered with cloth media disk filtration.

The success of the cloth media disk filter is contingent upon the compatibility of the filter with the secondary effluent quality to readily meet Title 22 standards. The final decision to move forward with continuous backwash filters or cloth media disk filters will be further explored during preliminary design after additional influent sampling and modeling is conducted.

The cost saving alternative includes headworks, oxidation ditch, secondary clarifier, cloth media disk filters, UV, and screw press. This tertiary treatment alternative is further parsed into Buildout and Phasing options for full Tertiary Treatment. The recommended number of unit processes for the Buildout and Phasing options are detailed in Table 1.19, with capital construction costs and O&M costs outlined in Table 1.20 and Table 1.21.

Table 1.19 Number of Process Units for the Recommended Alternative with Cloth Media Disk Filter
Wastewater Treatment Facilities Plan
King City

Process	Tertiary Treatment			Secondary Treatment		
	Buildout	Phase 1	Phase 2	Buildout	Phase 1	Phase 2
Headworks	1	1	-	1	1	-
Oxidation Ditch	3	2	1	3	2	1
Secondary Clarifier	3+1	2+1	1	3+1	2+1	1
Cloth Media Disk Filter	8+8	6+6	2+2	-	-	-
UV	3+1	2+1	1	-	-	-
Screw Press	1+1	1+1	-	1+1	1+1	-

Table 1.20 Cost of Tertiary Treatment Facility at Buildout with Cloth Media Disk Filter
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost(1)(2)	Total Annual O&M Cost(3)	Present Worth of 20-yr O&M Cost(4)	Present Worth of 20-yr Life Cycle Cost(5)
Headworks	$7,670,000	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$24,120,000	$207,400	$2,854,000	$26,974,000
Cloth Media Disk Filter	$4,090,000	$68,300	$940,000	$5,030,000
UV	$4,700,000	$103,300	$1,422,000	$6,122,000
Screw Press	$3,720,000	$229,600	$3,160,000	$6,880,000
Labor	-	$500,000	$6,881,000	$6,881,000
Total(6)	**$44,300,000**	**$1,147,600**	**$15,794,000**	**$60,094,000**

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix H for capital cost item details for each element.
(2) Buildout escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-year life cycle cost = capital construction cost + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

Table 1.21 Cost of Tertiary Treatment Facility Phased with Cloth Media Disk Filter Wastewater Treatment Facilities Plan King City					
Process	**Capital Construction Cost, Phase 1(1)(2)**	**Capital Construction Cost, Phase 2(1)(2)**	**Total Annual O&M Cost(3)**	**Present Worth of 20-yr O&M Cost(4)**	**Present Worth of 20-yr Life Cycle Cost(5)**
Headworks	$7,670,000	-	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$7,570,000	$207,400	$2,854,000	$27,584,000
Cloth Media Disk Filter	$3,060,000	$1,110,000	$68,300	$940,000	$5,110,000
UV	$3,530,000	$1,270,000	$103,300	$1,422,000	$6,222,000
Screw Press	$3,720,000	-	$229,600	$3,160,000	$6,880,000
Labor	-	-	$500,000	$6,881,000	$6,881,000
Total(6)	**$35,140,000**	**$9,950,000**	**$1,147,600**	**$15,794,000**	**$60,884,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020. Phase 2 escalation to midpoint of construction occurs January 1, 2023.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-yr life cycle cost = capital construction cost, phase 1 + capital construction cost, phase 2 + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

1.6.2 Recommended Alternative based on Preliminary Recycled Water Feasibility Analysis

The City's facility plan goals are to include enough secondary capacity in the short term to comply with anticipated new discharge requirements, produce unrestricted reuse-quality recycled water, and have enough treatment and disposal capacity to support these goals. The Preliminary Recycled Water Feasibility Analysis conducted by Carollo for Cal Water in spring 2017 concluded a maximum month recycled water demand of 94.8 acre-feet per month (AFM). A tertiary treatment capacity of 1.2 mgd is required to meet this recycled water demand for the City. Based on these facility plan goals and the City's desire to minimize initial capital costs, two additional alternatives are recommended, one with continuous backwash filters and the other with cloth media disk filters. Both include provisions for reuse/disposal facilities. These alternatives are sized for 1.3 mgd secondary

treatment capacity and 1.2 mgd tertiary treatment capacity in a phased approach. The capital costs for these alternatives are detailed in Table 1.22.

Table 1.22 Capital Costs Based on Preliminary Recycled Water Feasibility Analysis
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost, Phase 1[(1)(2)]	Capital Construction Cost, Phase 1[(1)(2)]
Headworks	$7,670,000	$7,670,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$17,160,000
Continuous Backwash Filter	$6,510,000	-
Cloth Media Disk Filter	-	$2,050,000[(4)]
UV	$2,360,000	$2,360,000[(4)]
Screw Press	$3,720,000	$3,720,000
Reuse/Disposal	$3,450,000	$3,450,000
Total	**$40,870,000**	**$36,410,000[(4)(5)]**

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Based on initial discussions, the tertiary treatment facilities could be paid for by Cal Water. In this case, the total construction cost for the City's 1.3 mgd secondary treatment facility with reuse/disposal would be $32,000,000.
(5) If the City were to build a 2.0 mgd secondary treatment facility with reuse/disposal facilities, the cost would be $38,960,000 ($35,510,000 + $3,450,000) with Cal Water paying for the tertiary filtration and disinfection facilities.

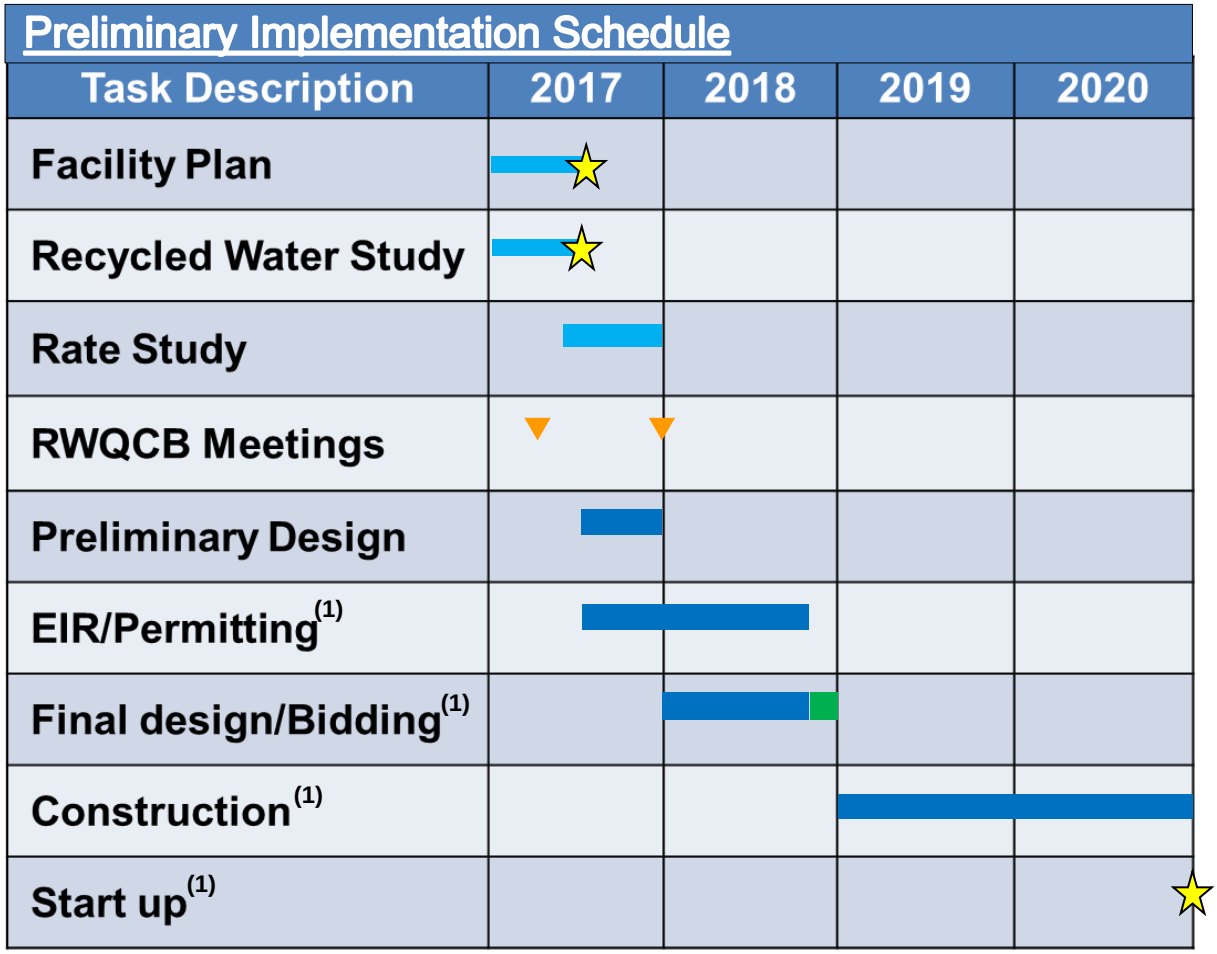
The reuse/disposal alternative would be sized to meet a Buildout ADMMF of 2.0 mgd, which is enough recycled water storage to support Alternative 4 in the Preliminary Recycled Water Feasibility Analysis as well as enough percolation and sprayfield capacity to handle the 20-year planning horizon flows. This first phase of 1.3 mgd secondary capacity would be sufficient for approximately 7 years, at which time Phase 2 would be implemented to expand the secondary capacity to meet the ADMMF of 2.0 mgd required at Buildout.

1.7 NEXT STEPS AND IMPLEMENTATION

The next step for the City is to review the options for Capital Improvements Program implementation. The recycled water study that Carollo is currently evaluating for Cal Water is a preliminary feasibility analysis, which will be used by Cal Water to decide whether or

not further recycled water feasibility analysis is warranted. The preliminary feasibility analysis and go/no-go decision by Cal Water is anticipated to be completed by July or August 2017. Should Cal Water and/or the City decide to pursue additional recycled water analysis, the next step would likely be a recycled water feasibility study that would provide planning-level documentation of uses, demands, analysis of alternatives, conceptual design of infrastructure needs, planning-level costs, and identification of funding mechanisms. At that point, additional partnership and cost-sharing opportunities could be discussed with Cal Water. For example, Cal Water may be interested in operating and maintaining the recycled water distribution system with a partnership agreement between Cal Water and the City for financing the treatment, distribution, and/or storage infrastructure.

In addition to the decision by Cal Water affecting the City's decision on effluent disposal and reuse options, the next step for the City is to choose one of the implementation alternatives. A preliminary program schedule is shown below. During the rate study process, funding sources including grant opportunities could also be developed.



Notes:

(1) Timelines for these tasks could differ based on the implementation alternative selected during preliminary design.

CURRENT AND FUTURE REGULATORY REQUIREMENTS

2.1 INTRODUCTION

The King City (City) is located in the Salinas Valley of Monterey County, California. The City owns and operates the wastewater collection, treatment, and disposal facilities that serve a population of approximately 12,900. The City's Wastewater Treatment Plant (WWTP) was originally constructed in 1970 and underwent capacity expansions in 1982, 1991, and 2010. The facility consists of a domestic treatment and disposal system as well as an industrial disposal-only system. The facility is located along the east bank of the Salinas River on Cemetery Road, King City, California 93930.

The domestic treatment facility has a design capacity of 1.2 million gallons per day (mgd) and includes the following major treatment processes:

- Headworks (flow metering, comminution/screening, and pumping).
- Treatment Ponds (five primary aerated/facultative ponds and two secondary polishing ponds).
- Effluent disposal pump station and distribution force main.
- Six spray irrigation fields for disposal of treated effluent.

Industrial wastewater from the facility known as ConAgra 45 (CAG 45) is pretreated at their own facility with a dissolved air flotation thickener (DAFT) as needed before being conveyed to the City's WWTP for disposal on seven (7) industrial wastewater sprayfields, which are separate from the domestic facility's sprayfields. No treatment of the CAG 45 wastewater occurs at the City's WWTP. The City is responsible for monitoring the industrial discharge from CAG 45. Historically, CAG 45 was an agricultural processing facility with high strength waste streams. Currently, the facility operates as a cogeneration plant with very little to no influent loading in the waste stream.

This chapter summarizes currently known regulatory requirements that affect the operation of the existing WWTP. This includes an overview of the regulations governing final effluent disposal, biosolids handling, and air emissions. Potential impacts of future regulations are also considered. Assessment of current and future regulatory requirements is critical to the development of appropriate facility planning alternatives. A more detailed discussion of regulations pertaining to unrestricted reuse-quality tertiary effluent in accordance with State Title 22 requirements will be presented in Chapter 4.

Chapter 2 summarizes:

- The City WWTP's current regulatory requirements.

- Existing federal, state, and regional regulatory requirements governing the discharge of treated wastewater, biosolids handling, and air quality (air emissions).
- Applicable new and emerging regulatory issues or policies being developed by the State Water Board or the State Legislature.

2.2 ASSESSMENT OF WATER QUALITY REGULATIONS

2.2.1 Current Water Quality Requirements

Wastewater discharges are governed by both federal and state requirements. The primary laws regulating water quality are the Clean Water Act (CWA) and the California Water Code. Under the CWA, the Environmental Protection Agency (EPA) is responsible for the regulation of the City's effluent discharges through the issuance of National Pollutant Discharge Elimination System (NPDES) permits. Municipal and industrial discharges to waters of the United States are controlled through effluent limits contained in waste discharge permits issued under the authority of the federal NPDES programs. The NPDES permitting program for California has been delegated to the State.

The California Water Code and the Porter-Cologne Act, a provision of the Code, require the State to adopt water quality policies, plans, and objectives for the protection of the State's waters. The State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCB) meet this requirement by establishing water quality criteria in regional Basin Plans, the Thermal Plan, the Ocean Plan, and the Inland Surface Waters, Enclosed Bays, and Estuaries Plan.

It is the responsibility of the SWRCB and RWQCB to preserve and enhance the quality of the state's waters through the issuance of waste discharge requirements (WDRs) to treatment facilities that discharge to land (e.g., via percolation ponds or sprayfields) and NPDES permits for treatment facilities that discharge to surface waters of the U.S. The RWQCB is also responsible for issuing recycled water permits and approving biosolids applications for dischargers within the State of California. Both the SWRCB and RWQCB have regulatory authority over projects using recycled water. Recycled water regulations will be discussed in more detail in Chapter 4.

Waste Discharge Requirements (WDRs): Permitting for the WWTP has been delegated to the Central Coast Regional Water Quality Control Board (Central Coast Regional Board).

The WWTP is currently operating under two WDRs:

- WDR Order No. 91-05 for the City of King Domestic Wastewater Facility (Domestic), which was adopted on January 11, 1991.
- WDR Order No. 91-84 for the City of King Industrial Wastewater Facility (Industrial from CAG 45), which was adopted on September 13, 1991.

Copies of the current WDR Orders are provided in Appendix A. The purpose of the WDRs is to set pollutant limits in discharges of wastewater effluent to land, including discharges to sprayfields. The WDRs also outline the general monitoring and reporting programs for the Domestic and Industrial facilities. The pollutant limits are designed to protect public health and present and future beneficial uses of receiving waters for both surface water and groundwater. The WDRs seek to preserve water quality objectives developed on a regional basis.

Each WDR permits land disposal via separate effluent disposal limitations for the domestic and industrial sprayfields.

Effluent Flow Limitations: The permitted maximum domestic discharge flow is 1.2 mgd (average daily maximum month flow [ADMMF]). The permitted maximum industrial discharge flow is 2.4 mgd from May 1 through November 30, and 1.0 mgd from December 1 through April 30 (ADMMF).

Effluent Discharge Limits: The receiving water limitations for effluent discharges to the domestic and industrial sprayfields are listed in Table 2.1. The domestic WDR requires that "the discharge shall not cause a statistically significant increase of constituents…in (the) underlying groundwater, as determined by comparison of samples collected from wells located upgradient and downgradient of the disposal area (Section C.2)." Similar language also exists in the industrial WDR.

2.2.2 Future Water Quality Requirements

Future regulatory considerations should be considered when planning for the City's WWTP needs over the next 20 years. Because continued regulatory compliance is necessary, identifying future regulatory trends is critical for:

- Developing treatment scenarios and alternatives.
- Planning space requirements for future regulatory compliance.
- Making budget considerations for major design and construction projects.

Table 2.1 Domestic and Industrial WWTP Effluent Discharge Requirements
Wastewater Treatment Facilities Plan
King City

Parameter	Domestic		Industrial	
	Monthly Average	Weekly Average	Monthly Average	Daily Maximum
Flow, mgd	1.2(1)	--	2.4(2) 1.0(3)	--
Settleable Solids, mL/L	0.8	1.2	1.0	5.0
Suspended Solids, mg/L	100	150	--	--
Total Suspended Solids Loading, ppd/ac	--	--	150(4)	200(4)
BOD_5, mg/L	100	150	1,200	1,300
BOD_5 Loading, ppd/ac	--	--	300(4)	400(4)
pH(5)	6.5 to 8.3	--	6.5 to 8.4	--
Total Dissolved Solids, mg/L	--	--	1,500	2,000
Boron, mg/L	--	--	--	1.0
Chromium (Total), mg/L	--	--	--	0.1
Copper, mg/L	--	--	--	0.2
Diethylethanolamine, mg/L	--	--	--	0.1
Zinc, mg/L	--	--	--	2.0
Nitrate, mg/L as N(6)	8	--	8	8
Sulfate, mg/L(6)	--	--	250	250
Chloride, mg/L(6)	--	--	250	250

Notes:
(1) WDR was last updated in 1991. The facility upgrade has since been completed, increasing the domestic effluent discharge capacity to a monthly mean of 1.2 mgd.
(2) On-season (May 1 through November 30).
(3) Off-season (December 1 through April 30).
(4) Maximum sprayfield loading rates.
(5) pH shall be within this range at all times.
(6) Discharge shall not cause concentrations in the downgradient groundwater to exceed these values.

Any future updates to the WDRs would likely incorporate the recommendations and/or requirements from the latest versions of the Water Quality Control Plan for the Central Coastal Basin (Basin Plan), State Resolution 68-16 (Antidegradation Policy), and the California Water Code Division 7. The WDRs may also need to include a mandatory pretreatment ordinance for any flows and loads accepted from future industrial and agricultural discharges. The Basin Plan, State Resolution 68-16, and future pretreatment ordinance are discussed in more detail in the following sections.

Basin Plan: The most recent Basin Plan was adopted by the Central Coast Regional Board in March 2016 as the Board's master water quality control planning document. It designates beneficial uses and water quality objectives for waters of the State within the Central Coast Region, including surface water and groundwater. It also includes programs of implementation to achieve water quality objectives.

The present and anticipated beneficial uses of the groundwater in the vicinity of the WWTP discharge area include domestic, agricultural, and industrial supply. The Basin Plan identifies the most frequently encountered water quality problem in the Central Coast Basin as the increase in salinity and hardness in local groundwaters. Additionally, it identifies the increasing nitrate concentration as a growing problem in the Salinas River Basin.

The 2016 Basin Plan tracks and provides recommendations by specific geographic area (hydrologic units) within the Basin. King City belongs to the Salinas River hydrologic unit which also includes Monterey Regional Water Pollution Control Agency (MRWPCA), U.S. Army Fort Hunter Liggett, California Army National Guard – Camp Roberts, the City of Paso Robles, the City of Atascadero, and parts of San Luis Obispo County. The Basin Plan recommends the following for King City (as a Salinas River discharger):

- Remain as separate treatment facilities with land disposal to evaporation/percolation systems and land application via irrigation where possible.
- Manage disposal to provide maximum nitrogen reduction via crop irrigation or wet and dry cycle percolation.
- Future facility expansions should include means for nitrogen reduction.
- Shallow groundwater monitoring will determine if additional improvements are necessary.
- Expand service area to include Pine Canyon if development continues in that area.

The City's existing WDRs currently limit the effluent nitrate concentration to 8 milligrams per liter (mg/L) (as nitrogen) and do not allow a statistically significant increase of nitrate in the receiving groundwater (as measured upgradient and downgradient of the sprayfields). Other constituents, such as sodium, chloride, Total Dissolved Solids (TDS), etc., are also regulated to not cause statistically significant increases in the concentrations in the groundwater. Inorganic chemicals, organic chemicals, and radionuclides are regulated to not exceed the limits set by the California Code of Regulations (CCR), Title 22, Chapter 15, Articles 4, 4.5, 5, and 5.5. Several groundwater monitoring wells are located upgradient and downgradient of the sprayfields to allow sampling for compliance of these groundwater constituents.

In the future, additional nitrogen reduction requirements (in the form of nitrate and/or ammonia) can be expected with future facility expansions. Land disposal through existing sprayfields could likely continue, though disposal through crop irrigation may be recommended. Furthermore, a recommendation for implementing reclaimed or recycled

water may be made, similar to recommendations already made by the Central Coast Regional Board for other Salinas River dischargers such as City of Paso Robles or the MRWPCA. Table 2.2 summarizes the Basin Plan's recent recommendations for wastewater effluent disposal within the Salinas River hydrologic unit.

Table 2.2 Basin Plan Recommendations for Salinas River Hydrologic Unit
Wastewater Treatment Facilities Plan
King City

Municipal Discharger	Current Treatment and Disposal Method	Future Recommendations
King City	Treatment: Oxidation ponds. Disposal: Sprayfields.	Maintain sprayfields; Provide maximum nitrogen reduction; Expand to Pine Canyon.
City of Atascadero	Treatment: Oxidation ponds. Disposal: Percolation ponds and golf course irrigation.	Additional connections to City sewage system.
U.S. Army Fort Hunter Liggett	Treatment: Unknown. Disposal: Sprayfields.	Maintain existing facilities and Improve spray disposal area.
California National Guard Camp Roberts	Treatment: Secondary treatment. Disposal: Percolation/evaporation ponds.	None
City of Paso Robles	Treatment: Trickling filters and oxidation ponds. Disposal: Surface water discharge and percolation ponds.	Wastewater reclamation with more stringent TDS and sodium controls.
Monterey County Department of Parks and Recreation	Unknown	None
San Luis Obispo County Service Area No. 7A (Oak Shores Development)	Treatment: Aerated ponds. Disposal: Sprayfields.	Major expansion planned; Relocate future disposal facilities far from Lake Nacimiento.
San Luis Obispo County Service Area No. 19 (Heritage Ranch)	Treatment: Aerated lagoons. Disposal: Drainageway outside Nacimiento Reservoir watershed.	None
Monterey Regional Water Pollution Control Agency	Treatment and Disposal: New regional plant producing reclaimed water for food crop irrigation.	Consolidation of Monterey Peninsula-Salinas areas with wastewater reclamation.

Antidegradation Policy: One of the main emphases of the City's WDR is to ensure protection of the groundwater underlying the WWTP vicinity. To accomplish this goal, several provisions require studies to determine that the groundwater will be protected. The

State's best practicable treatment or control (BPTC) policy is the primary document relied upon by the RWQCB for guidance.

This BPTC policy is the outcome of the SWRCB Resolution No. 68-16, known as the “Anti-Degradation Policy." It pre-dates the federal policy and is similar to the federal anti-degradation policy (40 CFR Section 131.12).

Specifically, Resolution No. 68-16 states the following:

1. *Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high qualities will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies.*
2. *Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.*

Resolution No. 68-16 establishes in (1) that where waters are of higher quality than required by State policies, such higher quality shall be maintained. The resolution also establishes the requirement in (2) that discharges to waters of the State shall be regulated to assure that the highest water quality is maintained. The discharges to waters of the State are required to use the BPTC necessary to maintain the highest water quality. The resolution is not a zero discharge standard, but a policy that existing quality be maintained when it is reasonable to do so.

In order to comply with the policy, it is important to understand the intent of BPTC as determined by the RWQCB. The RWQCB determined that BPTC applies to both treatment and control of wastewater. Treatment includes processes designed to remove constituents from wastewater discharges to levels that will not adversely impact the quality of receiving waters. Examples would include treatment facilities at the WWTP and programs such as industrial pretreatment programs. Control includes containment of constituents such that degradation of receiving waters is minimized. Examples of control of discharge include eliminating or minimizing sewer infiltration or exfiltration and concrete treatment structures.

Microconstituents and Bioaccumulative Constituents: In addition to the increasingly stringent regulation of nutrients, there is a trend towards increasing monitoring and potential

regulation of microconstituents and other contaminants of emerging concern (CECs) in the waters of California.

Microconstituents, also referred to as CECs by the EPA Office of Water, are substances that have been detected at low levels in surface waters and the environment and may potentially cause deleterious effects on aquatic life and the environment at relevant concentrations. CECs include:

- Persistent organic pollutants (POPs) such as polybrominated diphenyl ethers (PBDEs; used in flame retardants, furniture foam, plastics, etc.) and other organic contaminants.
- Pharmaceuticals and personal care products (PPCPs), including a wide suite of human prescribed drugs, over-the-counter medications, bactericides, sunscreens, and synthetic musks.
- Veterinary medicines such as antimicrobials, antibiotics, anti-fungals, growth promoters, hormones, and flea and tick control.
- Endocrine-disrupting chemicals (EDCs), including synthetic estrogens and androgens, naturally occurring estrogens, as well as many other compounds capable of modulating normal hormonal functions and steroidal synthesis in aquatic organisms.
- Nanomaterials such as carbon nanotubes or nano-scale particulate titanium dioxide.

Monitoring requirements for these trace pollutants are increasing, including requirements to analyze constituents at lower detection limits. It is likely that at some point in the future for selected constituents, water quality criteria followed by new effluent limits will be added to permits. Implementation of CEC standards is not expected in the near-term as the EPA is currently focused on assessing the potential impact CECs have on the environment, aquatic organisms, and human health.

The City should consider options and alternatives that minimize sources of these pollutants and remove them from the influent wastewater through increased source control and pollution prevention programs, where practicable. However, many of these CECs are ubiquitous, such as those found in PPCPs, and will be difficult to control at the source. The City should work with legislative and industry representatives to reduce or restrict the use of certain products where feasible and continue public outreach efforts to discourage improper disposal of consumer products.

Future Industrial and Agricultural Discharges: A mandatory pretreatment ordinance may be required for any discharge accepted by the City from industrial and agricultural sources. The City will need to evaluate the anticipated impact of any future industrial or agricultural effluent discharge and may require pretreatment of the effluent before allowing it to enter the wastewater treatment plant.

2.3 ASSESSMENT OF WASTEWATER BIOSOLIDS REGULATIONS

Sludge generated by a wastewater treatment facility is defined as biosolids once beneficial use criteria have been achieved, as determined by compliance with the EPA's Title 40 Part 503 regulations, through stabilization processes. Stabilization processes are described as those that help reduce pathogens and reduce vector attraction. Biosolids are defined as treated organic solid residuals resulting from the treatment of municipal sewage at a wastewater treatment facility. Biosolids are a product with a high carbon content and other beneficial use properties.

Several federal, state, and local regulations are in place that influence whether biosolids from municipal WWTPs can be beneficially used or disposed. Increased concern and debate over biosolids use/disposal and its associated environmental impacts have led to more stringent amendments to regulations. Changes in regulations affecting biosolids management are expected and make a flexible management program essential.

An overview of federal, state, and local biosolids regulations is discussed below. The specific relevance of pertinent biosolids regulations depends on the intended disposal method (i.e., on-site or off-site disposal) and the level of treatment achieved, whether unclassified, Class B, Class A, or Class A Exceptional Quality (EQ).

2.3.1 Federal Biosolids Regulations

Federal, state, and local agencies are responsible for regulating beneficial use/disposal of biosolids. The authority of each agency varies based on the beneficial use/disposal methods employed. However, key guidelines are established by the EPA. These guidelines are in turn implemented by state and local governments. Many state and local agencies in California have developed additional rules, guidelines, and criteria for biosolids management.

40 CFR 503 Regulations: In order to implement the long-term biosolids permitting program required by the Water Quality Act of 1987, the EPA initiated two rule-makings. The first rule-making established requirements and procedures for including biosolids management in NPDES permits, procedures for granting state biosolids management programs primacy over federal programs, and federal programs to implement biosolids permits if a state so chooses.

The second rule-making to regulate and control biosolids permitting was 40 CFR Part 503 Standards for the Use and Disposal of Sewage Sludge ("40 CFR 503"). This rule addresses three general categories of beneficial use/disposal of biosolids including:

- Land application of sewage sludge for beneficial use of organic content.
- Surface disposal of biosolids in a monofill, surface impoundment, or other dedicated site.

- Incineration of sewage sludge with or without auxiliary fuel.

Biosolids are classified by the EPA's 40 CFR 503 regulations as Class B or Class A, according to the level of pathogen reduction. Biosolids must also meet vector attraction and metal concentration limits. All biosolids must meet the ceiling concentration limits (CCL) for pollutants. Land applied biosolids must also meet either the pollutant concentration limits (PCL), cumulative pollutant loading rate (CPLR) limits, or annual pollutant loading rate (APLR) limits. Table 2.3 summarizes these limits required by 40 CFR 503 for land applied biosolids. Pathogen reduction requirements of 40 CFR 503 for land applied biosolids are summarized in Table 2.4.

Table 2.3 Pollutant Limits for Land Applied Biosolids
Wastewater Treatment Facilities Plan
King City

Pollutant	EPA CCL, mg/kg dry weight basis	EPA PCL for EQ Biosolids, mg/kg dry weight basis	EPA CPLR Limits for Biosolids, kg per hectare	EPA APLR Limits for Biosolids, kg per hectare
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Chromium	3,000	1,200	3,000	150
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum	75	-	-	-
Nickel	420	420	420	21
Selenium	100	36	36	5
Zinc	7,500	2,800	2,800	140
Applies to:	All biosolids that are land applied	Bulk biosolids and bagged biosolids	Bulk biosolids	Bagged biosolids

In addition to reducing pollutant and pathogen levels, 40 CFR 503 requirements mandate that biosolids undergo treatment to reduce the risk of vectors such as flies, mosquitoes, fleas, rodents, and birds that are attracted to the biosolids. In order to prevent the spread of disease-laden pathogens, biosolids must be treated to reduce their attractiveness to these types of vectors. Alternatively, drying the biosolids to reduce the moisture content to 10 percent or lower also meets the requirement. Vector attraction reduction requirements are summarized in Table 2.5.

Table 2.4 40 CFR 503 Biosolids Regulations – Pathogen Reduction Requirements Wastewater Treatment Facilities Plan King City	
Class A	**Class B**
• Either fecal coliform density is less than 1,000 MPN/gram of total dry solids, or the density of Salmonella species bacteria in the sludge is less than 3 MPN/4 grams of total dry solids. • Biosolids must be treated and/or meet one of the following alternatives before disposal. For more details on each treatment alternative, refer to 40 CFR 503.32(a): – Thermally treated. – High pH-high temperature treatment. – Treatment to reduce enteric virus to less than 1 PFU/4 grams of total dry solids) and viable helminth to less than 1/4 grams of total dry solids). – Treatment by composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, or pasteurization process. Specific operating conditions for each process has been specified in 40 CFR 503.32(a). – Use of processes equivalent to the above (subject to authority approval).	• Comply with site restrictions of land application of Class B biosolids as specified in 40 CFR 503.32(b)(2), (b)(3), or (b)(4). In summary, these restrictions include harvesting of certain food crops, grazing of animals, turf harvesting, and public access to lands where Class B biosolids were applied. • Biosolids must be treated and/or meet one of the following alternatives before disposal. For more details on each treatment alternative, refer to 40 CFR 503.32(b): – Geometric mean of seven samples of treated biosolids collected at the time of disposal shall meet a fecal coliform density of 2 million CFU or MPN/gram of total dry solids. – Processes that significantly reduce pathogens which include aerobic digestion, air drying, anaerobic digestion, composting, or lime stabilization. Specific operating conditions for each process has been specified in 40 CFR 503.32(b). – Use of processes equivalent to the above (subject to authority approval).
Notes: (1) CFU = Colony Forming Unit (2) PFU = Plaque Forming Unit	

Table 2.5	40 CFR 503 Biosolids Regulations – Vector Attraction Reduction Requirements Wastewater Treatment Facilities Plan King City
Alternative Number in 40 CFR 503.33(b)	**Description**
1	Mass of volatile solids shall be reduced by a minimum of 38 percent during biosolids treatment.
2	If the above requirement cannot be met, vector attraction reduction can be demonstrated by reducing volatile solids by a minimum of 17 percent by digesting a portion of previously digested biosolids anaerobically in the laboratory in a bench-scale unit for 40 additional days at a temperature between 30 and 37 degrees C.
3	If the above requirement cannot be met, vector attraction reduction can be demonstrated by reducing volatile solids by a minimum of 15 percent by digesting a portion of previously digested biosolids aerobically in the laboratory in a bench-scale unit for 30 additional days at a temperature of 20 degrees C.
4	Specific oxygen uptake rate for biosolids treated in an aerobic process is less than or equal to 1.5 mg of oxygen per hour per gram of total dry solids at a temperature of 20 degrees C.
5	Biosolids shall be treated in an aerobic process for 14 days or longer. During that time the temperature of biosolids shall be higher than 40 degrees C, with an average of 45 degrees C or higher.
6	The pH of biosolids shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 2 hours, and then at 11.5 or higher for an additional 22 hours at 25 degrees C.
7	The percent solids of material that does not contain unstabilized solids shall be equal to or greater than 75 percent based on moisture content and total solids prior to mixing with other materials.
8	The percent solids of material that contains unstabilized solids shall be equal to or greater than 90 percent based on moisture content and total solids prior to mixing with other materials.
9	Sewage sludge shall be injected below the surface of the land. No significant amount of the sewage sludge shall be present on the land surface within one hour after the sewage sludge is injected. When the sewage sludge that is injected below the surface of the land is Class A with respect to pathogens, the sewage sludge shall be injected below the land surface within eight hours after being discharged from the pathogen reduction process.

Table 2.5	40 CFR 503 Biosolids Regulations – Vector Attraction Reduction Requirements Wastewater Treatment Facilities Plan King City
Alternative Number in 40 CFR 503.33(b)	**Description**
10	Sewage sludge applied to the land surface or placed on a surface disposal site shall be incorporated into the soil within six hours after application to or placement on the land. When sewage sludge that is incorporated into the soil is Class A with respect to pathogens, the sewage sludge shall be applied to or placed on the land within eight hours after being discharged from the pathogen treatment process.

Class B Biosolids: Class B biosolids can be produced through any of the 40 CFR 503-defined Processes to Significantly Reduce Pathogens (PSRP). The quantity and quality of the processed sludge and biosolids produced must be monitored and recorded by each biosolids producer. Quality parameters include pathogen reduction, vector attraction reduction, and inorganic content (e.g., heavy metals). The PSRPs include aerobic digestion, air drying, mesophilic anaerobic digestion and static aerated pile composting. To meet Class B standards, the aerobic digestion process is typically operated for a minimum of 40 days to 60 days at 20 to 15 degrees Celsius, respectively. The air drying (sludge drying beds) process typically requires drying on sand beds or paved/unpaved basins for a minimum of three months, where the ambient average daily temperature is above 0 degrees Celsius for two of the three months. The mesophilic anaerobic digestion process can meet Class B Standards when operated between 15 days at 35 to 55 degrees Celsius and 60 days at 20 degrees Celsius. Composting operations are required to raise the temperature of biosolids to 40 degrees Celsius or higher for five days. The temperature in the compost pile must also exceed 55 degrees Celsius for four hours during the five-day period.

Land appliers must follow application restrictions and pollutant load restrictions for Class B biosolids at the time of application with regard to public contact, animal forage, and production of crops for human consumption. For example, Class B biosolids may only be applied at sites where there is no possibility of contact with the general public. These sites include certain types of agriculture, landfills, etc. Additional restrictions associated with Class B prevent crop harvesting, animal grazing, and public access for a defined period of time until environmental conditions have further reduced pathogens.

Class A Biosolids: Class A biosolids can be produced through any of the 40 CFR 503-defined Processes to Further Reduce Pathogens (PFRP). Class A biosolids have more stringent treatment requirements than Class B biosolids for pathogen reduction and may be

land applied where contact with the general public is possible (i.e., nurseries, gardens, golf courses, etc.).

The PFRPs include thermophilic anaerobic digestion, static aerated pile composting, heat drying, and pasteurization. To meet Class A standards, the thermophilic anaerobic digestion process must be operated at 50 degrees Celsius or higher for 30 minutes or longer. Composting operations are required to operate at 55 degrees Celsius or higher for three consecutive days. Heat drying must reduce the moisture content of the biosolids to 10 percent or lower. Pasteurization processes must maintain the temperature of the biosolids at 70 degrees Celsius for 30 minutes or longer.

Exceptional Quality Biosolids: Biosolids that meet the high quality pollutant concentrations limits of Table 2.3, one of the Class A pathogen reduction requirements of Table 2.4, and one of options 1 through 8 of the vector attraction reduction alternatives in Table 2.5, may be identified as EQ biosolids. EQ biosolids may be used and distributed in bulk or bag form and are not subject to general requirements and management practices other than monitoring, recordkeeping, and reporting to substantiate that the quality criteria have been met.

40 CFR 258 Regulations: In addition to the regulations set forth to govern biosolids permitting, 40 CFR 258 Solid Waste Disposal Facility Criteria was promulgated October 1991 to control the disposal of biosolids classified as solid wastes. Wastewater sludge is exempt from the definition of solid waste unless the sludge is co-disposed with household solid wastes. The regulations set forth criteria for landfills with respect to: location, design, operation, groundwater monitoring, and closure with the intent of protection of ground and surface water from contamination. The main requirement of co-disposed sludge is that it must meet the Paint Filter Liquids Test (EPA Method 9095A). This method determines the presence of free liquids in a sample. Well-dewatered sludge, such as in the case of WWTP's sludge, typically passes this test as it does not contain any free liquid.

2.3.2 State Biosolids Regulations

State biosolids beneficial use/disposal is primarily regulated by California’s SWRCB, the Division of Drinking Water (DDW) Programs, and the Regional Water Boards (Central Coast Regional Water Board regulates King City).

The California Department of Resources Recycling and Recovery (CalRecycle) oversees and regulates California’s solid waste disposal including co-disposal issues and biosolids use as a daily covering material. The main regulation dealing with land discharge of biosolids (and incineration ash) is CCR, Title 23, Division 3, Chapter 15. Other regulations and guidelines include Title 22, Division 4.5, Chapter 11; California Water Environment Association’s (CWEA) Manual of Good Practice for Agricultural Land Application of Biosolids; and the California Environmental Quality Act (CEQA).

The SWRCB's General Waste Discharge Requirements (GWDRs) for the Discharge of Biosolids to Land for use as a Soil Amendment in Agriculture, Silviculture, Horticulture, and Land Reclamation Activities covers the discharge of sewage sludge as a soil amendment. In order for such a discharge to be allowed, the sludge must have been treated, tested, and shown to be capable of being used beneficially and legally as a soil amendment as specified under 40 CFR 503. This order is intended to help streamline the regulatory process for such discharges but may not be appropriate for all sites using biosolids due to particular site-specific conditions or locations. Such sites are not precluded from being issued individual WDRs.

2.3.3 Local Biosolids Regulations

Many counties in California have developed, or are developing, ordinances for biosolids land application. The stringency of these county regulations ranges from requirements for relatively high minimum insurance to the complete or partial banning of sludge land application. Currently, Monterey County allows land application of Class B biosolids on a case-by-case basis as approved by the County Director of Health. Should the City need to haul biosolids to another county for land application, potential nearby options include:

- Santa Clara, Alameda, and Santa Barbara Counties - no regulations or ordinances currently enacted.
- Kern County - Class B land application allowed with conditions met.
- Fresno, Kings, and San Luis Obispo Counties - current ban on Class B land application but land application of Class A EQ biosolids allowed.

Updates to these biosolids regulations may arise in the future.

2.3.4 Future Regulatory Considerations for Biosolids Disposal

Biosolids generated at the City's WWTP are currently removed from the ponds only during periodic maintenance, however, future upgrades and/or expansions to the plant will likely increase the amount of biosolids generated.

The State of California does not directly regulate beneficial use of biosolids. The Regional Water Boards have the option of adopting the State's General Order for biosolids, while providing additional management requirements with no additional biosolids quality requirements. Also, CalRecycle and the California Department of Food and Agriculture (CDFA) have jurisdiction over certain aspects of organics management that could affect the future management of biosolids in the State.

Traditionally, the role of CalRecycle in biosolids beneficial use has been to define biosolids management practices that are considered landfill diversion for the purpose of municipalities attempting to meet the 50 percent landfill diversion target set by Assembly Bill (AB) 939. Landfill Alternative Daily Cover (ADC) and land application are the more common biosolids markets since they have been considered landfill diversion. However, the

following adopted and developing legislation is threatening the future viability of solids used as ADC:

- In 2012, AB 341 was adopted, which established a 75 percent landfill diversion goal. CalRecycle is in the process of defining and implementing the manner in which this goal will be achieved. This will include a decision on whether the use of biosolids as ADC will continue to be considered landfill diversion or if it will be classified as disposal.
- In 2014, AB 1594 was adopted and requires that green waste no longer qualify for diversion credit when used as ADC at a landfill. This bill may indirectly affect an agency's biosolids use/disposal program when it is fully implemented on January 1, 2020. Agencies that mix green waste with biosolids for use as ADC at landfills currently receive diversion credit under AB 939, but will no longer be able to do so for the green waste portion. It is expected that landfills will not accept biosolids (if not mixed with green waste) for ADC since they need the combination to achieve a workable moisture content.
- In 2014, Senate Bill (SB) 605 was adopted and requires the reduction of short-lived climate pollutants (including methane) to achieve statewide greenhouse gas (GHG) reduction targets. Since landfills represent 20 percent of the State's total methane emissions (a potent GHG) as a result of anaerobic degradation of organics, regulations are being developed requiring up to 90 percent diversion of organics sent to landfills by 2025. The California Air Resources Board (CARB) sees co-digestion of food waste and fats, oils, and grease with sewage sludge at WWTPs as a key strategy for achieving reductions in methane emissions across the state. The regulation requiring up to 90 percent diversion of organics from landfills is scheduled to be developed by 2018. There is concern that this or future legislation targeted at reducing statewide GHGs may eliminate the use of biosolids as ADC, may result in stricter permit requirements for biosolids (in other words required Class A disposal), and/or may eliminate the ability to dispose of biosolids at landfills altogether.

Should ADC be classified as disposal, this would end the practice of using biosolids and green waste as ADC, which would severely impact biosolids managers. However, CalRecycle may create rules specific to biosolids or help develop alternative routes (such as more extensive land application) for biosolids end-uses. Termination of landfill ADC would place capacity and price pressure on existing biosolids markets, such as compost and land application, increasing competition among utilities for available biosolids outlets.

While the state is limiting disposal options for biosolids, the state is also encouraging an increase in tracking and reporting of organic waste disposal and the eventual reduction in organic waste production. Legislation pertaining to these goals includes the following:

- Since April 2016, AB 1826 requires businesses and residential dwellings (of 5 units or more) generating 8 cubic yards (yd^3) or more of organic waste per week to arrange

for recycling services. This phased implementation bill decreases the 8 yd^3 diversion cap over time through 2020. This bill will reduce organic waste production and create market certainty for the diversion of organic waste from businesses and multifamily dwellings to a recycling service, such as WWTP anaerobic digesters.

- AB 876 requires a county or regional agency to track and annually report the amount of organic waste it will generate over a 15-year period, the additional organic waste recycling facility capacity that will be needed to process that organic waste, and identify new or expanded organic waste recycling facilities (such as WWTP anaerobic digesters) capable of safely meeting that additional need. The first report required by this legislation is due in August 2017.
- In spring 2017, the final regulation developed under AB 901 is expected to be adopted. This legislation changes how disposal and recycling is reported to CalRecycle. Waste, recycling, and compost facilities, as well as exporters, brokers, and transporters of recyclables or compost will be required to submit information directly to CalRecycle on the types, quantities, and destinations of materials that are disposed of, sold, or transferred inside or outside of the state. CalRecycle also gains enforcement authority to collect this information.

In summary, use and disposal of biosolids is becoming progressively more difficult in California. Land application of biosolids is restricted by many California counties, and fewer landfills are accepting biosolids. Numerous counties in California have developed or are currently developing ordinances for biosolids land application.

2.4 ASSESSMENT OF AIR QUALITY REGULATIONS

The federal Clean Air Act (CAA) requires the EPA to set national ambient air quality standards to protect human health and welfare. CARB is the agency responsible for coordination and oversight of State and local air pollution control programs in California and for implementing the CAA.

The agencies relevant to the City's air requirements include:

- Federal – EPA.
- State – CARB.
- Local – Monterey Bay Unified Air Pollution Control District (MBUAPCD).

These agencies issue air quality permits for the modification of existing facilities or the construction and operation of new facilities and establish new source pollutant levels and treatment requirements.

CARB has developed state air quality standards that are generally more stringent than federal standards. Other CARB duties include monitoring air quality in conjunction with local air districts, setting emissions standards for new motor vehicles, and reviewing agency

input on the State Implementation Plan (SIP). The SIP consists of emission standards for vehicles and consumer related sources set by CARB and attainment plans and rules adopted by local air districts.

The following sections provide summaries of the state air quality standards applicable to City operations.

2.4.1 State Regulations

The WWTP in the future would likely operate standby diesel engines. Any new engines would need to comply with the Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition (CI) Engines. CARB originally approved the ATCM in 2004. Subsequent to the adoption of the original ATCM in 2004, the U.S. EPA promulgated federal "New Source Performance Standards for Stationary Compression Ignition Internal Combustion Engines" (NSPS). In October 2010, CARB approved amendments to the ATCM to closely align California's requirements with those in the federal NSPS. The amended ATCM became effective May 19, 2011.

The ATCM requires a 0.15 gram per brake horsepower-hour (g/bhp-hr) particulate matter (PM) emission limit for all new emergency standby stationary compression ignition engines greater than or equal to 50 horsepower (hp). Annual maintenance and testing hours are limited to no more than 50 hours per calendar year. Local air districts may impose more limited hours. New emergency standby engines are required to meet the applicable non-methane hydrocarbon plus nitrogen oxides (NMHC+NOx), hydrocarbon (HC), and carbon monoxide (CO) Tier 2 or Tier 3 non-road CI engine emission standards, and Tier 4 standards that do not require add-on controls. Table 2.6 shows emission limits for engine sizes comparable to those likely to be used at the WWTP.

Table 2.6 ATCM Emission Standards for New Stationary Emergency Standby Diesel-Fueled CI Engines(1)
Wastewater Treatment Facilities Plan
King City

Maximum Engine Power	Particulate Matter	Non-Methane Hydrocarbon plus Nitrogen Oxides	Carbon Monoxide
600<hp<750 (450<kW<560)	0.15 (0.20)	3.0 (4.0)	2.6 (3.5)
hp>750 (kW>560)	0.15 (0.20)	4.8 (6.4)	2.6 (3.5)

Notes:
(1) All units in g/bhp-hr (g/kW-hr). May be subject to additional emission limitations as specified in current applicable district rules, regulations, or policies. Applicable to model years 2008 and later.

2.5 CROSS-MEDIA IMPACTS

The interconnection of regulations to the various areas impacted by wastewater treatment is an important consideration. Representatives from various air districts, RWQCB, Caltrans, and the EPA have been discussing the need for inter-agency coordination during the development of regulations. Cross-media regulations affect biosolids, compost processing, recycled water, AB 32 (regulating GHG emissions), CEQA, regulatory processes, development of Water Quality Control Plans (Basin Plans) and water quality standards/regulations, and impact assessments to air, water, and land media. These regulations should continue to be monitored for impacts to the facility plan implementation.

2.6 FLOOD HAZARD MITIGATION

Impacts to wastewater utilities due to flooding can include loss of power, damage to assets, and dangerous conditions for personnel. Flooding hazards can occur from severe rain events, swollen rivers, levee or dam failure, local drainage issues, and water distribution main breaks. The federal regulations pertaining to flooding are 44 CFR Parts 59, 60, 65, and 70 authorizing the National Flood Insurance Program (NFIP), which is administered by the U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA) in conjunction with state NFIP offices and local communities (e.g., cities or counties). The NFIP aims to reduce the impact of flooding on both public and private structures. The program encourages communities to adopt and enforce floodplain management regulations which help mitigate the effects of flooding on new and improved structures. Requirements for projects to comply with the NFIP are typically enforced at the local, state, and federal levels, and particularly when federal and/or state funding is sought (e.g., federal grants and/or State SRF loans).

Siting of new facility structures should consider proximity to flood hazards as defined on the current FEMA Flood Insurance Rate Maps (FIRMs). The FIRMs show areas affected by both 100-year and 500-year floods and include features such as floodways, levees, and high hazard flood elevations (Base Flood Elevations - BFEs). Critical facilities located with high hazard flood areas should be elevated above the BFEs.

The existing WWTP Domestic and Industrial WDRs also have requirements for flood protection of facilities. The Domestic WDR indicates that spray disposal areas shall be protected against 50- to 100-year frequency flood events. The Industrial WDR indicates that spray disposal areas shall be protected from 100-year frequency floods and 100-year rainfall seasons.

FLOW AND LOAD EVALUATION

3.1 INTRODUCTION

This chapter presents an evaluation of historical wastewater flows and loads at the King City (City) Wastewater Treatment Plant (WWTP), as well as the flows and loads that are projected for the 20-year planning horizon.

Historical wastewater flows and loads were evaluated to understand daily and seasonal trends, as well as variation due to drought and non-drought conditions. Current flows and loads were compared with design criteria of the existing facility and to understand regulatory compliance history. The flow and load projections developed in this chapter are based on an analysis of available historical data provided by the City, current flow monitoring conducted as part of the Collection System Master Plan, and available information related with future land use.

3.2 DEFINITIONS

The following definitions are used throughout this chapter:

- **Average Daily Flow (ADF):** ADF is the average flow during a one-day period. The WWTP monthly monitoring reports (MMRs) report ADF.
- **Average Annual Flow (AAF):** AAF flow is the average of the ADF values during a calendar year.
- **Average Day Maximum Month Flow (ADMMF):** ADMMF is the largest volume of flow anticipated to occur during either a continuous 30-day period or a calendar month. The WWTP MMRs report ADMMF.
- **Peak Hour Flow (PHF):** PHF is the largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Treatment plant facilities are typically sized for specific flow parameters, as shown in Table 3.1.

Table 3.1 Basis of WWTP Sizing Wastewater Treatment Facilities Plan King City	
Flow Parameter	**Element**
ADMMF, mgd	• Secondary Treatment Processes • Chemical Storage Facilities • Solids Handling Facilities
PHF, mgd	• Influent Pump Station • Headworks (bar screens and grit removal) • Secondary Clarifiers • Tertiary Filtration • Disinfection • Effluent Pump Station

3.3 FLOW

The WWTP currently treats municipal wastewater from the City to meet treatment standards and discharge requirements established by the Central Coast Regional Board. These requirements are outlined in the City's Waste Discharge Requirements (WDR) (Order No. 91-05), which was last renewed in 1991. The WDR discharge specifications allow an ADMMF of 1.2 mgd to the domestic sprayfields. The domestic wastewater includes all residential, commercial, and industrial wastewater that is generated within city limits, with the exception of the ConAgra 45 (CAG 45) industrial facility. CAG 45 was historically an agricultural processing facility that discharged to separate industrial sprayfields located adjacent to the domestic sprayfields. Industrial wastewater effluent was historically pretreated at the CAG 45 facility via a dissolved air flotation thickener (DAFT) prior to entering an industrial sewer for disposal on the industrial sprayfields at the WWTP.

The City monitors industrial wastewater discharge from CAG 45 under a separate WDR (Order No. 91-84). Currently, CAG 45 is a cogeneration facility with no plans to return to agricultural processing. The City has directed Carollo to exclude the CAG 45 facility from this analysis. Should CAG 45 return to agricultural or industrial processes in the future, pretreatment of the effluent would be required before accepting it into the domestic wastewater treatment plant.

3.3.1 Historical Flow Data

The historical average daily flows measured at the WWTP are reported in the MMRs as both influent and effluent flow. From January 2008 through October 2016, the data was plotted separately for non-drought years (2008 through 2011, Figure 3.1) and drought years (2012 through 2016, Figure 3.2). As expected, the non-drought years generally indicated a higher AAF than in the drought years which was likely due to water conservation efforts. Also, the non-drought years generally experienced an increase in flow and loads during the

dry weather months (March to October) compared to the wet weather months likely due to the increased farmworker population residing in the community only during agriculturally-intensive months. In comparison, during the drought years the dry weather months had less of an increase compared to the wet weather months. Flow in 2014 was relatively constant, and flow in 2015 was the lowest over the range of historical data, again likely due to water conservation efforts.

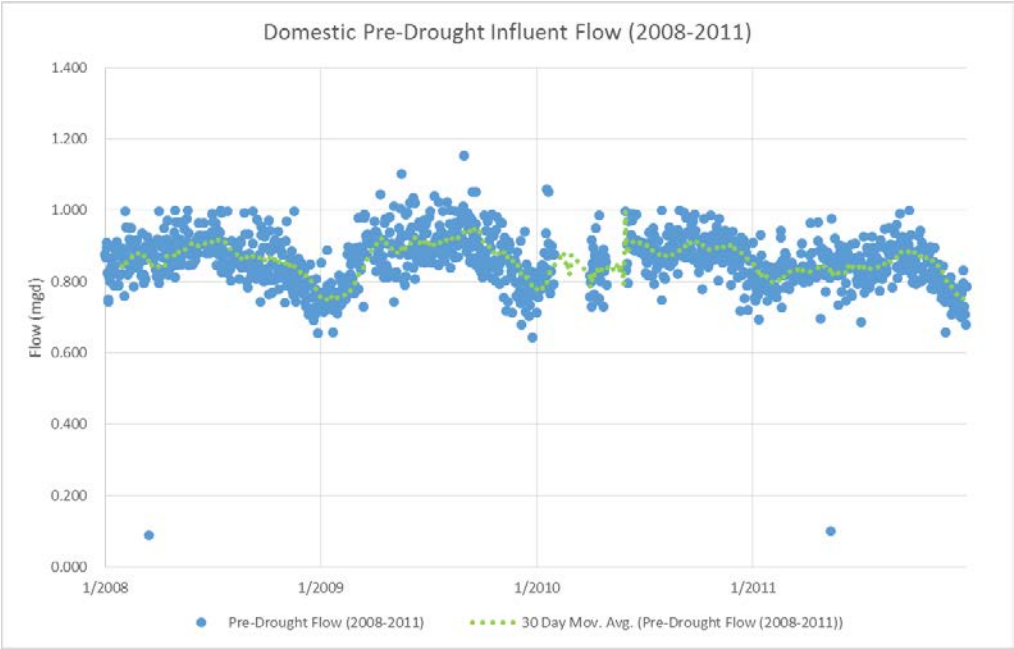


Figure 3.1 Domestic Pre-Drought Influent Flow (2008-2011)

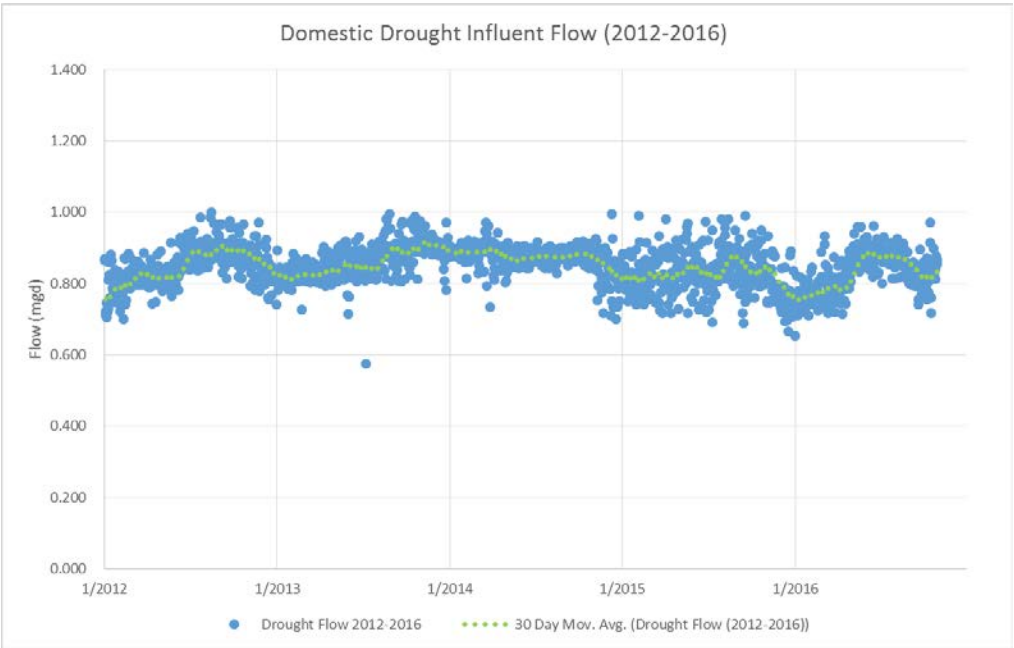


Figure 3.2 Domestic Drought Influent Flow (2012-2016)

From January 2008 through December 2011, non-drought ADMMF was approximated by calculating a 90th percentile flow of 0.94 mgd. Non-drought AAF is 0.86 mgd. From January 2012 through October 2016, drought ADMMF was approximated by calculating a 90th percentile flow of 0.91 mgd. Drought AAF is 0.85 mgd. Table 3.2 presents historical flows from 2008 to 2016.

Table 3.2 Historical Flow Analysis
Wastewater Treatment Facilities Plan
King City

Year	AAF, mgd	ADMMF, mgd	ADMMF/AAF Peaking Factor
2008	0.861	0.944	1.10
2009	0.871	0.981	1.13
2010	0.877	0.950	1.08
2011	0.830	0.905	1.09
2012	0.848	0.915	1.08
2013	0.861	0.925	1.07
2014	0.871	0.908	1.04
2015	0.826	0.910	1.10
2016	0.828	0.901	1.09
Non-Drought (2008-2011) Average	0.860	0.945	1.10
Drought (2012-2016) Average	0.847	0.912	1.08

As a comparison to historical flows, an analysis of potable water consumption data and GIS analysis of land use acreage was conducted. The ADMMF was calculated from flow projections and land use data and compared with water consumption data obtained from the 2015 Cal Water Urban Water Management Plan. Table 3.3 presents the data from that analysis.

Table 3.3 Water Consumption Data and Land Use Analysis
Wastewater Treatment Facilities Plan
King City

Land Use Type	Acreage	Wastewater Flow Factor, gpd/ac	Wastewater Flow, mgd
Single Family	327	1,200	0.39
Multi Family	59	2,000	0.12
Commercial	103	750	0.08
Industrial	342	550	0.19
Institutional/Governmental	144	600	0.08
Total	**975**	**-**	**0.86**

3.3.2 Future Flow Projections

Flow projections were developed starting from current ADMMF and anticipated community growth information based on current and future land use information from the following sources:

- King City General Plan (King City, 1998)
- Housing Element 2015-2023 (King City, 2015)
- Wastewater Master Plan (Boyle, 2007)
- Information provided by staff at Little Bear CSD
- Aerial analysis via GIS

Table 3.4 summarizes the analysis of flow projection by growth area. A 10-percent contingency has been included after the subtotal.

Table 3.4 Flow Projection by Growth Area
Wastewater Treatment Facilities Plan
King City

Growth Area	Number of Dwelling Units, con	Flow Factor, gal/con-d	Aerial Analysis, acre	Generation Factor, gpd/acre	Anticipated Flow, mgd
Current AAF, mgd	-	-	-	-	0.86
In-Fill Development	396	190	120	1,170	0.21
Creek Bridge(1)	170	185	-	-	0.03
Mills Ranch	368	185	-	-	0.07
Downtown Addition	650	185	-	-	0.12
New Commercial	-	-	35.3	750	0.03
Undeveloped Industrial	-	-	155	1,000	0.16
Lone Oak	-	-	-	-	-
Little Bear CSD, existing(2)	569	140	-	-	0.08
Proposed Annexations	Beyond 20-yr Planning Horizon				
Little Bear CSD, future/planned(3)	Beyond 20-yr Planning Horizon				
				Subtotal	1.56 mgd
				Contingency	10 percent
				PROJECTED AAF	**1.72 mgd**

Notes:
(1) Includes Arboleda.
(2) Only existing flows from Pine Canyon and Royal Estates (including septic and will-serve) are included in this estimate.
(3) Future/planned flows from Pine Canyon, Royal Estates, Morisoli, and Lot 71 are beyond the 20-year planning horizon of this Facility Plan.

The maximum peaking factor to project to ADMMF from AAF observed in the data set between 2008 and 2016 is 1.13, which occurred in July 2009. These peaking factors are shown in Table 3.5.

An initial estimate of the peak hour peaking factor that is used to project to peak hour flow (PHF) from AAF was developed by routing two design storms through the collection system model developed for the 2017 Collection System Master Plan. Estimated peak flows were determined based on routing a design storm based on both a January 18, 2010 wet weather event rainfall distribution curve and a Soil Conservation Service (SCS) Type 1 rainfall distribution curve. The total rainfall for both storms was 3 inches, which corresponds to a 10-year, 24-hour storm for the City. For the January 2010 event, an estimated PHF of 2.9 mgd was produced. For the SCS Type 1 event, an estimated PHF of 3.9 mgd was produced. Hence, the more conservative PHF of 3.9 mgd will be used for development of the peaking factor. The projected design flows are summarized in Table 3.5.

Table 3.5 Projected Design Flows
Wastewater Treatment Facilities Plan
King City

Flow Parameter	Current Flows, mgd	Design Peaking Factor (From AAF)	Anticipated 20-year Design Flows, mgd
AAF, mgd	0.86(1)	-	1.72(2)
ADMMF, mgd	0.98(3)	1.13(4)	2.00(5)
PHF, mgd	3.90(6)	4.53(7)	7.80(8)

Notes:
(1) From GIS land use analysis.
(2) From Table 3.4. Includes 10% contingency.
(3) Maximum historical ADMMF from 2008 to 2016, occurring in 2009.
(4) Maximum peaking factor from 2008 to 2016, occurring in 2009.
(5) Rounded up from 1.94.
(6) Equivalent to a 10-year, 24-hour storm for King City routed through a SCS Type 1 curve.
(7) Current PHF divided by current AAF.
(8) Rounded up from 7.79.

3.4 LOADS

3.4.1 Historical Load Data

Analysis of influent 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and ammonia as nitrogen (NH_3) concentrations are typically used to evaluate the capacity of existing facilities and for sizing new secondary treatment processes. Carollo recommends using 90th percentile loads as the basis of design of new facilities. BOD_5 and TSS loads are the primary design parameters used to determine treatment capacity of secondary treatment facilities and can be evaluated two ways: actual 90th percentile load

and/or calculated equivalent load based on 90th percentile concentration at a given design flow.

At the City, the WWTP is not required to monitor, and therefore has no record of, influent domestic wastewater constituents. Only effluent constituents, including effluent BOD_5 and TSS, are reported. The most recent WWTP design criteria from the 2010 Domestic WWTP and Disposal Facility Improvements Project will be used as the preliminary design criteria for this analysis. The 2010 project anticipated influent BOD_5 loading to be 3,133 pounds per day (ppd) and TSS to be 2,662 ppd (Carollo, 2010). The 2010 design loads and the future 20-year ADMMF were used to develop the future load projections for sizing the new secondary treatment process alternatives. Table 3.6 summarizes the 2010 and future 20-year design criteria.

Table 3.6 Treatment Plant Design Loads
Wastewater Treatment Facilities Plan
King City

Parameter	2010 Design Criteria(1)	Equivalent Concentration at ADMMF, mg/L	20-yr Design Criteria
ADMMF, mgd	1.2	-	2.0(2)
Influent BOD_5, ppd	3,133	313	5,221(3)
Influent TSS, ppd	2,662	266	4,437(3)

Notes:
(1) From 2010 Domestic Wastewater Treatment and Disposal Facilities Improvements Project (Carollo Engineers).
(2) Rounded up from 1.94 mgd as explained in Table 3.5.
(3) Calculated from equivalent concentration derived from 2010 Design Criteria.

3.5 INFLUENT WASTEWATER SAMPLING

In addition to the preliminary design criteria developed from 2010 design loads, influent wastewater sampling is recommended to establish a baseline for influent wastewater characteristics and to refine the 20-year design criteria. An initial 2-week sampling plan was developed and sampling was conducted between April 22, 2017 through April 28, 2017 and May 11, 2017 through May 17, 2017 to coincide with anticipated peak annual dry weather flows and peak loads generated during the agricultural season. The samples were collected and analyzed by Monterey Bay Analytical Services, who currently analyze the City's samples for regulatory reporting.

Summary tables of the recommended sampling plan and the sampling results from this initial 2-week sampling period are included in Tables 3.7 and 3.8, respectively. The results suggest a higher average BOD, TSS, and Total Kjeldahl Nitrogen loading than was initially assumed using 2010 design criteria. To further refine the design criteria for preliminary

design, additional monitoring of BOD, TSS, and nitrogen species is recommended during the 2017 dry weather agricultural season (e.g., two weeks in July and two weeks in September) and to continue on a quarterly basis until preliminary design. The detailed sampling water quality data are further detailed in Appendix B.

Table 3.7 Influent Water Quality Sampling Plan
Wastewater Treatment Facilities Plan
King City

Sample Parameter	Units	Sample Type[1]	Frequency[2]	Analytical Method[3]
Field Measurements:				
Influent Flow	mgd	Measured at time of sampling	7 days/week	-
pH[4]	-	Measured at time of sampling	7 days/week	-
Temperature[4]	degrees F	Measured at time of sampling	7 days/week	SM 2550 B
Routine Influent Wastewater Analysis:				
COD	mg/L	24-hr Composite	7 days/week	SM 5220 B, C, or D[5]
BOD_5	mg/L	24-hr Composite	7 days/week	SM 5210 B
Total Solids	mg/L	24-hr Composite	7 days/week	SM 2540 G
Volatile Solids	mg/L	24-hr Composite	7 days/week	SM 2540 G
Total Kjeldahl Nitrogen	mg/L	24-hr Composite	7 days/week	SM 4500-Norg B or C
Total Phosphorus	mg/L	24-hr Composite	7 days/week	SM 4500-P
Alkalinity	ppm $CaCO_3$	24-hr Composite	7 days/week	SM 2320 B
Ammonia (as N)	mg/L	24-hr Composite	7 days/week	SM 4500-NH_3 C
Nitrate (as N)	mg/L	24-hr Composite	7 days/week	SM 4500-NO_3 E[6]
Total Oxidized Nitrogen (Nitrite and Nitrate)	mg/L	24-hr Composite	7 days/week	SM 4500-NO_3 E
Total Suspended Solids	mg/L	24-hr Composite	7 days/week	SM 2540 D
Volatile Suspended Solids	mg/L	24-hr Composite	7 days/week	SM 2540 E

Table 3.7 Influent Water Quality Sampling Plan
Wastewater Treatment Facilities Plan
King City

Sample Parameter	Units	Sample Type(1)	Frequency(2)	Analytical Method(3)
Constituents for Recycled Water:				
Sulfate	mg/L	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Sodium	mg/L	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Chloride	mg/L	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Boron	mg/L	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Electrical Conductivity (EC_w)	µS/cm	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Calcium	mg/L	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Magnesium	mg/L	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Bicarbonate (HCO_3^-)	mg/L	24-hr Composite	3 times/week(7)	SM or EPA Method 200.7
Sodium Adsorption Ratio (SAR) or Adjusted SAR		Calculated	3 times/week(7)	-

Notes:

(1) Composite sampling will be flow-paced where possible and time-weighted elsewhere. Time-weighted samplers will be programmed with a non-uniform, time-weighted frequency to simulate the approximate flow characteristics.
(2) Frequency is once per day unless otherwise noted.
(3) SM refers to "Standard Methods for the Examination of Water and Wastewater, latest edition."
(4) On-line temperature and pH meters will be used where available. Otherwise, temperature and pH will be measured on grab samples obtained when the composite or grab sample is collected.
(5) HACH8000 is acceptable for COD using ranges 3-150 mg/L and 20-1500 mg/L.
(6) HACH8507 is acceptable for nitrite analysis.
(7) Sampling 3 times/week should occur on Tuesday, Thursday, and Saturday.

Table 3.8 Influent Water Quality Sampling Results[1]
Wastewater Treatment Facilities Plan
King City

Sample Parameter	Units	Sample Results[2]			Frequency[3]	Analytical Method[4]
		MIN	AVE	MAX		
Field Measurements:						
Influent Flow	mgd	1.10	1.19	1.35	7 days/week	-
pH	-	6.78	7.40	7.82	7 days/week	SM 4500-H+B
Temperature	degrees F	13.7	15.9	18.8	7 days/week	SM 2550
Routine Influent Wastewater Analysis:						
COD	mg/L	672	946	1,906	7 days/week	HACH 8000
BOD_5	mg/L	140	330	502	7 days/week	SM 5210 B
Total Solids	mg/L	894	1,082	1,400	7 days/week	SM 2540 B
Volatile Solids	mg/L	406	532	790	7 days/week	SM 2540 E
Total Kjeldahl Nitrogen	mg/L	55.3	79.3	109	7 days/week	SM 4500-NH_3 B, C.E
Total Phosphorus	mg/L	6.50	8.79	10.9	7 days/week	HACH 8190
Alkalinity	ppm $CaCO_3$	108	366	464	7 days/week	SM 2320 B
Ammonia (as N)	mg/L	44.9	65.4	98.4	7 days/week	SM 4500-NH_3 B, C; EPA Method 350.1
Nitrate (as N)	mg/L	ND	0.56	0.60	7 days/week	EPA Method 300.0
Total Oxidized Nitrogen (Nitrite and Nitrate)	mg/L	ND	0.77	1.30	7 days/week	Calculated[4]
Total Suspended Solids	mg/L	102	264	424	7 days/week	SM 2540 D
Volatile Suspended Solids	mg/L	80.0	235	386	7 days/week	SM 2540 E

Table 3.8 Influent Water Quality Sampling Results[1]
Wastewater Treatment Facilities Plan
King City

Sample Parameter	Units	Sample Results			Frequency[2]	Analytical Method[3]
		MIN	AVE	MAX		
Constituents for Recycled Water:						
Sulfate	mg/L	84.0	87.3	91.0	3 times/week	EPA Method 300.0
Sodium	mg/L	82.0	104	127	3 times/week	EPA Method 200.7
Chloride	mg/L	93.0	126	140	3 times/week	EPA Method 300.0
Boron	mg/L	0.24	0.27	0.33	3 times/week	EPA Method 200.7
Electrical Conductivity (EC_w)	µS/cm	1,216	1,445	1,664	3 times/week	SM 2510 B
Calcium	mg/L	41.0	51.9	63.0	3 times/week	EPA Method 200.7
Magnesium	mg/L	18.0	21.1	24.0	3 times/week	EPA Method 200.7
Bicarbonate (HCO_3^-)	mg/L	132	450	566	3 times/week	SM 2320 B
Sodium Adsorption Ratio (SAR)		2.70	3.07	3.80	3 times/week	Suarez, 1981
Adjusted SAR		2.40	2.82	3.20	3 times/week	Suarez, 1981

Notes:
(1) Sampling occurred during two (2) one week periods: April 22, 2017 through April 28, 2017, and May 11, 2017 through May 17, 2017.
(2) Frequency is once per day unless otherwise noted.
(3) SM refers to "Standard Methods for the Examination of Water and Wastewater, latest edition."
(4) Sum of nitrate-N and nitrite-N. Nitrite-N analyzed with EPA Method 300.0 is acceptable for nitrite analysis.

EFFLUENT REUSE AND DISPOSAL

4.1 INTRODUCTION

King City (City) would like to consider effluent reuse and disposal using urban irrigation and/or agricultural irrigation when recycled water demand exists and seasonal land disposal (i.e., sprayfields or percolation ponds) when recycled water demand does not exist. Alternatives considered would need to incorporate the current and future (anticipated) regulatory landscape, including recent State policies regarding the drought, the State Groundwater Management Act (SGMA), and salt and nutrient management planning.

Chapter 4 summarizes:

- Existing regulatory requirements governing effluent reuse and disposal.
- Compliance history of the wastewater treatment (WWTP) including review of available compliance data from January 2008 through October 2016 to identify ongoing permit issues.
- Conceptual-level design criteria for effluent disposal alternatives.
- Conceptual-level component sizing and preliminary site layouts for effluent disposal alternatives.
- Conceptual-level capital cost estimates for effluent disposal alternatives.

4.2 OVERVIEW OF EFFLUENT REUSE REGULATIONS

4.2.1 Recycled Water Regulations Overview

As discussed in Chapter 2, wastewater discharges are governed by both federal and state requirements. In California, the State Water Resources Control Board (SWRCB) administers statewide water rights, water pollution control, and water quality functions, while the nine Regional Water Quality Control Boards (RWQCBs) conduct planning, permitting, and enforcement activities. Both the SWRCB and RWQCB have regulatory authority over projects using recycled water.

The SWRCB establishes general policies governing the permitting of recycled water projects consistent with its role of protecting water quality and sustaining water supplies. The SWRCB also exercises general oversight over recycled water projects, including review of RWQCB permitting practices. The SWRCB's Division of Drinking Water (DDW) (formerly, California Department of Public Health) is charged with protection of public health and drinking water supplies and with the development of uniform water recycling criteria appropriate to particular uses of water. The RWQCB is charged with protection of surface

water and groundwater resources and with the issuance of permits that implement DDW recommendations.

This project lies within the jurisdiction of the Central Coast Regional Water Quality Control Board (Central Coast Regional Board) (Region 3). The Central Coast Regional Board has authority to issue Waste Discharge Requirements (WDRs) and/or water reclamation requirements to the recycled water supplier, the recycled water user, or both. In lieu of the WDR and water reclamation requirements, the Central Coast Regional Board has authority to issue Master Reclamation Permits to a supplier and/or distributor of recycled water, and this option appears to be more common.

4.2.2 Title 22 of the California Code of Regulations

The primary regulation governing recycled water use is published in Title 22, Division 4, Chapter 3 of the California Administrative Code (Title 22). Title 22 regulations define four categories of recycled water determined by the treatment level and effluent turbidity and disinfection levels, which are summarized in Table 4.1. In order to be used for agricultural spray irrigation of food crops or landscape irrigation, the City's recycled water treatment facilities would be required to meet the requirements for tertiary disinfected recycled water, which is the highest level of treatment defined by the State and allows for unrestricted reuse in virtually all recycled water applications. Domestic wastewater requires biological (secondary) treatment, filtration, and disinfection to Title 22 effluent limits before it can be considered tertiary recycled water. All of the treatment processes evaluated in this report have been accepted by the State as being capable of meeting the Title 22 regulatory requirements described hereafter.

In Title 22 tertiary disinfected recycled water, filtration through granular media must produce a daily average turbidity not exceeding 2 nephelometric turbidity units (NTU), a 95th percentile turbidity not exceeding 5 NTU, and a turbidity never exceeding 10 NTU. Colloidal and finely divided suspended matter must be “destabilized and agglomerated upstream from a filter by the addition of suitable floc forming chemical.” The filtration rate cannot exceed 5 gallons per minute per square foot (gpm/sq ft). Floc-forming chemicals must be added continuously, or automatically when the influent turbidity is greater than 5 NTU. Membrane filtration facilities must produce a 95th percentile turbidity of 0.2 NTU and never exceed 0.5 NTU.

Chlorine disinfection facilities must provide a *CT* value (the product of chlorine residual and modal contact time) of 450 milligram-minutes per liter (mg-min/L) with a modal contact time of at least 90 minutes based on peak dry weather flow. Alternative disinfection systems such as ultraviolet (UV) disinfection must be approved by the State as providing a 5-log virus removal efficiency in combination with the filtration process. In addition, the median concentration of total coliform bacteria in the disinfected tertiary effluent cannot exceed 2.2 most probable number (MPN) per 100 milliliters, and no single sample can exceed 23 MPN per 100 milliliters.

Recycled water regulations require that recycled water shall not be allowed to escape from any use area as surface flow that would either pond and/or enter waters of the State. Use area requirements are detailed in Title 22, Division 4, Section 60310 and typically in the Master Reclamation Permit. In addition, Title 22 and typically the Master Reclamation Permit describe recycled water producer, distributor, and user responsibilities including permitting, inspection, training, and reporting requirements.

Table 4.1 Approved Uses of Recycled Water
Wastewater Treatment Facilities Plan
King City

Treatment Level	Approved Uses	Total Coliform Standard (median)
Disinfected Tertiary Recycled Water	Spray Irrigation of Food Crops Landscape Irrigation(1) Non-restricted Recreational Impoundment	2.2 MPN/100 mL
Disinfected Secondary - 2.2 Recycled Water	Surface Irrigation of Food Crops Restricted Recreational Impoundment	2.2 MPN/100 mL
Disinfected Secondary - 23 Recycled Water	Pasture for Milking Animals Landscape Irrigation(2) Landscape Impoundment	23 MPN/100 mL
Undisinfected Secondary Recycled Water	Surface Irrigation of Orchards and Vineyards(3) Fodder, Fiber, and Seed Crops	N/A

Notes:
(1) Includes unrestricted access golf courses, parks, playgrounds, school yards, and other landscaped areas with similar access.
(2) Includes restricted access golf courses, cemeteries, freeway landscapes, and landscapes with similar public access.
(3) No fruit is harvested that has come in contact with irrigating water or the ground.

4.2.3 Recycled Water Policy

The SWRCB recognizes that a burdensome and inconsistent permitting process can impede the implementation of recycled water projects. In 2009, the SWRCB adopted a new Recycled Water (RW) Policy, SWRCB Res No. 2009-0011. The stated purpose of the Policy is “to increase the use of recycled water from municipal wastewater sources […]” (SWRCB, 2012) to allow the state to become more independent from its existing water supply sources, which are subject to significant climatic disruptions. In addition, as a separate measure, the Policy helps to “preserve, enhance, and restore the quality of California’s water resources” (SWRCB, 2009). The RW Policy establishes more uniform

requirements for water recycling throughout the State and streamlines the permit application process in most instances.

The RW Policy includes a mandate that the State increase the use of recycled water over 2002 levels by at least 200,000 acre-feet per year (AFY) by 2020 and by at least 300,000 AFY by 2030. Also included are goals for stormwater reuse, conservation, and potable water offsets by recycled water. The responsibility for achieving these mandates and goals is placed both on recycled water purveyors and potential users.

According to the RW Policy, most recycled water irrigation projects that meet DDW requirements and other State or Local regulations can be adopted by the RWQCBs within 120 days. These streamlined projects will not require a monitoring component.

4.2.4 Recycled Water General Order

The SWRCB adopted a General Order (WQO 2014-0090) on June 3, 2014 to streamline permitting for recycled water. Coverage under this General Order is limited to treated municipal wastewater for non-potable uses. It does not apply to the use of recycled water for groundwater recharge or the disposal of treated wastewater by means of percolation ponds. The General Order establishes standard conditions for the use of recycled water, relieving producers, distributors, and users of recycled water from the sometimes lengthy permit approval process and providing them with certainty around the requirements that they will be expected to meet.

If the City were to develop the new wastewater treatment facility to include production of recycled water, a new recycled water permit would be required. Though a site-specific permit may ultimately be needed, it is advantageous for the City to pursue permitting under this WQO as a first step. To obtain coverage under the Order, the City will be required to submit a Notice of Intent and an application fee to the Central Coast Regional Board.

4.2.5 Salt and Nutrient Management Plan

The 2009 RW Policy requires that local stakeholders, such as local water and wastewater entities, develop salt and nutrient management plans (SNMP) for each groundwater basin using recycled water in California. The purpose of the plans is to protect groundwater from accumulating salts and nutrients that would otherwise degrade groundwater quality and limit its uses. The plans will be adopted by the RWQCBs as amendments to the regions' Basin Plan. The policy required completion of the plans by May 14, 2014, with the possibility for a two-year extension (until May 14, 2016) if substantial progress was demonstrated.

To date, within the Greater Monterey County Integrated Regional Water Management (IRWM) planning region (which includes King City), no one has formally initiated the salt and nutrient management planning process. However, the Greater Monterey County IRWM is in the process of updating the IRWM Plan (between February 2017 and October 2018) to

address arsenic, nitrate, perchlorate, and chromium-VI in communities impacted by these contaminants in the region. Meanwhile, the Central Coast Regional Board has been including language in new stormwater permits pertaining to coordination requirements for salt and nutrient management.

The SWRCB Staff has proposed an amendment to the RW Policy to add monitoring requirements for contaminants of emerging concern (CECs) in recycled water. In 2009, in accordance with the RW Policy, the SWRCB convened a science advisory panel (Panel) to provide guidance on future actions related to monitoring CECs in recycled water. This Panel submitted a report titled: “Monitoring Strategies for Chemicals of Emerging Concern in Recycled Water – Recommendations of a Science Advisory Panel” (Panel Report). The Panel Report provided recommendations for monitoring specific CECs in recycled water used for groundwater recharge reuse. For recycled water used for landscape irrigation, the Panel did not recommend monitoring of CECs, but recommended monitoring of some surrogates. The SWRCB incorporated the Panel’s recommendations into a proposed amendment to the RW Policy.

4.2.6 WWTP Permit Compliance History

Since the original plant design, the regulatory climate and enforcement world has significantly changed. Mandatory minimum penalties were implemented by the SWRCB in 1999 and began to be enforced in 2006. Today, the regulatory climate is increasingly stringent. Occasional permit non-compliance is no longer acceptable to the SWRCB, environmental conservation groups, or the general public.

The mission of the SWRCB is:

> *To preserve, enhance, and restore the quality of California’s water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations.*

The SWRCB and the nine RWQCBs are charged with protecting water quality. Doing so requires regular updates to regulatory requirements based on the latest research and data. As a result, permits including WDRs are consistently getting more stringent over time.

The existing WWTP relies on a pond-based treatment system for primary and secondary treatment. The system has served the City well over several decades but has a number of drawbacks: there is not sufficient room to further expand the ponds for additional treatment capacity, and facultative pond performance is inherently affected by the weather (temperature, wind, and precipitation).

The WWTP must comply with regulatory requirements established by its WDRs. For this Facility Plan, the major regulatory requirements that affect the operation of the WWTP were reviewed along with the WWTP's compliance record. A summary of the permitting issues that affect the proposed Facility Plan is provided below.

Secondary Treatment: As discussed in Chapter 2 and summarized in Table 2.1, the existing domestic effluent discharge requirements have not changed since 1991. Ongoing permit exceedances of plant effluent limits for biochemical oxygen demand (BOD) and total suspended solids (TSS) indicate a need for additional secondary treatment capacity. There were at least 24 BOD exceedances and 40 TSS exceedances during January 2008 through October 2016. This same issue was noted in the 2007 Master Plan Update, which led to the deepening of and the addition of aerators in Ponds 1A and 1B in 2010. Despite the City's efforts to improve secondary treatment performance, the ongoing permit exceedances of plant effluent limits for BOD and TSS support the need for increased secondary treatment capacity beyond the capacity of the existing ponds.

As regulatory requirements have gotten more stringent over the years and with the initiation of mandatory minimum penalties in 2000, it will become more difficult in the future to reliably meet permit compliance with the pond system. As discussed earlier in this chapter, Title 22 tertiary disinfected recycled water is required to meet very stringent effluent limits of filtration and disinfection parameters. In order to meet these tertiary treatment requirements, secondary effluent must be treated to a much higher quality than is typically achievable with a pond-based system, especially for BOD and TSS.

Nutrients and Emerging Contaminants: Nutrients such as nitrogen in the form of ammonia, nitrates, or total nitrogen have been identified as concerns in the Basin Plan. Other permittees in the Central Coast Region (e.g., City of Soledad) have received more restrictive limits for nitrogen in their recent permit. Nutrient management in the form of nitrogen reduction is also a priority of the Basin Plan with the recommendation that future facility expansions include a means for nitrogen reduction because facultative ponds have difficulty removing nitrogen during cold-weather months. The need for year-round nitrogen reduction in the future will likely be beyond the capacity of the existing ponds.

CECs include pharmaceuticals and personal care products, industrial chemicals present at low concentrations, and endocrine-disrupting chemicals. In general, these and other low-concentration contaminants have been identified as potential future issues for both effluent discharges and recycled water applications. It was determined, however, that permitting around CECs would likely not take affect within the 20-year planning window for this Facility Plan.

Disinfection: The existing WDR does not have requirements for effluent disinfection. In order to meet Title 22 tertiary disinfected recycled water requirements, new disinfection facilities will need to be planned.

During the March 29, 2017 meeting with Carollo, the City, and the Central Coast Regional Board to discuss the Facility Plan, the Central Coast Regional Board indicated that while the domestic and industrial WDRs are not currently being updated, significantly more stringent secondary effluent limits for BOD, TSS, ammonia, and nitrate can be expected in the future. It was discussed that future secondary effluent BOD and TSS limits of 30 mg/L

each and a future total nitrogen secondary effluent limit at or lower than 10 mg/L can be reasonably expected. The Central Coast Regional Board also indicated that sprayfield effluent disposal is a nitrogen reduction strategy that will continue to be encouraged for the Salinas River Basin. Other effluent disposal methods such as percolation ponds will need to be further evaluated (such as considering groundwater levels), but may be allowed by the Central Coast Regional Board. The Central Coast Regional Board also confirmed that sprayfield or percolation pond effluent disposal would most likely not require disinfection as currently operated.

4.3 CONCEPTUAL-LEVEL DESIGN CRITERIA

4.3.1 Overview of Effluent Reuse and Disposal

As future regulations become more stringent, the existing ponds will have difficulty meeting year-round secondary effluent requirements and Title 22 unrestricted reuse-quality effluent. Recommendations for treatment alternatives that can meet future secondary and tertiary effluent quality requirements are discussed in Chapter 5.

Recommendations for recycled water uses and demands in the King City area are currently being evaluated in a separate study conducted by Cal Water and Carollo. Cal Water provides potable water service in the City. Water served by the Cal Water district comes from local groundwater with an existing system consisting of six wells, three storage tanks, six booster pumps, and more than 29 miles of pipeline. Cal Water has been delivering an average of 2.5 mgd to more than 2,500 service connections in the last five years.

Any recycled water produced by the City would require coordination and partnership with Cal Water because of the existing "anti-paralleling statute" (California Public Utilities Code, Chapter 8.5 Section 1501) that prohibits duplication of service within the service area of any public or private water utility without approval or payment for loss of revenue and use of facilities. For example, Cal Water could be interested in operating and maintaining the recycled water distribution system with a partnership agreement between Cal Water and the City for financing the treatment, distribution, and/or storage infrastructure.

The recycled water study that Carollo is currently evaluating for Cal Water is a preliminary feasibility analysis, which will be used by Cal Water to decide whether or not further recycled water feasibility analysis is warranted. The preliminary feasibility analysis and go/no-go decision by Cal Water is anticipated to be completed by June 2017. Should Cal Water and/or the City decide to pursue additional recycled water analysis, the next step would likely be a recycled water feasibility study that would provide planning-level documentation of uses, demands, analysis of alternatives, conceptual design of infrastructure needs, planning-level costs, and identification of funding mechanisms.

4.3.2 Effluent Reuse and Disposal Alternatives

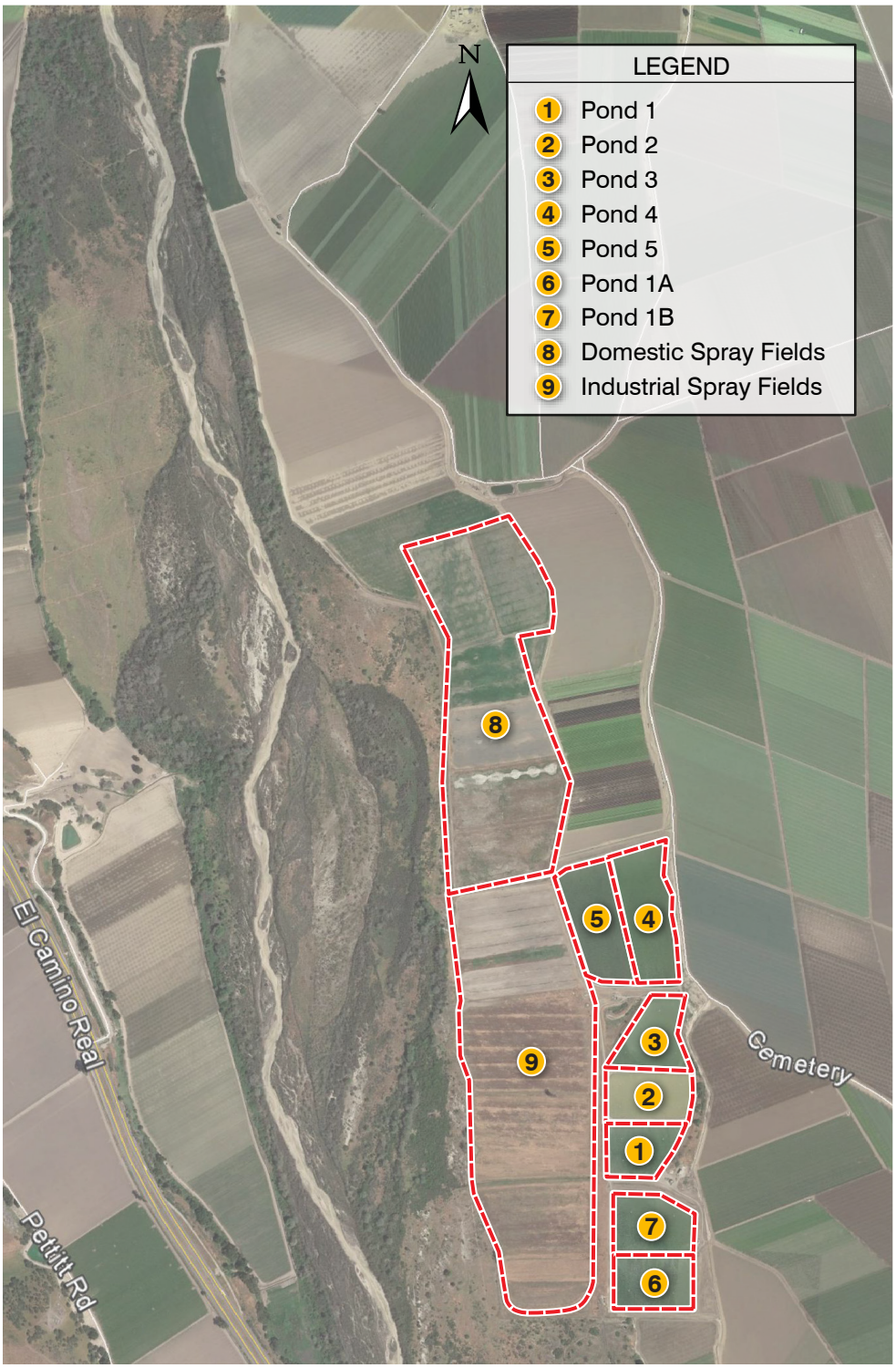
The primary goal of the new facility is to produce tertiary effluent for reuse. The anticipated water reuse demands will be evaluated by Carollo as a separate project in conjunction with Cal Water. Depending on future recycled water demands, the WWTP will need to include modifications to the current effluent disposal scheme. Options for modification of the reuse and disposal facilities may include use of the existing domestic sprayfields or conversion of the existing treatment ponds to percolation basins. The existing facilities are displayed in Figure 4.1 and a summary of the existing facility's sprayfield and pond dimensions is shown in Table 4.2.

Table 4.2 Existing Facility Dimensions
Wastewater Treatment Facilities Plan
King City

Location	Bottom Area, ac	Top Area(1), ac	Volume(2), AF
Pond 1A	5.0	6.5	61.1
Pond 1B	4.9	6.3	61.1
Pond 1	4.4	5.3	50.0
Pond 2	4.6	5.6	51.4
Pond 3	4.5	5.5	51.4
Pond 4	9.8	10.3	48.3
Pond 5	8.7	9.6	48.3
Domestic Sprayfields	-	54(3)	-
Industrial Sprayfields	-	65(4)	-

Notes:
(1) Pond top area estimated from aerial ortho-photography from 2016 Google Earth image.
(2) Pond volume estimated from the 2010 Domestic Wastewater Treatment and Disposal Facility Improvements drawings (2010 Carollo).
(3) Domestic sprayfields area estimated from 2016 Google Earth image. 2010 Carollo drawings state 65 acres.
(4) Industrial sprayfields area estimated from 2016 Google Earth image and plant staff input.

In the future, approximately 1.7 mgd of effluent will need to be reused or disposed of on an average annual basis. Effluent disposal alternatives need to be considered for periods with little to no recycled water demands. In addition to recycled water demand, the two recommended alternatives for additional effluent disposal are sprayfields and percolation ponds. Further discussion with the Central Coast Regional Board is needed to determine the effluent quality (e.g., undisinfected or disinfected secondary or tertiary effluent) required for the effluent disposal alternatives.



EXISTING FACILITIES

FIGURE 4.1

CITY OF KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

carollo

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Sprayfields: Approximately 54 acres of domestic sprayfields are currently used for domestic undisinfected secondary effluent disposal, at a permitted capacity of 0.8 inches/day. Grass is grown on the sprayfields. Effluent disposal occurs through a combination of evapotranspiration and percolation.

Percolation Ponds: An alternative to sprayfields is earthen percolation ponds, which would provide both storage volume as well as percolation disposal capacity. For this analysis, the design percolation rate is 0.8 inches/day, which is a conservative percolation value for the silty sand soil underlying the treatment ponds. The percolation ponds would be constructed within the existing oxidation ponds with modifications to the pond bottoms to improve permeability (i.e., removal of the existing clay liner).

The percolation ponds would be operated with a 2-foot freeboard. In general, the greater the pond water depth, the greater the percolation rate. Actual pond capacity varies from pond to pond as well as seasonally based on factors such as the time of year, specific geotechnical features, groundwater elevation, and the groundwater influence from adjacent percolation ponds.

Lined Storage Ponds: Another alternative to sprayfields or percolation ponds is lined storage ponds, which would provide storage volume for non-potable recycled water used for agricultural irrigation.

Agricultural Irrigation: Another alternative to sprayfields, percolation ponds, or storage ponds is disposal of non-potable recycled water on agricultural land for irrigation.

Water Balance: Because the current sprayfields lack sufficient capacity to dispose of the entire 1.7 mgd effluent flow during periods without recycled water demands, alternatives of sprayfields, percolation ponds, and lined storage ponds must be added or combined to make a complete reuse/disposal project.

The proposed tertiary facility siting for secondary, tertiary, and solids treatment facilities is within existing Ponds 1 and 2 (10.9 acres total). These are the two ponds closest to the existing headworks and outside of the 100-year FEMA Zone A special flood hazard area. The existing facility has additional land from Ponds 1A, 1B, 3, 4, and 5 (approximately 38 acres total) that could potentially be converted into additional sprayfields, percolation ponds, and/or lined storage ponds. The existing facility also has approximately 65 acres of industrial sprayfields that are currently used at varying capacities throughout the year, which could be considered for additional domestic sprayfields or converted into percolation or storage ponds. Based on the age of the sprayfields as well as information obtained from City staff regarding ponding issues, it is recommended that percolation rates be tested during preliminary design to determine whether sprayfield improvements (e.g., additional ripping or disking of vegetated fields) will be required.

A preliminary water balance analysis was conducted using average annual effluent flow estimates (over a monthly distribution) and estimated rates for effective irrigation, percolation, precipitation, and evaporation (as applicable) for sprayfields, percolation ponds, and storage ponds. A detailed breakdown of the water balance alternatives and costs are shown in Appendix C. Based on this analysis, five alternatives were considered:

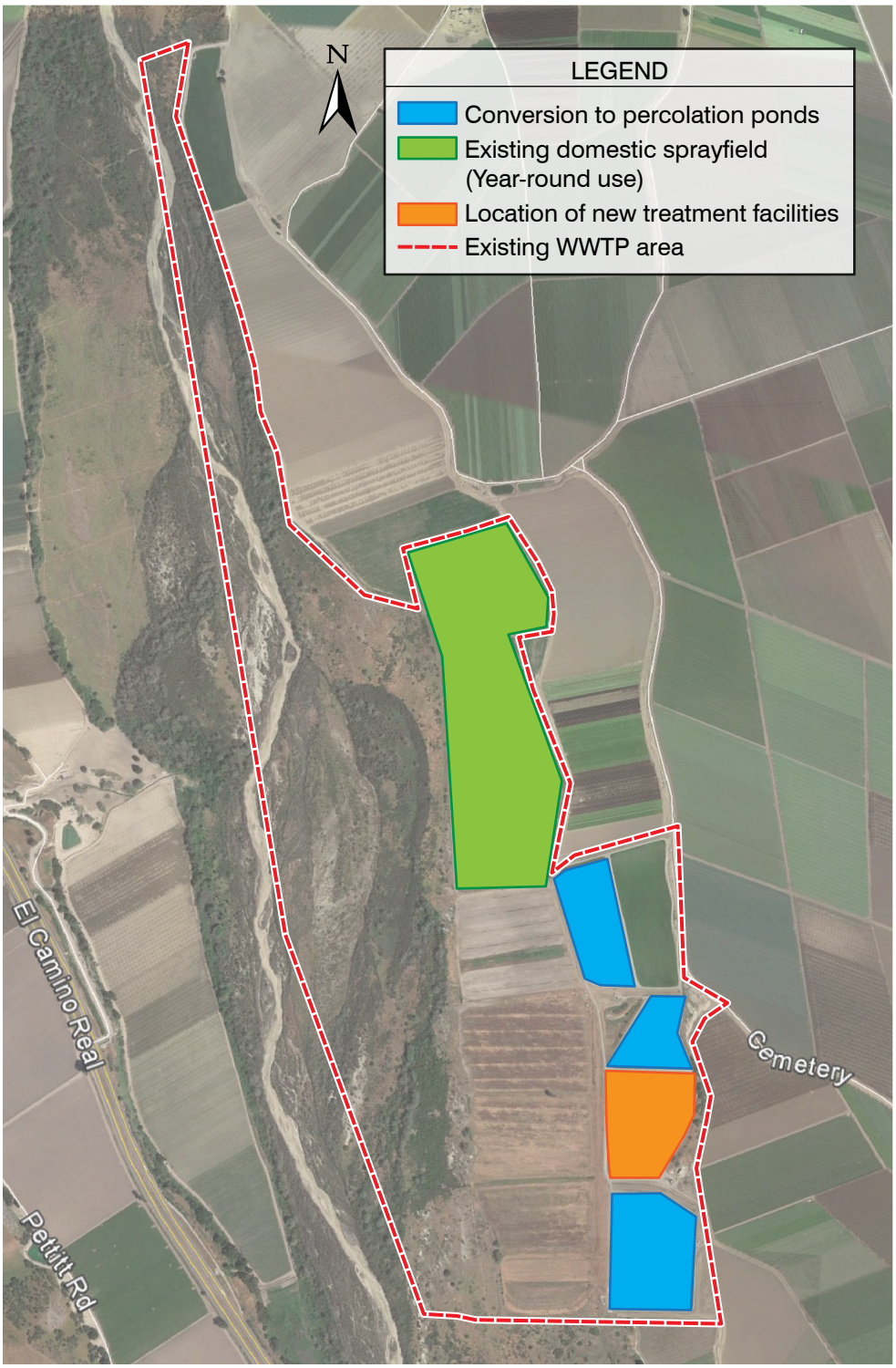
Alternative No. 1: Continue the use of the existing domestic sprayfields year-round and convert Ponds 1A, 1B, 3, and 5 to new percolation ponds. Pond 4 can be taken out of service. Alternative No. 1 is displayed in Figure 4.2.

Alternative No. 2: Abandon the use of the existing domestic sprayfields and convert Ponds 1A, 1B, 3, 4, and 5 to new percolation ponds. Add an additional 41 acres of percolation pond capacity. Alternative No. 2 is displayed in Figure 4.3.

Alternative No. 3: Use the existing domestic sprayfields during the non-irrigation season. Convert Ponds 1A, 1B, 3, and 5 to new percolation ponds. Identify 575 acres of adjacent agricultural area for irrigation (Title 22 unrestricted reuse). Convert Pond 4 to recycled water storage. Alternative No. 3 is displayed in Figure 4.4.

Alternative No. 4: Continue the use of the existing domestic sprayfields year-round. Add an additional 20 acres of sprayfields in Ponds 4 and 5. Keep Pond 3 in service with existing clay liner and use for storage of treated secondary effluent. Abandon Ponds 1A and 1B. Alternative No. 4 is displayed in Figure 4.5.

Alternative No. 5: Abandon the use of the existing domestic sprayfields. Identify 575 acres of adjacent agricultural area for irrigation (Title 22 unrestricted reuse). Convert Ponds 1A, 1B, 3, 4, and 5 to recycled water storage. Add an additional 27 acres of recycled water storage capacity. Alternative No. 5 is displayed in Figure 4.6.



ALTERNATIVE NO. 1

FIGURE 4.2

CITY OF KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

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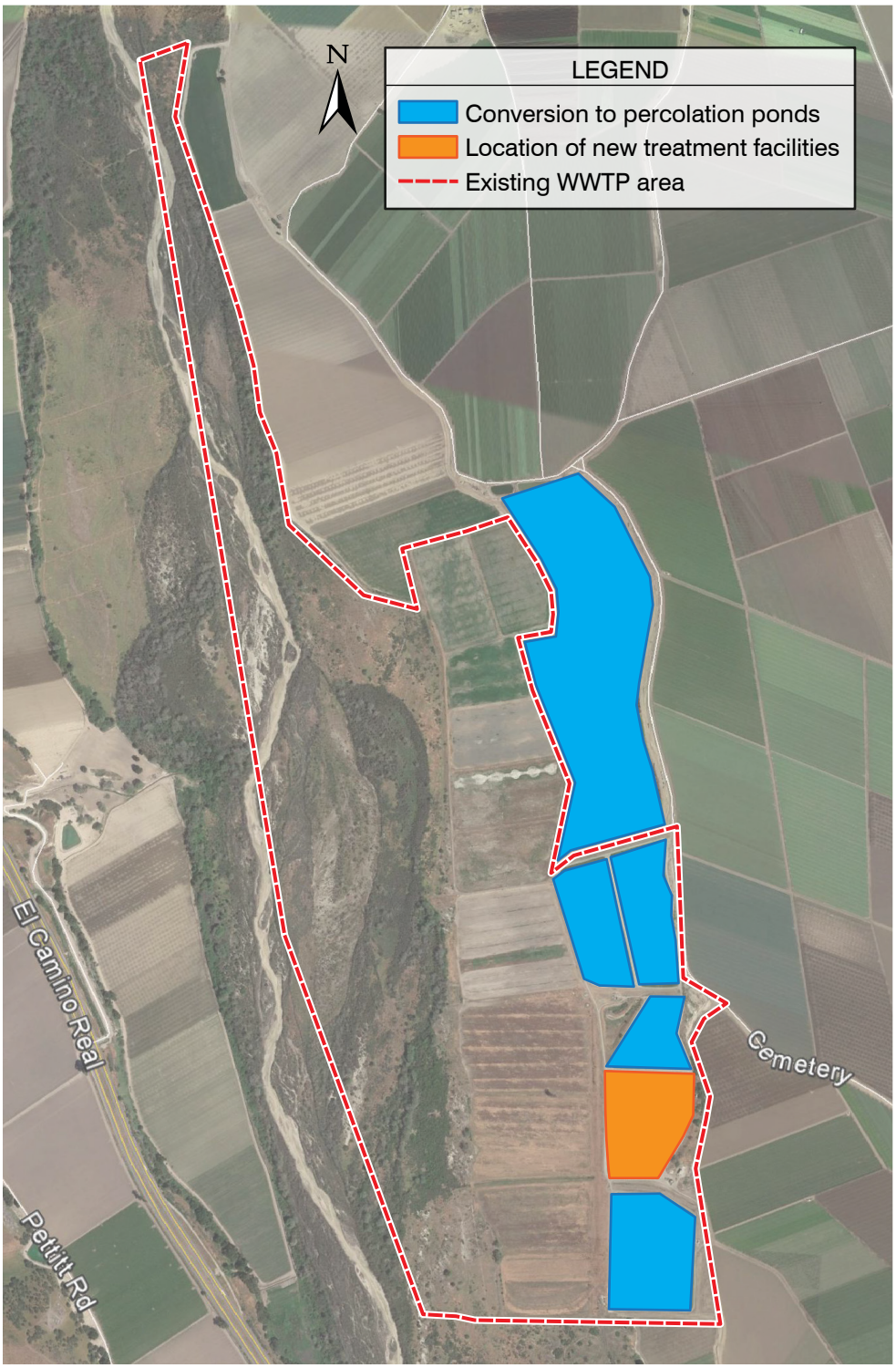

ALTERNATIVE NO. 2

FIGURE 4.3

THE CITY OF KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

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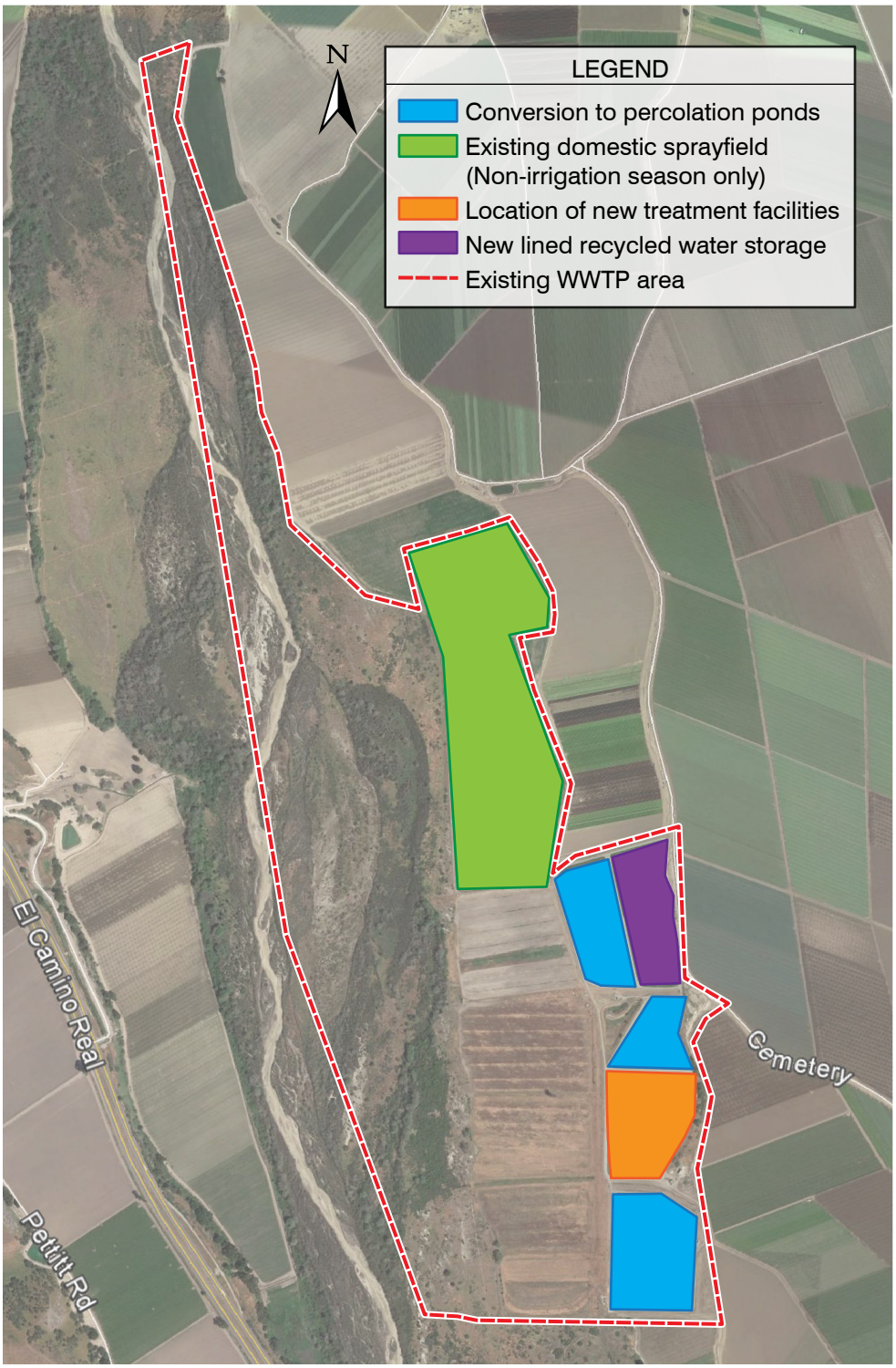

ALTERNATIVE NO. 3

FIGURE 4.4

THE CITY OF KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

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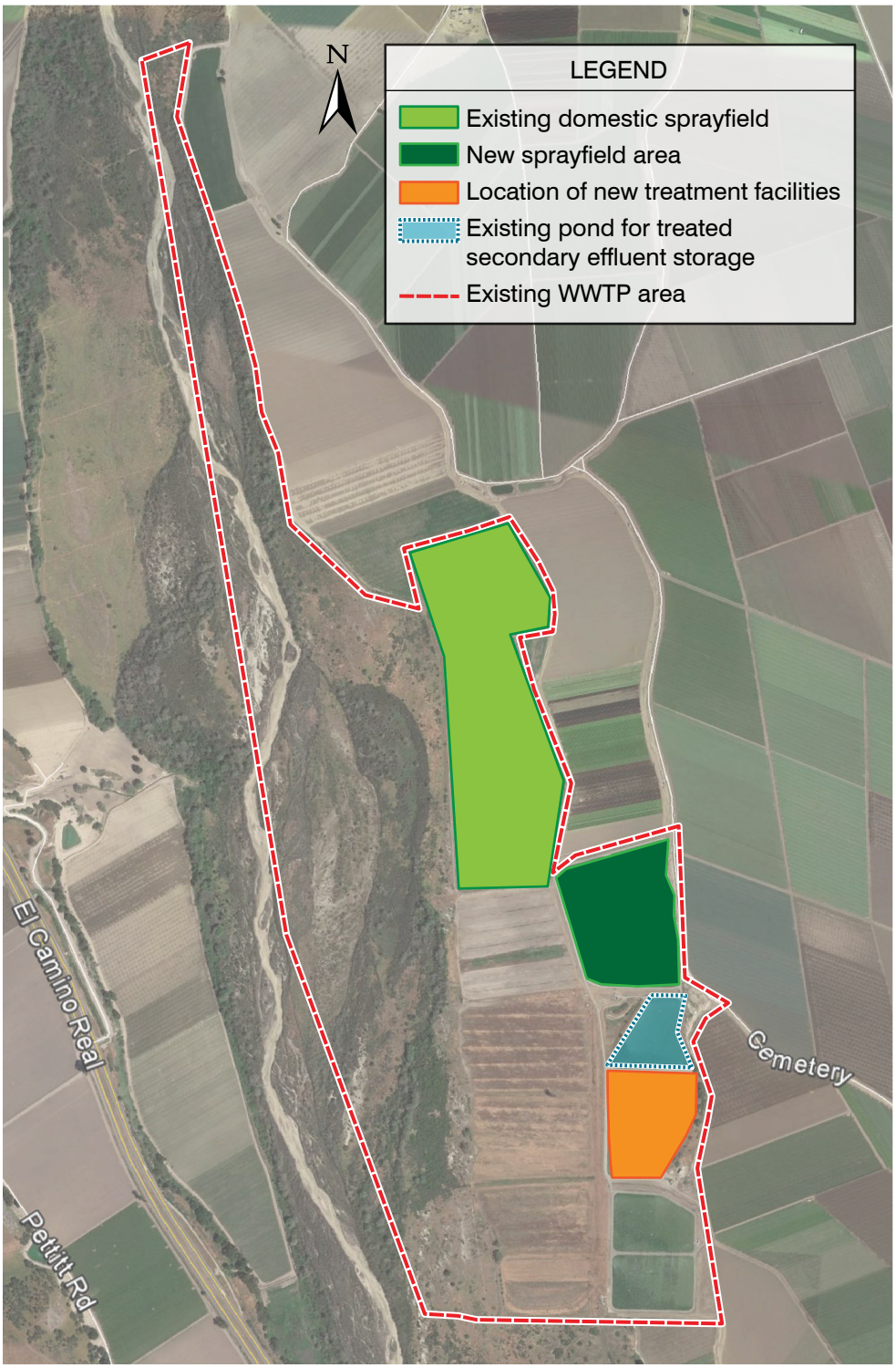

ALTERNATIVE NO. 4

FIGURE 4.5

THE CITY OF KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

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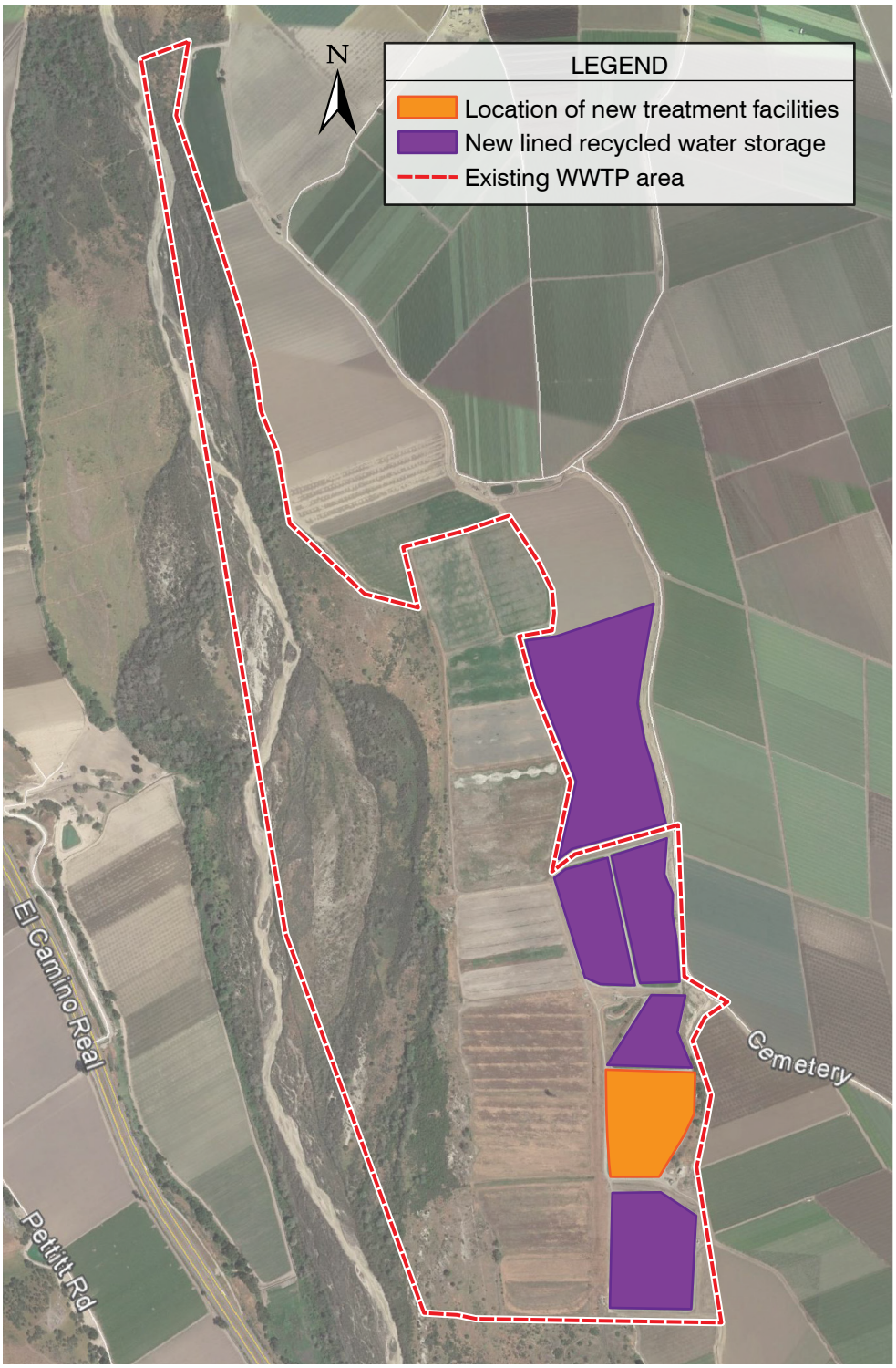

ALTERNATIVE NO. 5

FIGURE 4.6

THE CITY OF KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

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The summary of the effluent reuse and disposal alternatives evaluated using the results of individual water balances is shown in Table 4.3. The construction cost of each effluent reuse and disposal alternative is shown in Table 4.4.

Table 4.3 Initial Screening of Effluent Reuse and Disposal Options
Wastewater Treatment Facilities Plan
King City

Alternative	Existing Sprayfield Area, ac	New Sprayfield Area, ac	New Percolation Pond Area(1), ac	New Storage Pond Area(1), ac	Agricultural Irrigation, ac
1	54(2)	0	23(3)	0	0
2	Not Used	0	74(4)(5)	0	0
3	54(6)	0	23(7)	10	575
4(8)	54(2)	20	0	0	0
5	Not Used	0	0	61(4)(9)	575

Notes:
(1) Bottom pond area (effective percolation area) required is shown. Approximately 20 percent additional top pond area is required to account for sloped pond walls and berms.
(2) Domestic sprayfields in use year-round.
(3) 23 acres is available by converting Ponds 1A, 1B, 3, and 5. Pond 4 can be taken out of service.
(4) 33 acres is available by converting Ponds 1A, 1B, 3, 4, and 5.
(5) An additional 41 acres of percolation pond bottom area is required (approximately 50 acres of top pond area).
(6) Domestic sprayfields only in use during non-irrigation season.
(7) 23 acres is available by converting Ponds 1A, 1B, 3, and 5. Pond 4 will be converted to recycled water storage.
(8) Pond 3, pond bottom area of 4.5 acres, will be kept in service with the existing clay liner intact and used for storage of treated secondary effluent.
(9) An additional 27 acres of lined storage pond bottom area is required (approximately 33 acres of top pond area).

Table 4.4 Cost of Effluent Reuse and Disposal Options
Wastewater Treatment Facilities Plan
King City

Alternative	Capital Construction Cost(1)(2)	Recycled Water Production, AFY
1	$2,510,000	0
2	$7,000,000	0
3	$3,450,000	891
4	$2,050,000	0
5	$9,720,000	1,773

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix C for capital cost for water balance alternatives.
(2) Buildout escalation to midpoint of construction occurs April 1, 2020.

TREATMENT ALTERNATIVES ANALYSIS

5.1 INTRODUCTION

Based on the discussions in the previous chapters, there is a need to develop and evaluate alternatives that meet current and future treatment objectives and permit compliance requirements. Drivers for these alternatives include the following:

- King City's (City's) desire to produce tertiary-treated effluent meeting Title 22 unrestricted reuse requirements.
- City's desire to sell land adjacent to the treatment facility.
- Additional plant capacity required to accommodate anticipated growth in the City.
- Potential for change in current permit requirements (i.e., updates to the City's Waste Discharge Requirements [WDR] by the Central Coast Regional Board).
- Increasing difficulty meeting existing treatment objectives and anticipated permit requirements with existing pond-based system.
- Need to repair/rehabilitate aging infrastructure.
- Ongoing maintenance needs of the existing pond system including removing accumulated biosolids and inert solids that could cause an internal load.
- Potential for future regulations on nutrients, including ammonia and nitrate. Providing nitrogen reduction in future facility expansions is also included in the 2016 Basin Plan.
- Future sea level rise and flooding concerns.

This chapter describes the project options considered and the methodology for selection of recommended alternatives to best meet the goals of the City.

5.2 BASIS FOR ALTERNATIVES

The design flows and loads were determined in Chapter 3 and are shown in Table 5.1. These flows and loads were developed from a combination of historical data provided by the City, flow monitoring conducted as part of the 2017 Collection System Master Plan, and available information related to future land use. As discussed in Chapter 3, this facility plan excludes the flows and loads from the existing industrial wastewater discharge from ConAgra 45 (CAG 45). The design flows and loads are projected for the 20-year planning horizon. Recommended process elements and facility size based on a 20-year planning horizon allows for more confidence since the duration takes probable future permit requirements and wastewater treatment plant (WWTP) conditions into consideration.

Prior to conducting the Preliminary Recycled Water Feasibility Analysis and determining actual recycled water demands, the initial analysis included tertiary treatment of the full average daily maximum month flow (ADMMF) of 2.0 mgd. Buildout and Phasing alternatives for both full tertiary treatment and secondary treatment only were considered to develop alternatives with lower initial capital costs. Once actual recycled water demand information was determined, an additional alternative with a tertiary treatment capacity of 1.2 mgd was analyzed, which would meet the maximum month recycled water demand of 94.8 acre-feet per month (AFM).

Table 5.1 20-Year Design Influent Flows and Loads Wastewater Treatment Facilities Plan King City

Average Annual Flow, mgd	1.7
Average Day Max Month Flow, mgd	2.0
Maximum Daily Flow(1)(2), mgd	3.2
Peak Hour Flow, mgd	7.8
Design Influent BOD_5 Load, ppd	5,220
Design Influent TSS Load, ppd	4,440

Notes:
(1) Maximum daily flow (MDF) is defined as the maximum daily flow during dry weather.
(2) Initial tertiary filtration and disinfection processes were sized using MDF rather than peak hour flow to reduce the overall size of these processes and their respective costs. During periods of high wet weather flow, secondary effluent would bypass the tertiary filtration and disinfection facilities for disposal at the sprayfields or future percolation ponds.

All alternatives should provide reliable treatment capacity for the design flows and loads, provide flexibility to meet future regulatory requirements (including total nitrogen removal), and must be able to fit on the existing site since the City plans to sell some adjacent land to the existing wastewater ponds. As previously discussed in Chapter 4, the existing pond-based treatment system will have difficulty maintaining a consistent secondary effluent quality required to produce Title 22 unrestricted reuse-quality effluent. As future regulations for nutrients become more stringent, the existing ponds will also have difficulty meeting year-round nitrogen reduction requirements. Depending on future recycled water demands, the WWTP will need to include modifications to the current disposal and storage scheme as discussed in Chapter 4.

5.3 SUMMARY OF COMMON IMPROVEMENTS NEEDED

Based on the age of the existing facilities and the drivers and objectives for the future WWTP, the majority of the existing treatment facilities must be replaced. A proposed tertiary facility flow schematic outlining each of the process alternatives is shown in Figure 5.1. Of the new elements, there are several common processes that would work in

conjunction with any of the secondary, tertiary, or solids treatment alternatives. Common elements include:

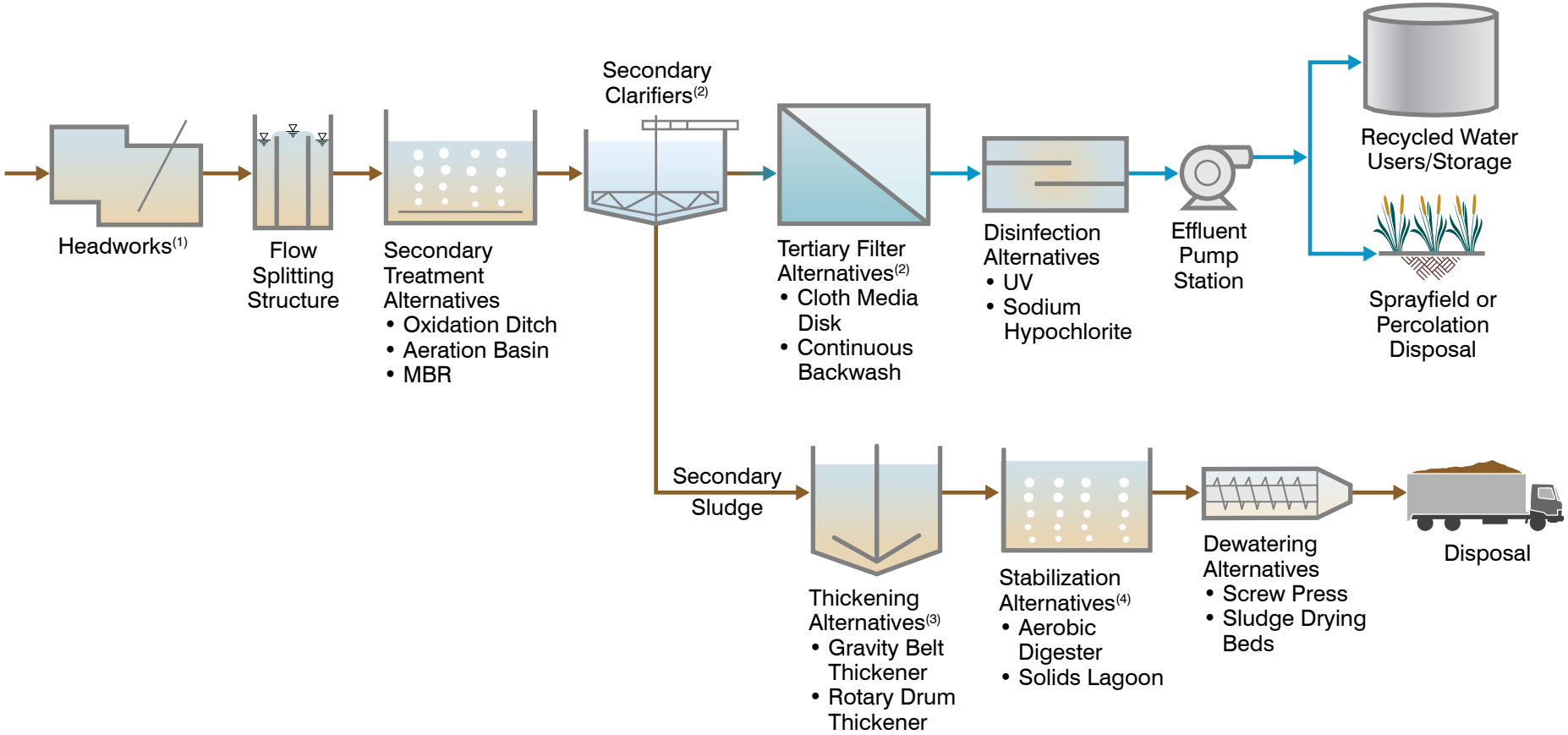
Septage Receiving Station: A new septage receiving station is desired by the City for receiving septage unloaded from hauling vehicles. The receiving station can be a source of revenue for the City and would provide a service to the surrounding communities. Wastes received could include residential, portable toilet, septage tank, and/or pre-approved industrial wastes. Typically, liquid waste is pumped into a septage receiving station where rags and trash are removed and deposited into a dumpster. Following initial trash removal, grit is removed and deposited into a dumpster. The flow is then combined with the influent wastewater for treatment. Further investigation during future phases of the WWTP upgrade to determine market size (i.e., type, extent of service area, waste strength) as well as design criteria such as hours of operation and desired invoicing features would be used to determine facility size and design requirements.

Headworks and Influent Pumping: The existing headworks includes influent metering using a Parshall flume sized for a maximum flow of 5.75 million gallons per day (mgd) followed by a comminutor and influent pump station with a firm capacity of 2.4 mgd (total capacity of 3.5 mgd). When the comminutor is out of service, flow can bypass through a manual bar screen with 1.75-inch openings. Due to the age and condition of the existing headworks, all structural and mechanical components need to be replaced. This includes new mechanical bar screens to protect downstream facilities. The headworks capacity would be upsized to handle the design peak hour flow (PHF) of 7.8 mgd. Replacing the headworks structure will also allow raising of the hydraulic grade line at the head of the facility, allowing gravity flow through the remainder of the facility and minimizing the need for intermediate pumping. The recommended components of the new headworks include:

- Parshall flumes
- Mechanical bar screens with 1/4-inch spacing
- Vortex grit chamber with grit pumping and grit classifier
- New influent pump station with submersible pumps

The flow schematic for the proposed headworks is shown in Figure 5.2.

Parshall Flumes: It is recommended that the new Parshall flumes include an ultrasonic level measurement device with flow metering transmitted through a new plant supervisory control and data acquisition (SCADA) system for remote indication and reporting. To maintain accuracy, the ultrasonic liquid level devices should be calibrated at least once a year.



NOTES:

1. See proposed headworks flow schematic.
2. Omitted if MBR used.
3. Omitted if oxidation ditch or solids lagoon used.
4. Omitted if oxidation ditch used.

PROPOSED TERTIARY FACILITY FLOW SCHEMATIC

FIGURE 5.1

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WASTEWATER TREATMENT FACILITIES PLAN

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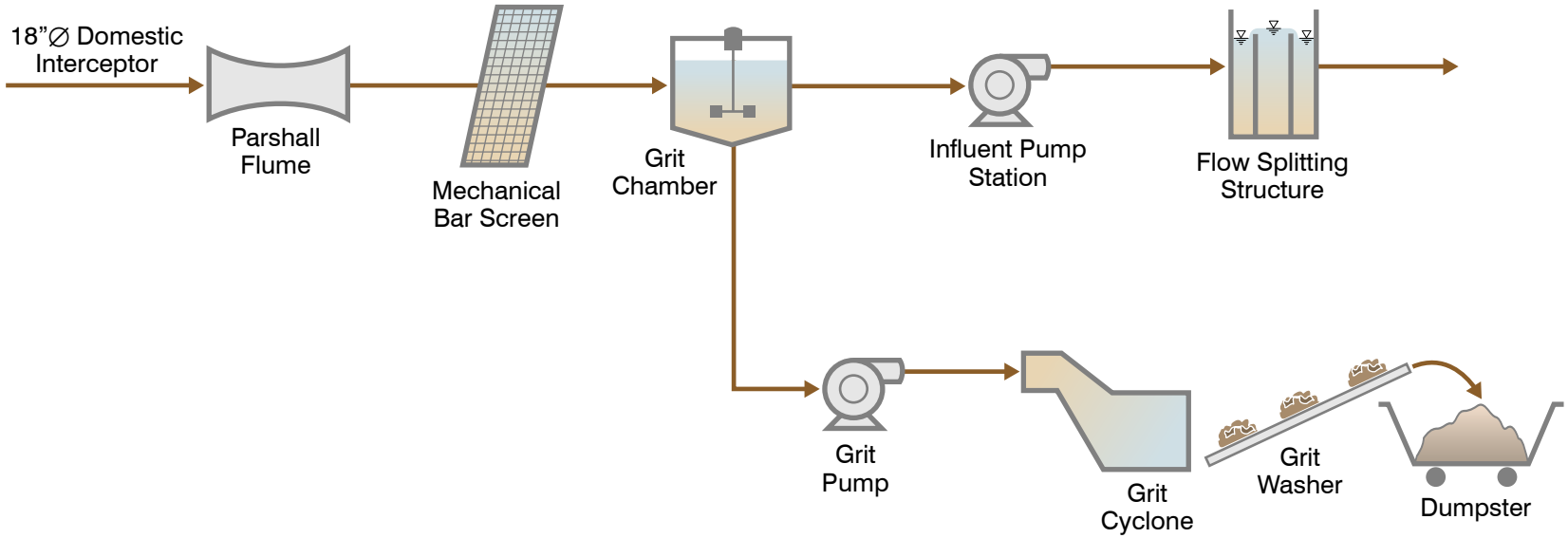

PROPOSED HEADWORKS FLOW SCHEMATIC

FIGURE 5.2

THE CITY OF KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

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Mechanical Bar Screens: New mechanical bar screens that are mechanically cleaned and include 1/4-inch spacing are recommended to capture and remove rags and trash. The bar screens would operate automatically based on either time or differential water level across the screen. The screenings that are removed from the wastewater by the mechanical screens are deposited onto a conveyor, and the conveyor moves the screenings to a washer compactor where the wet screenings are sprayed with water as they are slowly compacted using a shafted screw. The screenings are dewatered as they are pushed by the screw into a discharge chute. The water removed from the screenings is directed back to the influent and the washed and compacted screenings are deposited into a dumpster for disposal at a landfill.

Grit Removal: A new vortex grit chamber is recommended for the headworks. As the wastewater passes through the unit, the grit settles to the bottom. To aid in this process, each unit is equipped with a paddle mechanism that is driven by an electric motor and gearbox. The grit that is removed is periodically pumped from the bottom of the vortex units to one of two classifiers. Each classifier has a cyclone, which removes the majority of the liquid prior to discharging the slurry into the classifiers. Once in the classifiers, the organics pass over a weir as the grit is washed and travel up an inclined screw conveyor. The washed and dewatered grit is then deposited into a dumpster for disposal. The liquid that is removed in the cyclones and classifiers continues on to further treatment.

Influent Pump Station: A new influent pump station is recommended for the WWTP due to the age of the existing structural and mechanical components. The new influent pumps and wet well would be upsized to handle the design PHF of 7.8 mgd.

Flow Splitter Structure: A new flow splitter structure is proposed to follow the influent pump station to evenly distribute the flow to the new secondary treatment process.

Effluent Disposal (Irrigation) Pump Station: The existing effluent disposal (or irrigation) pump station has a firm capacity of 1.6 mgd with two 800 gallons per minute (gpm) pumps and one 350 gpm pump. Flow enters the pump station from Box No. 7 and is pumped to the domestic sprayfields. The recommendation is to keep the existing irrigation pump station in place. The pump station will be further evaluated for recommended improvements during preliminary design.

One scenario that could be explored during preliminary design is tertiary effluent flow equalization which could be provided in the form of percolation or storage ponds to store the peak hour flows, while the irrigation pump station could be used to handle the peak day demands of the recycled water users.

5.4 IDENTIFICATION OF SECONDARY TREATMENT OPTIONS

Identification of secondary treatment options is needed to address the current and future treatment objectives and permit compliance requirements discussed at the beginning of this chapter. This task was completed in two phases. The first phase was a preliminary screening of new secondary treatment options. Any of the treatment options deemed feasible were further discussed, evaluated, and selected with the City during the second phase.

5.4.1 Preliminary Screening of Secondary Treatment Options

There are several treatment processes that can be used to provide additional secondary treatment capacity, either alone or in combination with other processes, in order to achieve desired effluent water quality. Table 5.2 provides a list of secondary treatment processes that are commonly considered, along with the constituents they most commonly remove.

Table 5.2 Secondary Processes Meeting Permit Discharge Requirements
Wastewater Treatment Facilities Plan
King City

Process	Ability To Remove		
	Organics (BOD)(1)	**Ammonia(2)**	**Total Nitrogen(2)**
Suspended Growth			
Activated Sludge	✓	✓	✓
Attached Growth			
Trickling Filters (1-Stage)	✓		
Nitrifying Trickling Filters		✓	
Denitrification Filters			✓
Land Based Systems			
Ponds (Aerated)	✓	Summer only	

Notes:
(1) Current permit discharge requirement.
(2) Anticipated future permit discharge requirement.

While there are variations of suspended growth, activated sludge processes such as oxidation ditches, conventional activated sludge basins, sequencing batch reactors, and membrane bioreactors, the biological treatment process is essentially the same. Similarly, there are variations of attached growth processes, such as trickling filters, that incorporate different types of media that biological growth attaches to, but the biological treatment process is essentially the same.

Of the options considered, Carollo recommends a suspended growth, activated sludge process for the various reasons indicated in Table 5.3 and the following sections.

Table 5.3 Initial Screening of Secondary Treatment Options Wastewater Treatment Facilities Plan King City					
Treatment Option	**Adds BOD Capacity**	**Removes Ammonia**	**Improves Final UVT(1)**	**Reliable**	**Move Forward**
Additional Ponds	Yes	Summer only	No	Maybe	No - Does not meet WQ objectives
Trickling Filter	Yes	Only if 2-stage	No	Yes	No
Activated Sludge	Yes	Yes	Yes	Yes	Yes

Notes:

(1) Ultraviolet Transmittance (UVT) is an important design criteria for the UV disinfection alternative as discussed in the Tertiary Treatment section of this chapter.

5.4.1.1 Secondary Treatment Options:

- Adding new ponds and/or converting the existing polishing ponds could provide additional biochemical oxygen demand (BOD) and total suspended solids (TSS) treatment, however, a pond system would have difficulty meeting the secondary effluent quality needed to support downstream processes associated with producing Title 22 unrestricted reuse-quality tertiary effluent. Ponds would also not provide year-round ammonia or total nitrogen removal since the natural removal process is dependent on temperature and sunlight. In addition, the City desires to sell adjacent land parcels not needed for the new tertiary treatment facility making allocation of land to build new ponds an inviable option.
- Trickling filters, while a proven and effective treatment process, do not have the flexibility to remove ammonia or total nitrogen unless more than one unit is installed in series (2-stage). They are poor processes to include upstream of UV since they are prone to intermittent high effluent TSS due to sloughing, which negatively impacts UVT. UV is one of two recommended disinfection alternatives needed to produce Title 22 unrestricted reuse-quality tertiary effluent. A weakness of any attached growth process (trickling filters or nitrifying trickling filters) is that they are sensitive to temperature with potentially unreliable performance in the winter months. Additionally, lightly loaded trickling filters (e.g., nitrifying trickling filters) are prone to attracting snails that strip the attached biological growth from the media. Additional operational expenses are required to control the snails. For these reasons, Carollo does not recommend trickling filters or any other attached growth process for the City.
- Activated sludge processes provide reliable, year-round BOD, ammonia, and total nitrogen removal and provide the most flexibility for meeting increasingly stringent discharge requirements. The main disadvantage of these processes is they typically have a high operations and maintenance (O&M) cost due to process aeration air

demand. Carollo recommends moving forward with the activated sludge options and further defining these process alternatives.

5.4.2 Further Definition of Secondary Treatment Options

At the February 2, 2017 facility plan workshop with the City, an overview of secondary treatment options was discussed, including:

- Additional oxidation ponds.
- Trickling filters (fixed film/attached growth process).
- Conventional activated sludge (CAS) aeration basins with Modified Ludzack-Ettinger (MLE) process.
- Oxidation ditch (extended aeration activated sludge).
- Membrane bioreactor (MBR).

During the workshop, City staff agreed that adding additional oxidation ponds was not a preferred alternative due to inherent process limitations such as temperature and sunlight dependency, wind issues, difficulty nitrifying in the winter, solids accumulation affecting treatment and hydraulic capacity, and difficulty complying with current and probable future permit requirements. As discussed above, trickling filters are also not a viable option due to seasonal limitations and O&M considerations. Hence, the activated sludge processes that Carollo recommends further evaluating include:

- Secondary Treatment Alternative 1: CAS with MLE
- Secondary Treatment Alternative 2: Oxidation Ditch
- Secondary Treatment Alternative 3: MBR

The flow schematics for each of the secondary treatment alternatives are shown in Figure 5.3, Figure 5.4, and Figure 5.5.

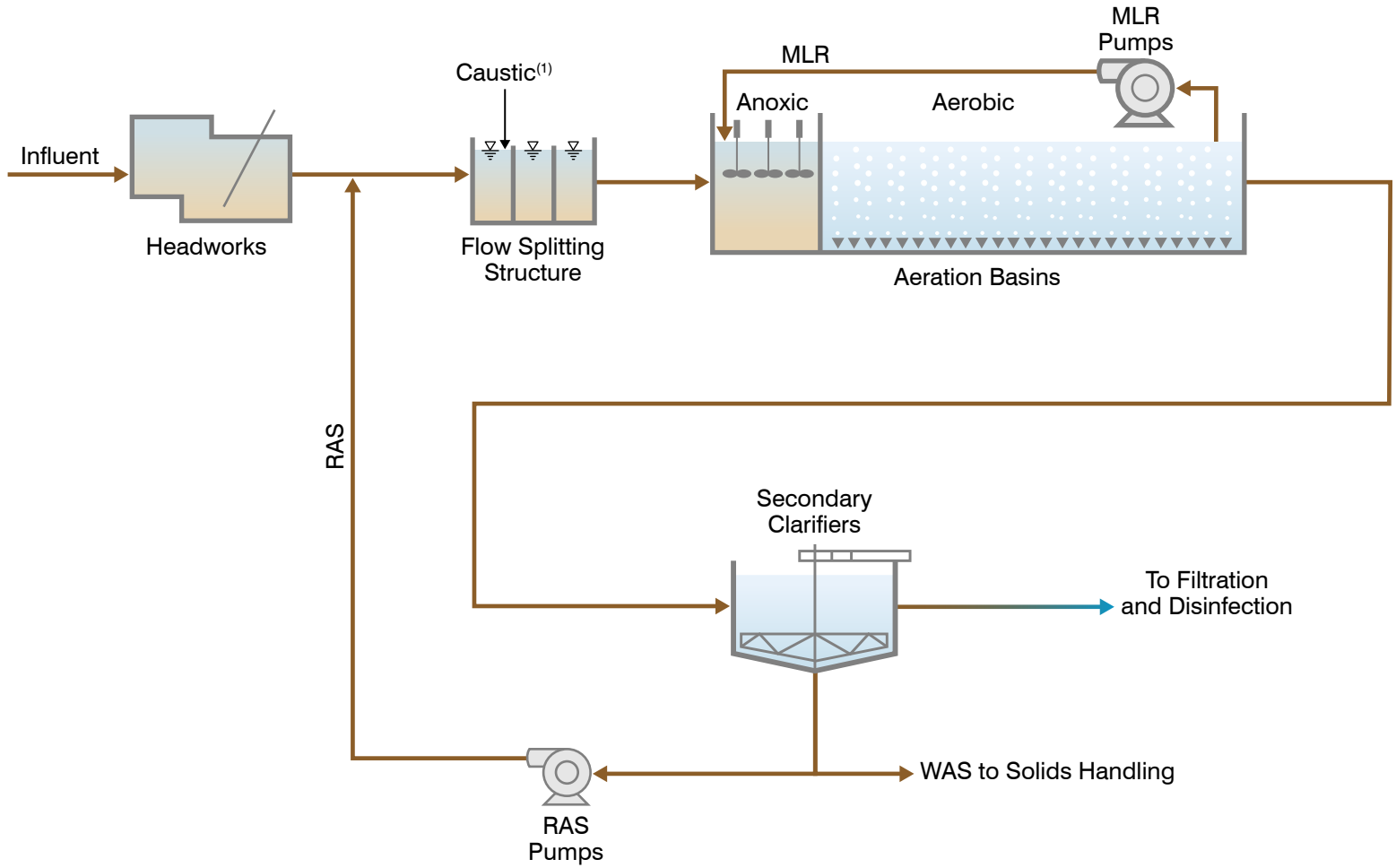
CAS with MLE: The CAS with MLE option typically consists of rectangular concrete, open-air basins which include a smaller anoxic zone followed by larger aerobic zones. Process air is supplied in the aerobic zones by an aeration system consisting of mechanical blowers (e.g., multistage centrifugal-type) and diffusers (e.g., submerged fine bubble membrane-type) to allow for organics removal and ammonia removal (nitrification) to occur while keeping the mixed liquor in suspension. The nitrate produced during the nitrification step is then recycled from the end of the aerobic zone to the front of the anoxic zone by use of a mixed liquor return (MLR) pump and combined with the raw wastewater in the influent stream to allow for nitrate removal (denitrification) to occur. The anoxic zone is unaerated and requires mixers to keep the mixed liquor in suspension. The typical conventional activated sludge process includes secondary clarifiers, which allow activated sludge floc to settle from the main liquid stream via gravity settling. A portion of the settled activated sludge is returned to the beginning of the aeration basins as return activated sludge (RAS)

to maintain the mixed liquor concentration in the aeration basins, and a portion of the remaining activated sludge is removed from the system as waste activated sludge (WAS) and sent to the solids handling portion of the plant.

The CAS with MLE option is a common, proven technology that can be used in a wide range of climates to reliably remove organics, ammonia, and total nitrogen. It can also be easily expanded or modified in the future (e.g., adding on extra anoxic and/or aerobic zones) to increase overall capacity or improve the process to remove both total nitrogen and phosphorous. Disadvantages of the CAS with MLE option are the use of more complicated process controls and mechanical equipment as compared to oxidation ditches. This increased operational complexity and additional maintenance associated with the diffusers, mechanical blowers, and MLR pumps result in greater operator attention and periodic shutdowns to clean, replace, and repair the equipment. An example of a proposed CAS with MLE is shown in Figure 5.6.

Oxidation Ditch: Oxidation ditches typically consist of oval-shaped concrete, open-air basins made up of one or more concentric rings. Flow is recirculated in a racetrack configuration with a smaller anoxic volume upfront to facilitate denitrification. Organics removal and nitrification occurs in the larger aerobic volume. The anoxic zone typically includes mixers to keep the mixed liquor in suspension. Oxygen in the aerobic zone is supplied by brush or mechanical aerators that agitate the surface of the water to introduce oxygen. The typical oxidation ditch process includes secondary clarifiers, which allow activated sludge floc to settle from the main liquid stream. A portion of the settled activated sludge is returned to the beginning of the oxidation ditch as RAS, and the remaining activated sludge is removed from the system as WAS and sent to the solids handling portion of the plant.

The advantages of an oxidation ditch process compared with the CAS with MLE option and the MBR option is that it is simpler to operate, requires less maintenance (i.e., no membranes, blowers, or submerged diffusers that require cleaning or maintenance), and provides a higher degree of reliability in handling shock loads and avoiding process upsets. Also, oxidation ditches do not typically require a standby basin since the ditch typically does not need to be taken out of service for maintenance. Disadvantages of the oxidation ditch process include a larger footprint and slightly increased aeration costs due to the reduced efficiency of mechanical aeration compared to diffused aeration. An example of a proposed oxidation ditch is shown in Figure 5.7.



NOTES:

1. Caustic may be required for supplemental alkalinity. Caustic feed system would include storage tanks, metering pumps, and containment areas.

SECONDARY TREATMENT ALTERNATIVE 1 CAS WITH MLE FLOW SCHEMATIC

FIGURE 5.3

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WASTEWATER TREATMENT FACILITIES PLAN

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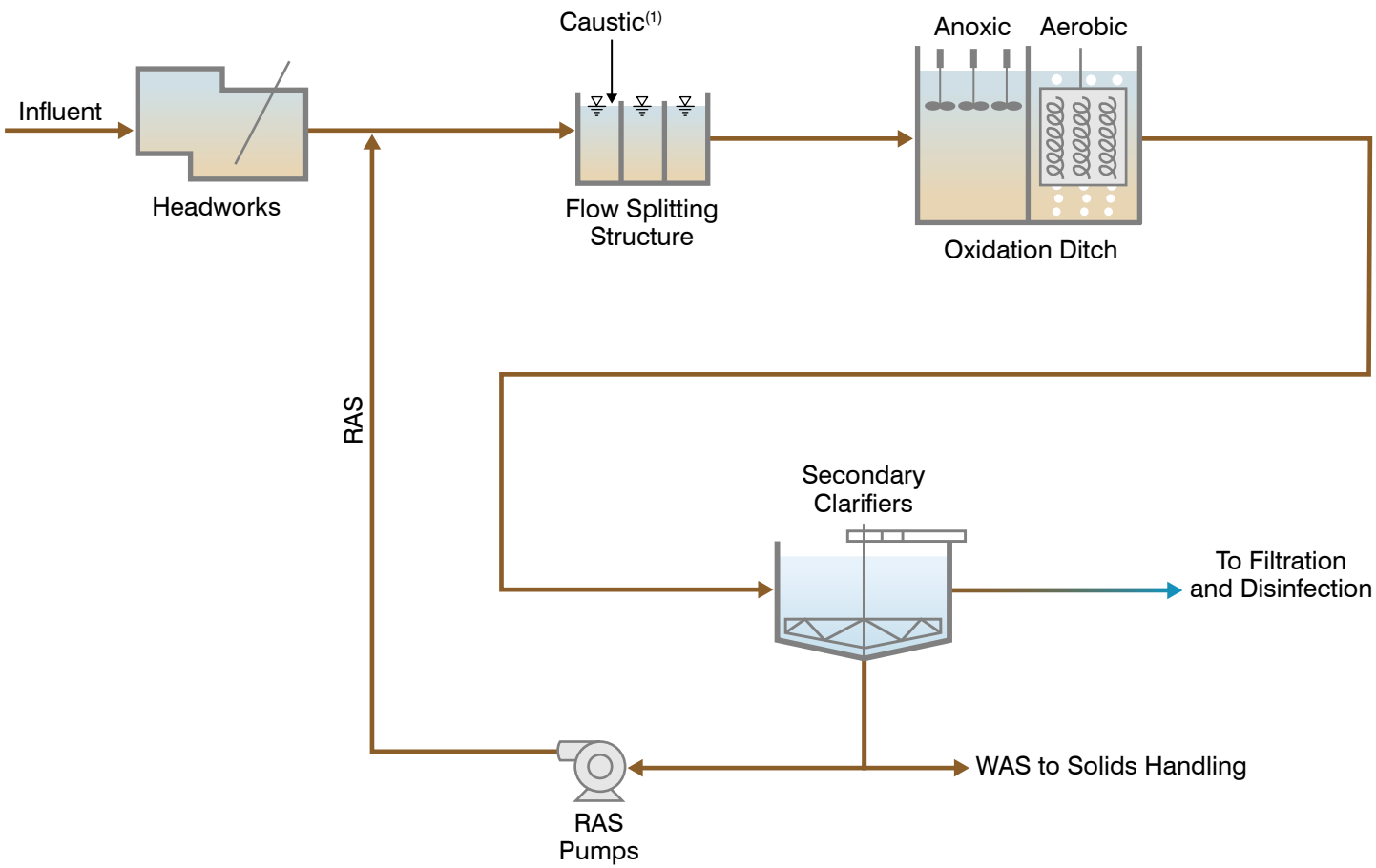

NOTES:

1. Caustic may be required for supplemental alkalinity. Caustic feed system would include storage tanks, metering pumps, and containment areas.

SECONDARY TREATMENT ALTERNATIVE 2 OXIDATION DITCH FLOW SCHEMATIC

FIGURE 5.4

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WASTEWATER TREATMENT FACILITIES PLAN

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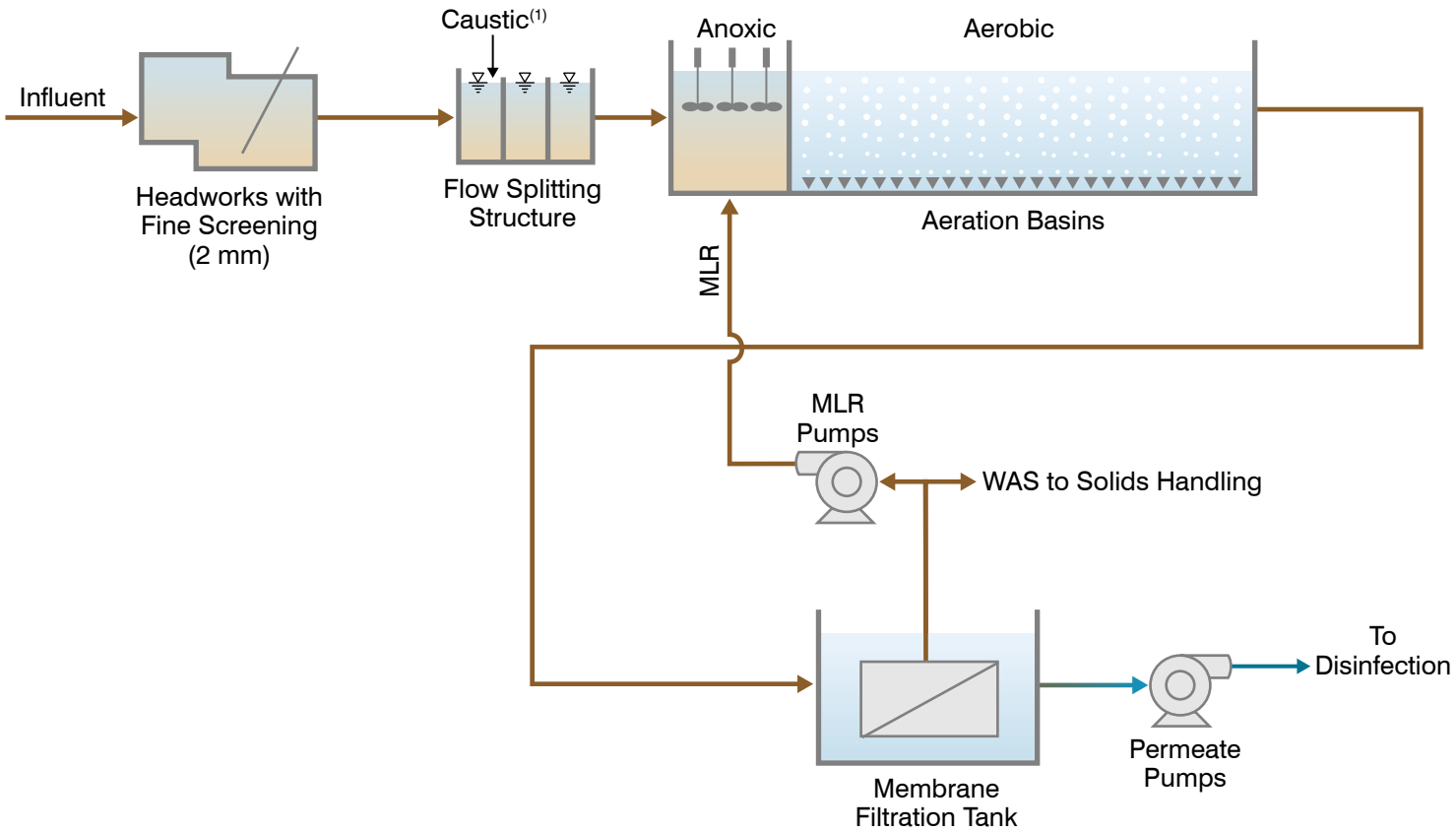

NOTES:

1. Caustic may be required for supplemental alkalinity. Caustic feed system would include storage tanks, metering pumps, and containment areas.

SECONDARY TREATMENT ALTERNATIVE 3
MBR FLOW SCHEMATIC

FIGURE 5.5

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WASTEWATER TREATMENT FACILITIES PLAN

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Figure 5.6 Example of CAS with MLE Secondary Treatment

Figure 5.7 Example of Proposed Oxidation Ditch Secondary Treatment

MBR: The MBR process consists of CAS with MLE followed by membrane bioreactor basins. This process is similar to a CAS with MLE process, except that the solids separation occurs using membrane micro-filters instead of secondary clarifiers. The membranes also reduce turbidity to the levels required by Title 22 for unrestricted reuse-quality effluent, therefore, no filter is required downstream of an MBR process to produce tertiary treated effluent. Because solids separation is performed with membranes instead of gravity settling, the mixed liquor suspended solids (MLSS) concentration can be much higher (up to 8,000 mg/L compared to the 2,500 mg/L to 3,000 mg/L required by CAS with MLE alone). The higher MLSS concentration results in reduced aeration basin volume required compared to the CAS with MLE option. Since secondary clarifiers and tertiary

filters are not required with the MBR process, the overall secondary treatment facility footprint is typically smaller compared to other more traditional suspended growth processes.

Unique requirements associated with the MBR option include:

- Screening requirements for MBRs are more stringent than for the CAS with MLE or oxidation ditch options, which results in the need to provide screens at the headworks with 2 mm spacing.
- Additional blowers are needed for the MBR option compared to the CAS with MLE option. These blowers are for process air and membrane air scouring. If the blowers are housed in a common building, the MBR blower building will have a larger footprint than the CAS with MLE blower building.
- As with the CAS with MLE option, MLR pumps are added to return the accumulated solids from the new MBR tank to the aeration basins. However, RAS pumps are not required.
- Additional tanks and a mechanical building are required to house the membrane equipment including the membranes, permeate pumps, recirculation pumps, and membrane cleaning facilities.

The primary advantages of the MBR option are that it is a compact, proven technology with numerous municipal applications in the United States, and it produces a high quality effluent for reuse applications without the need for an additional filtration process. Disadvantages are that membranes require fine screening pretreatment and periodic cleaning with chemicals to mitigate fouling. The MBR option also has an increased energy cost associated with the additional aeration and pumping requirements. An example of a proposed MBR is shown in Figure 5.8.

Comparison of Secondary Treatment Options: A steady-state BioWin process model was used to determine the preliminary design criteria for each secondary treatment option. A summary of the design criteria is presented in Table 5.4.

Figure 5.8 Example of Proposed MBR Secondary Treatment

Table 5.4 Preliminary Design Criteria for Secondary Treatment Options
Wastewater Treatment Facilities Plan
King City

Item	Option		
	CAS with MLE	**Oxidation Ditch**	**MBR**
Number of Basins	3 + 1	3	3 + 1
Volume of Basins, MG Each	0.70	1.20	0.25
Total Active Basin Volume, MG(1)	2.20	3.50	0.75
Design Solids Retention Time, days	10	25	10
Design Mixed Liquor Suspended Solids, mg/L	2,600	3,000	8,000
Number of Secondary Clarifiers	3 + 1	3 + 1	-
Secondary Clarifier Diameter, ft	70	70	-
Clarifier Overflow Rate, gpd/sf	780	780	-
Target Effluent BOD, mg/L	20	20	20
Target Effluent TSS, mg/L	20	20	<5
Target Effluent Total N-N/Nitrate-N, mg/L	8/5	8/5	8/5

Notes:

(1) An anoxic volume of 20 percent of total volume is included in all options to allow for denitrification.

Evaluation of the secondary treatment options includes a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 5.5. A summary of the economic evaluation is outlined in Table 5.6.

Each of the secondary treatment alternatives evaluated can effectively operate without primary clarifiers, which are not included in this comparative analysis due to additional capital and O&M costs. However, they may be evaluated as an option during preliminary design in order to reduce the required treatment capacity of the recommended secondary treatment process.

Table 5.5 Secondary Treatment Options Evaluation of Non-Economic Factors
Wastewater Treatment Facilities Plan
King City

	Criteria Scale: 1 (Least Favorable) to 3 (Most Favorable)		
Item	**CAS with MLE**	**Oxidation Ditch**	**MBR**
Safety	2	2	1
Meets Permit Requirements	3	3	3
Ease of O&M	2	3	1
Constructability	2	2	3
Reliability	3	3	3
Ammonia/Nitrate Removal	3	3	3
Odor	2	2	3
Total Score	**17**	**18**	**17**

5.4.3 Economic Comparison of Secondary Treatment Alternatives

Planning level cost estimates were developed for the treatment alternatives for both capital (construction) costs and comparative O&M costs under the following assumptions:

- Where required or recommended, process units and equipment would have one standby unit for each size unit provided.
- New facilities are proposed to be sited on or adjacent to existing facilities, primarily within clay-lined Ponds 1 and 2. Required sitework may include process water drainage from the ponds, tilling, solar drying, dredging, and hauling of existing pond sludge, removal of the existing clay liners, and backfill/compaction. It is assumed that there is no contaminated soil excavation disposal or pile foundation required. During preliminary design, further subsurface investigation will need to be conducted to better define the scope and cost associated with sitework and structural foundation improvements.

- The total direct capital costs include the following components:
  - Structural, equipment, and piping with adjustments for 20 cities ENR Construction Cost Index from December 2016 and Location Factor of Salinas, CA.
  - Sitework allowance of 20 percent for the items described above.
  - Yard piping allowance of 10 percent.
  - Electrical, instrumentation, and controls (EI&C) allowance of 30 percent to include a new electrical service and plant-wide SCADA system.
- The following components were added to the total direct costs in order to arrive at the total construction cost for each alternative evaluated:
  - Estimating contingency of 30 percent.
  - Contractor general conditions of 15 percent and overhead and profit of 12 percent.
  - Sales tax on 50 percent of the total direct cost subtotal at a rate of 7.875 percent.
  - Escalation to midpoint of construction, estimated to be April 1, 2020.
- Planning-level O&M costs were developed on a comparative basis between alternatives to identify only unique process requirements.
- Annual O&M costs include:
  - Power, assumed at $0.12/kWh
  - Maintenance requirements such as parts replacement
  - Chemical usage and delivery
  - Sludge dredging and hauling
  - Costs do not include labor differences, which will be discussed in a later section of this chapter when the overall life cycle costs are presented.
- Annual O&M costs were brought to present worth over a 20-year life cycle assuming 6 percent interest and 3 percent inflation.

Planning-level capital and O&M cost estimates for each of the treatment alternatives are summarized at the end of each alternative comparison discussion, beginning with Table 5.6 for secondary treatment. The basis of developing the cost estimates is further detailed in Appendix D. The detailed capital cost breakdowns are shown in Appendix E and the comparative O&M cost breakdowns are shown in Appendix F.

Table 5.6	Economic Comparison of Secondary Treatment Alternatives Wastewater Treatment Facilities Plan King City	
		Cost
CAS with MLE	Capital Construction Costs(1)	$28,630,000
	Comparative Annual O&M Costs(2)	$245,800
	Present Worth of Comparative 20-year O&M Cost(3)	$3,383,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$32,013,000**
Oxidation Ditch	Capital Construction Costs(1)	$24,120,000
	Comparative Annual O&M Costs(2)	$206,000
	Present Worth of Comparative 20-year O&M Cost(3)	$2,835,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$26,955,000**
MBR	Capital Construction Costs(1)	$23,770,000
	Comparative Annual O&M Costs(2)	$441,900
	Present Worth of Comparative 20-year O&M Cost(3)	$6,081,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$29,851,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix E for capital cost item details for each alternative.
(2) Comparative annual O&M costs unique to each alternative were developed for comparative purposes. See Appendix F for a summary of O&M cost details.
(3) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76). Comparative Annual O&M Costs reported in this table are rounded to the nearest hundred dollars. All other costs are rounded to the nearest thousand dollars.
(4) Present worth of comparative life cycle cost = capital cost + present worth of comparative 20-year O&M cost. Note that this is not a total life cycle cost for the whole alternative, as common elements are not included.

5.5 IDENTIFICATION OF TERTIARY TREATMENT OPTIONS

Identification of tertiary treatment options is needed to address the future facility objectives and permit compliance requirements discussed in Chapter 4 and at the beginning of this chapter. All of the tertiary filtration and disinfection processes evaluated for this project have been accepted by the State as being capable of meeting the Title 22 requirements described in Chapter 4. Two filtration alternatives and two disinfection alternatives were selected based on water quality requirements, future flow capacity of the facility, demonstrated reliability, and relative ease of operation and maintenance. These alternatives were evaluated and compared based on economic and non-economic

considerations. Any of these treatment options deemed feasible were further discussed and evaluated with the City.

The tertiary treatment options were sized using maximum daily flow (MDF) rather than PHF to reduce the overall size of the tertiary processes. When flows exceed the MDF of 3.2 mgd, the wet weather flow will bypass the tertiary treatment processes for discharge directly to the sprayfields or percolation ponds.

5.5.1 Preliminary Screening of Tertiary Filtration Options

There are several processes that can be used for filtration, either alone or in combination with other processes, in order to achieve desired effluent water quality. Filtration technologies that are commonly considered include membrane filters (such as hollow fiber membrane filters), surface filters (such as cloth media disk filters), and granular media filters (such as continuous backwash filters). While there are variations within each filtration technology (e.g., metal mesh disk filters or cloth media disk filters), the filtered effluent quality produced by each filtration technology will meet the requirements for Title 22 unrestricted reuse-quality effluent. For the MBR option already discussed for secondary treatment, an additional tertiary filtration process would not be required due to the filtration inherent to the MBR process. However, both the CAS with MLE and oxidation ditch secondary options would require a tertiary filtration step.

Of the filtration options considered, Carollo recommends evaluating cloth media disk filters and granular media filters. Hollow fiber membrane filters are not further considered because they are a similar technology to MBRs and thus are a redundant process to consider.

Cloth Media Disk Filters: Cloth media disk filters remove solids by sedimentation as well as filtration. The heavier solids settle out before reaching the filter cloth, and an intermittent sludge pump removes the settled solids from the bottom of the tank. As secondary effluent flows through the filters, solids are accumulated on and within the depth of the filter cloth forming a mat that provides additional filtration. As the mat is formed, headloss through the cloth increases, causing the liquid level in the tank to rise.

Automatic filter backwash typically begins based on liquid level. The reversal of flow removes the majority of particles that have accumulated on the surface of, and within, the filter cloth. Depending on the filter media type, automated cleaning can also be achieved through high-pressure spray wash as well as chemical cleaning.

Advantages of the cloth media disk filter are it has a small footprint, uses minimal energy including pumping requirements, and requires minimal operator attention. A disadvantage of the cloth media disk filter is the potential for media clogging and scaling, affecting operational run time as well as O&M time and labor.

Granular Media Filters: Granular media filters include conventional single and multimedia filters, deep-bed filters, and continuous backwash filters. Conventional single and

multimedia filters typically utilize sand or anthracite media and have a media depth of two to four feet. Deep-bed filters use larger-sized media, usually anthracite, and have a greater depth of four to eight feet of media. In continuous backwash filters, the water flows upward instead of downward through a three to six-foot deep sand bed.

The continuous backwash filter was evaluated as the granular media filtration alternative for the City. Other granular media filters are not further considered based on the applicability for this size of facility.

An advantage of the continuous backwash filter is there is no need to construct backwash water holding basins, waste backwash water holding basins, or backwash pumps since the media is continuously backwashed, which can significantly reduce the filter construction cost and increase ease of operation. With this type of filter, the media is continuously cleaned by recycling the sand internally through an airlift pipe and sand washer, which reduces operator attention required. A disadvantage of the continuous backwash filter is higher power cost due to the continuous operation of an air compressor.

Comparison of Tertiary Filtration Options: A summary of the design criteria for each of the filtration options is presented in Table 5.7. Evaluation of the filtration options includes a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 5.8. A summary of the economic evaluation is outlined in Table 5.11.

Table 5.7 Preliminary Design Criteria for Filtration Options
Wastewater Treatment Facilities Plan
King City

Item	Option	
	Cloth Media Disk	**Continuous Backwash**
Number	1+1	10+2
Filter Loading Rate, gpm/sf	6.0	5.0
Number of Disks per Unit	8	-
Surface Area per Disk, sf	53.8	-
Surface Area per Filter, sf	-	50
Total Surface Area, sf	860	600

Table 5.8 Tertiary Filtration Options Evaluation of Non-Economic Factors Wastewater Treatment Facilities Plan King City		
	Criteria Scale: 1 (Least Favorable) to 3 (Most Favorable)	
Item	**Cloth Media Disk**	**Continuous Backwash**
Safety	2	2
Meets Permit Requirements	3	3
Ease of O&M	2	3
Constructability	2	2
Reliability	3	3
Odor	2	2
Total Score	**14**	**15**

5.5.2 Preliminary Screening of Disinfection Options

The disinfection technologies available for recycled water systems consist of ozone, ultraviolet (UV) light, pasteurization, and chlorination. Of the disinfection options considered for this size of facility, Carollo recommends evaluating UV and chlorination since both are proven, reliable disinfection processes that can safely follow the evaluated filtration technologies and meet Title 22 unrestricted reuse-quality effluent. Ozone is not recommended for further evaluation because while it is commonplace for potable water disinfection, the use for wastewater disinfection is scarce. Ozone also typically has the highest life cycle cost of the four technologies. Pasteurization is also not recommended for further evaluation because it is uncommon for use in wastewater disinfection (other than biosolids generation) and requires significant power consumption and heat generation equipment. Furthermore, the turbine would require an air emissions permit.

UV Disinfection: While several configurations of UV disinfection exist for recycled water (open channel, in-vessel, and microwave), in-vessel UV was evaluated as the UV option for this facility based on the applicability for this size of facility. In-vessel UV has been approved by the State Department of Public Health for recycled water disinfection. It also has a small footprint requirement, requires minimal operator attention and reduced maintenance compared with chlorination, and is not known to form disinfection byproducts (DBP). An example of an in-vessel UV system is shown in Figure 5.9.

Figure 5.9 Example of In-Vessel UV Disinfection

UV design criteria is based primarily on 1) UVT, which is a measure of the quantity of UV light transmittable through the wastewater, which could be reduced by color, turbidity, certain metals, TDS, TSS, and other factors, and 2) UV dose, which is determined for each target organism (bacteria and/or virus in this case) according to Title 22 regulations. Since UVT data for future filtered secondary effluent is not available, an assumption of 55 percent UVT for post-media filtration was made according to National Water Research Institute (NWRI) 2012 guidelines. If membrane filtration is used, a design UVT of 65 percent could be used (per NWRI 2012 guidelines), which could reduce the sizing of the units by as much as 40 percent and reduce the O&M requirements.

The minimum required UV dose for Title 22 tertiary recycled water applications is significantly lower for effluent that has received membrane filtration compared to media filtration (80 versus 100 millijoules per square centimeter [mJ/cm^2]). For this evaluation, media filtration was assumed for a more conservative analysis.

Equipment reliability must be considered when designing a UV system. For open channel systems, the NWRI guidelines recommend a standby bank per channel or a standby channel be installed to ensure that the specified UV dose is provided under worst-case conditions with one bank of lamps out of service. For in-vessel systems, Carollo recommends a standby reactor be provided.

Because UV system sizing is very manufacturer-specific, during preliminary design a refinement of the UV disinfection design criteria would be made based on the selected filtration alternative, and up to three manufacturers would be considered. At that time, an

open channel installation could also be considered to determine the most cost-effective alternative for the City.

An advantage of UV disinfection is that it is a physical process rather than a chemical process, therefore, no chemicals are used to disinfect the water and no disinfection residual is created that could negatively impact the receiving water. UV disinfection also typically requires a smaller footprint than sodium hypochlorite disinfection. Disadvantages include higher power usage than sodium hypochlorite disinfection and increased O&M related with bulb replacement and cleaning. Safety considerations associated with UV disinfection include operator exposure to UV light and the potential for mercury release from lamp bulbs if damaged.

Chlorination and Dechlorination: While wastewater chlorination can be achieved through different systems and configurations (open concrete basin or in-pipe configurations using chlorine gas, delivered sodium hypochlorite, onsite-generated sodium hypochlorite), for the size of this facility, an open concrete basin using delivered sodium hypochlorite is recommended. Chlorine gas has additional O&M and safety considerations, and onsite-generated sodium hypochlorite requires additional equipment and increased power consumption. Dechlorination may be required prior to sprayfield or percolation pond disposal and to maintain chlorine residual control for the recycled water distribution system. For dechlorination (when required), delivered sodium bisulfite is recommended.

The major components of a sodium hypochlorite/sodium bisulfite disinfection system are a chlorine contact basin, sodium hypochlorite and sodium bisulfite storage tanks for bulk deliveries, chemical metering pumps, chemical piping, chemical mixing and/or injector units, and a chemical feed control system. It is assumed that the new metering pumps and controls would be located in a Chemical Feed Building located adjacent to the chlorine contact basin. An example of a chlorine contact basin is shown in Figure 5.10.

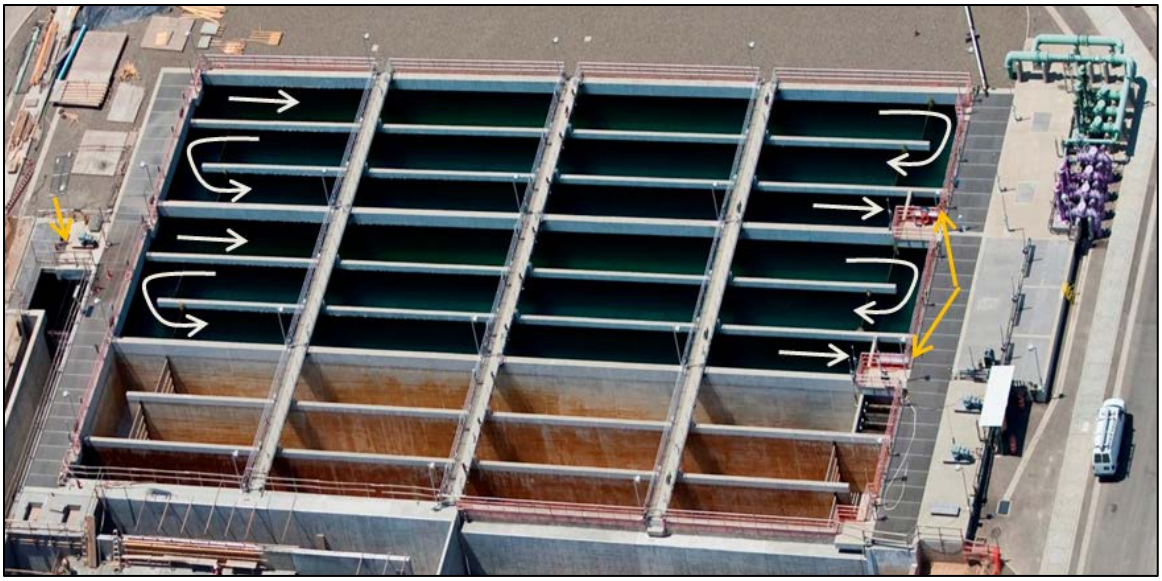


Figure 5.10 Example of Chlorine Contact Basin

Advantages of a sodium hypochlorite system include it is a proven, reliable process and it has the ability to maintain a disinfectant residual in the recycled water distribution system which, while not required by Title 22, is recommended to avoid biological growth within the pipes. With an automatic chemical feed control system in place, a disinfection system would require little operator attention. Disadvantages include periodic chlorine contact basin cleaning, reliance on chemical deliveries, and chemical feed and chemical mixer/injector equipment maintenance. Sodium hypochlorite could also generate DBPs, degrade and become less effective in sunlight (and hence a two-week storage quantity is recommended), and generate sodium which could impact recycled water quality. Chlorine is highly corrosive and toxic in all forms, and thus storage, shipping, and handling requires additional safety and O&M considerations.

Comparison of Disinfection Options: A summary of the design criteria for each of the disinfection options is presented in Table 5.9. Evaluation of the disinfection options includes a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 5.10. A summary of the economic evaluation is outlined in Table 5.11.

Table 5.9 Preliminary Design Criteria for Disinfection Options
Wastewater Treatment Facilities Plan
King City

Item	Option	
	Chlorination	**UV**
Number of Reactors	1	3+1
Total Volume, cu ft	35,650	-
Reactor Diameter, in	-	54
CT, mg-min/L	450	-
Modal Contact Time at PHF, min	90	-
Required Chlorine Residual, mg/L	5	-
Design UV Transmittance, percent	-	55
Minimum UV Dose, mJ/cm^2	-	102
Safety Factor	1.3	-
Total Coliform Bacteria, MPN/100 mL	<2.2(1) <23(2) <240(3)	<2.2(1)

Notes:
(1) 7-day median.
(2) Shall not be exceeded in more than one sample in any 30-day period.
(3) No sample shall exceed 240 MPN/100 mL.

Table 5.10 Disinfection Options Evaluation of Non-Economic Factors
Wastewater Treatment Facilities Plan
King City

Item	Criteria Scale: 1 (Least Favorable) to 3 (Most Favorable)	
	Chlorination (Sodium Hypochlorite)	**UV**
Safety	2	3
Meets Permit Requirements	3	3
Ease of O&M	3	1
Constructability	2	3
Reliability	3	3
Odor	2	3
Total Score	**15**	**16**

Table 5.11 Economic Comparison of Tertiary Treatment Alternatives
Wastewater Treatment Facilities Plan
King City

		Cost
Filtration		
Cloth Media Disk Filter	Capital Construction Costs(1)	$4,090,000
	Comparative Annual O&M Costs(2)	$1,100
	Present Worth of Comparative 20-year O&M Cost(3)	$16,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$4,106,000**
Continuous Backwash Filter	Capital Construction Costs(1)	$13,000,000
	Comparative Annual O&M Costs(2)	$11,800
	Present Worth of Comparative 20-year O&M Cost(3)	$163,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$13,163,000**
Disinfection		
Chlorination	Capital Construction Costs(1)	$3,090,000
	Comparative Annual O&M Costs(2)	$83,100
	Present Worth of Comparative 20-year O&M Cost(3)	$1,144,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$4,234,000**
UV	Capital Construction Costs(1)	$4,700,000
	Comparative Annual O&M Costs(2)	$103,300
	Present Worth of Comparative 20-year O&M Cost(3)	$1,422,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$6,122,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix E for capital cost item details for each alternative.
(2) Comparative annual O&M costs unique to each alternative were developed for comparative purposes. See Appendix F for a summary of O&M cost details.
(3) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76). Comparative Annual O&M Costs reported in this table are rounded to the nearest hundred dollars. All other costs are rounded to the nearest thousand dollars.
(4) Present worth of comparative life cycle cost = capital cost + present worth of comparative 20-year O&M cost. Note that this is not a total life cycle cost for the whole alternative, as common elements are not included.

5.6 IDENTIFICATION OF SOLIDS TREATMENT OPTIONS

Identification of solids treatment options is needed to address the regulatory objectives for biosolids as discussed in Chapter 2. Any of these treatment options deemed feasible were further discussed and evaluated with the City.

5.6.1 Preliminary Screening of Solids Treatment Options

Solids collected in the existing treatment system currently accumulate in the pond system and are periodically dredged and removed. With the proposed new facility, the majority of the solids generated will be WAS generated from the secondary treatment process. An additional but smaller source of solids will be generated by the filter backwash.

Several solids treatment and handling processes can be used to thicken, stabilize, and dewater wastewater sludge. The type of solids treatment recommended is based on the type of secondary sludge produced and, as discussed in Chapter 2, the intended disposal method (on-site or off-site) and the level of treatment achieved, whether Class A EQ, Class A, Class B, or less than Class B (unclassified). Currently in Monterey County, land application of Class B biosolids is allowed on a case-by-case basis as approved by the County Director of Health. For this evaluation, it is assumed that Class B biosolids will be produced by the new facility.

As shown in Table 5.12, for WAS produced by CAS with MLE, oxidation ditch, or MBR, there are several treatment processes that can be used for thickening, stabilization, and dewatering.

Table 5.12 Solids Treatment Options
Wastewater Treatment Facilities Plan
King City

Secondary Treatment Alternative	Solids Treatment Step Required		
	Thickening	Stabilization	Dewatering
CAS With MLE	✓	✓	✓
Oxidation Ditch(1)			✓
MBR	✓	✓	✓

Notes:
(1) WAS generated by the 25-day solids retention time in the oxidation ditch is anticipated to comply with the pathogen reduction and vector attraction reduction requirements of the 40 CFR 503 biosolids regulations.

5.6.2 Preliminary Screening of Solids Thickening Options

WAS removed from the CAS with MLE or MBR systems contains an average of 0.5 percent solids. To minimize the hydraulic loading and aeration requirements on the downstream stabilization process, the WAS is typically thickened with a mechanical process. For this

size facility, recommended thickening options are a gravity belt thickener (GBT) or a rotary drum thickener (RDT). Other types of thickening options, such as a dissolved air flotation thickener (DAFT) or gravity thickener (GT), are typically only cost-effective at larger facilities (in the range of 5 mgd or above).

Gravity Belt Thickeners: GBTs are metal-framed mechanical units that rely on separating liquid from solids by gravity drainage through a porous filter belt. Typical thickened WAS from GBTs can be up to 4 to 5 percent solids. An advantage of GBTs is that they are a reliable and relatively low-maintenance process with low energy consumption. A GBT is typically placed inside of a building with ventilation and odor control and is viewable from floor level which makes belt and roller adjustments and sludge monitoring easily accessible. A disadvantage of GBTs is that emissions of solids, liquids, corrosive gases, and odors within the building may be an O&M concern for plant staff. An example of a GBT is shown in Figure 5.11.

Figure 5.11 Example of Gravity Belt Thickener

Rotary Drum Thickeners: RDTs are metal-framed mechanical units with a screened rotating drum supported by a center shaft. The screen material can be filter cloth, perforated plate, or wire mesh. Performance of an RDT is similar to a GBT with additional

advantages such as an enclosed drum environment, potentially smaller footprint, and lesser requirement for operator attention.

An RDT is typically installed within a building like a GBT, however, emissions of solids, liquids, corrosive gases, and odors within the building is anticipated to be less of a concern.

Comparison of Solids Thickening Options: A summary of the design criteria for each of the solids thickening options is presented in Table 5.13. Evaluation of the solids thickening options includes a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 5.14. A summary of the economic evaluation is outlined in Table 5.19.

Table 5.13 Preliminary Design Criteria for Solids Thickening Options
Wastewater Treatment Facilities Plan
King City

Item	Gravity Belt Thickener and Rotary Drum Thickener
Number	1+1
Feed Solids (WAS), percent	0.5
Cake Solids, percent	4 to 6
Feed Volume, gal/wk	529,200
Weekly Dry Solids to Process, dry lb/wk	26,460
Hydraulic Loading, 12 h/d, 7 d/wk, gpm	105
Solids Loading, 12 h/d, 7 d/wk, dry lb/hr	315
Filtrate Volume, gal/wk	367,000

Table 5.14 Solids Thickening Options Evaluation of Non-Economic Factors
Wastewater Treatment Facilities Plan
King City

	Criteria Scale: 1 (Least Favorable) to 3 (Most Favorable)	
Item	**Gravity Belt Thickener**	**Rotary Drum Thickener**
Safety	2	3
Meets Permit Requirements	3	3
Ease of O&M	1	3
Constructability	2	3
Reliability	3	3
Odor	1	3
Total Score	**12**	**18**

5.6.3 Preliminary Screening of Stabilization Options

In order to meet the pathogen reduction requirements of 40 CFR 503, approved solids stabilization options include aerobic digestion, air drying, anaerobic digestion, composting, or lime stabilization. Specific operating conditions for each of these processes is further specified in 40 CFR 503.32(b). For the new facility, aerobic digestion and solids lagoons are the recommended solids stabilization options.

Anaerobic digestion is not recommended for this facility because no primary sludge is being generated. There are also significant additional capital and O&M costs as well as increased process complexity associated with anaerobic digesters. On-site composting is not recommended at this time because of the additional O&M considerations required, however, off-site composting could be considered as part of the disposal options explored during preliminary design. Lime stabilization is not recommended at this time since it increases the volume of the treated biosolids. However, it can achieve Class A treatment levels especially when used in conjunction with other dewatering techniques and could be explored during preliminary design if achieving Class A biosolids is desired.

Aerobic Digestion: Conventional aerobic digestion stabilizes sludge after meeting a minimum solids detention time to prevent odors, minimize vector attraction, and reduce pathogens. The amount of solids will also be reduced during aerobic digestion, which results in decreased solids handling requirements and costs. An additional benefit of aerobic digestion is improvement of the sludge dewatering characteristics. The improved dewatering allows for good separation of the solid and liquid phases and hence less water to haul offsite.

Aerobic digesters are typically open-air concrete basins similar to an aeration basin. An example of an aerobic digester is shown in Figure 5.12. They must be operated between temperatures of 15 and 20 degrees Celsius and for a total hydraulic residence time of 60 and 40 days, respectively, in order to meet Class B pathogen reduction requirements. The digesters can be operated in two stages to reduce the combined hydraulic residence time required. The aerobic digestion process includes aeration (normally supplied through mechanical blowers and coarse bubble diffusers) to supply oxygen to the bacteria breaking down the sludge, to prevent odors, and to keep the digester mixed. Mixers can also be included to assist with mixing.

Advantages of aerobic digesters compared with solids lagoons are the increased process control capability, reduced facility footprint, and reduced potential for odors. Disadvantages of aerobic digesters compared with solids lagoons are increased power cost and maintenance associated with the aeration and mixing system as well as periodic maintenance (cleaning and inspection) requirements of the digester basins.

Figure 5.12 Example of an Aerobic Digester

Solids Lagoon: Solids lagoons are earthen waste stabilization ponds usually 4 to 8 feet deep. An example of a solids lagoon is shown in Figure 5.13. Solids lagoons are not mechanically mixed or aerated. Instead, a layer of water at the surface (water cap) contains dissolved oxygen due to atmospheric reaeration and algal respiration, which supports aerobic and facultative organisms that stabilize the organic solids. The sludge layer at the bottom of the lagoon supports anaerobic fermentation by anaerobic organisms. The intermediate layer is the anoxic, facultative zone.

Advantages of solids lagoons are that they are reliable, easy to operate, and require little energy. Disadvantages include requiring significant land area and the possibility of odors, especially during spring or fall inversion of the aerobic and anaerobic layers due to temperature fluctuations. Odors can be mitigated by maintaining a water cap at all times. As solids accumulate in the lagoons, hydraulic capacity is reduced until the solids are periodically dredged and removed.

Figure 5.13 Example of a Solids Lagoon

Comparison of Stabilization Options: A summary of the design criteria for each of the stabilization options is presented in Table 5.15. Evaluation of the stabilization options includes a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 5.16. A summary of the economic evaluation is outlined in Table 5.19.

Table 5.15 Preliminary Design Criteria for Solids Stabilization Options
Wastewater Treatment Facilities Plan
King City

Item	Option	
	Aerobic Digester	**Solids Lagoon**
Number of Basins/Stages	2	-
Number of Zones	4	-
Feed Rate, mgd	0.02	0.02
Zone Dimensions, Each	38’ x 38’	-
SRT	21-d(1)	5-yr
Side Water Depth, ft		
Minimum, ft	18.4	-
Maximum, ft	20.0	10.0
Volume, MG Each	0.22	-
Total Volume, MG	0.86	52
Storage Volume, percent	-	70(2)

Table 5.15	Preliminary Design Criteria for Solids Stabilization Options Wastewater Treatment Facilities Plan King City

Notes:

(1) 40 CFR 503 biosolids regulations require a total aerobic digester SRT of 60-d at 15°C to meet Class B solids. If aerobic digesters are placed in series, only 70 percent of the required total SRT is needed, or 42-d. With two stages, each stage requires a 21-d SRT.

(2) Assumes 10 foot depth with 2 feet of freeboard and a 1 foot water cap.

Table 5.16 Solids Stabilization Options Evaluation of Non-Economic Factors
Wastewater Treatment Facilities Plan
King City

	Criteria Scale: 1 (Least Favorable) to 3 (Most Favorable)	
Item	**Aerobic Digester**	**Solids Lagoon**
Safety	3	2
Meets Permit Requirements	3	2
Ease of O&M	1	3
Constructability	1	2
Reliability	3	2
Odor	3	1
Total Score	**14**	**12**

5.6.4 Preliminary Screening of Dewatering Options

With limited land application options and an increasingly stringent regulatory climate for biosolids, sludge dewatering is typically an economically required step to reduce the moisture content of the biosolids prior to truck hauling and disposal (e.g., landfill disposal). The two most common dewatering options are solar drying through sludge drying beds and mechanical dewatering. Mechanical dewatering options include screw presses, belt filter presses, and centrifuges. For this size facility and because of land availability (from conversion of existing ponds), the two recommended options to consider are sludge drying beds and screw presses. Belt filter presses and centrifuges are not recommended for this size facility due to the additional operator attention and odors associated with the belt filter press and the additional power consumption associated with the centrifuge.

Sludge Drying Beds: Sludge drying beds are a simple and effective method of sludge dewatering. This method relies on solar energy for evaporation of moisture from the sludge. There are several ways to determine the area of sludge beds needed. Three common methods are: mass loading represented as pounds of solids applied per day per unit area, unit area of sludge drying beds per unit of influent flow, and liquid depth of sludge applied per unit area. For the purpose of this analysis, the first method, mass loading represented as pounds of solids applied per day per unit area, is used.

Stabilized sludge from either the aerobic digester or solids lagoon would be pumped to the sludge drying beds. Sludge is typically maintained at a shallow depth (e.g., 18 inches). While the biosolids are drying, the liquid is decanted and typically collected and pumped back to the headworks. After solar drying for between 30 to 90 days (achieving approximately 60 to 80 percent solids), the biosolids are then removed from the sludge drying beds with a front-end loader and stockpiled. The biosolids are then hauled offsite for reuse or disposal.

All sludge transfer and drying operations would be conducted by City staff. The City could contract with a private contractor who has a RWQCB permit for biosolids land application (e.g., Synagro, Engel & Gray, or Liberty Compost) to haul away stockpiled biosolids. With this option, routine sampling and monitoring of biosolids samples is required by 40 CFR 503.16 based on the amount of sludge produced annually to demonstrate vector attraction and pathogen reduction.

Dewatered biosolids could be stockpiled in a lined stockpile area, which will reduce hauling costs, protect the groundwater underlying the facility site, and give the City flexibility when dealing with biosolids disposal. The liner material is typically HDPE or concrete, but conversion of the existing clay-lined ponds could be explored further with input from the Central Coast Regional Board. Consideration of the proximity of sludge drying beds and any associated stockpile areas to the 100-year flood plain is required to protect against incidental flooding and onsite runoff. The new sludge drying beds and stockpile areas would need to be built within walls or dikes that extend above the 100-year flood elevation with 2 feet of freeboard.

Screw Press: Because of the rising land value and concerns over groundwater protection from biosolids decant liquid or runoff, a new mechanical dewatering process consisting of a screw press could be installed rather than building sludge drying beds. An example of a screw press is shown in Figure 5.14.

A screw press consists of a horizontally mounted screw conveyor that moves biosolids down a reduced diameter bowl thereby increasing pressure along the length of the screw press, which results in the dewatering of the biosolids. The main advantages of screw presses are their mechanical simplicity, lower power requirements, and ability to be operated on a 24-hour schedule. Screw presses also require minimal operator attention and have the ability to contain odors. They are typically housed in a dewatering building at an elevated height to allow dewatered sludge cake to drop into a hopper that loads directly into hauling trucks. An additional advantage of screw presses is the potential to produce Class A biosolids with additional heat and lime addition. If Class A production is desired, the required additional components should also be considered during preliminary design.

Figure 5.14 Example of a Screw Press

Comparison of Dewatering Options: A summary of the design criteria for each of the dewatering options is presented in Table 5.17. Evaluation of the dewatering options includes a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 5.18. A summary of the economic evaluation is outlined in Table 5.19.

Table 5.17 Preliminary Design Criteria for Solids Dewatering Options
Wastewater Treatment Facilities Plan
King City

Item	Option	
	Sludge Drying Beds	**Screw Press**
Number	1	1+1
Area, ac	5.0	-
Feed Solids Concentration, percent	0.5 to 0.75	0.5 to 2
Feed Volume, gal/wk	453,600	572,500
Weekly Dry Solids to Process, dry lb/wk	24,360	24,000
Operation	24 h/d, 7 d/wk	12 h/d, 4 d/wk
Hydraulic Loading, gpm	45	200
Solids Loading, dry lb/h	145	500
Filtrate Volume, gal/wk	-	122,450

Table 5.18 Solids Dewatering Options Evaluation of Non-Economic Factors Wastewater Treatment Facilities Plan King City		
	Criteria Scale: 1 (Least Favorable) to 3 (Most Favorable)	
Item	**Screw Press**	**Drying Beds**
Safety	2	2
Meets Permit Requirements	3	3
Ease of O&M	3	2
Constructability	3	3
Reliability	3	3
Odor	3	1
Total Score	**17**	**14**

5.6.5 Economic Comparison of Solids Treatment Alternatives

Table 5.19 Economic Comparison of Solids Treatment Alternatives Wastewater Treatment Facilities Plan King City		
		Cost
Thickening		
Gravity Belt Thickener	Capital Construction Costs(1)	$2,390,000
	Comparative Annual O&M Costs(2)	$11,800
	Present Worth of Comparative 20-year O&M Cost(3)	$163,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$2,553,000**
Rotary Drum Thickener	Capital Construction Costs(1)	$2,730,000
	Comparative Annual O&M Costs(2)	$1,200
	Present Worth of Comparative 20-year O&M Cost(3)	$17,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$2,747,000**
Stabilization		
Aerobic Digestion	Capital Construction Costs(1)	$6,180,000
	Comparative Annual O&M Costs(2)	$188,400
	Present Worth of Comparative 20-year O&M Cost(3)	$2,593,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$8,773,000**
Solids Lagoon	Capital Construction Costs(1)	$1,500,000
	Comparative Annual O&M Costs(2)	$1,120,300
	Present Worth of Comparative 20-year O&M Cost(3)	$15,417,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$16,917,000**

Table 5.19 Economic Comparison of Solids Treatment Alternatives Wastewater Treatment Facilities Plan King City		
		Cost
Dewatering		
Sludge Drying Bed	Capital Construction Costs(1)	$4,090,000
	Comparative Annual O&M Costs(2)	$47,300
	Present Worth of Comparative 20-year O&M Cost(3)	$651,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$4,741,000**
Screw Press	Capital Construction Costs(1)	$3,720,000
	Comparative Annual O&M Costs(2)	$229,600
	Present Worth of Comparative 20-year O&M Cost(3)	$3,160,000
	Present Worth of Comparative Life-Cycle Cost(4)	**$6,880,000**

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix E for capital cost item details for each alternative.
(2) Comparative annual O&M costs unique to each alternative were developed for comparative purposes. See Appendix F for a summary of O&M cost details.
(3) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76). Comparative Annual O&M Costs reported in this table are rounded to the nearest hundred dollars. All other costs are rounded to the nearest thousand dollars.
(4) Present worth of comparative life cycle cost = capital cost + present worth of comparative 20-year O&M cost. Note that this is not a total life cycle cost for the whole alternative, as common elements are not included.

5.7 OPTIONS FOR OVERALL TERTIARY FACILITY AND RECOMMENDED ALTERNATIVE

5.7.1 Options for Overall Tertiary Facility

A workshop was held with the City on March 30, 2017 to discuss potential treatment options, non-economic considerations associated with each treatment process, and planning-level comparative life-cycle cost estimates for each treatment option. The Meeting Minutes and Presentation from the March 30, 2017 and earlier meetings can be found in Appendix G. Based on the range of options evaluated in this chapter, Carollo presented two overall tertiary facility configurations for the City to consider. These two potential configurations for the overall tertiary facility (based on the secondary treatment option) are shown in Table 5.20.

Table 5.20 Recommended Configurations for Overall Tertiary Facility Wastewater Treatment Facilities Plan King City						
	Liquid Treatment			Biosolids Treatment		
Alternative	Secondary Treatment	Filtration	Disinfection	Thickening	Stabilization	Dewatering
1	Oxidation Ditch with Secondary Clarifiers	Continuous Backwash Filter	UV	N/A	N/A	Screw Press
2	MBR	N/A	UV	Rotary Drum Thickener	Aerobic Digester	Screw Press

A comparison of the capital construction costs of two potential configurations including the common elements are shown in Table 5.21.

Table 5.21 Total Capital Construction Costs(1) of Overall Tertiary Facility Wastewater Treatment Facilities Plan King City		
Process	**Oxidation Ditch Configuration Cost**	**MBR Configuration Cost**
Headworks	$7,670,000	$7,670,000
Secondary Treatment (Includes Splitter Box and Secondary Clarifiers if Required)	$24,120,000	$23,770,000
Continuous Backwash Filters	$13,000,000	N/A
UV	$4,700,000	$4,700,000
Rotary Drum Thickener	N/A	$2,730,000
Aerobic Digester	N/A	$6,180,000
Screw Press	$3,720,000	$3,720,000
Total	**$53,210,000**	**$48,770,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix E for capital cost item details for each element.

5.7.2 Recommended Alternative for Overall Tertiary Facility

Based on feedback obtained from the March 30, 2017 workshop, the City prefers Alternative No. 1: headworks, oxidation ditch, secondary clarifier, continuous backwash filter, UV, and screw press. A preliminary facility site plan is shown in Figure 5.15 and a preliminary hydraulic profile for the proposed facility is shown in Figure 5.16. Given that the

construction costs for Alternatives Nos. 1 and 2 are similar, the decision to move forward with Alternative No. 1 was made on a qualitative basis and from input from the City. Alternative No. 1 is further parsed into Buildout and Phasing options for both Secondary Treatment only and full Tertiary Treatment. The Buildout and Phasing options are detailed in Table 5.22.

Table 5.22 Number of Unit Process Options for the Recommended Alternative Wastewater Treatment Facilities Plan King City

	Tertiary Treatment			Secondary Treatment		
Process	**Buildout**	**Phase 1**	**Phase 2**	**Buildout**	**Phase 1**	**Phase 2**
Headworks	1	1	-	1	1	-
Oxidation Ditch	3	2	1	3	2	1
Secondary Clarifier	3+1	2+1	1	3+1	2+1	1
Continuous Backwash Filter	10+2	6+2	4	-	-	-
UV	3+1	2+1	1	-	-	-
Screw Press	1+1	1+1	-	1+1	1+1	-

LEGEND

1. Headworks
2. Oxidation Ditches
3. RAS/WAS Pump Station
4. Secondary Clarifiers
5. Continuous Backwash Filters
6. UV Disinfection
7. Irrigation Pump Station (Existing)
8. Screw Press

N

0 150

Scale in Feet

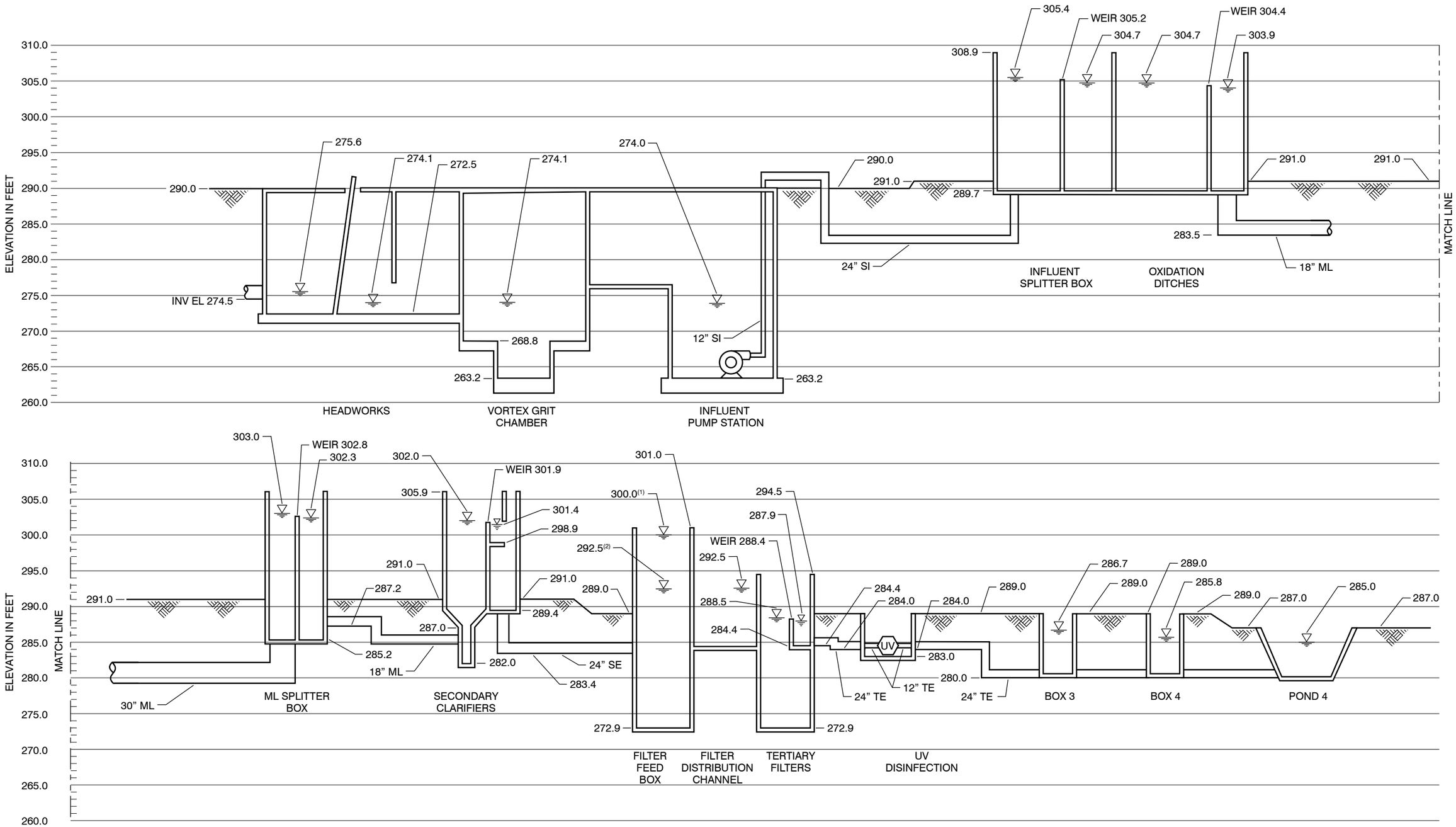
PRELIMINARY
TERTIARY FACILITY SITE PLAN

FIGURE 5.15

KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

carollo

kc0517rf6-10406.ai



NOTES:

1. WATER SURFACE ELEVATION AT PHF 7.8 MGD.
2. WATER SURFACE ELEVATION AT MDDF 3.2 MGD.

PRELIMINARY HYDRAULIC PROFILE

FIGURE 5.16

KING CITY
WASTEWATER TREATMENT FACILITIES PLAN

carollo

kc0817rf1-10406.ai

The Tertiary Treatment at Buildout option cost was developed based on a WWTP that would allow treatment of an ADMMF of 2.0 mgd based on an escalation to midpoint of construction of April 1, 2020. The cost of the Tertiary Treatment at Buildout option is shown in Table 5.23.

Table 5.23 Cost of Tertiary Treatment Facility at Buildout
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost(1)(2)	Total Annual O&M Cost(3)	Present Worth of 20-yr O&M Cost(4)	Present Worth of 20-yr Life Cycle Cost(5)
Headworks	$7,670,000	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$24,120,000	$207,400	$2,854,000	$26,974,000
Continuous Backwash Filter	$13,000,000	$46,200	$636,000	$13,636,000
UV	$4,700,000	$103,300	$1,422,000	$6,122,000
Screw Press	$3,720,000	$229,600	$3,160,000	$6,880,000
Labor	-	$500,000	$6,881,000	$6,881,000
Total(6)	**$53,210,000**	**$1,125,500**	**$15,490,000**	**$68,700,000**

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix H for capital cost item details for each element.
(2) Buildout escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-year life cycle cost = capital construction cost + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

The Phased Tertiary Treatment option consists of a two-part phasing approach. Phase 1 cost was developed based on a WWTP that would allow treatment of two-thirds of the Buildout ADMMF at 1.3 mgd. Phase 1 cost is based on an escalation to midpoint of construction of April 1, 2020. Phase 2 would bring the WWTP to buildout capacity and allow treatment of an ADMMF of 2.0 mgd. Phase 2 cost is based on an escalation to midpoint of construction of January 1, 2023. The cost of the Tertiary Treatment Phased option is shown in Table 5.24.

Table 5.24 Cost of Tertiary Treatment Facility Phased Wastewater Treatment Facilities Plan King City

Process	Capital Construction Cost, Phase 1(1)(2)	Capital Construction Cost, Phase 2(1)(2)	Total Annual O&M Cost(3)	Present Worth of 20-yr O&M Cost(4)	Present Worth of 20-yr Life Cycle Cost(5)
Headworks	$7,670,000	-	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$7,570,000	$207,400	$2,854,000	$27,584,000
Continuous Backwash Filter	$8,690,000	$4,680,000	$46,200	$636,000	$14,006,000
UV	$3,530,000	$1,270,000	$103,300	$1,422,000	$6,222,000
Screw Press	$3,720,000	-	$229,600	$3,160,000	$6,880,000
Labor	-	-	$500,000	$6,881,000	$6,881,000
Total(6)	**$40,770,000**	**$13,520,000**	**$1,125,500**	**$15,490,000**	**$69,780,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020. Phase 2 escalation to midpoint of construction occurs January 1, 2023.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-yr life cycle cost = capital construction cost, phase 1 + capital construction cost, phase 2 + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

The Secondary Treatment only at Buildout option cost was developed based on a WWTP that would allow treatment of an ADMMF of 2.0 mgd based on an escalation to midpoint of construction of April 1, 2020. However, tertiary treatment is not included in this estimate. The cost of the Secondary Treatment only at Buildout option is shown in Table 5.25.

Table 5.25 Cost of Secondary Treatment Facility at Buildout
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost(1)(2)	Total Annual O&M Cost(3)	Present Worth of 20-yr O&M Cost(4)	Present Worth of 20-yr Life Cycle Cost(5)
Headworks	$7,670,000	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$24,120,000	$207,400	$2,854,000	$26,974,000
Screw Press	$3,720,000	$229,600	$3,160,000	$6,880,000
Labor	-	$300,000	$4,129,000	$4,129,000
Total(6)	**$35,510,000**	**$776,000**	**$10,680,000**	**$46,190,000**

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix H for capital cost item details for each element.
(2) Buildout escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-year life cycle cost = capital construction cost + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

The Phased Secondary Treatment only option consists of a two-part phasing approach that would only include secondary treatment and no tertiary treatment. Phase 1 cost was developed based on a WWTP that would allow treatment of two-thirds of the Buildout ADMMF at 1.3 mgd. Phase 1 cost is based on an escalation to midpoint of construction of April 1, 2020. Phase 2 would bring the WWTP to buildout capacity and allow treatment of an ADMMF of 2.0 mgd. Phase 2 cost is based on an escalation to midpoint of construction of January 1, 2023. The cost of the Secondary Treatment only phased option is shown in Table 5.26.

Table 5.26 Cost of Secondary Treatment Facility Phased Wastewater Treatment Facilities Plan King City

Process	Capital Construction Cost, Phase 1[(1)(2)]	Capital Construction Cost, Phase 2[(1)(2)]	Total Annual O&M Cost[(3)]	Present Worth of 20-yr O&M Cost[(4)]	Present Worth of 20-yr Life Cycle Cost[(5)]
Headworks	$7,670,000	-	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$7,570,000	$207,400	$2,854,000	$27,584,000
Screw Press	$3,720,000	-	$229,600	$3,160,000	$6,880,000
Labor	-	-	$300,000	$4,129,000	$4,129,000
Total[(6)]	**$28,550,000**	**$7,570,000**	**$776,000**	**$10,680,000**	**$46,800,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020. Phase 2 escalation to midpoint of construction occurs January 1, 2023.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-yr life cycle cost = capital construction cost, phase 1 + capital construction cost, phase 2 + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

5.7.3 Cost Saving Alternative for Overall Tertiary Facility

Although the tertiary filtration alternative originally preferred by the City is continuous backwash filtration, an option to reduce overall facility costs was considered with cloth media disk filtration.

The success of the cloth media disk filter is contingent upon the compatibility of the filter with the secondary effluent quality to readily meet Title 22 standards. The final decision to move forward with continuous backwash filters or cloth media disk filters will be further explored during preliminary design after additional influent sampling and modeling is conducted.

This cost saving alternative includes headworks, oxidation ditch, secondary clarifier, cloth media disk filters, UV, and screw press. This tertiary treatment alternative is further parsed into Buildout and Phasing options for full Tertiary Treatment. The Buildout and Phasing options are detailed in Table 5.27.

Table 5.27 Number of Unit Process Options for the Recommended Alternative with Cloth Media Disk Filter
Wastewater Treatment Facilities Plan
King City

	Tertiary Treatment			Secondary Treatment		
Process	**Buildout**	**Phase 1**	**Phase 2**	**Buildout**	**Phase 1**	**Phase 2**
Headworks	1	1	-	1	1	-
Oxidation Ditch	3	2	1	3	2	1
Secondary Clarifier	3+1	2+1	1	3+1	2+1	1
Cloth Media Disk Filter	8+8	6+6	2+2	-	-	-
UV	3+1	2+1	1	-	-	-
Screw Press	1+1	1+1	-	1+1	1+1	-

The Tertiary Treatment at Buildout option cost was developed based on a WWTP that would allow treatment of an ADMMF of 2.0 mgd based on an escalation to midpoint of construction of April 1, 2020. The cost of the Tertiary Treatment at Buildout option is shown in Table 5.28.

Table 5.28 Cost of Tertiary Treatment Facility at Buildout with Cloth Media Disk Filter Wastewater Treatment Facilities Plan King City

Process	Capital Construction Cost(1)(2)	Total Annual O&M Cost(3)	Present Worth of 20-yr O&M Cost(4)	Present Worth of 20-yr Life Cycle Cost(5)
Headworks	$7,670,000	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$24,120,000	$207,400	$2,854,000	$26,974,000
Cloth Media Disk Filter	$4,090,000	$68,300	$940,000	$5,030,000
UV	$4,700,000	$103,300	$1,422,000	$6,122,000
Screw Press	$3,720,000	$229,600	$3,160,000	$6,880,000
Labor	-	$500,000	$6,881,000	$6,881,000
Total(6)	**$44,300,000**	**$1,147,600**	**$15,794,000**	**$60,094,000**

Notes:

(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix H for capital cost item details for each element.
(2) Buildout escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-year life cycle cost = capital construction cost + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

The Phased Tertiary Treatment option consists of a two-part phasing approach. Phase 1 cost was developed based on a WWTP that would allow treatment of two-thirds of the Buildout ADMMF at 1.3 mgd. Phase 1 cost is based on an escalation to midpoint of construction of April 1, 2020. Phase 2 would bring the WWTP to buildout capacity and allow treatment of an ADMMF of 2.0 mgd. Phase 2 cost is based on an escalation to midpoint of construction of January 1, 2023. The cost of the Tertiary Treatment Phased option is shown in Table 5.29.

Table 5.29 Cost of Tertiary Treatment Facility Phased with Cloth Media Disk Filter
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost, Phase 1(1)(2)	Capital Construction Cost, Phase 2(1)(2)	Total Annual O&M Cost(3)	Present Worth of 20-yr O&M Cost(4)	Present Worth of 20-yr Life Cycle Cost(5)
Headworks	$7,670,000	-	$39,000	$537,000	$8,207,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$7,570,000	$207,400	$2,854,000	$27,584,000
Cloth Media Disk Filter	$3,060,000	$1,110,000	$68,300	$940,000	$5,110,000
UV	$3,530,000	$1,270,000	$103,300	$1,422,000	$6,222,000
Screw Press	$3,720,000	-	$229,600	$3,160,000	$6,880,000
Labor	-	-	$500,000	$6,881,000	$6,881,000
Total(6)	**$35,140,000**	**$9,950,000**	**$1,147,600**	**$15,794,000**	**$60,884,000**

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020. Phase 2 escalation to midpoint of construction occurs January 1, 2023.
(3) See Appendix F for a summary of O&M cost details.
(4) Present worth is based on a 20-year life, a discount rate of 6 percent, and an inflation rate of 3 percent (P/A=13.76).
(5) Present worth of 20-yr life cycle cost = capital construction cost, phase 1 + capital construction cost, phase 2 + present worth of 20-yr O&M cost.
(6) Costs do not include reuse or disposal alternatives.

5.7.4 Recommended Alternatives based on Preliminary Recycled Water Feasibility Analysis

The City's facility plan goals are to include enough secondary capacity in the short term to comply with anticipated new discharge requirements, produce unrestricted reuse-quality recycled water, and have enough treatment and disposal capacity to support these goals. The Preliminary Recycled Water Feasibility Analysis conducted by Carollo for Cal Water in

spring 2017 concluded the recommended maximum month recycled water demand for the City is 94.8 AFM. Based on this recommendation and the City's desire to minimize initial capital costs, two additional alternatives are recommended, one with continuous backwash filters and the other with cloth media disk filters. Both include provisions for reuse/disposal facilities. These alternatives are sized for 1.3 mgd secondary treatment capacity and 1.2 mgd tertiary treatment capacity. The capital costs for these alternatives are detailed in Table 5.30.

Table 5.30 Capital Costs Based on Preliminary Recycled Water Feasibility Analysis
Wastewater Treatment Facilities Plan
King City

Process	Capital Construction Cost, Phase 1[(1)(2)]	Capital Construction Cost, Phase 1[(1)(2)]
Headworks	$7,670,000	$7,670,000
Oxidation Ditch/Secondary Clarifier	$17,160,000	$17,160,000
Continuous Backwash Filter	$6,510,000	-
Cloth Media Disk Filter	-	$2,050,000[(4)]
UV	$2,360,000	$2,360,000[(4)]
Screw Press	$3,720,000	$3,720,000
Reuse/Disposal	$3,450,000	$3,450,000
Total	**$40,870,000**	**$36,410,000[(4)(5)]**

Notes:
(1) Cost estimate is based on 2017 Dollars and includes 30 percent estimating contingency. See Appendix I for phased capital cost item details for each element.
(2) Phase 1 escalation to midpoint of construction occurs April 1, 2020.
(3) See Appendix F for a summary of O&M cost details.
(4) Based on initial discussions, the tertiary treatment facilities could be paid for by Cal Water. In this case, the total construction cost for the City's 1.3 mgd secondary treatment facility with reuse/disposal would be $32,000,000.
(5) If the City were to build a 2.0 mgd secondary treatment facility with reuse/disposal facilities, the cost would be $38,960,000 ($35,510,000 + $3,450,000) with Cal Water paying for the tertiary filtration and disinfection facilities.

The reuse/disposal component of this project would be sized to meet a Buildout ADMMF of 2.0 mgd with enough recycled water storage volume to support Alternative 4 in the Preliminary Recycled Water Feasibility Analysis as well as enough percolation and sprayfield capacity to handle the anticipated flows in the 20-year planning horizon. This first phase of 1.3 mgd secondary capacity would be sufficient for approximately 7 years, at which time Phase 2 would be implemented to expand the secondary capacity to meet the ADMMF of 2.0 mgd required at Buildout.

APPENDIX A – WASTE DISCHARGE REQUIREMENTS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

1102-A Laurel Lane
San Luis Obispo, California 93401

ORDER No. 91-05

WASTE DISCHARGE REQUIREMENTS
FOR
CITY OF KING DOMESTIC WASTEWATER FACILITY
MONTEREY COUNTY

The California Regional Water Quality Control Board, Central Coast Region, (hereafter Board), finds that:

1. Mr. Blaine Michaelis, City Manager, filed a Report of Waste Discharge on April 25, 1990, in accordance with Section 13260 of the California Water Code. The report was filed on behalf of the City of King requesting revision to the City's existing Waste Discharge Requirement Order No. 84-58, to allow an increase in flow from 0.79 MGD to 1.2 MGD.

2. The City of King (hereafter Discharger) owns and operates a domestic wastewater treatment and disposal facility located along the east bank of the Salinas River, as shown on Attachments "A" and "B".

3. Domestic wastewater volumes discharged averaged approximately 0.7 million-gallons-per-day during 1989. The City is in the process of making improvements to the domestic facilities. Proposed design capacity (average) for the domestic wastewater system is 1.20 MGD.

4. Domestic wastewater facilities consist of a comminutor, an influent pump station and a series of stabilization ponds with spray disposal. Proposed expansion includes deepening three existing primary ponds and adding an additional 18.5 acres of spray disposal area, as shown on Attachment "B".

5. The additional 18.5 acres of spray disposal area is will be protected against the 50 to 100 year frequency flood event.

6. This discharge is presently regulated by "Waste Discharge Requirements for the City of King, Monterey County," adopted by the Board on July 13, 1984. It has been regulated by the Board for more than 28 years.

7. Depth to groundwater in the vicinity of the disposal area varies between four and nine feet. Shallow groundwater quality from monitoring wells in the vicinity of the disposal facility is as follows (December, 1989 data):

	Concentration, mg/l	
Constituent	Upgradient	Downgradient*
Total Dissolved Solids	340	415
Sodium	38	63
Chloride	28	67
Sulfate	98	114
Nitrate (as N)	6.4	<0.01
Boron	0.39	0.39

*Averaged from two wells

8. The Board adopted the Water Quality Control Plan, Central Coastal Basin (Basin Plan), on March 14, 1975. The Basin Plan contains policies and strategies for protecting beneficial uses of water in the Central Coast Region of California.

9. Present and anticipated beneficial uses of groundwater in the vicinity of the discharge include:

   a. Domestic supply
   b. Agricultural supply
   c. Industrial supply

10. Present and anticipated beneficial uses of the Salinas River in the vicinity of the discharge include:

    a. Municipal and domestic supply;
    b. Agricultural supply;
    c. Industrial supply;
    d. Groundwater recharge;
    e. Water contact recreation;
    f. Non-contact water recreation;
    g. Wildlife habitat;
    h. Warm fresh-water habitat; and,
    i. Fish migration.

11. An area wide waste treatment management plan, entitled Water Quality Management Plan for the Monterey Bay Area (208) Plan), was adopted by the Association of Monterey Bay Area Governments, a designated agency, on July 12, 1978, and subsequently certified by the State Water Resources Control Board on September 21, 1978. The 208 Plan recommends investigations be made of municipal treatment and disposal methods within the Salinas Valley for alternatives that would reduce nitrates discharged to groundwater.

12. These requirements are exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000 et seq.) in accordance with Section 15301, Chapter 3, Title 14, California Administrative Code (Existing Facilities exemption). The City of King certified a final Environmental Impact Report for the wastewater treatment plant improvements on February 13, 1990, in accordance with the California Environmental Quality Act (Public Resources Code, Section 211500, et seq.) and the California Code of Regulations.

13. Discharge of waste is a privilege, not a right, and authorization to discharge is conditional upon the discharge complying with provisions of Division 7 of the California Water Code and any more stringent effluent limitations necessary to implement water quality control plans, to protect beneficial uses, and to prevent nuisance. Compliance with this Order should assure this and mitigate any potential adverse changes in water quality due to the discharge.

14. On October 22, 1990, the Board notified the Discharger and interested agencies and persons of its intent to revise waste discharge requirements for the discharge and provided them with an opportunity to submit written views and comments.

15. After considering all comments pertaining to this discharge during a public hearing on January 11, 1991, this Order was found consistent with the above findings.

IT IS HEREBY ORDERED, pursuant to authority in Section 13263 of the California Water Code, that the City of King, its agents and assigns, may discharge waste providing compliance is maintained with the following:

(Note: other prohibitions and conditions, definitions, and the method of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements" dated January, 1984. Applicable paragraphs are referenced in paragraph D.3. of this Order.)

A. PROHIBITIONS

1. Discharge of any wastewater from transport, treatment, or disposal systems (including overflow, bypass and overspray) to the Salinas River, drainageways, and adjacent properties is prohibited.

2. Discharge to areas other than pond and spray disposal areas shown in Attachment "B" is prohibited.

3. Discharge within 100 feet of any well used for domestic supply is prohibited.

B. DISCHARGE SPECIFICATIONS

1. Until domestic facility improvements described in Finding Nos. 4 and 5, above, are complete, the discharge of domestic wastewater during any month shall not exceed a mean of 0.79 MGD.

2. After domestic facility improvements are complete and upon written approval from the Executive Officer, the discharge of domestic wastewater during any month shall not exceed a mean of 1.2 MGD.

3. Effective January 1, 1992, effluent discharged to the domestic spray disposal areas shall not exceed the following limitations:

Parameter	Units	30 Day Mean	7 Day Mean
Settleable Solids	ml/l	0.8	1.2
Suspended Solids	mg/l	100	150
Biochemical Oxygen Demand, 5 day	mg/l	100	150

As an alternative, the Discharger may establish a maintenance plan which provides equivalent results as the effluent limits specified above. Use of a maintenance plan in lieu of the limits defined above, shall be effective only if approved in writing by the Executive Officer.

4. Ponds shall not have a pH less than 6.5 or greater than 8.3.

5. All spray disposal areas shall be on lands owned or controlled by the discharger.

6. The spray disposal areas shall be managed so at least one-half of the spray disposal area is not in use at any given time.

7. Wastewater shall be applied to spray disposal areas using a regular rotation. Rotation from one spray area to another shall occur at least weekly.

8. Wastewater applied to spray disposal areas shall not pond.

9. Vegetation shall be maintained in spray disposal areas to enhance nutrient uptake and shall be controlled so it does not interfere with access for inspection and operation and maintenance.

10. Nearby drainageways shall be properly maintained to prevent flooding of the treatment and disposal systems.

11. Stabilization ponds shall be maintained to minimize solids concentrations discharged to the spray disposal area and to prevent soil clogging of the disposal area.

C. RECEIVING WATER LIMITATIONS

1. The discharge shall not cause nitrate concentrations in the groundwater downgradient of the disposal area to exceed 8 mg/l (as N).

2. The discharge shall not cause a statistically significant increase of constituents (nitrate, sodium, chloride, TDS, etc.) in underlying groundwater, as determined by comparison of samples collected from wells located upgradient and downgradient of the disposal area.

3. Discharge shall not cause concentrations of inorganic chemicals, organic chemicals, or radionuclides in groundwater to exceed the

limits set forth in California Code of Regulations, Title 22, Chapter 15, Articles 4, 4.5, 5 and 5.5.

D. PROVISIONS

1. Requirements prescribed by this Order supersede the requirements prescribed by

   Order No. 84-58, adopted by the Board on July 13, 1984, which is hereby rescinded.

2. The discharger shall comply with "Monitoring and Reporting Program No. 91-05", as specified by the Executive Officer.

3. The discharger shall comply with the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements", dated January, 1984. Provision A.13. does not apply to the "New Disposal Area" shown on Attachment "B".

4. To complete domestic facility improvements to the domestic facility as described in Finding No. 4. and 5., above, the Discharger shall comply with the following time schedule.

Task	Compliance Date	Report Due
Submit Final Operation and Maintenance Manual for New Disposal Area Flood Control	4/15/91	5/1/91

5. By September 1, 1991, the Discharger shall submit a technical report and operation and maintenance plan which satisfies Discharge Specification B.3. of this order.

6. Pursuant to Title 23, Chapter 3, Sub-Chapter 9, of the California Code of Regulations, the Discharger must submit a written report to the Executive Officer not later than July 1, 1995, that addresses:

   a. Whether there will be changes in the continuity, character, location, or volume of the discharge over the following five years; and,

   b. Whether, in its opinion, there is any portion of the Order that is incorrect, obsolete, or otherwise in need of revision.

I, WILLIAM R. LEONARD, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Coast Region, on January 11, 1991.

William R. Leonard
Executive Officer

sm30:91-05.WDR

CITY OF KING

PLANNING AREA BOUNDARY

CITY LIMITS

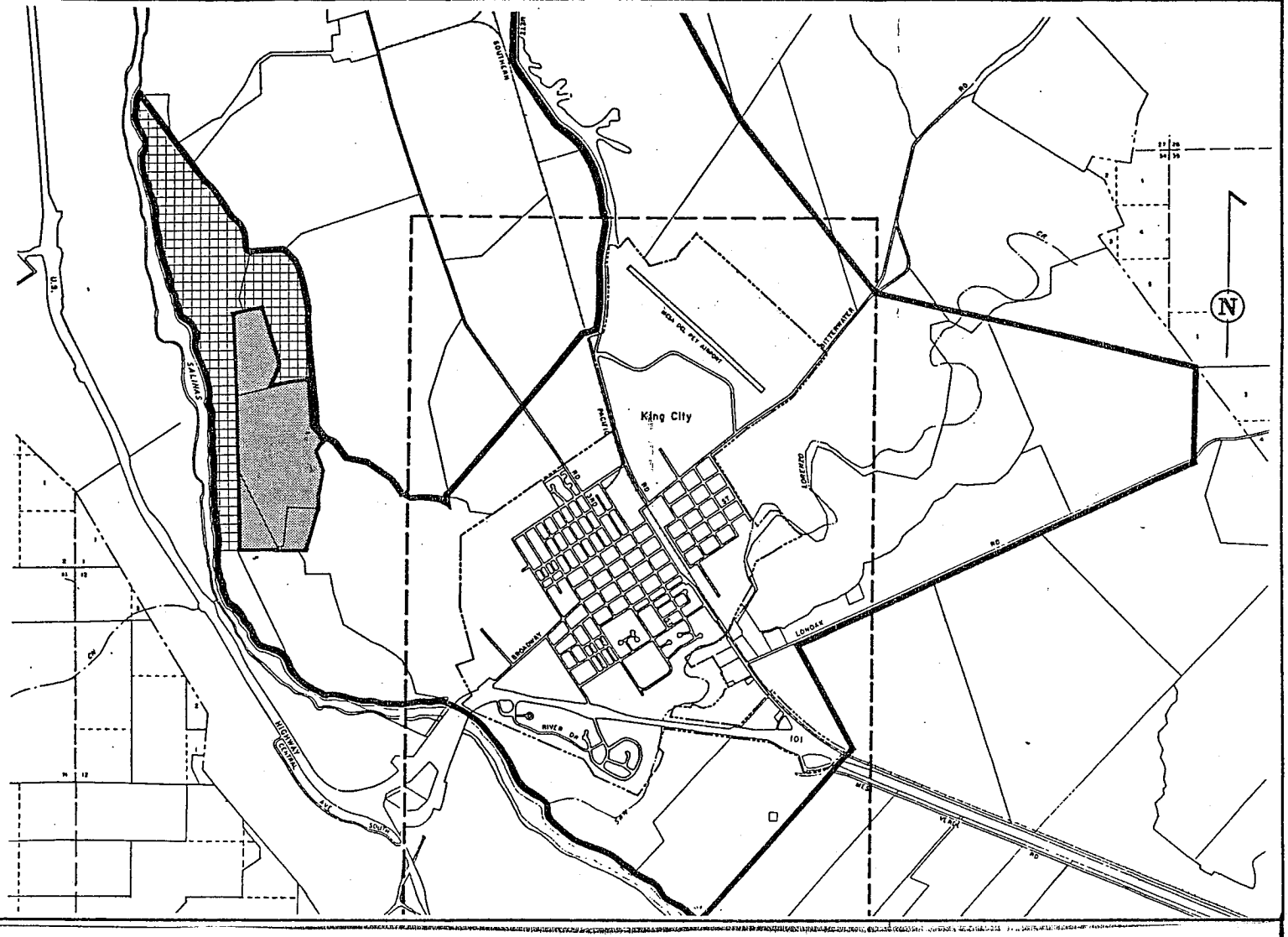
EXISTING WASTEWATER TREATMENT PLANT

PROPOSED ANNEXATION AREA

KING CITY WASTEWATER TREATMENT PLANT EXPANSION

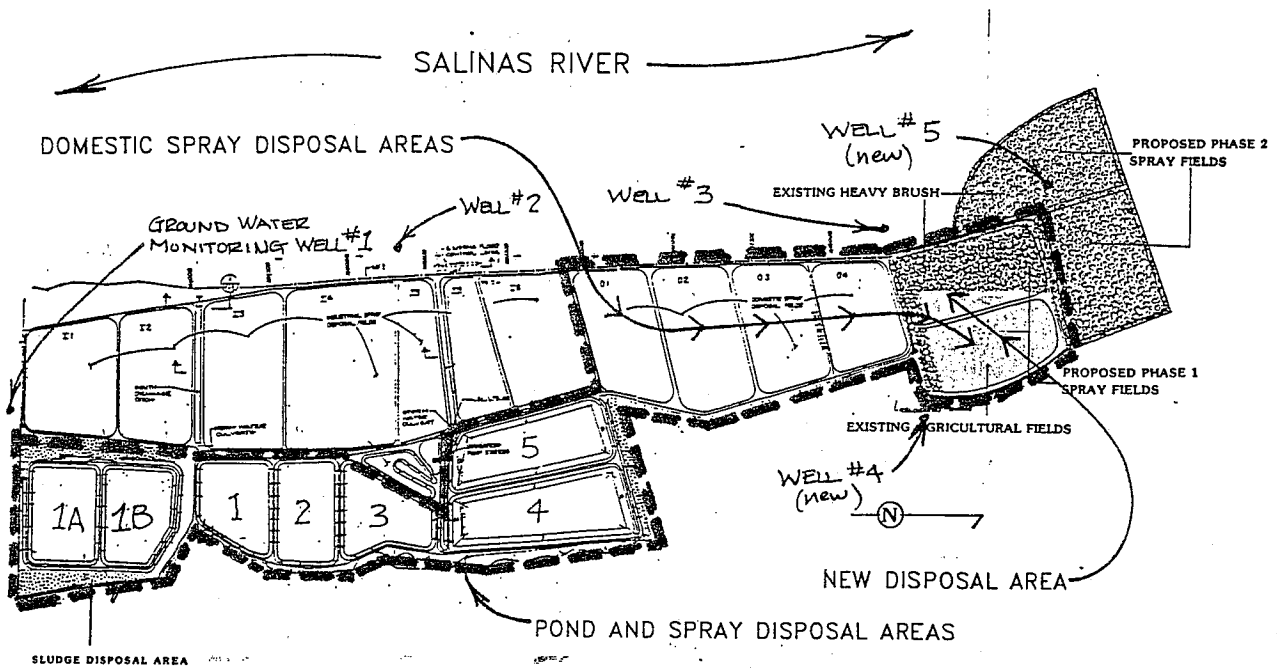
0 2400 4800

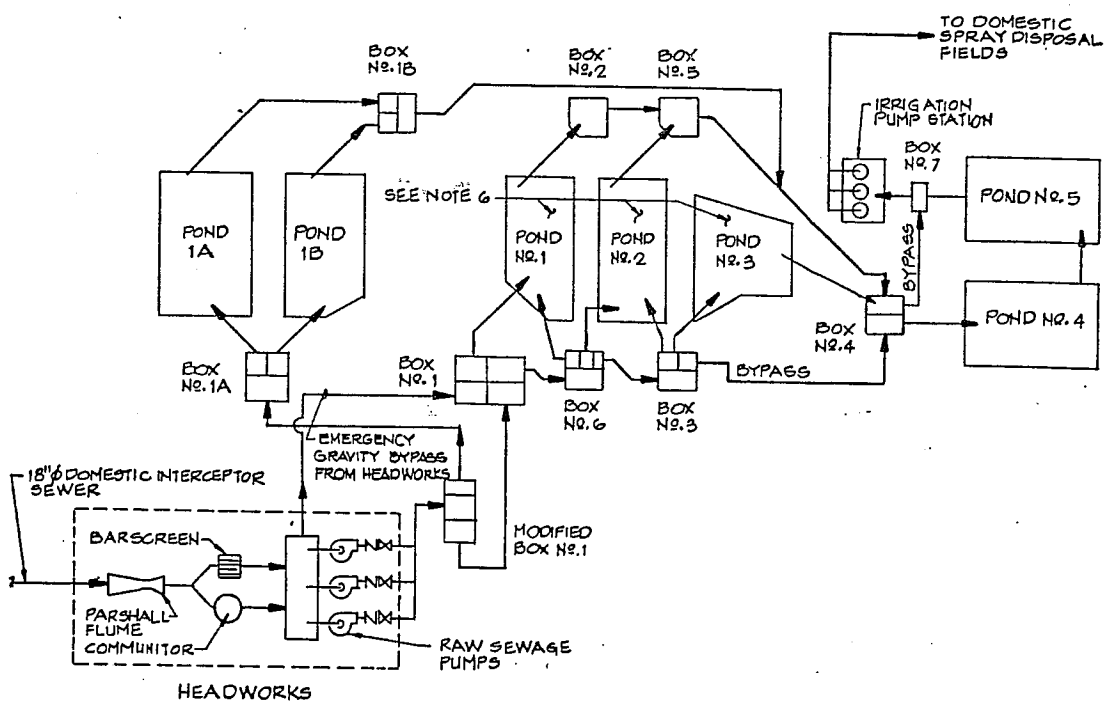
FEET



ATTACHMENT A

CITY OF KING VICINITY MAP





FLOW SCHEMATIC

ATTACHMENT B

CITY OF KING DOMESTIC WASTEWATER TREATMENT PLANT

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM NO. 91-05
FOR
CITY OF KING DOMESTIC WASTEWATER FACILITY

DOMESTIC WASTEWATER MONITORING

WATER SUPPLY MONITORING

Representative samples of the municipal water supply shall be collected and analyzed as follows:

Constituent	Units	Type of Sample	Sampling Frequency
Total Dissolved Solids	mg/l	Grab	Annually - July
Sodium	mg/l	Grab	" "
Chloride	mg/l	Grab	" "
Sulfate	mg/l	Grab	" "
Boron	mg/l	Grab	" "

INFLUENT MONITORING

Volume of influent shall be measured and reported as follows:

Constituent	Units	Type of Sample	Sampling Frequency
Flow Volume	mgd	Metered	Daily
Maximum Daily Flow	mgd	- - - -	Monthly
Mean Daily Flow	mgd	Calculated	"

EFFLUENT MONITORING

Representative samples of effluent discharged to the domestic spray disposal areas shall be collected and analyzed as follows:

Constituent	Units	Type of Sample	Sampling Frequency
Settleable Solids	ml/l	Grab	Monthly
Suspended Solids	mg/l	Grab	"
BOD, 5-day	mg/l	Grab	"
"Total" Nitrogen (as N) (Total Kjeldahl + Nitrate + Nitrite)	mg/l	Grab	Quarterly (Jan.Apr.,July,Oct.)
pH	units	Grab	" "
Total Dissolve Solids	mg/l	Grab	Semi-Annually (Jan. & July)
Sodium	mg/l	Grab	" "
Chloride	mg/l	Grab	" "
Sulfate	mg/l	Grab	" "
Boron	mg/l	Grab	" "

RECEIVING WATER SAMPLING

Samples of groundwater shall be collected from shallow well nos. 1, 2, 3, 4 and 5. Discharger shall construct new wells associated with the "New Disposal Area" as shown on Attachment "B"; proposed location and construction details shall be submitted to and approved by the Executive Officer prior to construction. After construction, reference point elevations and well logs of each well shall be submitted to this office. After depth to groundwater has been measured, the wells shall be purged and samples shall be collected as follows:

Constituent	Units	Type of Sample	Sampling Frequency
Depth to Groundwater	feet	Measured	Semi-Annually (Jan. & July)
Nitrate Nitrogen (as N)	mg/l	Grab	" "
Total Dissolved Solids	mg/l	Grab	" "
Sodium	mg/l	Grab	" "
Chloride	mg/l	Grab	" "
Sulfate	mg/l	Grab	" "
Boron	mg/l	Grab	" "

DISPOSAL AREA INSPECTION

The discharger shall make at least weekly inspections of the treatment and disposal systems. In making the inspection, the discharger shall note compliance status with this Order, particularly Discharge Prohibition A.l. and Discharge Specifications B.8., B.9, and B.10. A log of these inspections shall be maintained. A summary of observations made during the inspections shall be submitted with each monthly monitoring report.

REPORTING

Monitoring reports, and laboratory analysis sheets, shall be submitted by the dates in the following schedule:

Data Required	Report Due
Daily, Weekly, Monthly	20th Day or Each Month
All Other	20th Day of the month following the month of sampling.

ORDERED BY William R. Leonard
Executive Officer

January 11, 1991
Date

FD/C/sm30:91-05.MRP

ID#3 272100001

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5414

ORDER NO. 91-84

WASTE DISCHARGE REQUIREMENTS FOR CITY OF KING INDUSTRIAL WASTEWATER FACILITY MONTEREY COUNTY

The California Regional Water Quality Control Board, Central Coast Region, (hereafter Board), finds:

1. Mr. Blaine Michaelis, City Manager, filed a Report of Waste Discharge on February 26, 1991 in accordance with Section 13260 of the California Water Code. The report was filed on behalf of the City of King for authorization to discharge industrial wastewater within the upper Salinas Valley Hydraulic Unit. The information supports a request for revised waste discharge requirements.

2. The City of King (hereafter Discharger), operates a wastewater treatment and disposal system located one mile northwest of the City, adjacent to the Salinas River. The facilities are as shown on Attachments "A and B" of this Order. Domestic wastewater treatment and disposal facilities are regulated by separate waste discharge requirements and are located adjacent to the industrial facilities.

3. The City of King is directly responsible for wastewater collection, transport, treatment (as needed) and disposal from each industrial user connected to the system. As building permit authority, it is incumbent upon the City to protect the environment to the greatest degree possible and insure its industrial system is protected and utilized properly. This responsibility includes preventing wastewater overflows and restricting or prohibiting the volume, type or concentration of wastes, through a pretreatment program.

4. Industrial wastewater currently consists of onion and garlic processing water exclusively from Basic Vegetable Products Inc., (formerly Basic American Foods) and boiler and cooling tower blow down water from their cogeneration power plant. The natural gas fired power plant, produces steam for the food processing plant and generates electricity for sale to Pacific Gas and Electric Company.

5. During the 1990 peak processing season (May 1 - November 30) an average of 1.55 million gallons-per-day (mgd) of treated wastewater was discharged at this facility. Calendar year 1990 non-peak processing flows (December 1 - April 30) averaged 0.29 mgd. Treatment of the wastewater currently includes screening and dissolved air flotation (DAF) thickeners for solids removal. Wastewater is discharged to sprayfields with a design capacity of 2.4 mgd.

6. The sprayfield is located on level topography consisting of silty sands and course gravels with some thin clay lenses. Depth to ground water is approximately 15 feet below the surface of the sprayfield.

Groundwater in the vicinity of discharge is characterized as follows:

Total Dissolved Solids	517 mg/l
Sodium	67 mg/l
Chloride	80 mg/l
Nitrate (as N)	2 mg/l
Sulfate	137 mg/l
Boron	0.4 mg/l

7. The Salinas River, is located west of the sprayfield and flows in a northerly direction.

8. These waste discharge requirements are being revised based on improvements made to treatment facilities. The discharge has been regulated by Waste Discharge Requirements Order No. 87-166, adopted by the Board on October 9, 1987. This discharge has been regulated by the Board since the 1984.

9. The Water Quality Control Plan, Central Coastal Basin, (Basin Plan) was adopted by the Board on November 17, 1989. The Basin Plan incorporates statewide plans and policies by reference and contains a strategy for protecting beneficial uses of State waters.

10. Present and anticipated beneficial uses of groundwater in the vicinity of the discharge include:

    a. Domestic and Municipal Supply;
    b. Agricultural Supply; and,
    c. Industrial Supply.

11. Present and anticipated beneficial uses of the Salinas River that could be affected by the discharge include:

    a. Domestic and municipal supply;
    b. Water contact recreation;
    c. Non contact water recreation;
    d. Industrial service supply;
    e. Agricultural supply;
    f. Industrial process supply;
    g. Fish migration;
    h. Warm fresh-water habitat;
    i. Ground water
    j. Wildlife habitat; and,
    k. Cold fresh-water habitat.

12. These waste discharge requirements are for an existing facility and are exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.) in accordance with Section 15301, Chapter 3, Title 14, of the California Code of Regulations.

13. Discharge of waste is a privilege, not a right, and authorization to discharge is conditional upon the discharge complying with provisions of Division 7 of the California Water Code and any more stringent effluent limitations necessary to implement water quality control plans, to protect beneficial uses, and to prevent nuisance. Compliance with this Order should assure this and mitigate any potential adverse changes in water quality due to the discharge.

14. On September 19, 1991, the Board notified the Discharger and interested agencies and persons of its intent to re-issue waste discharge requirements for the discharge and has provided them with a copy of the proposed order and an opportunity to submit written views and comments.

15. After considering all comments pertaining to this discharge during a public hearing on September 13, 1991, this Order was found consistent with the above findings.

IT IS HEREBY ORDERED THAT, pursuant to authority in Section 13263 of the California Water Code, the City of King, its agents, successors, and assigns, may discharge waste to the industrial spray fields, providing compliance is maintained with the following:

(Note: other prohibitions and conditions, definitions, and the method of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for Waste Discharge

Requirements" dated January, 1984. Applicable paragraphs are referenced in paragraph D.4. of this Order.)

A. Prohibitions

1. Discharge to areas other than the industrial irrigation spray disposal areas shown in Attachment "B", is prohibited.

2. Discharge of any wastes including overflow, bypass, and seepage from transport, treatment, or disposal systems to adjacent drainageways or adjacent properties is prohibited.

3. Bypass of the treatment facility and discharge of un-treated or partially treated wastes directly to the Salinas River or tributaries is prohibited.

4. Ponding of wastewater within the spray disposal area after a maximum of 48 hours after completion of application to a field is prohibited.

5. Discharge of sludge within the Salinas River floodplain is prohibited.

B. Discharge Specifications

1. Daily industrial wastewater flow averaged over each month shall not exceed the following:

May 1-November 30 (on-season): 2.4 mgd

December 1-April 30 (off-season): 1.0 mgd

Flow limits are not an entitlement, but rather a maximum allowable capacity providing all other conditions of this Order are met.

2. Effluent discharged to sprayfield areas shall not exceed the following limitations:

Parameter	Units	Monthly Mean	Daily Maximum
Total Dissolved Solids	mg/l	1500	2000
Settleable Solids	ml/l	1.0	5.0
Biochemical Oxygen Demand (BOD, 5-day)	mg/l	1200	1300
Boron	mg/l		1.0
Chromium (Total)	mg/l		0.1
Copper	mg/l		0.2
Diethylethanolamine	mg/l		0.1
Zinc	mg/l		2.0

3. Effluent discharged to sprayfields shall not have a pH less than 6.5 or greater than 8.4.

4. Surface drainage shall be excluded from running onto the sprayfield areas.

5. Berms and/or levees shall be provided in the sprayfield areas to retain waters in the designated disposal area.

6. Sprayfield area loading rates for BOD_5 and Total Suspended Solids (TSS) shall be as follows:

	Maximum Monthly Avg.	Daily Maximum
BOD_5	300 lbs/acre-day	400 lbs/acre-day
TSS	150 lbs/acre-day	200 lbs/acre-day

The loading rates stipulated above are maximums and shall be reduced as required to assure the wastewater discharge meets all terms of this Order.

7. Vegetation shall be maintained in spray disposal areas as much as is practicable to enhance nutrient and salt uptake.

8. Spray disposal areas shall be allowed to dry to approximate field moisture condition between wastewater applications

9. Discharge areas shall be disc or plowed regularly to break up accumulated solids and keep soils aerated.

10. Wastewater discharge areas shall be protected from 100-year frequency floods and 100-year rainfall seasons.

C. Ground Water Limitations

1. The discharge shall not cause concentrations in the groundwater downgradient of the disposal area to exceed the following:

Nitrate	8 mg/l (as N)
Sulfate	250 mg/l
Chloride	250 mg/l

2. The discharge shall not cause a significant increase of mineral constituent concentrations in underlying groundwater, as determined by comparison of samples collected from wells located upgradient and downgradient of the disposal area.

3. The discharge shall not cause concentrations of chemicals and radionuclides in groundwater to exceed limits set forth in Title 22, Chapter 15, Articles 4, 4.5, 5 and 5.5 of the California Code of Regulations.

D. Provisions

1. Order No. 87-166 "Waste Discharge Requirements for the City of King Industrial Wastewater Facility and Indirect Dischargers, Monterey County", adopted by the Board on October 9, 1987 and Cease and Desist Order No. 91-07 adopted by the Board on January 11, 1991, is hereby rescinded.

2. Discharger shall comply with "Monitoring and Reporting Program No. 91-84," as specified by the Executive Officer.

3. In the event of a rainstorm that causes a portion of the domestic wastewater sprayfields to become unusable, the Discharger may discharge treated domestic wastewater to the industrial sprayfields. The domestic wastewater discharge must meet the effluent limitations of this Order and Order No. 91-05 "Waste Discharge Requirements for City of King Domestic Wastewater Facility".

4. Discharger shall comply with all items of the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements" dated January, 1984.

5. Discharger shall comply with the following time schedule (See paragraph "C.4." of the "Standard Provisions and Reporting Requirements"):

<u>Tasks</u>

a. Submit updated O & M Manual for sprayfield areas.

Completion: November 1, 1991
Report Due: November 15, 1991

b. Submit a technical report detailing the effectiveness of the existing ground water monitoring program and any proposed improvements.

Report Due: June 1, 1992

6. Pursuant to Title 23, Chapter 3, Subchapter 9, of the California Code of Regulations, the Discharger must submit a written report to the Executive Officer not later than January 1996, addressing:

   a. Whether there will be changes in the continuity, character, location, or volume of the discharge; and,

   b. Whether, in their opinion, there is any portion of the Order that is incorrect, obsolete, or otherwise in need of revision.

I, WILLIAM R. LEONARD, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Coast Region, on September 13, 1991.

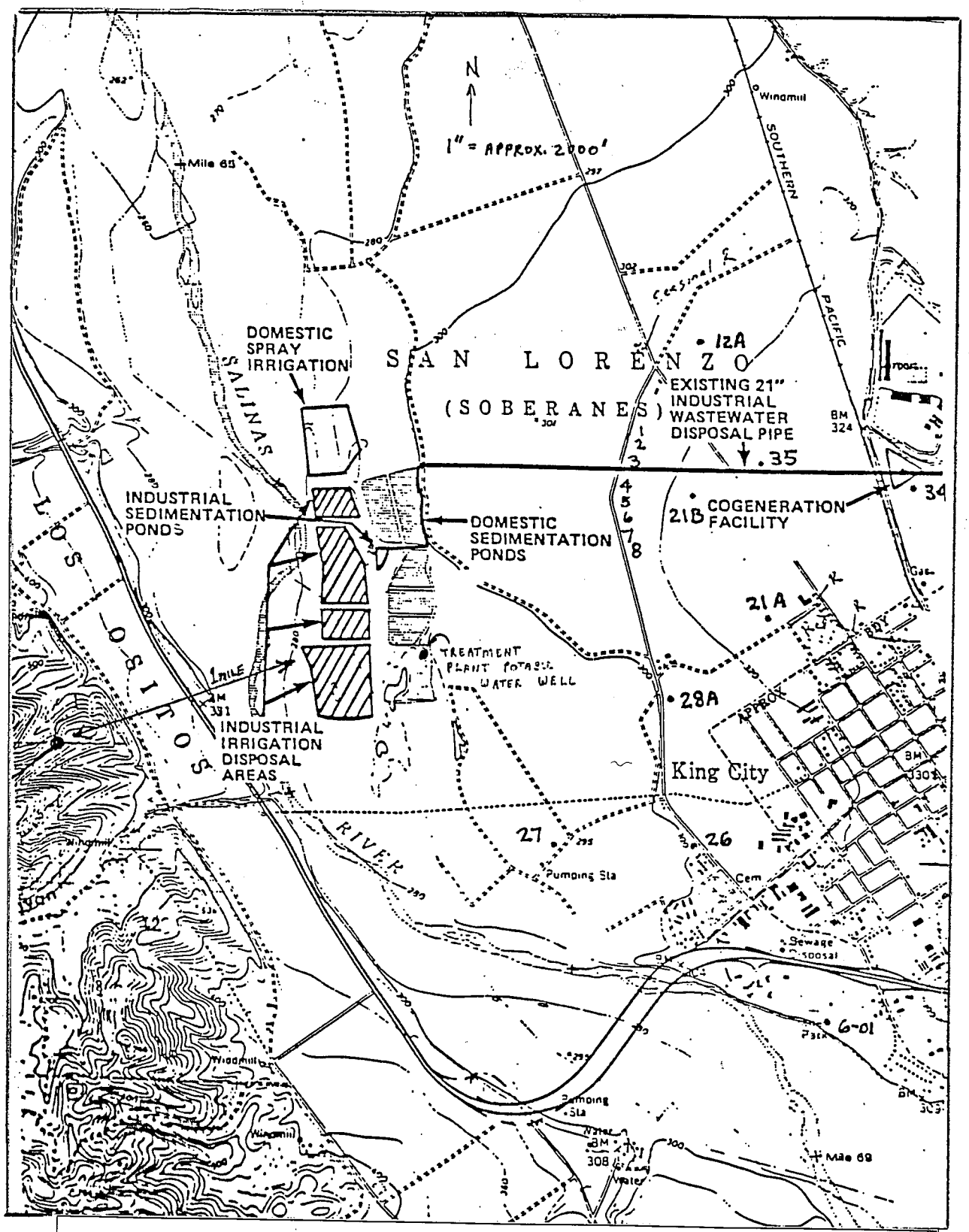
William R. Leonard
Executive Officer

sm19:91-84.WDR

VICINITY MAP

KING CITY INDUSTRIAL WDR ORDER NO. 91-84

ATTACHMENT "A"



SITE MAP

KING CITY INDUSTRIAL WDR ORDER NO. 91-84

ATTACHMENT "B"

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM NO. 91-84
FOR
CITY OF KING
INDUSTRIAL WASTEWATER FACILITY

REVISED July 23, 1992

Water Supply Monitoring

Representative samples of the industrial water supply shall be collected and analyzed as follows:

Constituent	Units	Type of Sample	Sampling Frequency
Total Dissolved Solids	mg/l	Grab	Annually-July
Sodium	mg/l	Grab	" "
Chloride	mg/l	Grab	" "
Sulfate	mg/l	Grab	" "
Boron	mg/l	Grab	" "

Effluent Monitoring

Representative samples of effluent discharged to the spray disposal system shall be collected and analyzed, during the operating season, as follows:

Constituent	Units	Type of Sample	Minimum Sampling and Analyzing Frequency
Flow Volume	mgd	Metered	Daily
Settleable Solids	ml/l	Grab	Weekly
BOD_5	mg/l	Grab	"
Suspended Solids	mg/l	Grab	"
Mean Daily Flow	mgd	Calculated	Monthly
pH	units	Grab	"
Total Nitrogen (as N) (Total Kjeldahl + Nitrate + Nitrite)	mg/l	Grab	July & October
Chemical Oxygen Demand	mg/l	Grab	" "
Total Dissolved Solids	mg/l	Grab	" "
Sodium	mg/l	Grab	" "
Chloride	mg/l	Grab	" "
Sulfate	mg/l	Grab	" "
Boron	mg/l	Grab	" "
Chromium	mg/l	Grab	" "
Copper	mg/l	Grab	" "
Zinc	mg/l	Grab	" "

Receiving Water Monitoring

Samples of groundwater shall be collected from shallow well numbers 1, 2, 3, 4 and 5 located upgradient and downgradient of the disposal area. After depth to groundwater has been measured, the wells shall be purged and samples shall be collected as follows:

Parameter	Units	Type of Sample	Minimum Sampling and Analyzing Frequency	
Depth to Groundwater	feet	Measured	Semi-Annually (Jan. & July)	
Nitrate Nitrogen (as N)	mg/l	Grab	"	"
Total Dissolved Solids	mg/l	Grab	"	"
Sodium	mg/l	Grab	"	"
Chloride	mg/l	Grab	"	"
Sulfate	mg/l	Grab	"	"
Boron	mg/l	Grab	"	"

Disposal Area Inspection

The discharger shall make at least weekly inspections of the treatment and disposal systems. In making the inspection, the discharger shall note compliance status with this Order, particularly Discharge Prohibitions A.1. through A.5., Discharge Specifications B.4. through B.11., and Provision D.5. A log of these inspections shall be maintained. A summary of observations made during the inspections shall be submitted with each monthly monitoring report.

Reporting

Monitoring reports, and laboratory analysis sheets, shall be submitted by the dates in the following schedule:

Data Required	Report Due
Daily, Weekly, Monthly	20th Day of Each Month
All Other	20th Day of the month following the month of sampling.

ORDERED BY: _____
Executive Officer

July 23, 1992
Date

BEH:sg14-91-84.MRP

APPENDIX B – WATER QUALITY DATA

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB65814**

Collection Date/Time:	4/22/2017	7:50	Sample Collector:	BROWN L	Client Sample #:
Submittal Date/Time:	4/22/2017	13:00	Sample ID	HEADWORKS	

Sample Description: Headworks, 24 hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**181**	1		10	2	1:00:00 PM	5/1/2017	BS
Ammonia-N	SM4500NH3 B,	mg/L	**44.9**	1		0.5	0.3	9:22:00 AM	5/1/2017	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**221**	1		10	2	2:26:00 PM	5/3/2017	MP
Biochemical Oxygen De	SM5210B	mg/L	**140**	1		2	2	4:00:00 PM	4/22/2017	MP
Boron	EPA200.7	mg/L	**0.33**	1		0.05	0.01	.2:57:00 PM	4/25/2017	HM
Calcium	EPA200.7	mg/L	**63**	1		0.5	0.1	.2:57:00 PM	4/25/2017	HM
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**	1		10	2	2:26:00 PM	5/3/2017	MP
Chem. Oxygen Demand	SM5220 D	mg/L	**1009**	1	IL	5	5	5:17:00 PM	4/26/2017	LRH
Chloride	EPA300.0	mg/L	**93**	4		4.0	1.0	8:01:00 PM	4/22/2017	DH
Hydroxide	SM2320B	mg/L	**Not Detected**	1		10	2	2:26:00 PM	5/3/2017	MP
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**55.3**	10		5	5	.0:00:00 AM	5/5/2017	BS
Magnesium	EPA200.7	mg/L	**24**	1		0.5	0.2	.2:57:00 PM	4/25/2017	HM
MLVSS/MLTSS	Calculation		**0.87**	1				9:33:00 AM	4/28/2017	LRH
Nitrate as NO3-N	EPA300.0	mg/L	**0.5**	4		0.4	0.04	8:01:00 PM	4/22/2017	DH
Nitrite as NO2-N	EPA300.0	mg/L	**0.5**	4		0.4	0.04	8:01:00 PM	4/22/2017	DH
pH (Field Test)	SM4500-H+B	pH	**6.78**	1				7:50:00 AM	4/22/2017	LB
Phosphorus, Total	HACH 8190	mg/L	**9.00**	50		1.5	1.5	1:51:00 PM	5/4/2017	LRH/MP
SAR (Sodium Adsorption	Suarez, 1981		**2.8**	1				2:08:00 PM	5/2/2017	HM
SAR, Adjusted	Suarez, 1981		**2.8**	1				2:08:00 PM	5/2/2017	HM
Sodium	EPA200.7	mg/L	**103**	1		0.5	0.2	.2:57:00 PM	4/25/2017	HM
Specific Conductance (E.	SM2510B	µmhos/	**1216**	1		1	1	.1:20:00 AM	4/26/2017	HM
Sulfate	EPA300.0	mg/L	**84**	4		4.0	1.0	8:01:00 PM	4/22/2017	DH
Temperature (Field)	SM2550	° C	**17.3**	1				7:50:00 AM	4/22/2017	LB
Total Diss. Solids_by Cal	SM1030E	mg/L	**778**	1		10	10	.1:20:00 AM	4/26/2017	HM
Total Nitrogen	Calculation	mg/L	**56.3**	1		0.5	0.5	3:31:00 PM	5/5/2017	LRH
Total Solids	SM2540B	mg/L	**974**	1		5	5	.0:50:00 AM	4/28/2017	MP
Total Susp. Solids	SM2540D	mg/L	**206**	1		2	2	2:25:00 PM	4/25/2017	MP

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Volatile Solids	SM2540E	mg/L	**471**	1	5	5	.0:50:00 AM	4/28/2017	MP
Volatile Suspended Solid	SM2540E	mg/L	**180**	1	5	5	2:25:00 PM	4/25/2017	MP

Sample Comments: Flow 807 MGD IL: RPD exceeds laboratory control limit

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

MBAS
MONTEREY BAY ANALYTICAL SERVICES
PRECISION • ACCURACY • DEPENDABILITY

4 Justin Court, Suite D
Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	Analysis Requested: COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus	SO4, NA, CL, B, Conductivity	Ca, Mg, HCO3, SAR
65814		Headworks 24 hour Composite Sample 0800-0745	4/21/17-4/22/17	0750	3.6						1	p	2 Liter	X	X	X	X	X	X

	Printed Name	Signature	Date	Time
Sampled by:	Linda Brown	Linda Brown		
Relinquished by:	Linda Brown	Linda Brown	4/22/17	1300
Received by:				
Relinquished by:				
Received by:	Monterey Bay Analytical Services	[illegible]	4/22/17	1300

Comment: Is sample for regulatory purposes? Yes / No
Field ph - 6.78
Flow 807 MGD
Field Temp +17.3°C

[ ] Payment received Check # Amount: Receipt # Date:

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

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4 Justin Court Suite D, Monterey, CA 93940
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www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB65823**

Collection Date/Time:	4/23/2017	7:50	Sample Collector:	BROWN, L	Client Sample #:
Submittal Date/Time:	4/24/2017	9:51	Sample ID	HEADWORKS	

Sample Description: Headworks 24 Hour Composite Sample - 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**108**	1		10	2	1:00:00 PM	5/1/2017	BS
Ammonia-N	SM4500NH3 B,	mg/L	**49.4**	5		2.5	1.5	9:22:00 AM	5/1/2017	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**132**	1		10	2	2:08:00 PM	5/2/2017	HM
Biochemical Oxygen De	SM5210B	mg/L	**366**	1	MN	2	2	1:20:00 PM	4/25/2017	MP/MB
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**	1		10	2	5:00:00 PM	4/25/2017	LRH
Chem. Oxygen Demand	SM5220 D	mg/L	**902**	1	IL	5	5	5:17:00 PM	4/26/2017	LRH
Hydroxide	SM2320B	mg/L	**Not Detected**	1		10	2	5:00:00 PM	4/25/2017	LRH
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**61.7**	10		5	5	.0:00:00 AM	5/5/2017	BS
Nitrate as NO3-N	EPA300.0	mg/L	**0.6**	4		0.4	0.04	5:15:00 PM	4/24/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.5**	4		0.4	0.04	5:15:00 PM	4/24/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.38**	1				7:50:00 AM	4/23/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.4**	1		0.1		4:40:00 PM	4/24/2017	LRH
Phosphorus, Total	HACH 8190	mg/L	**7.00**	50		1.5	1.5	1:51:00 PM	5/4/2017	LRH/MP
QC Ratio TDS/SEC	Calculation		**0.53**	1				.0:04:00 AM	4/28/2017	LRH
Specific Conductance (E.	SM2510B	µmhos/	**1317**	1		1	1	.1:20:00 AM	4/26/2017	HM
Temperature (Field)	SM2550	° C	**16.5**	1				7:50:00 AM	4/23/2017	LB
Total Diss. Solids	SM2540C	mg/L	**695**	1		10	10	1:30:00 PM	4/26/2017	MP
Total Diss. Solids_by Cal	SM1030E	mg/L	**843**	1		10	10	.1:20:00 AM	4/26/2017	HM
Total Nitrogen	Calculation	mg/L	**62.8**	1		0.5	0.5	3:32:00 PM	5/5/2017	LRH
Total Solids	SM2540B	mg/L	**894**	1		5	5	.0:50:00 AM	4/28/2017	MP
Total Susp. Solids	SM2540D	mg/L	**173**	1		2	2	2:25:00 PM	4/25/2017	MP
Volatile Solids	SM2540E	mg/L	**406**	1		5	5	.0:50:00 AM	4/28/2017	MP
Volatile Suspended Solid	SM2540E	mg/L	**148**	1		5	5	2:25:00 PM	4/25/2017	MP

Sample Comments: Field Measurments - Flow= 849, pH= 7.38, Temp= 16.5°c IL: RPD exceeds laboratory control limit MN: Method procedures not followed. (Incubated for 6 days)

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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4 Justin Court, Suite D
Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Routine	Other	Repeat	Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
65823		Headworks 24 hour Composite Sample 0800-0745	4/22/17-4/23/17	0750	4C						1	p	2 Liter	X	X	X	X		

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	4/24/17	0950	Field ph 7.38
Received by:					Flow 849
Relinquished by:					Field Temp 16.5
Received by:	Monterey Bay Analytical Services	[illegible]	4/24/17	[illegible]	

[ ] Payment received Check # Amount: Receipt # Date:

65823 - 24 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C — YES (-65823) NO NA — <2 Hr (-65824) Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
65823-24	250ml	H_2SO_4 $Na_2S_2O_3$	4/24/17
↓	~~250ml~~ 500ml	H_2SO_4	Pre-Pres

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB65824**

Collection Date/Time:	4/24/2017	7:50	Sample Collector:	BROWN, L	Client Sample #:
Submittal Date/Time:	4/24/2017	9:51	Sample ID	HEADWORKS	

Sample Description: Headworks 24 Hour Composite Sample - 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**363**	1		10	2	1:00:00 PM	5/1/2017	BS
Ammonia-N	SM4500NH3 B,	mg/L	**45.9**	5		2.5	1.5	9:22:00 AM	5/1/2017	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**443**	1		10	2	2:08:00 PM	5/2/2017	HM
Biochemical Oxygen De	SM5210B	mg/L	**319**	1	MN	2	2	1:20:00 PM	4/25/2017	MP/MB
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**	1		10	2	5:00:00 PM	4/25/2017	LRH
Chem. Oxygen Demand	SM5220 D	mg/L	**742**	1	IL	5	5	5:17:00 PM	4/26/2017	LRH
Hydroxide	SM2320B	mg/L	**Not Detected**	1		10	2	5:00:00 PM	4/25/2017	LRH
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**63.8**	10		5	5	.0:00:00 AM	5/5/2017	BS
Nitrate as NO3-N	EPA300.0	mg/L	**0.6**	4		0.4	0.04	5:38:00 PM	4/24/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.5**	4		0.4	0.04	5:38:00 PM	4/24/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.30**	1				7:50:00 AM	4/24/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.5**	1		0.1		4:40:00 PM	4/24/2017	LRH
Phosphorus, Total	HACH 8190	mg/L	**6.50**	50		1.5	1.5	1:51:00 PM	5/4/2017	LRH/MP
QC Ratio TDS/SEC	Calculation		**0.57**	1				.0:04:00 AM	4/28/2017	LRH
Specific Conductance (E.	SM2510B	µmhos/	**1274**	1		1	1	.1:20:00 AM	4/26/2017	HM
Temperature (Field)	SM2550	° C	**15.0**	1				7:50:00 AM	4/24/2017	LB
Total Diss. Solids	SM2540C	mg/L	**725**	1		10	10	1:30:00 PM	4/26/2017	MP
Total Diss. Solids_by Cal	SM1030E	mg/L	**815**	1		10	10	.1:20:00 AM	4/26/2017	HM
Total Nitrogen	Calculation	mg/L	**64.9**	1		0.5	0.5	3:32:00 PM	5/5/2017	LRH
Total Solids	SM2540B	mg/L	**974**	1		5	5	.0:50:00 AM	4/28/2017	MP
Total Susp. Solids	SM2540D	mg/L	**153**	1		2	2	2:25:00 PM	4/25/2017	MP
Volatile Solids	SM2540E	mg/L	**474**	1		5	5	.0:50:00 AM	4/28/2017	MP
Volatile Suspended Solid	SM2540E	mg/L	**137**	1		5	5	2:25:00 PM	4/25/2017	MP

Sample Comments: Field Measurments - Flow= 940, pH= 7.30, Temp= 15.0°c IL: RPD exceeds laboratory control limit MN: Method procedures not followed. (Incubated for 6 days)

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is City of King	
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	Analysis Requested: COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
65824		Headworks 24 hour Composite Sample 0800-0745	4/23/17-4/24/17	0750	8.4						1	p	2 Liter	X	X	X	X		

	Printed Name	Signature	Date	Time
Sampled by:	Linda Brown	Linda Brown		
Relinquished by:	Linda Brown	Linda Brown	4/24/17	0950
Received by:				
Relinquished by:				
Received by:	Monterey Bay Analytical Services	[illegible]	4/24/	9:5

Comment: Is sample for regulatory purposes? Yes / No
Field ph 7.30
Flow 940
Field Temp 15.0

[ ] Payment received Check # Amount: Receipt #

65823 - 24 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C — YES (-65823) NO NA (-2 Hr -65824) Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
65823-24	250ml	H_2SO_4 $Na_2S_2O_3$	4/24/17
↓	~~250ml~~ 500ml	H_2SO_4	Pre-Pres

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB66025**

Collection Date/Time: 4/25/2017 7:50 Sample Collector: BROWN L Client Sample #:

Submittal Date/Time: 4/25/2017 12:13 Sample ID

Sample Description: Headworks 24 hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**440**	1		10	2	.0:00:00 AM	5/2/2017	BS
Ammonia-N	SM4500NH3 B,	mg/L	**77.8**	5		2.5	1.5	9:22:00 AM	5/1/2017	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**537**	1		10	2	.0:00:00 AM	5/2/2017	BS
Biochemical Oxygen De	SM5210B	mg/L	**364**	1		2	2	8:50:00 AM	4/26/2017	MP/MB
Boron	EPA200.7	mg/L	**0.29**	1		0.05	0.01	.2:52:00 PM	5/2/2017	MW
Calcium	EPA200.7	mg/L	**50**	1		0.5	0.1	.2:52:00 PM	5/2/2017	MW
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**	1		10	2	.0:30:00 AM	5/11/2017	DH
Chem. Oxygen Demand	SM5220 D	mg/L	**942**	1	IL	5	5	5:17:00 PM	4/26/2017	LRH
Chloride	EPA300.0	mg/L	**136**	1		1	0.25	4:31:00 PM	4/26/2017	HM
Hydroxide	SM2320B	mg/L	**Not Detected**	1		10	2	.0:30:00 AM	5/11/2017	DH
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**95.4**	2		1	1	.0:00:00 AM	4/28/2017	BS
Magnesium	EPA200.7	mg/L	**21**	1		0.5	0.2	.2:52:00 PM	5/2/2017	MW
Nitrate as NO3-N	EPA300.0	mg/L	**0.6**	1		0.1	0.01	4:31:00 PM	4/26/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.6**	1		0.1	0.01	4:31:00 PM	4/26/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.58**	1				.0:28:00 AM	4/25/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.0**	1		0.1		4:15:00 PM	5/12/2017	BS
Phosphorus, Total	HACH 8190	mg/L	**9.50**	50		1.5	1.5	1:51:00 PM	5/4/2017	LRH/MP
SAR (Sodium Adsorption	Suarez, 1981		**3.8**	1				.1:33:00 AM	5/3/2017	MW
Sodium	EPA200.7	mg/L	**127**	1	IJ	0.5	0.2	.2:52:00 PM	5/2/2017	MW
Specific Conductance (E.	SM2510B	µmhos/	**1543**	1		1	1	.1:20:00 AM	4/26/2017	HM
Sulfate	EPA300.0	mg/L	**91**	1		1	0.25	4:31:00 PM	4/26/2017	HM
Temperature (Field)	SM2550	° C	**15.5**	1				.0:28:00 AM	4/25/2017	LB
Total Diss. Solids_by Cal	SM1030E	mg/L	**988**	1		10	10	.1:20:00 AM	4/26/2017	HM
Total Nitrogen	Calculation	mg/L	**96.6**	1		0.5	0.5	2:42:00 PM	4/28/2017	MP
Total Solids	SM2540B	mg/L	**1151**	1		5	5	.0:50:00 AM	4/28/2017	MP
Total Susp. Solids	SM2540D	mg/L	**270**	1		2	2	2:25:00 PM	4/25/2017	MP
Volatile Solids	SM2540E	mg/L	**577**	1		5	5	.0:50:00 AM	4/28/2017	MP

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Volatile Suspended Solid	SM2540E	mg/L	**243**	1	5	5	2:27:00 PM	4/25/2017	MP

Sample Comments: IJ: ICV and/or CCV above acceptance limits. IL: RPD exceeds laboratory control limit

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL

H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.

D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

MBAS
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PRECISION • ACCURACY • DEPENDABILITY

4 Justin Court, Suite D
Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis CL2 Residual	Coliform Analysis Routine	Coliform Analysis Other	Coliform Analysis Repeat	Coliform Analysis Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus	SO4, NA, CL, B, Conductivity	Ca, Mg, HCO3, SAR
		Headworks 24 hour Composite Sample 0800-0745	4/24/17-4/25/17	0750	10.3						2 / 1	p	500mL 2 Liter	X	X	X	X	X	X
66025																			

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	4/25/17	1200	Field ph 7.58
Received by:					Flow 780
Relinquished by:					Field Temp 15.5
Received by:	Monterey Bay Analytical Services	Mikelly	4/25/17	1213	

[ ] Payment received Check # Amount: Receipt # Date:

MP

66025 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES (NO) NA <2 Hr Is there evidence of chilling? (YES) NO NA

Did bottles arrive intact? (YES) NO NA

Did bottle labels agree with COC? (YES) NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
66025	500ml	H_2SO_4 ~~$Na_2S_2O_3$~~	4/25/17
	250ml	HNO_3	↓

Pre Pres. MP

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, May 11, 2017

Lab Number: AB66118

Collection Date/Time: 4/26/2017 9:50 Sample Collector: BROWN, L Client Sample #: Headworks
Submittal Date/Time: 4/26/2017 14:45 Sample ID WW

Sample Description: Headworks 24 Hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Date Analyzed	Time Analyzed	Analyst:
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**391**	1		10	2	5/2/2017	10:00:00 AM	BS
Ammonia-N	SM4500NH3	mg/L	**58.3**	5		2.5	1.5	5/9/2017	10:25:00 AM	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**477**	1		10	2	5/3/2017	9:02:00 AM	MP
Biochemical Oxygen Demand	SM5210B	mg/L	**305**	1		2	2	4/28/2017	9:00:00 AM	MP
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**	1		10	2	5/3/2017	9:02:00 AM	MP
Chem. Oxygen Demand	Hach 8000	mg/L	**934**	2		10	10	5/10/2017	4:11:00 PM	LRH
Hydroxide	SM2320B	mg/L	**Not Detected**	1		10	2	5/3/2017	9:02:00 AM	MP
Kjehldahl Nitrogen	SM4500-NH	mg/L	**81.9**	2		1	1	4/28/2017	10:00:00 AM	BS
Nitrate as NO3-N	EPA300.0	mg/L	**0.5**	4	BB	0.4	0.04	4/26/2017	9:43:00 PM	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.8**	4		0.4	0.04	4/26/2017	9:43:00 PM	HM
pH (Field Test)	SM4500-H+	pH	**7.41**	1				4/26/2017	7:50:00 AM	LB
pH (Laboratory)	SM4500-H+	pH (H)	**7.5**	1		0.1		4/26/2017	8:48:00 AM	BS
Phosphorus, Total	HACH 8190	mg/L	**9.00**	50		1.5	1.5	5/4/2017	1:51:00 PM	LRH/MP
Temperature (Field)	SM2550	° C	**18.8**	1				4/26/2017	7:50:00 AM	LB
Total Nitrogen	Calculation	mg/L	**83.2**	1		0.5	0.5	4/28/2017	2:42:00 PM	MP
Total Solids	SM2540B	mg/L	**994**	1		5	5	4/28/2017	10:50:00 AM	MP
Total Susp. Solids	SM2540D	mg/L	**267**	1		2	2	5/2/2017	2:00:00 PM	MP
Volatile Solids	SM2540E	mg/L	**417**	1		5	5	4/28/2017	10:50:00 AM	MP
Volatile Suspended Solids	SM2540E	mg/L	**240**	1		5	5	5/2/2017	2:00:00 PM	MP

Sample Comments: Field Results: pH=7.41, Flow=807, Temp=18.8°c BB: Sample > 4x spike concentration.

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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4 Justin Court, Suite D
Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is City of King	
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	Analysis Requested: COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
66118		Headworks 24 hour Composite Sample 0800-0745	4/25/17-4/26/17	0750	6.9						1	p	2 Liter	X	X	X	X		

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	4/26/17	1445	Field ph 7.41
Received by:					Flow 807
Relinquished by:					Field Temp 13.8
Received by:	Monterey Bay Analytical Services	[illegible]	4/26/17	1445	

[ ] Payment received Check # Amount: Receipt # Date:

66118 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES NO NA <2 Hr Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
	500ml	H2SO4	4/26/17
	250ml	H2SO4 NaOH	"

Pre Pres.

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB66268**

Collection Date/Time: 4/27/2017 7:55 Sample Collector: BROWN L Client Sample #:

Submittal Date/Time: 4/28/2017 13:50 Sample ID

Sample Description: Headworks 24 hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**385**	1		10	2	.0:00:00 AM	5/2/2017	BS
Ammonia-N	SM4500NH3 B,	mg/L	**53.6**	5		2.5	1.5	.0:25:00 AM	5/8/2017	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**470**	1		10	2	2:31:00 PM	5/3/2017	MP
Biochemical Oxygen De	SM5210B	mg/L	**260**	1		2	2	9:00:00 AM	4/28/2017	MP
Boron	EPA200.7	mg/L	**0.27**	1		0.05	0.01	3:33:00 PM	5/2/2017	MW
Calcium	EPA200.7	mg/L	**51**	1		0.5	0.1	3:33:00 PM	5/2/2017	MW
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**	1		10	2	2:31:00 PM	5/3/2017	MP
Chem. Oxygen Demand	SM5220 D	mg/L	**858**	2		10	10	4:11:00 PM	5/10/2017	LRH
Chloride	EPA300.0	mg/L	**123**	4		4.0	1.0	.2:50:00 AM	4/29/2017	HM
Hydroxide	SM2320B	mg/L	**Not Detected**	1		10	2	2:31:00 PM	5/3/2017	MP
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**73.8**	10		5	5	.0:00:00 AM	5/5/2017	BS
Magnesium	EPA200.7	mg/L	**21**	1		0.5	0.2	3:33:00 PM	5/2/2017	MW
MLVSS/MLTSS	Calculation		**0.93**	1				8:58:00 AM	5/4/2017	LRH
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	.2:50:00 AM	4/29/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.7**	4		0.4	0.04	.2:50:00 AM	4/29/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.31**	1				7:50:00 AM	4/27/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.5**	1		0.1		4:00:00 PM	4/28/2017	BS
Phosphorus, Total	HACH 8190	mg/L	**8.00**	50		1.5	1.5	1:51:00 PM	5/4/2017	LRH/MP
SAR (Sodium Adsorption	Suarez, 1981		**2.9**	1				2:31:00 PM	5/3/2017	MP
SAR, Adjusted	Suarez, 1981		**2.8**	1				2:31:00 PM	5/3/2017	MP
Sodium	EPA200.7	mg/L	**99**	1	IJ	0.5	0.2	3:33:00 PM	5/2/2017	MW
Specific Conductance (E.	SM2510B	µmhos/	**1381**	1		1	1	1:45:00 PM	5/2/2017	HM
Sulfate	EPA300.0	mg/L	**88**	4		4.0	1.0	.2:50:00 AM	4/29/2017	HM
Temperature (Field)	SM2550	° C	**16.2**	1				7:50:00 AM	4/27/2017	LB
Total Diss. Solids_by Cal	SM1030E	mg/L	**884**	1		10	10	1:45:00 PM	5/2/2017	HM
Total Nitrogen	Calculation	mg/L	**74.5**	1		0.5	0.5	3:37:00 PM	5/5/2017	LRH
Total Solids	SM2540B	mg/L	**1010**	1		5	5	4:40:00 PM	5/3/2017	MP

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Total Susp. Solids	SM2540D	mg/L	**227**	1	2	2	2:00:00 PM	5/2/2017	MP
Volatile Solids	SM2540E	mg/L	**505**	1	5	5	4:40:00 PM	5/3/2017	MP
Volatile Suspended Solid	SM2540E	mg/L	**211**	1	5	5	2:00:00 PM	5/2/2017	MP

Sample Comments: IJ: ICV and/or CCV above acceptance limits. Flow 816

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus	SO4, NA, CL, B, Conductivity	Ca, Mg, HCO3, SAR
											1	P	500ml w/ H_2SO_4						
66268		Headworks 24 hour Composite Sample 0800-0745	4/26/17-4/27/17	0750	9.0						1	p	2 Liter	X	X	X	X	X	X

	Printed Name	Signature	Date		Time	Comment
Sampled by:	Linda Brown	Linda Brown				Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	4/28/17			Field ph 7.31
Received by:						Flow 816
Relinquished by:						Field Temp 16.2
Received by:	Monterey Bay Analytical Services	[illegible]	4/28/17	1350		

[ ] Payment received Check # Amount: Receipt # Date:

King City
66268-66269

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES (NO) NA <2 Hr Is there evidence of chilling? (YES) NO NA

Did bottles arrive intact? (YES) NO NA

Did bottle labels agree with COC? (YES) NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
66268-	500mL	H_2SO_4	pre-pres
66269	250mL	HNO_3	4/28/17

added $Na_2S_2O_3$

Lab ID	Cont. Size	Pres	Date/Initials
after pouring to	250mL	H_2SO_4	pre-pres sample

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB66269**

Collection Date/Time: 4/28/2017 7:50 Sample Collector: BROWN L Client Sample #:

Submittal Date/Time: 4/28/2017 13:50 Sample ID

Sample Description: Headworks 24 hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**426**	1		10	2	.0:00:00 AM	5/2/2017	BS
Ammonia-N	SM4500NH3 B,	mg/L	**64.8**	5		2.5	1.5	.0:25:00 AM	5/8/2017	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**520**	1		10	2	2:31:00 PM	5/3/2017	MP
Biochemical Oxygen De	SM5210B	mg/L	**287**	1		2	2	9:00:00 AM	4/28/2017	MP
Boron	EPA200.7	mg/L	**0.28**	1		0.05	0.01	3:36:00 PM	5/2/2017	MW
Calcium	EPA200.7	mg/L	**51**	1		0.5	0.1	3:36:00 PM	5/2/2017	MW
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**	1		10	2	2:31:00 PM	5/3/2017	MP
Chem. Oxygen Demand	SM5220 D	mg/L	**1088**	1		5	5	4:11:00 PM	5/10/2017	LRH
Chloride	EPA300.0	mg/L	**130**	4		4.0	1.0	1:13:00 AM	4/29/2017	HM
Hydroxide	SM2320B	mg/L	**Not Detected**	1		10	2	2:31:00 PM	5/3/2017	MP
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**88.8**	10		5	5	.0:00:00 AM	5/5/2017	BS
Magnesium	EPA200.7	mg/L	**21**	1		0.5	0.2	3:36:00 PM	5/2/2017	MW
MLVSS/MLTSS	Calculation		**0.88**	1				8:58:00 AM	5/4/2017	LRH
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	1:13:00 AM	4/29/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	1:13:00 AM	4/29/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.50**	1				7:50:00 AM	4/28/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.7**	1		0.1		4:00:00 PM	4/28/2017	BS
Phosphorus, Total	HACH 8190	mg/L	**10.50**	50		1.5	1.5	1:51:00 PM	5/4/2017	LRH/MP
SAR (Sodium Adsorption	Suarez, 1981		**3.0**	1				2:31:00 PM	5/3/2017	MP
SAR, Adjusted	Suarez, 1981		**2.9**	1				2:31:00 PM	5/3/2017	MP
Sodium	EPA200.7	mg/L	**102**	1	IJ	0.5	0.2	3:36:00 PM	5/2/2017	MW
Specific Conductance (E.	SM2510B	µmhos/	**1496**	1		1	1	1:45:00 PM	5/2/2017	HM
Sulfate	EPA300.0	mg/L	**88**	4		4.0	1.0	1:13:00 AM	4/29/2017	HM
Temperature (Field)	SM2550	° C	**14.9**	1				7:50:00 AM	4/28/2017	LB
Total Diss. Solids_by Cal	SM1030E	mg/L	**957**	1		10	10	1:45:00 PM	5/2/2017	HM
Total Nitrogen	Calculation	mg/L	**88.8**	1		0.5	0.5	3:38:00 PM	5/5/2017	LRH
Total Solids	SM2540B	mg/L	**1040**	1		5	5	4:40:00 PM	5/3/2017	MP

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Total Susp. Solids	SM2540D	mg/L	**357**	1	2	2	2:00:00 PM	5/2/2017	MP
Volatile Solids	SM2540E	mg/L	**495**	1	5	5	4:40:00 PM	5/3/2017	MP
Volatile Suspended Solid	SM2540E	mg/L	**315**	1	5	5	2:00:00 PM	5/2/2017	MP

Sample Comments: IJ: ICV and/or CCV above acceptance limits. Flow 793

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis CL2 Residual	Coliform Analysis Routine	Coliform Analysis Other	Coliform Analysis Repeat	Coliform Analysis Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
66269		Headworks 24 hour Composite Sample 0800-0745	4/27/17-4/28/17	0750	5.3						1	p	2 Liter	X	X	X	X		

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	4/28/17		Field ph 7.50
Received by:					Flow 793
Relinquished by:					Field Temp 14.9
Received by:	Monterey Bay Analytical Services	[signature]	4/28/17	1350	

[ ] Payment received Check # Amount: Receipt # Date:

King City
66268-66269

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C — YES (NO) NA <2 Hr — Is there evidence of chilling? (YES) NO NA

Did bottles arrive intact? (YES) NO NA

Did bottle labels agree with COC? (YES) NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
66268-	500mL	H_2SO_4	pres pres
66269	250mL	HNO_3	4/28/17

added $Na_2S_2O_3$

Lab ID	Cont. Size	Pres	Date/Initials
after pouring to 250mL		H_2SO_4	pre-pres sample

Comments

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Phosphorus QC Summary (Hach 8190)

Date: 5/4/2017
LSC Stock Lot# 062116 LCS Stock exp: 062119
QCS Stock Lot# 022217 QCS Stock exp: 022220

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
LCB	---	<0.03	---	< 0.03	13:51
LFBL	0.03	0.03	100	50%-150%	13:51
LFB	0.30	0.29	97	90%-110%	13:51
QCS	0.30	0.29	97	80%-120%	13:51
LFD	0.30	0.29	97	90%-110%	13:51
LCCB	---	<0.03	---	< 0.03	13:51

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria		MS Time	MSD Time
								MS/MSD	RPD		
AB66151	0.09	0.30	0.38	0.38	97	97	0.0	70%-130%	≤10%	13:51	13:51

LCB = Laboratory Control Blank; LFBL = Laboratory Fortified Blank Low; LFB= Laboratory Fortified Blank; QCS = Quality Control Standar; LFBD= Laboratory Fortified Blank Duplicate; LCCB = Laboratory Control Continuing Blank; MS = Matrix Spike; MSD= Matrix Spike Duplicate

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Alkalinity QC Summary (SM 2320B)

Date Analyzed: 5/1/2017
QC Stock Lot# 052757 QC Stock exp: 1/17/2016

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
CCVB	----	<10	----	<10	13:00
ICV	40	39	97.5	95%-105%	13:00

Sample ID	Sample (mg/L)	Sample Dup (mg/L)	% RPD	Acceptance Criteria RPD	Time
AB65916	131	133	2	≤10%	13:00

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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BOD/CBOD QC Summary (SM 5210B)

Date Analyzed:	05/03/17	Date Read:	05/08/17
Time Analyzed:	9:00	Time Read:	14:30
GGA Lot#	A6320	GGA exp:	11/9/2021

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %
GGA	198	172	86.9	85-115

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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COD QC Summary (Hach 8000)

Date Analyzed: 4/26/2027
QC Stock Lot# 1511927 QC Stock exp: May-17

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
LCB	---	<5	---	<5	16:36
LCS 250	250	252	101%	90%-110%	16:36
LCSD 250	250	252	101%	90%-110%	16:36
LCCB	---	<5	---	<5	16:36

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria		Time
								MS/MSD	RPD	
AB64646	66	50	132	124	132%	116%	13	80%-120%	≤10%	17:17

IL (17:17): RPD exceeds laboratory control limit

LCB = Laboratory ; LCSL = Laboratory Control Standard Low; LCS= Laboratory Control Standard; QC LCSD= Laboratory Control Standard Dup;
LCCB = Laboratory Control Continuing Blank; MS = Matrix Spike; MSD= Matrix Spike Duplicate

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Ammonia by Distillation QC Summary (SM 4500-NH3)

Date: 5/1/2017
Time: 9:22
QC Stock Lot# 022217 QC Stock exp: 022220

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria
LCB	---	<0.5	---	<0.5
LCS	5.0	4.6	92	90%-110%

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria	
								MS/MSD	RPD
AB65631	0.0	5.0	5.0	5.2	100	104	4	80%-120%	≤10%

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source;
RPD = Relative Percent Difference; Rec = Recovery

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Specific Conductance QC Summary (SM 2510B)

Date Analyzed: 4/26/2017

	Value (umhos/cm)	Result (umhos/cm)	% Rec	Acceptance Criteria	Time	QC Lot#
LCS	1412	1413	100.1%	95%-105%	1120	20170426
LCSH	24800	24730	99.7%	95%-105%	1120	20161221

Sample ID	Sample (umhos/cm)	Sample Dup (umhos/cm)	% RPD	Acceptance Criteria	Time
AB65913	626	629	0.5%	≤10%	1120
AB65923	883	885	0.2%	≤10%	1120
AB66035	415	418	0.7%	≤10%	1120

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source;
RPD = Relative Percent Difference; Rec = Recovery

Batch # 20170425 EP)A 200.7

Analyte/		IC	Prep	LCS	%Rec	LCSD	%Rec	%Diff	IC Verification			QCS (95-105%)		
WL	Range	Blank	Blank	Result	85-115%	Result	85-115%		Value	Result	%Rec	Value	Result	%Rec
B 249.678	0.05-5ppm	0.01	0.00	1.02	102.4%	1.05	105.2%	2.7%	1	1.02	101.8%	1	1.04636	104.6%
B 249.772	0.05-5ppm	0.02	0.01	1.03	102.6%	1.06	105.6%	2.9%	1	1.03	102.5%	1	1.06232	106.2%
Ca 317.933	50-300ppm	-7.33	-7.24	48.4	96.8%	50.5	101.0%	4.2%	50	48.5	97.0%	50	49.68847	99.4%
Ca 396.847	0.5-50ppm	-0.04	0.04	49.5	98.9%	50.4	100.8%	1.9%	50	49.1	98.2%	50	50.43510	100.9%
Mg 202.582	50-1000ppm	-3.05	-3.04	51.4	102.9%	52.8	105.5%	2.5%	50	52.1	104.3%	50	53.75706	107.5%
Mg 279.078	0.5-50ppm	-0.01	0.00	49.7	99.5%	51.0	102.0%	2.6%	50	50.1	100.3%	50	51.91399	103.8%
Mn 257.610	10ppb-11ppm	-0.56	-0.74	996	99.6%	1021	102.1%	2.5%	1000	1000	100.0%	1000	1026.33398	102.6%
Mn 260.568	10ppb-11ppm	-0.62	-0.34	1002	100.2%	1028	102.8%	2.6%	1000	1003	100.3%	1000	1029.17004	102.9%
Na 568.821	50-1000ppm	8.27	6.83	52.2	104.4%	54.0	107.9%	3.3%	50	52.9	105.8%	50	52.13193	104.3%
Na 589.592	0.5-50ppm	0.33	0.29	50.0	99.9%	51.6	103.3%	3.3%	50	49.3	98.5%	50	50.78603	101.6%

Sample ID AB65822

Analyte/	Sample	MS	%Rec	MSD	%Rec	%Diff	CCV (90-110%)			%Diff	CC
WL	Value	Result	70-130%	Result	70-130%		Value	Result	%Rec	10%	Blank
B 249.678	1.85	2.77	92.0%	2.72	87.0%	1.8%	1	0.98	97.6%	4.1%	0.01
B 249.772	1.89	2.83	94.8%	2.80	91.3%	1.2%	1	0.99	99.3%	3.2%	0.00
Ca 317.933	8.6	66.6	116.1%	64.8	112.5%	2.7%	50	50.3	100.5%	3.6%	-7.35
Ca 396.847	13.4	60.9	95.1%	59.9	93.2%	1.6%	50	47.4	94.7%	3.6%	-0.06
Mg 202.582	66.5	117.8	102.6%	115.7	98.4%	1.8%	50	50.7	101.5%	2.7%	-3.01
Mg 279.078	63.3	110.9	95.4%	108.9	91.4%	1.8%	50	49.4	98.8%	1.4%	-0.02
Mn 257.610	-1	1016	101.7%	999	100.0%	1.7%	1000	974	97.4%	2.6%	-0.97
Mn 260.568	2	1041	103.9%	1023	102.1%	1.7%	1000	989	98.9%	1.4%	-2.26
Na 568.821	114.4	158.7	88.5%	159.8	90.7%	0.7%	50	48.4	96.7%	8.9%	12.97
Na 589.592	116.0	163.0	94.1%	158.9	85.8%	2.6%	50	50.6	101.3%	2.7%	0.60

Batch # 20170502 EPA 200.7

Analyte/		IC	Prep	LCS	%Rec	LCSD	%Rec	%Diff	IC Verification			QCS (95-105%)		
WL	Range	Blank	Blank	Result	85-115%	Result	85-115%		Value	Result	%Rec	Value	Result	%Rec
B 249.678	0.05-5ppm	0.01	0.00	0.93	93.3%	0.94	93.7%	0.4%	1	0.92	92.3%	1	0.9	90.6%
B 249.772	0.05-5ppm	0.02	0.01	1.02	102.5%	1.03	103.1%	0.6%	1	1.01	101.0%	1	1.0	99.5%
Ca 317.933	50-300ppm	-7.82	-7.88	49.6	99.1%	49.9	99.8%	0.6%	50	48.9	97.8%	50	47.8	95.6%
Ca 396.847	0.5-50ppm	-0.19	-0.25	53.2	106.5%	53.7	107.4%	0.9%	50	52.1	104.2%	50	51.7	103.4%
Mg 202.582	50-1000ppm	-2.86	-2.95	56.1	112.3%	56.3	112.6%	0.3%	50	54.5	108.9%	50	54.7	109.4%
Mg 279.078	0.5-50ppm	0.04	-0.03	51.0	101.9%	51.2	102.4%	0.5%	50	49.7	99.4%	50	49.4	98.9%
Na 568.821	50-1000ppm	2.81	5.66	60.8	121.7%	56.3	112.7%	7.7%	50	56.7	113.3%	50	56.3	112.5%
Na 589.592	0.5-50ppm	0.56	0.37	53.8	107.6%	54.0	107.9%	0.3%	50	53.2	106.5%	50	52.2	104.5%

Sample ID AB66140

Analyte/	Sample	MS	%Rec	MSD	%Rec	%Diff	CCV (90-110%)			%Diff	CC
WL	Value	Result	70-130%	Result	70-130%		Value	Result	%Rec	10%	Blank
B 249.678	0.43	2.03	80.1%	2.00	78.7%	1.4%	1	0.82	82.3%	11.4%	0.01
B 249.772	0.45	2.24	89.2%	2.18	86.5%	2.5%	1	0.90	90.1%	11.3%	0.01
Ca 317.933	85.3	188.3	103.0%	183.2	97.9%	2.8%	50	43.9	87.9%	10.7%	-7.87
Ca 396.847	90.3	178.5	88.2%	172.9	82.6%	3.2%	50	45.5	91.1%	13.4%	-0.24
Mg 202.582	85.0	188.8	103.7%	185.7	100.7%	1.6%	50	49.3	98.7%	9.9%	-2.94
Mg 279.078	78.9	171.5	92.6%	167.8	89.0%	2.1%	50	45.7	91.3%	8.5%	0.02
Na 568.821	83.7	182.9	99.2%	189.9	106.2%	3.7%	50	49.1	98.2%	14.3%	6.70
Na 589.592	84.8	180.6	95.7%	175.4	90.6%	2.9%	50	47.5	95.1%	11.3%	0.23

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300.0 QC Report

All units expressed in mg/L

20170422

		F	Cl	NO2-N	SO4	NO3-N
Spike amount		**2**	**20**	**2**	**20**	**2**
	ICVB	0.0	0.0	0.0	0.0	0.1
	ICV	2.1	21.0	2.1	21.0	2.1
	Rec 90-110%	105.0	105.0	105.0	105.0	105.0
	ICVL	0.2	2.0	0.2	2.0	0.3
	Rec 50-150%	100.0	100.0	100.0	100.0	150.0
Sample ID	**AB65814**	0.2	93.0	0.5	84.0	0.5
	MS	1.8	114.0	2.2	105.0	2.4
	Rec 80-120%	80.0	105.0	85.0	105.0	95.0
	MSD	1.8	113.0	2.2	104.0	2.4
	Rec 80-120%	80.0	100.0	85.0	100.0	95.0
	Diff 10%	0.0	0.9	0.0	1.0	0.0
	CCV	2.0	21.0	2.1	21.0	2.1
	Rec 90-110%	100.0	105.0	105.0	105.0	105.0
	Diff 10%	4.9	0.0	0.0	0.0	0.0
	CCVB	0.0	0.0	0.0	0.0	0.0

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300.0 QC Report

All units expressed in mg/L **20170428**

		Cl	NO2-N	SO4	NO3-N
Spike amount		**20**	**2**	**20**	**2**
	ICVB	0.0	0.1	0.4	0.0
	ICV	21.2	2.2	21.5	2.2
	Rec 90-110%	106.0	109.5	107.5	110.0
	ICVL	2.4	0.3	2.4	0.3
	Rec 50-150%	120.0	125.0	120.0	150.0
Sample ID	**AB66275**	28.6	0.3	99.7	2.3
	MS	49.5	2.2	122.4	4.7
	Rec 80-120%	104.5	95.5	113.5	117.5
	MSD	49.7	2.2	122.2	4.7
	Rec 80-120%	105.5	95.0	112.5	117.5
	Diff 10%	0.4	0.5	0.2	0.0
	CCV	20.9	2.2	21.2	2.2
	Rec 90-110%	104.5	109.0	106.0	108.5
	Diff 10%	1.4	0.5	1.0	0.8
	CCVB	0.0	0.1	0.4	0.0

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Kjehldahl Nitrogen QC Summary (SM 4500-NH3)

Date: 5/5/2017
Time: 10:00
QC Stock Lot# 54153 QC Stock exp: 50319

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria
LCB	---	<0.5	---	<0.5
LCS	5.0	4.9	98	90%-110%
LCB	---	<0.5	---	<0.5
LCS	5.0	4.5	90	90%-110%

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria	
								MS/MSD	RPD
AB66206	2.2	5.0	7.5	7.9	106	114	5.2	80%-120%	≤10%

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source;
RPD = Relative Percent Difference; Rec = Recovery

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Kjehldahl Nitrogen QC Summary (SM 4500-NH3)

Date: 4/28/2017
Time: 10:00
QC Stock Lot# 54153 QC Stock exp: 50319

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria
LCB	---	<0.5	---	<0.5
LCS	5.0	4.9	98	90%-110%

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria	
								MS/MSD	RPD
AB66157	5.2	5.0	9.5	9.7	86	90	2.1	80%-120%	≤10%

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source;
RPD = Relative Percent Difference; Rec = Recovery

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Specific Conductance QC Summary (SM 2510B)

Date Analyzed: 5/2/2017

	Value (umhos/cm)	Result (umhos/cm)	% Rec	Acceptance Criteria	Time	QC Lot#
LCS	1412	1412	100.0%	95%-105%	1345	20170502
LCSH	24800	24760	99.8%	95%-105%	1345	20161221

Sample ID	Sample (umhos/cm)	Sample Dup (umhos/cm)	% RPD	Acceptance Criteria	Time
AB66143	1217	1221	0.3%	≤10%	1345
AB66240	521	523	0.4%	≤10%	1345
AB66276	643	645	0.3%	≤10%	1345

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source;
RPD = Relative Percent Difference; Rec = Recovery

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TSS QC Summary (SM 2540D)

Date Analyzed: 4/25/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
Method Blank	---	<2	---	<2	14:25

Sample ID	TSS/VSS	Sample (mg/L)	Sample Duplicate (mg/L)	% RPD	Acceptance Criteria	Time
AB65840	TSS	8900	8840	0.7	≤10%	14:25
	VSS	5900	5900	0.0	≤10%	14:25

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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TSS QC Summary (SM 2540D)

Date Analyzed: 5/2/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
Method Blank	---	<2	---	<2	14:00

Sample ID	TSS/VSS	Sample (mg/L)	Sample Duplicate (mg/L)	% RPD	Acceptance Criteria	Time
AB66242	TSS	1100	1190	7.9	≤10%	14:00
	VSS	910	970	6.4	≤10%	14:00
AB66288	TSS	61	68	10.9	≤10%	14:00

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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TS QC Summary (SM 2540C)

Date Analyzed: 4/28/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %	Time
ICVB	---	0	---	<10	10:50
ICVL	100	120	120	80-120	10:50
ICV	500	511	102.2	90-110	10:50

Sample ID	Sample (mg)	Sample Dup (mg)	% RPD	Acceptance Criteria % RPD	Time
AB66118 TS	994	1014	2.0	10	10:50
AB66118 VS	417	437	4.7	10	10:50

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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TS QC Summary (SM 2540C)

Date Analyzed: 5/3/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %	Time
ICVB	---	9	---	<10	16:40
ICVL	100	89	89	80-120	16:40
ICV	500	494	98.8	90-110	16:40

Sample ID	Sample (mg)	Sample Dup (mg)	% RPD	Acceptance Criteria % RPD	Time
AB66269 TS	1040	1150	10.0	10	16:40
AB66269 VS*	495	570	14.1	10	16:40

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

*RPD exceeds lab control limit

City of King City
Sal Morales
212 S. Vanderhurst
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ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB67207**

Collection Date/Time:	5/11/2017	7:50	Sample Collector:	BROWN, L	Client Sample #:
Submittal Date/Time:	5/11/2017	13:45	Sample ID	HEADWORKS	

Sample Description: Headworks 24 Hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**436**	1		10	2	9:00:00 AM	5/15/2017	BS
NH3 as N	EPA 350.1	mg/L	**97.2**	20		2.0	0.74	1:00:00 PM	5/15/2017	LRH
Bicarbonate (as HCO3-)	SM2320B	mg/L	**532**	1		10	2	9:00:00 AM	5/15/2017	BS
Biochemical Oxygen De	SM5210B	mg/L	**418**	1		2	2	1:00:00 PM	5/12/2017	MP
Boron	EPA200.7	mg/L	**0.26**	1		0.05	0.01	.2:23:00 PM	5/18/2017	MW
Calcium	EPA200.7	mg/L	**57**	1		0.5	0.1	.2:23:00 PM	5/18/2017	MW
Chem. Oxygen Demand	SM5220 D	mg/L	**836**	2		10	10	2:36:00 PM	5/17/2017	LRH
Chloride	EPA300.0	mg/L	**138**	4		4.0	1.0	1:49:00 AM	5/12/2017	HM
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**102**	10		5	5	.0:00:00 AM	5/26/2017	BS
Magnesium	EPA200.7	mg/L	**22**	1		0.5	0.2	.2:23:00 PM	5/18/2017	MW
MLVSS/MLTSS	Calculation		**0.89**	1				9:59:00 AM	5/22/2017	HM
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	1:49:00 AM	5/12/2017	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.6**	4		0.40	0.10	1:49:00 AM	5/12/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.6**	4		0.4	0.04	1:49:00 AM	5/12/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.82**	1				7:50:00 AM	5/11/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.3**	1		0.1		4:00:00 PM	5/11/2017	BS/MB
Phosphorus, Total	EPA 365.1	mg/L	**10.9**	10		0.20	0.143	1:40:00 PM	6/5/2017	LRH
SAR (Sodium Adsorption	Suarez, 1981		**3.3**	1				3:24:00 PM	5/19/2017	MW
SAR, Adjusted	Suarez, 1981		**3.2**	1				3:24:00 PM	5/19/2017	MW
Sodium	EPA200.7	mg/L	**114**	1		0.5	0.2	.2:23:00 PM	5/18/2017	MW
Specific Conductance (E.	SM2510B	µmhos/	**1565**	1		1	1	8:50:00 AM	5/12/2017	HM
Sulfate	EPA300.0	mg/L	**84**	4		4.0	1.0	1:49:00 AM	5/12/2017	HM
Temperature (Field)	SM2550	° C	**15.8**	1				7:50:00 AM	5/11/2017	LB
Total Diss. Solids_by Cal	SM1030E	mg/L	**1002**	1		10	10	8:50:00 AM	5/12/2017	HM
Total Nitrogen	Calculation	mg/L	**102.6**	1		0.5	0.5	4:15:00 PM	5/26/2017	HM
Total Solids	SM2540B	mg/L	**1310**	1	H	5	5	7:30:00 AM	5/19/2017	HM/MP
Total Susp. Solids	SM2540D	mg/L	**398**	1		2	2	4:00:00 PM	5/18/2017	MP

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Volatile Solids	SM2540E	mg/L	**715**	1	5	5	7:30:00 AM	5/19/2017	HM/MP
Volatile Suspended Solid	SM2540E	mg/L	**354**	1	5	5	4:00:00 PM	5/18/2017	MP

Sample Comments: H: Analyzed outside of holding time. (Analyzed at 7 days, 23hrs, 40min) Field Results: pH=7.82, Flow-765, Temp=15.8°c

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

MBAS
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4 Justin Court, Suite D
Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus	SO4, NA, CL, B, Conductivity	Ca, Mg, HCO3, SAR
67207		Headworks 24 hour Composite Sample 0800-0745	5/10/17-5/11/17	0750	17.4						1	p	2 Liter	X	X	X	X	X	X

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	5/11/17	1345	Field ph 7.82
Received by:					Flow 765
Relinquished by:					Field Temp 15.8
Received by:	Monterey Bay Analytical Services	[illegible]	5/11/17	1345	

[ ] Payment received Check # Amount: Receipt # Date:

67207 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES (NO) NA <2 Hr Is there evidence of chilling? (YES) NO NA

Did bottles arrive intact? (YES) NO NA

Did bottle labels agree with COC? (YES) NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Pre-preserved

Lab ID	Cont. Size	Pres	Date/Initials
	500ml	H_2SO_4	5/11/17
	500ml	H_2SO_4 $NaZSZO_3$	
	250ml	HNO_3	

Lab ID	Cont. Size	Pres	Date/Initials

Comments

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

 Thursday, July 06, 2017

Lab Number: **AB67300**

Collection Date/Time:	5/12/2017	7:50	Sample Collector:	BROWN L	Client Sample #:
Submittal Date/Time:	5/13/2017	10:30	Sample ID	HEADWORKS	

Sample Description: Headworks 24 hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**431**	1		10	2	9:00:00 AM	5/19/2017	BS
Ammonia-N	EPA 350.1	mg/L	**85.1**	10		1.00	0.40	4:00:00 PM	6/5/2017	LRH/BS
Bicarbonate (as HCO3-)	SM2320B	mg/L	**526**	1		10	2	9:00:00 AM	5/19/2017	BS
Biochemical Oxygen De	SM5210B	mg/L	**423**	1		2	2	4:30:00 PM	5/13/2017	DH/MP
Chem. Oxygen Demand	SM5220 D	mg/L	**920**	2		10	10	2:36:00 PM	5/17/2017	LRH
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**92.7**	10		5	5	.0:00:00 AM	5/26/2017	BS
MLVSS/MLTSS	Calculation		**0.91**	1				9:59:00 AM	5/22/2017	HM
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	7:06:00 PM	5/16/2017	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.6**	1		0.1	0.025	7:06:00 PM	5/16/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.6**	4		0.4	0.04	7:06:00 PM	5/16/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.51**	1				7:50:00 AM	5/13/2017	LB
Phosphorus, Total	EPA 365.1	mg/L	**9.7**	10		0.20	0.143	1:40:00 PM	6/5/2017	LRH
Temperature (Field)	SM2550	° C	**16.4**	1				7:50:00 AM	5/13/2017	LB
Total Nitrogen	Calculation	mg/L	**93.3**	1		0.5	0.5	4:16:00 PM	5/26/2017	HM
Total Solids	SM2540B	mg/L	**1085**	1		5	5	7:30:00 AM	5/19/2017	HM/MP
Total Susp. Solids	SM2540D	mg/L	**227**	1		2	2	4:00:00 PM	5/18/2017	MP
Volatile Solids	SM2540E	mg/L	**520**	1		5	5	7:30:00 AM	5/19/2017	HM/MP
Volatile Suspended Solid	SM2540E	mg/L	**206**	1		5	5	4:00:00 PM	5/18/2017	MP

Sample Comments: Flow 842

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

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(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Routine	Other	Repeat	Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
67300		Headworks 24 hour Composite Sample 0800-0745	5/11/17-5/12/17	0750	7.9						1	p	2 Liter	X	X	X	X		
											1	p	500						

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	5/13/17	1030	Field ph 7.51
Received by:					Flow ~~765~~ 842
Relinquished by:					Field Temp 16.4
Received by:	Monterey Bay Analytical Services	[illegible]	5/13/17	1030	

[ ] Payment received Check # Amount: Receipt # Date:

67300

Sample Condition Upon Receipt

COC Info

recommend <6°C

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES NO NA <2 Hr

Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution Continue

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
67300	500	H_2SO_4	5/12 LB

pH <2

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB67301**

Collection Date/Time:	5/13/2017	7:50	Sample Collector:	BROWN L	Client Sample #:
Submittal Date/Time:	5/13/2017	10:30	Sample ID	HEADWORKS	

Sample Description: Headworks 24 hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**464**	1		10	2	9:00:00 AM	5/19/2017	BS
Ammonia-N	EPA 350.1	mg/L	**98.4**	10		1.00	0.40	4:00:00 PM	6/5/2017	LRH/BS
Bicarbonate (as HCO3-)	SM2320B	mg/L	**566**	1		10	2	9:00:00 AM	5/19/2017	BS
Biochemical Oxygen De	SM5210B	mg/L	**502**	1		2	2	4:30:00 PM	5/13/2017	DH/MP
Boron	EPA200.7	mg/L	**0.24**	1		0.05	0.01	2:42:00 PM	5/18/2017	MW
Calcium	EPA200.7	mg/L	**50**	1		0.5	0.1	2:42:00 PM	5/18/2017	MW
Chem. Oxygen Demand	SM5220 D	mg/L	**976**	2		10	10	2:36:00 PM	5/17/2017	LRH
Chloride	EPA300.0	mg/L	**140**	4		4.0	1.0	7:28:00 PM	5/16/2017	HM
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**109**	10		5	5	.0:00:00 AM	5/26/2017	BS
Magnesium	EPA200.7	mg/L	**21**	1		0.5	0.2	2:42:00 PM	5/18/2017	MW
MLVSS/MLTSS	Calculation		**0.91**	1				.0:00:00 AM	5/22/2017	HM
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	7:28:00 PM	5/16/2017	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.7**	1		0.1	0.025	7:28:00 PM	5/16/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.7**	4		0.4	0.04	7:28:00 PM	5/16/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.65**	1				7:50:00 AM	5/13/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.8**	1		0.1		.2:00:00 PM	5/13/2017	DH
Phosphorus, Total	EPA 365.1	mg/L	**10.0**	10		0.20	0.143	1:40:00 PM	6/5/2017	LRH
SAR (Sodium Adsorption	Suarez, 1981		**3.0**	1				3:26:00 PM	5/19/2017	MW
SAR, Adjusted	Suarez, 1981		**2.8**	1				3:26:00 PM	5/19/2017	MW
Sodium	EPA200.7	mg/L	**99**	1		0.5	0.2	2:42:00 PM	5/18/2017	MW
Specific Conductance (E.	SM2510B	µmhos/	**1664**	1		1	1	.0:40:00 AM	5/18/2017	HM
Sulfate	EPA300.0	mg/L	**87**	4		4.0	1.0	7:28:00 PM	5/16/2017	HM
Temperature (Field)	SM2550	° C	**16.0**	1				7:50:00 AM	5/13/2017	LB
Total Diss. Solids_by Cal	SM1030E	mg/L	**1065**	1		10	10	.0:40:00 AM	5/18/2017	HM
Total Nitrogen	Calculation	mg/L	**109.7**	1		0.5	0.5	4:16:00 PM	5/26/2017	HM
Total Solids	SM2540B	mg/L	**1400**	1		5	5	7:30:00 AM	5/19/2017	HM/MP
Total Susp. Solids	SM2540D	mg/L	**424**	1		2	2	4:00:00 PM	5/18/2017	MP

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Volatile Solids	SM2540E	mg/L	**790**	1	5	5	7:30:00 AM	5/19/2017	HM/MP
Volatile Suspended Solid	SM2540E	mg/L	**386**	1	5	5	4:00:00 PM	5/18/2017	MP

Sample Comments: Flow 827

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is City of King	
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus	SO4, NA, CL, B, Conductivity	Ca, Mg, HCO3, SAR
67301		Headworks 24 hour Composite Sample 0800-0745	5/12/17-5/13/17	0750	9.2						1	p	2 Liter	X	X	X	X	X	X
											1	p	500						

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	5/13/17	1030	Field ph 7.65
Received by:					Flow 827
Relinquished by:					Field Temp 16.0
Received by:	Monterey Bay Analytical Services	De Adell	5/13/17	1030	

[ ] Payment received Check # Amount: Receipt # Date:

67301

Sample Condition Upon Receipt

COC Info

recommend <10

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES NO NA <2 Hr

Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution Continue

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
67301	500	H_2SO_4	5/13 LD
67301	250	HNO_3	5/13 RA

pH <2

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB67397**

Collection Date/Time:	5/14/2017	7:50	Sample Collector:	BROWN, L	Client Sample #:
Submittal Date/Time:	5/15/2017	15:00	Sample ID	HEADWORKS	

Sample Description: Headworks 24 Hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**347**	1		10	2	1:00:00 PM	5/22/2017	BS
Ammonia-N	EPA 350.1	mg/L	**55.8**	1		0.1	0.04	4:00:00 PM	6/5/2017	LRH/BS
Bicarbonate (as HCO3-)	SM2320B	mg/L	**423**	1		10	2	1:00:00 PM	5/22/2017	BS
Biochemical Oxygen De	SM5210B	mg/L	**303**	1		2	2	5:00:00 PM	5/15/2017	LRH/DH
Chem. Oxygen Demand	SM5220 D	mg/L	**672**	2		10	10	2:36:00 PM	5/17/2017	LRH
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**61.2**	10		5	5	.0:00:00 AM	5/26/2017	BS
MLVSS/MLTSS	Calculation		**0.87**	1				3:11:00 PM	5/22/2017	HM
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	8:35:00 PM	5/16/2017	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.4**	4		0.40	0.10	8:35:00 PM	5/16/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.4**	4		0.4	0.04	8:35:00 PM	5/16/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.18**	1				7:50:00 AM	5/14/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.4**	1		0.1		4:45:00 PM	5/15/2017	BS
Phosphorus, Total	EPA 365.1	mg/L	**7.3**	5		0.10	0.0715	3:13:00 PM	6/2/2017	LRH
Temperature (Field)	SM2550	° C	**14.7**	1				7:50:00 AM	5/14/2017	LB
Total Nitrogen	Calculation	mg/L	**61.6**	1		0.5	0.5	4:16:00 PM	5/26/2017	HM
Total Solids	SM2540B	mg/L	**975**	1		5	5	7:30:00 AM	5/19/2017	HM/MP
Total Susp. Solids	SM2540D	mg/L	**220**	1		2	2	4:00:00 PM	5/18/2017	MP
Volatile Solids	SM2540E	mg/L	**460**	1		5	5	7:30:00 AM	5/19/2017	HM/MP
Volatile Suspended Solid	SM2540E	mg/L	**192**	1		5	5	4:00:00 PM	5/18/2017	MP

Sample Comments: Field Results: pH=7.18, Flow=845, Temp=14.7°C

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
67397		Headworks 24 hour Composite Sample 0800-0745	5/13/17-5/14/17	0758	11.9						1	p	2 Liter	X	X	X	X		

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	5/15/17	1500	Field ph 7.18
Received by:					Flow 845
Relinquished by:					Field Temp 14.7°
Received by:	Monterey Bay Analytical Services		5/15/17	1500	

[ ] Payment received Check # Amount: Receipt # Date:

67397-98 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES NO NA <2 Hr Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
67397-98	500ml	H_2SO_4	Pre-preserved
	500ml	H_2SO_4 $Na_2S_2O_3$	5/15/17 MY

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB67398**

Collection Date/Time:	5/15/2017	7:50	Sample Collector:	BROWN, L	Client Sample #:
Submittal Date/Time:	5/15/2017	15:00	Sample ID	HEADWORKS	

Sample Description: Headworks 24 Hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**377**	1		10	2	1:00:00 PM	5/22/2017	BS
Ammonia-N	EPA 350.1	mg/L	**66.7**	1		0.1	0.04	4:00:00 PM	6/5/2017	LRH/BS
Bicarbonate (as HCO3-)	SM2320B	mg/L	**516**	1		10	2	1:00:00 PM	5/22/2017	BS
Biochemical Oxygen De	SM5210B	mg/L	**334**	1		2	2	5:00:00 PM	5/15/2017	LRH/DH
Chem. Oxygen Demand	SM5220 D	mg/L	**1906**	2		10	10	2:36:00 PM	5/17/2017	LRH
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**69.3**	10		5	5	.0:00:00 AM	5/26/2017	BS
MLVSS/MLTSS	Calculation		**0.87**	1				.2:15:00 PM	5/23/2017	LRH
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	8:57:00 PM	5/16/2017	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.4**	4		0.40	0.10	8:57:00 PM	5/16/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.4**	4		0.4	0.04	8:57:00 PM	5/16/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.41**	1				7:50:00 AM	5/15/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.5**	1		0.1		4:45:00 PM	5/15/2017	BS
Phosphorus, Total	EPA 365.1	mg/L	**9.2**	5		0.10	0.0715	3:13:00 PM	6/2/2017	LRH
Temperature (Field)	SM2550	° C	**13.7**	1				7:50:00 AM	5/15/2017	LB
Total Nitrogen	Calculation	mg/L	**69.7**	1		0.5	0.5	4:17:00 PM	5/26/2017	HM
Total Solids	SM2540B	mg/L	**1105**	1		5	5	7:30:00 AM	5/19/2017	HM/MP
Total Susp. Solids	SM2540D	mg/L	**297**	1		2	2	.2:40:00 PM	5/19/2017	MP
Volatile Solids	SM2540E	mg/L	**525**	1		5	5	7:30:00 AM	5/19/2017	HM/MP
Volatile Suspended Solid	SM2540E	mg/L	**258**	1		5	5	.2:40:00 PM	5/19/2017	MP

Sample Comments: Field Results: pH=7.41, Flow=935, Temp=13.7°C

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is City of King	
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis CL2 Residual	Coliform Analysis Routine	Coliform Analysis Other	Coliform Analysis Repeat	Coliform Analysis Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
67398		Headworks 24 hour Composite Sample 0800-0745	5/14/17-5/15/17	0750	12.1						1	p	2 Liter	X	X	X	X		

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	5/15/17	1500	Field ph 7.41
Received by:					Flow 935
Relinquished by:					Field Temp 13.7
Received by:	Monterey Bay Analytical Services		5/15/17	1500	

[ ] Payment received Check # Amount: Receipt # Date:

67397-98 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES NO NA <2 Hr Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
67397-98	500ml	H_2SO_4	Pre-preserved
	500ml	H_2SO_4 $Na_2S_2O_3$	5/15/17 MY

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Tuesday, June 06, 2017

Lab Number: **AB67597**

Collection Date/Time:	5/16/2017	8:15	Sample Collector:	BROWN L	Client Sample #:
Submittal Date/Time:	5/16/2017	14:38	Sample ID	HEADWORKS	

Sample Description: Headworks 24 Hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Date Analyzed	Time Analyzed	Analyst:
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**429**	1		10	2	5/22/2017	1:00:00 PM	BS
Ammonia-N	EPA 350.1	mg/L	**62.4**	10		1.00	0.37	5/30/2017	1:00:00 PM	LRH
Biochemical Oxygen Demand	SM5210B	mg/L	**319**	1		2	2	4/21/2017	10:35:00 AM	MP
Boron	EPA200.7	mg/L	**0.24**	1		0.05	0.01	5/18/2017	5:59:00 PM	MW
Calcium	EPA200.7	mg/L	**41**	1		0.5	0.1	5/18/2017	5:59:00 PM	MW
Chem. Oxygen Demand	Hach 8000	mg/L	**704**	2	IL	10	10	5/31/2017	11:48:00 AM	LRH
Chloride	EPA300.0	mg/L	**124**	4		4.0	1.0	5/17/2017	7:23:00 AM	HM
Kjehldahl Nitrogen	SM4500-NH	mg/L	**92.4**	10		5	5	5/26/2017	10:00:00 AM	BS
Magnesium	EPA200.7	mg/L	**18**	1		0.5	0.2	5/18/2017	5:59:00 PM	MW
MLVSS/MLTSS	Calculation		**0.90**	1				5/23/2017	12:15:00 PM	LRH
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	5/17/2017	7:23:00 AM	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.5**	4		0.40	0.10	5/17/2017	7:23:00 AM	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.5**	4		0.4	0.04	5/17/2017	7:23:00 AM	HM
pH (Field Test)	SM4500-H+	pH	**7.68**	1				5/16/2017	8:15:00 AM	LB
pH (Laboratory)	SM4500-H+	pH (H)	**7.5**	1		0.1		5/16/2017	4:30:00 PM	BS
Phosphorus, Total	EPA 365.1	mg/L	**9.5**	5		0.10	0.07	6/2/2017	3:13:00 PM	LRH
SAR (Sodium Adsorption Ratio)	Suarez, 1981		**2.7**	1				5/22/2017	4:00:00 PM	LRH
SAR, Adjusted	Suarez, 1981		**2.4**	1				5/22/2017	4:00:00 PM	LRH
Sodium	EPA200.7	mg/L	**82**	1		0.5	0.2	5/18/2017	5:59:00 PM	MW
Specific Conductance (E.C)	SM2510B	µmhos/c	**1546**	1		1	1	5/18/2017	10:40:00 AM	HM
Sulfate	EPA300.0	mg/L	**89**	4		4.0	1.0	5/17/2017	7:23:00 AM	HM
Temperature (Field)	SM2550	° C	**15.4**	1				5/16/2017	8:15:00 AM	LB
Total Nitrogen	Calculation	mg/L	**92.9**	1		0.5	0.5	5/31/2017	9:02:00 AM	LRH
Total Solids	SM2540B	mg/L	**1230**	1		5	5	5/22/2017	5:10:00 PM	MP
Total Susp. Solids	SM2540D	mg/L	**368**	1		2	2	5/19/2017	12:40:00 PM	MP
Volatile Solids	SM2540E	mg/L	**635**	1		5	5	5/22/2017	5:10:00 PM	MP
Volatile Suspended Solids	SM2540E	mg/L	**333**	1		5	5	5/19/2017	12:40:00 PM	MP

Sample Comments: Field Measurements: pH=7.68, Flow=805, Temp=15.4 IL: RPD exceeds laboratory control limit

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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Monterey, CA 93940
(831) 375-MBAS (6227)
(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is	City of King
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis CL2 Residual	Coliform Analysis Routine	Coliform Analysis Other	Coliform Analysis Repeat	Coliform Analysis Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus	SO4, NA, CL, B, Conductivity	Ca, Mg, HCO3, SAR
67597		Headworks 24 hour Composite Sample 0800-0745	5/15/17-5/16/17	0815	11.8						1	p	2 Liter	X	X	X	X	X	X

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	5/16/17	1430	Field ph 7.68
Received by:					Flow 805
Relinquished by:					Field Temp 15.4
Received by:	Monterey Bay Analytical Services	[signature]	5/16/17	14:40	

[ ] Payment received Check # Amount: Receipt # Date:

67597 King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES NO NA <2 Hr Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
	500ml	H_2SO_4	Pre-Pres
	500ml	H_2SO_4 $NaAsO_2$	5/16/14 MVP
	250ml	HNO_3	5/16/14 MVP

Lab ID	Cont. Size	Pres	Date/Initials

Comments

City of King City
Sal Morales
212 S. Vanderhurst
King City, CA 93930

Monterey Bay Analytical Services
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
www.MBASinc.com
ELAP Certification Number: 2385

 Thursday, July 06, 2017

Lab Number: **AB67640**

Collection Date/Time:	5/17/2017	7:50	Sample Collector:	BROWN L	Client Sample #:
Submittal Date/Time:	5/17/2017	11:42	Sample ID	HEADWORKS	

Sample Description: Headworks 24 hour Composite Sample 0800-0745

Analyte	Method	Unit	**Result**	Dilution	Qual	PQL	MDL	Time Analyzed	Date Analyzed	Analyst:
Alkalinity, Total (as CaC	SM2320B	mg/L	**341**	1		10	2	9:00:00 AM	5/24/2017	BS
Ammonia-N	EPA 350.1	mg/L	**55.9**	1		0.1	0.04	4:00:00 PM	6/5/2017	LRH/BS
Bicarbonate (as HCO3-)	SM2320B	mg/L	**416**	1		10	2	9:00:00 AM	5/24/2017	BS
Biochemical Oxygen De	SM5210B	mg/L	**281**	1		2	2	.0:35:00 AM	5/17/2017	MP
Chem. Oxygen Demand	SM5220 D	mg/L	**756**	2	IL	10	10	.1:48:00 AM	5/31/2017	LRH
Kjehldahl Nitrogen	SM4500-NH3 B,	mg/L	**62.5**	10		5	5	.0:00:00 AM	5/26/2017	BS
MLVSS/MLTSS	Calculation		**0.78**	1				.2:18:00 PM	5/23/2017	LRH
Nitrate as NO3-N	EPA300.0	mg/L	**Not Detected**	4		0.4	0.04	2:28:00 PM	5/17/2017	HM
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.4**	1		0.1	0.025	2:28:00 PM	5/17/2017	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.4**	4		0.4	0.04	2:28:00 PM	5/17/2017	HM
pH (Field Test)	SM4500-H+B	pH	**7.15**	1				7:50:00 AM	5/17/2017	LB
pH (Laboratory)	SM4500-H+B	pH (H)	**7.3**	1		0.1		4:35:00 PM	5/17/2017	LRH
Phosphorus, Total	EPA 365.1	mg/L	**6.9**	5		0.10	0.0715	3:13:00 PM	6/2/2017	LRH
Temperature (Field)	SM2550	° C	**16.7**	1				7:50:00 AM	5/17/2017	LB
Total Nitrogen	Calculation	mg/L	**62.9**	1		0.5	0.5	4:24:00 PM	5/26/2017	HM
Total Solids	SM2540B	mg/L	**1005**	1		5	5	5:10:00 PM	5/22/2017	MP
Total Susp. Solids	SM2540D	mg/L	**102**	1		2	2	.2:40:00 PM	5/19/2017	MP
Volatile Solids	SM2540E	mg/L	**460**	1		5	5	5:10:00 PM	5/22/2017	MP
Volatile Suspended Solid	SM2540E	mg/L	**80**	1		5	5	.2:40:00 PM	5/19/2017	MP

Sample Comments: Flow:7196 IL: RPD exceeds laboratory control limit

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit J = Result is less than PQL
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

Chain of Custody / Analysis Request

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(831) 641-0734 (Fax)
MontereyBayAnalytical@USA.net

Client / Company Name	City of King	email address to sent report & invoice:	smorales@kingcity.com
Attn:	Sal Morales	Drinking water [ ] Wastewater [X] Monitoring Well [ ] Soil [ ] Sludge [ ]	
Mailing Address	212 South Vanderhurst	For State or Local Health Department reporting, the System # is City of King	
Billing Address	King City, CA 93930	Phone # 831-682-1007	831-386-5968

MBAS Lab #	Project ID or Source Code #	Sample Site / Description (Well Name, APN#, Address, Stormdrain #)	Sampling Date	Sampling Time	Receiving Temp.	Coliform Analysis: CL2 Residual	Coliform Analysis: Routine	Coliform Analysis: Other	Coliform Analysis: Repeat	Coliform Analysis: Special	# Cont.	Container Type	Container Size	COD, BOD	TS, VS TSS, VSS	TKN, Total Oxized Nitrogen(Nitrite & Nitrate) Amonia as N, Nitrate as N	ALK, Total Phosphorus		
67640		Headworks 24 hour Composite Sample 0800-0745	5/16/17-5/17/17	0780	13.4						1 / 1	p	500mL / 2 Liter	X	X	X	X		

	Printed Name	Signature	Date	Time	Comment
Sampled by:	Linda Brown	Linda Brown			Is sample for regulatory purposes? Yes / No
Relinquished by:	Linda Brown	Linda Brown	5/17/17	1140	Field ph 7.15
Received by:					Flow 7.96
Relinquished by:					Field Temp 16.7
Received by:	Monterey Bay Analytical Services	[signature]	5/17/17	11:42	Sample Clear

[ ] Payment received Check # Amount: Receipt # Date:

ARV

67640 – King City

Sample Condition Upon Receipt

COC Info

Was temp acceptable? Chemistry ≤6°C Micro ≤10°C YES NO NA <2 Hr Is there evidence of chilling? YES NO NA

Did bottles arrive intact? YES NO NA

Did bottle labels agree with COC? YES NO NA

Discrepency Documentation:

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Person Contacted: _____ Method: In Person/Phone/Email _____

Problem _____

Resolution _____

Sample Split/Filtration

Lab ID	Cont. Size	Pres	Date/Initials
67640	~~250mL~~ 500mL	H_2SO_4 + Thio	5/1/17 ZRK
67640	250mL	H_2SO_4	✓

Lab ID	Cont. Size	Pres	Date/Initials

Comments

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831.375.MBAS (6227), 831.641.0734 (Fax)
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http://www.MBASinc.com

Alkalinity QC Summary (SM 2320B)

Date Analyzed: 5/15/2017
QC Stock Lot# 052757 QC Stock exp: 1/17/2016

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
Method Blank	----	<10	----	<10	9:00
LCS	40	38	95	95%-105%	9:00
LCSD	40	38	95	95%-105%	9:00

Sample ID	Sample (mg/L)	Sample Dup (mg/L)	% RPD	Acceptance Criteria RPD	Time
AB67199	148	151	2	≤10%	9:00

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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MontereyBayAnalytical@usa.net
http://www.MBASinc.com

BOD/CBOD QC Summary (SM 5210B)

Date Analyzed:	05/12/17	Date Read:	05/17/17
Time Analyzed:	13:00	Time Read:	15:00
GGA Lot#	A6320	GGA exp:	11/9/2021

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %
GGA	198	229	115.7	85-115

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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MontereyBayAnalytical@usa.net
http://www.MBASinc.com

COD QC Summary (Hach 8000)

Date Analyzed: 5/17/2017
QC Stock Lot# 1511922 QC Stock exp: May 2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
LCB	---	<5	---	<5	14:36
LFB 250	250	249	100%	90%-110%	14:36
LFBD	250	248	99%	90%-110%	14:36
LCCB	---	<5	---	90%-110%	14:36

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria		Time
								MS/MSD	RPD	
AB67600	167	250	393	367	107%	97%	10	80%-120%	≤10%	14:36

Spike= 0.5 mL 1000 ppm storck + 1.5 mL sample

LCB = Laboratory Control Blank; LFB= Laboratory Fortified Blank; LFBD=Laboratory Fortified Blank Duplicate; LCCB = Laboratory Control Continuing Blank; MS = Matrix Spike; MSD= Matrix Spike Duplicate

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MontereyBayAnalytical@usa.net
http://www.MBASinc.com

COD QC Summary (Hach 8000)

Date Analyzed: 5/31/2017
QC Stock Lot# 1511922 QC Stock exp: May-17

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
LCB-Low	---	<5	---	<5	12:26
LFB 50	50	43	86%	90%-110%	12:26
LFBD 50	50	47	94%	90%-110%	12:26
LCCB-Low	---	<5	---	90%-110%	12:26
LCB-High	---	<5	---	<5	11:48
LFB 250	250	248	99%	90%-110%	11:48
LFBD 250	250	255	102%	90%-110%	11:48
LCCB-High	---	<5	---	90%-110%	11:48

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria		Time
								MS/MSD	RPD	
AB68154-Low	31	50	78	81	94%	100%	6	80%-120%	≤10%	12:26
AB68154-High	378	250	645	604	107%	90%	17	80%-120%	≤10%	11:48

HP: Low concentration blank spike recovery out of limits.
IL: RPD exceeds laboratory control limit

LCB = Laboratory Control Blank; LFB= Laboratory Fortified Blank; LFBD=Laboratory Fortified Blank Duplicate; LCCB = Laboratory Control Continuing Blank; MS = Matrix Spike; MSD= Matrix Spike Duplicate

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Ammonia by Gas Diffusion QC Summary (EPA 351.2)

Date: 5/15/2017
Time: 13:00
LCS Stock Lot# 102816 QC Stock exp: 102819

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria
Method Blank	---	<0.1	---	<0.1
LCS	1.0	1.0	96	90%-110%
Method Blank Dup	---	<0.1	---	<0.1
LCS	1.0	0.9	94	90%-110%

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria	
								MS/MSD	RPD
AB67264	0.4	1.0	1.4	1.5	100	110	7	80%-120%	≤10%

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source;
RPD = Relative Percent Difference; Rec = Recovery

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Kjehldahl Nitrogen QC Summary (SM 4500-NH3)

Date: 5/26/2017
Time: 10:00
QC Stock Lot# 54153 QC Stock exp: 50319

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria
LCB	---	<0.5	---	<0.5
LFB	5.0	5.2	104	90%-110%
LCB	---	<0.5	---	<0.5
LFB	5.0	5.1	102	90%-110%

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria	
								MS/MSD	RPD
AB67269	0.9	5.0	5.8	6.0	98	102	4.0	80%-120%	≤10%

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LFB = Laboratory Fortified Blank; LFBD = Laboratory Fortified Blank Duplicate ;LCB= Laboratory Control Blank; LCBD = Laboratory Control Blank Duplicate

RPD = Relative Percent Difference; Rec = Recovery

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TSS QC Summary (SM 2540D)

Date Analyzed: 5/19/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
Method Blank	---	<2	---	<2	12:40

Sample ID	TSS/VSS	Sample (mg/L)	Sample Duplicate (mg/L)	% RPD	Acceptance Criteria	Time
AB67585	TSS	1980	1960	1.0	≤10%	12:40

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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TS QC Summary (SM 2540C)

Date Analyzed: 5/19/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %	Time
ICVB	---	17*	---	<10	7:30
ICVL	100	106	106	80-120	7:30
ICV	500	517	103.4	90-110	7:30

Sample ID	Sample (mg)	Sample Dup (mg)	% RPD	Acceptance Criteria % RPD	Time
AB67398 TS	1105	1135	2.7	10	7:30
AB66269 VS	525	570	8.2	10	7:30

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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TSS QC Summary (SM 2540D)

Date Analyzed: 5/18/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
Method Blank	---	ND	---	<2	1600

Sample ID	TSS/VSS	Sample (mg/L)	Sample Duplicate (mg/L)	% RPD	Acceptance Criteria	Time
AB67341	TSS	10240	10220	0.2	≤10%	1600
AB67341	VSS	6880	6860	0.3	≤10%	1600

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

Batch # 20170518

Analyte/		IC	Prep	LCS	%Rec	LCSD	%Rec	%Diff	IC Verification			Qual	QCS YYYYMMDD		%Rec
WL	Range	Blank	Blank	Result	85-115%	Result	85-115%		Value	Result	%Rec	Code	Value	Result	95-105%
B 249.678	0.05-5ppm	0.00	-0.01	0.99	99.0%	1.01	100.8%	1.8%	1	1.01	101.5%		1	1.0	101.3%
B 249.772	0.05-5ppm	0.00	-0.01	0.99	98.8%	1.03	102.8%	4.0%	1	1.02	101.8%		1	1.0	102.0%
Ca 317.933	50-300ppm	-1.64	-1.75	48.5	97.0%	48.31	96.6%	0.3%	50	50.1	100.3%		50	50.9	101.8%
Ca 396.847	0.5-50ppm	-0.11	-0.16	46.2	92.4%	57.7	115.0%	22.1%	50	49.8	99.5%	IL	50	59.9	119.7%
Mg 202.582	50-1000ppm	-1.88	-2.06	48.9	97.7%	48.9	97.7%	0.0%	50	50.1	100.2%		50	49.2	98.4%
Mg 279.078	0.5-50ppm	0.07	-0.04	47.4	94.8%	53.3	106.7%	11.7%	50	48.9	97.8%		50	54.2	108.4%
Na 568.821	50-1000ppm	9.63	8.87	48.9	97.8%	101.8	203.7%	70.2%	50	48.7	97.3%	LQ, IL	50	94.4	188.8%
Na 589.592	0.5-50ppm	0.25	0.00	48.3	96.7%	53.8	107.7%	10.8%	50	50.1	100.1%		50	56.2	112.4%

Sample ID AB67229

Analyte/	Sample	MS	%Rec	MSD	%Rec	%Diff	LCSD (90-110%)			%Diff	CC	Qual
WL	Value	Result	70-130%	Result	70-130%		Value	Result	%Rec	10%	Blank	Code
B 249.678	0.03	1.88	92.8%	1.76	86.7%	6.7%	1	0.87	87.0%	15.4%	-0.01	IA, IL
B 249.772	0.02	1.88	92.9%	1.78	87.5%	5.9%	1	0.87	87.3%	15.4%	-0.01	
Ca 317.933	46.9	143.4	96.5%	136.1	89.2%	5.2%	50	44.1	88.1%	12.9%	-1.70	
Ca 396.847	46.0	135.3	89.3%	125.7	79.8%	7.3%	50	42.4	84.7%	16.1%	-0.11	
Mg 202.582	25.8	122.4	96.6%	115.9	90.2%	5.4%	50	43.4	86.7%	14.4%	-1.98	
Mg 279.078	27.8	120.2	92.4%	114.1	86.3%	5.2%	50	42.9	85.8%	13.0%	0.01	
Na 568.821	40.7	116.9	76.1%	109.3	68.6%	6.6%	50	39.4	78.9%	21.0%	9.26	
Na 589.592	28.4	120.2	91.8%	113.7	85.3%	5.5%	50	43.1	86.2%	14.9%	0.01	

Sample ID AB67608

Analyte/	Sample	MS	%Rec	MSD	%Rec	%Diff	LCSD (90-110%)			%Diff	CC	Qual
WL	Value	Result	70-130%	Result	70-130%		Value	Result	%Rec	10%	Blank	Code
B 249.678	0.12	1.00	87.9%	1.00	87.2%	0.8%	1	0.90	90.0%	12.0%	0.00	IL
B 249.772	0.13	1.01	88.4%	1.01	88.5%	0.0%	1	0.90	90.0%	12.3%	-0.01	IL
Ca 317.933	74.1	115.9	83.6%	116.5	84.9%	0.6%	50	45.6	91.3%	9.4%	-1.66	
Ca 396.847	66.0	101.3	70.7%	100.4	68.9%	0.9%	50	42.1	84.2%	16.7%	-0.08	IA, IL
Mg 202.582	25.9	70.5	89.2%	70.6	89.4%	0.1%	50	44.0	88.1%	12.9%	-1.97	IA, IL
Mg 279.078	26.6	69.4	85.6%	69.5	85.8%	0.2%	50	44.4	88.8%	9.6%	0.04	
Na 568.821	57.3	93.3	72.1%	90.4	66.3%	3.2%	50	42.3	84.7%	13.9%	12.39	IA, IL
Na 589.592	62.6	103.4	81.5%	104.1	82.9%	0.7%	50	45.0	90.0%	10.7%	0.56	IL

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300.0 QC Report

All units expressed in mg/L

Batch I **20170511**

		Cl	NO2-N	SO4	Br	NO3-N
Spike amount		**20**	**2**	**20**	**2**	**2**
	ICVB	0.1	0.1	0.0	0.0	0.0
	ICV	20.1	2.1	20.1	2.0	2.0
	Rec 90-110%	100.5	104.5	100.5	100.0	100.5
	ICVL	2.0	0.2	1.8	0.2	0.2
	Rec 50-150%	100.0	115.0	90.0	115.0	95.0
Sample ID	**AB67206**	19.9	0.3	88.2	0.1	0.3
	MS	40.0	2.1	108.2	2.0	2.2
	Rec 80-120%	100.5	89.0	100.0	97.0	97.0
	MSD	39.9	2.0	108.1	2.1	2.2
	Rec 80-120%	100.0	88.5	99.5	98.0	97.0
	Diff 10%	0.3	0.5	0.1	1.0	0.0
	CCV	20.0	2.1	20.1	2.0	2.0
	Rec 90-110%	100.0	105.0	100.5	100.0	100.0
	Diff 10%	0.3	0.5	0.3	0.6	0.5
	CCVB	0.1	0.0	0.0	0.0	0.0

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Phosphorus QC Summary (EPA365.1)

Date: 6/5/2017
LSC Stock Lot# 022217 LCS Stock exp: 022220
QCS Stock Lot# 062116 QCS Stock exp: 062118

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
LCB	---	<0.02	---	< 0.02	13:40
LFBL	0.02	0.02	94	50%-150%	13:40
LFB	0.30	0.29	97	90%-110%	13:40
QCS	0.30	0.31	103	80%-120%	13:40
LFD	0.30	0.28	93	90%-110%	13:40
LCCB	---	<0.02	---	< 0.02	13:40

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria		MS Time	MSD Time
								MS/MSD	RPD		
AB67301	1.02	0.30	1.30	1.41	93	130	8	70%-130%	≤10%	13:40	13:40

LCB = Laboratory Control Blank; LFBL = Laboratory Fortified Blank Low; LFB= Laboratory Fortified Blank; QCS = Quality Control Standar; LFBD= Laboratory Fortified Blank Duplicate; LCCB = Laboratory Control Continuing Blank; MS = Matrix Spike; MSD= Matrix Spike Duplicate

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Phosphorus QC Summary (EPA 365.1)

Date: 6/2/2017
LSC Stock Lot# 022217 LCS Stock exp: 0202220
QCS Stock Lot# 062116 QCS Stock exp: 062118

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
LCB	---	<0.02	---	< 0.02	13:51
LFBL	0.02	0.02	75	50%-150%	13:51
LFB	0.30	0.30	100	90%-110%	13:51
QCS	0.30	0.30	100	80%-120%	13:51
LFD	0.30	0.31	103	90%-110%	13:51
LCCB	---	<0.02	---	< 0.02	13:51

Spiked Sample ID	Sample (mg/L)	Spiked (mg/L)	MS (mg/L)	MSD (mg/L)	MS % Rec	MSD % Rec	MS-MSD % RPD	Acceptance Criteria		MS Time	MSD Time
								MS/MSD	RPD		
AB67165	0.06	0.30	0.40	0.39	113	110	2.5	70%-130%	≤10%	13:51	13:51

LCB = Laboratory Control Blank; LFBL = Laboratory Fortified Blank Low; LFB= Laboratory Fortified Blank; QCS = Quality Control Standar; LFBD= Laboratory Fortified Blank Duplicate; LCCB = Laboratory Control Continuing Blank; MS = Matrix Spike; MSD= Matrix Spike Duplicate

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Alkalinity QC Summary (SM 2320B)

Date Analyzed: 5/19/2017
QC Stock Lot# 162510 QC Stock exp: 10/4/2017

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria	Time
Method Blank	----	<10	----	<10	9:00
LCS	40	39	97.5	95%-105%	9:00

Sample ID	Sample (mg/L)	Sample Dup (mg/L)	% RPD	Acceptance Criteria RPD	Time
AB63707	153	154	1	≤10%	9:00

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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BOD/CBOD QC Summary (SM 5210B)

Date Analyzed:	05/13/17	Date Read:	05/18/17
Time Analyzed:	16:30	Time Read:	13:40
GGA Lot#	A6320	GGA exp:	11/9/2021

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %
GGA	198	222	112.1	85-115

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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300.0 QC Report

All units expressed in mg/L

20170516

		Cl	NO2-N	SO4	NO3-N
Spike amount		**20**	**2**	**20**	**2**
	ICVB	0.1	0.1	0.0	0.0
	ICV	19.9	2.1	20.0	2.0
	Rec 90-110%	99.5	104.0	100.0	101.0
	ICVL	2.1	0.2	1.8	0.2
	Rec 50-150%	105.0	110.0	90.0	100.0
Sample ID	**AB67525**	32.9	0.3	131.9	0.0
	MS	53.5	2.1	153.7	2.0
	Rec 80-120%	103.0	90.5	109.0	98.5
	MSD	53.5	2.1	153.5	2.0
	Rec 80-120%	103.0	90.0	108.0	97.5
	Diff 10%	0.0	0.5	0.1	1.0
	CCV	20.0	2.1	20.3	2.0
	Rec 90-110%	100.0	106.5	101.5	101.5
	Diff 10%	0.3	1.2	0.8	0.3
	CCVB	0.1	0.0	0.0	0.0

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BOD/CBOD QC Summary (SM 5210B)

Date Analyzed:	05/15/17	Date Read:	05/20/17
Time Analyzed:	17:00	Time Read:	17:00
GGA Lot#	A6320	GGA exp:	11/9/2021

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %
GGA	198	189	95.5	85-115

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

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BOD/CBOD QC Summary (SM 5210B)

Date Analyzed:	05/17/17	Date Read:	05/22/17
Time Analyzed:	9:20	Time Read:	12:36
GGA Lot#	A6320	GGA exp:	11/9/2021

	Value (mg/L)	Result (mg/L)	% Rec	Acceptance Criteria %
GGA	198	130	65.7	85-115

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; SS = Second Source; RPD = Relative Percent Difference; Rec = Recovery

GGA Low recovery
BOD read back with wrong probe

APPENDIX C – WATER BALANCE AND COSTS

Hydrologic Balance - Alternative No. 1 | **Avg Annual Flow =** | **1.72** | **mgd**
Wastewater Treatment Plant Master Plan | 54.0 | acres
City of King City

	Flow[1]		Sprayfield						Title 22 Reuse						Ponds								
Month	**mgd**	**(AF/mo)**	**Crop[2]**	**Irrigation (in/day)**	**Sprayfield Application (in/day)**	**Irrigation Distribution**	**Acres[3]**	**Estimated Use[4] (AF)**	**Ag Reuse (Acres)**	**Ag Reuse (AF)**	**Urban Reuse (Acres)**	**Urban Reuse (AF)**	**All Irrigation (AF)**	**Recycled Water Excess (AF/mo)**	**Area (acres)**	**Perc Rate (in/day)**	**Perc Rate (AF/mo)**	**Evap/ Precip[5],[6] (in/mo)**	**Evap/ Precip (AF/mo)**	**Monthly Storage (AF)**	**Cumulative Storage (AF)**	**Cumulative Storage (MG)**	**Imported Water (AF)**
November	1.68	154.5	Mix	0.05	**0.80**	3.3%	**54.0**	114.5							**START SEASONAL STORAGE**								
	Subtotal							114.5	**0.0**	0.0	**0.0**	0.0	114.5	40.0	**23.2**	**0.80**	-46.4	-1.12	-2.2	0.0	**0.0**	**0.0**	0.0
December	1.54	146.8	Mix	0.00	0.80	0.0%	54.0	108.0															
	Subtotal							108.0	0.0	0.0	0.0	0.0	108.0	38.8	23.2	0.80	-47.9	0.89	1.7	-7.5	**0.0**	**0.0**	7.5
January	1.49	142.0	Mix	0.00	0.80	0.0%	54.0	108.0															
	Subtotal							108.0	0.0	0.0	0.0	0.0	108.0	34.0	23.2	0.80	-47.9	6.03	11.6	-2.3	**0.0**	**0.0**	2.3
February	1.58	136.1	Mix	0.01	0.80	0.4%	54.0	108.8															
	Subtotal							108.8	0.0	0.0	0.0	0.0	108.8	27.2	23.2	0.80	-43.3	4.33	8.4	-7.7	**0.0**	**0.0**	7.7
March	1.77	168.9	Mix	0.08	0.80	5.7%	54.0	119.2															
	Subtotal							119.2	0.0	0.0	0.0	0.0	119.2	49.6	23.2	0.80	-47.9	1.05	2.0	3.7	**3.7**	**1.2**	0.0
April	1.77	163.1	Mix	0.16	0.80	10.7%	54.0	129.3															
	Subtotal							129.3	0.0	0.0	0.0	0.0	129.3	33.8	23.2	0.80	-46.4	-2.99	-5.8	-18.4	**0.0**	**0.0**	14.7
May	1.78	169.1	Mix	0.21	0.80	14.1%	54.0	136.0															
	Subtotal							136.0	0.0	0.0	0.0	0.0	136.0	33.2	23.2	0.80	-47.9	-5.92	-11.4	-26.2	**0.0**	**0.0**	26.2
June	1.80	166.2	Mix	0.23	0.80	15.5%	54.0	138.7															
	Subtotal							138.7	0.0	0.0	0.0	0.0	138.7	27.5	23.2	0.80	-46.4	-7.37	-14.2	-33.2	**0.0**	**0.0**	33.2
July	1.81	171.8	Mix	0.24	0.80	16.5%	54.0	140.6															
	Subtotal							140.6	0.0	0.0	0.0	0.0	140.6	31.2	23.2	0.80	-47.9	-8.46	-16.4	-33.1	**0.0**	**0.0**	33.1
August	1.86	176.7	Mix	0.22	0.80	14.9%	54.0	137.6															
	Subtotal							137.6	0.0	0.0	0.0	0.0	137.6	39.1	23.2	0.80	-47.9	-7.80	-15.1	-24.0	**0.0**	**0.0**	24.0
September	1.82	167.8	Mix	0.17	0.80	11.9%	54.0	131.6															
	Subtotal							131.6	0.0	0.0	0.0	0.0	131.6	36.2	23.2	0.80	-46.4	-5.79	-11.2	-21.4	**0.0**	**0.0**	21.4
October	1.73	164.6	Mix	0.10	0.80	7.0%	54.0	121.8															
	Subtotal							121.8	0.0	0.0	0.0	0.0	121.8	42.9	23.2	0.80	-47.9	-3.39	-6.6	-11.6	**0.0**	**0.0**	11.6
Total (AF)		**1,927.4**		**1.5**		**100.0%**		**1,494.0**		**0.0**		**0.0**		**433.4**									**181.6**
Check (AF)		**1,553.1**															**-564.5**		**-59.1**		**3.7**	**1.2**	

Notes:
(1) Effluent flow values based on an average annual flow at build-out conditions.
(2) Crop make-up assumed.
(3) Area of sprayfields based on Alternative scenario.
(4) Average ETo - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average ETo from June 1993 to September 2016.
(5) Pan Evaporation - Western Regional Climate Center (WRCC) for Nacimiento Dam (http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA). Represents monthly average data from 1957 to 1978. A 0.75 pan coefficient was applied to obtain evaporation rates.
(6) Precipitation - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average precipitation from June 1993 to September 2016.

Hydrologic Balance - Alternative No. 2 | **Avg Annual Flow =** **1.72** **mgd**
Wastewater Treatment Plant Master Plan | 54.0 acres
City of King City

	Flow[1]		Sprayfield						Title 22 Reuse						Ponds								
Month	**mgd**	**(AF/mo)**	**Crop[2]**	**Irrigation (in/day)**	**Sprayfield Application (in/day)**	**Irrigation Distribution**	**Acres[3]**	**Estimated Use[4] (AF)**	**Ag Reuse (Acres)**	**Ag Reuse (AF)**	**Urban Reuse (Acres)**	**Urban Reuse (AF)**	**All Irrigation (AF)**	**Recycled Water Excess (AF/mo)**	**Area (acres)**	**Perc Rate (in/day)**	**Perc Rate (AF/mo)**	**Evap/ Precip[5],[6] (in/mo)**	**Evap/ Precip (AF/mo)**	**Monthly Storage (AF)**	**Cumulative Storage (AF)**	**Cumulative Storage (MG)**	**Imported Water (AF)**
November	1.68	154.5	Mix	0.05	**0.80**	3.3%	**0.0**	0.0							**START SEASONAL STORAGE**								
	Subtotal							0.0	**0.0**	0.0	**0.0**	0.0	0.0	154.5	**74.0**	**0.80**	-148.0	-1.12	-6.9	0.0	**0.0**	**0.0**	0.0
December	1.54	146.8	Mix	0.00	0.80	0.0%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	146.8	74.0	0.80	-152.9	0.89	5.5	-0.7	**0.0**	**0.0**	0.7
January	1.49	142.0	Mix	0.00	0.80	0.0%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	142.0	74.0	0.80	-152.9	6.03	37.2	26.3	**26.3**	**8.6**	0.0
February	1.58	136.1	Mix	0.01	0.80	0.4%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	136.1	74.0	0.80	-138.1	4.33	26.7	24.6	**50.9**	**16.6**	0.0
March	1.77	168.9	Mix	0.08	0.80	5.7%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	168.9	74.0	0.80	-152.9	1.05	6.5	22.4	**73.3**	**23.9**	0.0
April	1.77	163.1	Mix	0.16	0.80	10.7%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	163.1	74.0	0.80	-148.0	-2.99	-18.4	-3.4	**69.9**	**22.8**	0.0
May	1.78	169.1	Mix	0.21	0.80	14.1%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	169.1	74.0	0.80	-152.9	-5.92	-36.5	-20.3	**49.6**	**16.2**	0.0
June	1.80	166.2	Mix	0.23	0.80	15.5%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	166.2	74.0	0.80	-148.0	-7.37	-45.4	-27.3	**22.3**	**7.3**	0.0
July	1.81	171.8	Mix	0.24	0.80	16.5%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	171.8	74.0	0.80	-152.9	-8.46	-52.2	-33.3	**0.0**	**0.0**	11.0
August	1.86	176.7	Mix	0.22	0.80	14.9%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	176.7	74.0	0.80	-152.9	-7.80	-48.1	-24.4	**0.0**	**0.0**	24.4
September	1.82	167.8	Mix	0.17	0.80	11.9%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	167.8	74.0	0.80	-148.0	-5.79	-35.7	-15.9	**0.0**	**0.0**	15.9
October	1.73	164.6	Mix	0.10	0.80	7.0%	0.0	0.0															
	Subtotal							0.0	0.0	0.0	0.0	0.0	0.0	164.6	74.0	0.80	-152.9	-3.39	-20.9	-9.2	**0.0**	**0.0**	9.2
Total (AF)		**1,927.4**		**1.5**		**100.0%**		**0.0**		**0.0**		**0.0**		**1,927.4**									**61.2**
Check (AF)		**188.4**															**-1,800.7**		**-188.4**		**73.3**	**23.9**	

Notes:
(1) Effluent flow values based on an average annual flow at build-out conditions.
(2) Crop make-up assumed.
(3) Area of sprayfields based on Alternative scenario.
(4) Average ETo - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average ETo from June 1993 to September 2016.
(5) Pan Evaporation - Western Regional Climate Center (WRCC) for Nacimiento Dam (http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA). Represents monthly average data from 1957 to 1978. A 0.75 pan coefficient was applied to obtain evaporation rates.
(6) Precipitation - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average precipitation from June 1993 to September 2016.

Hydrologic Balance - Alternative No. 3 | **Avg Annual Flow =** **1.72** **mgd**
Wastewater Treatment Plant Master Plan | 54.0 acres
City of King City

	Flow[1]		Sprayfield						Title 22 Reuse						Ponds								
Month	**mgd**	**(AF/mo)**	**Crop[2]**	**Irrigation (in/day)**	**Sprayfield Application (in/day)**	**Irrigation Distribution**	**Acres[3]**	**Estimated Use[4] (AF)**	**Ag Reuse (Acres)**	**Ag Reuse (AF)**	**Urban Reuse (Acres)**	**Urban Reuse (AF)**	**All Irrigation (AF)**	**Recycled Water Excess (AF/mo)**	**Area (acres)**	**Perc Rate (in/day)**	**Perc Rate (AF/mo)**	**Evap/ Precip[5],[6] (in/mo)**	**Evap/ Precip (AF/mo)**	**Monthly Storage (AF)**	**Cumulative Storage (AF)**	**Cumulative Storage (MG)**	**Imported Water (AF)**
November	1.68	154.5	Mix	0.05	**0.80**	3.3%	**54.0**	114.5							**START SEASONAL STORAGE**								
	Subtotal							114.5	**0.0**	0.0	**0.0**	0.0	114.5	40.0	**23.2**	**0.80**	-46.4	-1.12	-2.2	0.0	**0.0**	**0.0**	0.0
December	1.54	146.8	Mix	0.00	0.80	0.0%	**54.0**	108.0															
	Subtotal							108.0	**0.0**	0.0	0.0	0.0	108.0	38.8	23.2	0.80	-47.9	0.89	1.7	-7.5	**0.0**	**0.0**	7.5
January	1.49	142.0	Mix	0.00	0.80	0.0%	**54.0**	108.0															
	Subtotal							108.0	**0.0**	0.0	0.0	0.0	108.0	34.0	23.2	0.80	-47.9	6.03	11.6	-2.3	**0.0**	**0.0**	2.3
February	1.58	136.1	Mix	0.01	0.80	0.4%	**54.0**	108.8															
	Subtotal							108.8	**0.0**	0.0	0.0	0.0	108.8	27.2	23.2	0.80	-43.3	4.33	8.4	-7.7	**0.0**	**0.0**	7.7
March	1.77	168.9	Mix	0.08	0.80	5.7%	**0.0**	0.0															
	Subtotal							0.0	**575.0**	123.6	0.0	0.0	123.6	45.3	23.2	0.80	-47.9	1.05	2.0	-0.7	**0.0**	**0.0**	0.7
April	1.77	163.1	Mix	0.16	0.80	10.7%	**0.0**	0.0															
	Subtotal							0.0	**300.0**	118.2	0.0	0.0	118.2	44.9	23.2	0.80	-46.4	-2.99	-5.8	-7.3	**0.0**	**0.0**	7.3
May	1.78	169.1	Mix	0.21	0.80	14.1%	**0.0**	0.0															
	Subtotal							0.0	**225.0**	120.4	0.0	0.0	120.4	48.7	23.2	0.80	-47.9	-5.92	-11.4	-10.7	**0.0**	**0.0**	10.7
June	1.80	166.2	Mix	0.23	0.80	15.5%	**0.0**	0.0															
	Subtotal							0.0	**200.0**	113.8	0.0	0.0	113.8	52.4	23.2	0.80	-46.4	-7.37	-14.2	-8.2	**0.0**	**0.0**	8.2
July	1.81	171.8	Mix	0.24	0.80	16.5%	**0.0**	0.0															
	Subtotal							0.0	**175.0**	109.2	0.0	0.0	109.2	62.6	23.2	0.80	-47.9	-8.46	-16.4	-1.7	**0.0**	**0.0**	1.7
August	1.86	176.7	Mix	0.22	0.80	14.9%	**0.0**	0.0															
	Subtotal							0.0	**225.0**	127.4	0.0	0.0	127.4	49.2	23.2	0.80	-47.9	-7.80	-15.1	-13.8	**0.0**	**0.0**	13.8
September	1.82	167.8	Mix	0.17	0.80	11.9%	**0.0**	0.0															
	Subtotal							0.0	**275.0**	120.0	0.0	0.0	120.0	47.8	23.2	0.80	-46.4	-5.79	-11.2	-9.8	**0.0**	**0.0**	9.8
October	1.73	164.6	Mix	0.10	0.80	7.0%	**0.0**	0.0															
	Subtotal							0.0	**425.0**	111.9	0.0	0.0	0.0	52.7	23.2	0.80	-47.9	-3.39	-6.6	-1.8	**0.0**	**0.0**	1.8
Total (AF)		**1,927.4**		**1.5**		**100.0%**		**439.3**		**944.5**		**0.0**		**543.6**									**71.4**
Check (AF)		**498.4**			**0.27**												**-564.5**		**-59.1**		**0.0**	**0.0**	

Notes:
(1) Effluent flow values based on an average annual flow at build-out conditions.
(2) Crop make-up assumed.
(3) Area of sprayfields based on Alternative scenario.
(4) Average ETo - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average ETo from June 1993 to September 2016.
(5) Pan Evaporation - Western Regional Climate Center (WRCC) for Nacimiento Dam (http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA). Represents monthly average data from 1957 to 1978. A 0.75 pan coefficient was applied to obtain evaporation rates.
(6) Precipitation - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average precipitation from June 1993 to September 2016.

Hydrologic Balance - Alternative No. 4 | **Avg Annual Flow =** **1.72** **mgd**
Wastewater Treatment Plant Master Plan | 54.0 acres
City of King City

	Flow[1]		Sprayfield						Title 22 Reuse						Ponds								
Month	**mgd**	**(AF/mo)**	**Crop[2]**	**Irrigation (in/day)**	**Sprayfield Application (in/day)**	**Irrigation Distribution**	**Acres[3]**	**Estimated Use[4] (AF)**	**Ag Reuse (Acres)**	**Ag Reuse (AF)**	**Urban Reuse (Acres)**	**Urban Reuse (AF)**	**All Irrigation (AF)**	**Recycled Water Excess (AF/mo)**	**Area (acres)**	**Perc Rate (in/day)**	**Perc Rate (AF/mo)**	**Evap/ Precip[5],[6] (in/mo)**	**Evap/ Precip (AF/mo)**	**Monthly Storage (AF)**	**Cumulative Storage (AF)**	**Cumulative Storage (MG)**	**Imported Water (AF)**
November	1.68	154.5	Mix	0.05	**0.80**	3.3%	**74.0**	156.9							**START SEASONAL STORAGE**								
	Subtotal							156.9	**0.0**	0.0	**0.0**	0.0	156.9	-2.4	**4.5**	**0.00**	0.0	-1.12	-0.4	0.0	**0.0**	**0.0**	0.0
December	1.54	146.8	Mix	0.00	0.80	0.0%	74.0	148.0															
	Subtotal							148.0	0.0	0.0	0.0	0.0	148.0	-1.2	4.5	0.00	0.0	0.89	0.3	-0.9	**0.0**	**0.0**	0.9
January	1.49	142.0	Mix	0.00	0.80	0.0%	74.0	148.0															
	Subtotal							148.0	0.0	0.0	0.0	0.0	148.0	-6.0	4.5	0.00	0.0	6.03	2.3	-3.7	**0.0**	**0.0**	3.7
February	1.58	136.1	Mix	0.01	0.80	0.4%	74.0	149.1															
	Subtotal							149.1	0.0	0.0	0.0	0.0	149.1	-13.1	4.5	0.00	0.0	4.33	1.6	-11.4	**0.0**	**0.0**	11.4
March	1.77	168.9	Mix	0.08	0.80	5.7%	74.0	163.4															
	Subtotal							163.4	0.0	0.0	0.0	0.0	163.4	5.5	4.5	0.00	0.0	1.05	0.4	5.9	**5.9**	**1.9**	0.0
April	1.77	163.1	Mix	0.16	0.80	10.7%	74.0	177.2															
	Subtotal							177.2	0.0	0.0	0.0	0.0	177.2	-14.1	4.5	0.00	0.0	-2.99	-1.1	-15.2	**0.0**	**0.0**	9.4
May	1.78	169.1	Mix	0.21	0.80	14.1%	74.0	186.3															
	Subtotal							186.3	0.0	0.0	0.0	0.0	186.3	-17.2	4.5	0.00	0.0	-5.92	-2.2	-19.4	**0.0**	**0.0**	19.4
June	1.80	166.2	Mix	0.23	0.80	15.5%	74.0	190.1															
	Subtotal							190.1	0.0	0.0	0.0	0.0	190.1	-23.9	4.5	0.00	0.0	-7.37	-2.8	-26.7	**0.0**	**0.0**	26.7
July	1.81	171.8	Mix	0.24	0.80	16.5%	74.0	192.7															
	Subtotal							192.7	0.0	0.0	0.0	0.0	192.7	-20.9	4.5	0.00	0.0	-8.46	-3.2	-24.1	**0.0**	**0.0**	24.1
August	1.86	176.7	Mix	0.22	0.80	14.9%	74.0	188.6															
	Subtotal							188.6	0.0	0.0	0.0	0.0	188.6	-11.9	4.5	0.00	0.0	-7.80	-2.9	-14.8	**0.0**	**0.0**	14.8
September	1.82	167.8	Mix	0.17	0.80	11.9%	74.0	180.3															
	Subtotal							180.3	0.0	0.0	0.0	0.0	180.3	-12.5	4.5	0.00	0.0	-5.79	-2.2	-14.7	**0.0**	**0.0**	14.7
October	1.73	164.6	Mix	0.10	0.80	7.0%	74.0	166.9															
	Subtotal							166.9	0.0	0.0	0.0	0.0	166.9	-2.2	4.5	0.00	0.0	-3.39	-1.3	-3.5	**0.0**	**0.0**	3.5
Total (AF)		**1,927.4**		**1.5**		**100.0%**		**2,047.4**		**0.0**		**0.0**		**-120.0**									**128.7**
Check (AF)		**2,058.9**			**1.25**												**0.0**		**-11.5**		**5.9**	**1.9**	

Notes:
(1) Effluent flow values based on an average annual flow at build-out conditions.
(2) Crop make-up assumed.
(3) Area of sprayfields based on Alternative scenario.
(4) Average ETo - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average ETo from June 1993 to September 2016.
(5) Pan Evaporation - Western Regional Climate Center (WRCC) for Nacimiento Dam (http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA). Represents monthly average data from 1957 to 1978. A 0.75 pan coefficient was applied to obtain evaporation rates.
(6) Precipitation - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average precipitation from June 1993 to September 2016.

Hydrologic Balance - Alternative No. 5 | **Avg Annual Flow =** | **1.72** | **mgd**
Wastewater Treatment Plant Master Plan | 54.0 | acres
City of King City

	Flow[1]		Sprayfield						Title 22 Reuse						Ponds								
Month	**mgd**	**(AF/mo)**	**Crop[2]**	**Irrigation (in/day)**	**Sprayfield Application (in/day)**	**Irrigation Distribution**	**Acres[3]**	**Estimated Use[4] (AF)**	**Ag Reuse (Acres)**	**Ag Reuse (AF)**	**Urban Reuse (Acres)**	**Urban Reuse (AF)**	**All Irrigation (AF)**	**Recycled Water Excess (AF/mo)**	**Area (acres)**	**Perc Rate (in/day)**	**Perc Rate (AF/mo)**	**Evap/ Precip[5],[6] (in/mo)**	**Evap/ Precip (AF/mo)**	**Monthly Storage (AF)**	**Cumulative Storage (AF)**	**Cumulative Storage (MG)**	**Imported Water (AF)**
November	1.68	154.5	Mix	0.05	**0.80**	3.3%	**0.0**	0.0							**START SEASONAL STORAGE**								
	Subtotal							0.0	**575.0**	69.2	**0.0**	0.0	69.2	85.3	**59.7**	**0.00**	0.0	-1.12	-5.6	79.7	**79.7**	**26.0**	0.0
December	1.54	146.8	Mix	0.00	0.80	0.0%	0.0	0.0															
	Subtotal							0.0	575.0	0.0	0.0	0.0	0.0	146.8	59.7	0.00	0.0	0.89	4.4	151.2	**230.9**	**75.2**	0.0
January	1.49	142.0	Mix	0.00	0.80	0.0%	0.0	0.0															
	Subtotal							0.0	575.0	0.0	0.0	0.0	0.0	142.0	59.7	0.00	0.0	6.03	30.0	172.0	**402.9**	**131.3**	0.0
February	1.58	136.1	Mix	0.01	0.80	0.4%	0.0	0.0															
	Subtotal							0.0	575.0	8.2	0.0	0.0	8.2	127.8	59.7	0.00	0.0	4.33	21.5	149.4	**552.3**	**180.0**	0.0
March	1.77	168.9	Mix	0.08	0.80	5.7%	0.0	0.0															
	Subtotal							0.0	575.0	123.6	0.0	0.0	123.6	45.3	59.7	0.00	0.0	1.05	5.2	50.5	**602.8**	**196.4**	0.0
April	1.77	163.1	Mix	0.16	0.80	10.7%	0.0	0.0															
	Subtotal							0.0	575.0	226.5	0.0	0.0	226.5	-63.5	59.7	0.00	0.0	-2.99	-14.9	-78.3	**524.4**	**170.9**	0.0
May	1.78	169.1	Mix	0.21	0.80	14.1%	0.0	0.0															
	Subtotal							0.0	575.0	307.6	0.0	0.0	307.6	-138.5	59.7	0.00	0.0	-5.92	-29.5	-168.0	**356.5**	**116.1**	0.0
June	1.80	166.2	Mix	0.23	0.80	15.5%	0.0	0.0															
	Subtotal							0.0	575.0	327.1	0.0	0.0	327.1	-160.9	59.7	0.00	0.0	-7.37	-36.7	-197.6	**158.9**	**51.8**	0.0
July	1.81	171.8	Mix	0.24	0.80	16.5%	0.0	0.0															
	Subtotal							0.0	575.0	358.7	0.0	0.0	358.7	-187.0	59.7	0.00	0.0	-8.46	-42.1	-229.0	**0.0**	**0.0**	70.2
August	1.86	176.7	Mix	0.22	0.80	14.9%	0.0	0.0															
	Subtotal							0.0	575.0	325.6	0.0	0.0	325.6	-149.0	59.7	0.00	0.0	-7.80	-38.8	-187.8	**0.0**	**0.0**	187.8
September	1.82	167.8	Mix	0.17	0.80	11.9%	0.0	0.0															
	Subtotal							0.0	575.0	250.9	0.0	0.0	250.9	-83.1	59.7	0.00	0.0	-5.79	-28.8	-111.9	**0.0**	**0.0**	111.9
October	1.73	164.6	Mix	0.10	0.80	7.0%	0.0	0.0															
	Subtotal							0.0	575.0	151.5	0.0	0.0	0.0	13.2	59.7	0.00	0.0	-3.39	-16.9	-3.7	**0.0**	**0.0**	3.7
Total (AF)		**1,927.4**		**1.5**		**100.0%**		**0.0**		**2,149.1**		**0.0**		**-221.6**									**373.6**
Check (AF)		**152.0**			**0.00**												**0.0**		**-152.0**		**602.8**	**196.4**	

Notes:
(1) Effluent flow values based on an average annual flow at build-out conditions.
(2) Crop make-up assumed.
(3) Area of sprayfields based on Alternative scenario.
(4) Average ETo - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average ETo from June 1993 to September 2016.
(5) Pan Evaporation - Western Regional Climate Center (WRCC) for Nacimiento Dam (http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA). Represents monthly average data from 1957 to 1978. A 0.75 pan coefficient was applied to obtain evaporation rates.
(6) Precipitation - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average precipitation from June 1993 to September 2016.

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Alternative No. 1 - Reuse and Disposal	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3 and 5)	65,830	CY		$ 7.00	1	1.0	1.00	$ 460,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3 and 5)	41,464	CY		$ 2.50	1	1.0	1.00	$ 100,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3 and 5)	7,584	CY		$ 103.24	1	1.0	1.00	$ 780,000	
	TOTAL DIRECT COST									**$ 1,340,000**
	Estimating Contingency	30	%		$ 402,000					
	SUBTOTAL								**$ 1,740,000**	
	Contractor General Conditions	15	%		$ 261,000					
	SUBTOTAL								**$ 2,000,000**	
	Contractor Overhead and Profit	12	%		$ 240,000					
	SUBTOTAL								**$ 2,240,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 52,763					
	SUBTOTAL								**$ 2,290,000**	
	Escalation to Midpoint of Construction	3	%		$ 218,837.96					
	SUBTOTAL								**$ 2,510,000**	
	TOTAL CONSTRUCTION COST									**$ 2,510,000**

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Alternative No. 2 - Reuse and Disposal	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3, 4, and 5)	80,032	CY		$ 7.00	1	1.0	1.00	$ 560,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3, 4, and 5)	56,437	CY		$ 2.50	1	1.0	1.00	$ 140,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3, 4, and 5)	10,019	CY		$ 103.24	1	1.0	1.00	$ 1,030,000	
4	New Percolation Pond Excavation	563,839	CY		$ 2.50	1	1.0	1.00	$ 1,410,000	
5	New Pond Rip Rap Placement	5,573	CY		$ 103.24	1	1.0	1.00	$ 580,000	
	TOTAL DIRECT COST									**$ 3,720,000**
	Estimating Contingency	30	%		$ 1,116,000					
	SUBTOTAL								**$ 4,840,000**	
	Contractor General Conditions	15	%		$ 726,000					
	SUBTOTAL								**$ 5,570,000**	
	Contractor Overhead and Profit	12	%		$ 668,400					
	SUBTOTAL								**$ 6,240,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 146,475					
	SUBTOTAL								**$ 6,390,000**	
	Escalation to Midpoint of Construction	3	%		$ 610,643.91					
	SUBTOTAL								**$ 7,000,000**	
	TOTAL CONSTRUCTION COST									**$ 7,000,000**

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PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Alternative No. 3 - Reuse and Disposal

LOCATION FACTOR: 110.4
20 CITIES ENR CCI DEC 2016: 10530

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3, and 5)	65,830	CY		$ 7.00	1	1.0	1.00	$ 460,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3, and 5)	41,464	CY		$ 2.50	1	1.0	1.00	$ 100,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3, and 5)	7,584	CY		$ 103.24	1	1.0	1.00	$ 780,000	
4	Sludge Removal (Pond 4)	14,202	CY		$ 7.00	1	1.0	1.00	$ 100,000	
5	Clay Liner Removal (Pond 4)	14,973	CY		$ 2.50	1	1.0	1.00	$ 40,000	
6	New Pond Liner (Pond 4)	449,188	SF		$ 0.81	1	1.0	1.00	$ 360,000	
	TOTAL DIRECT COST									**$ 1,840,000**
	Estimating Contingency	30	%		$ 552,000					
	SUBTOTAL								**$ 2,390,000**	
	Contractor General Conditions	15	%		$ 358,500					
	SUBTOTAL								**$ 2,750,000**	
	Contractor Overhead and Profit	12	%		$ 330,000					
	SUBTOTAL								**$ 3,080,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 72,450					
	SUBTOTAL								**$ 3,150,000**	
	Escalation to Midpoint of Construction	3	%		$ 301,021.65					
	SUBTOTAL								**$ 3,450,000**	
	TOTAL CONSTRUCTION COST									**$ 3,450,000**

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PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Alternative No. 4 - Reuse and Disposal

LOCATION FACTOR: 110.4
20 CITIES ENR CCI DEC 2016: 10530

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	New Sprayfield	20	AC		$ 291.69	1	1.0	1.00	$ 10,000	
2	Sludge Removal (Ponds 4 and 5)	28,573	CY		$ 7.00	1	1.0	1.00	$ 200,000	
3	Clay Liner Removal (Ponds 4 and 5)	30,224	CY		$ 2.50	1	1.0	1.00	$ 80,000	
4	Pond Fill (Ponds 4 and 5)	289,404	CY		$ 2.75	1	1.0	1.00	$ 800,000	
	TOTAL DIRECT COST									**$ 1,090,000**
	Estimating Contingency	30	%		$ 327,000					
	SUBTOTAL								**$ 1,420,000**	
	Contractor General Conditions	15	%		$ 213,000					
	SUBTOTAL								**$ 1,630,000**	
	Contractor Overhead and Profit	12	%		$ 195,600					
	SUBTOTAL								**$ 1,830,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 42,919					
	SUBTOTAL								**$ 1,870,000**	
	Escalation to Midpoint of Construction	3	%		$ 178,701.74					
	SUBTOTAL								**$ 2,050,000**	
	TOTAL CONSTRUCTION COST									**$ 2,050,000**

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
JOB # :	10406A.00	**20 CITIES ENR CCI DEC 2016:**	10530
LOCATION :	King City	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
ELEMENT # :	Alternative No. 5 - Reuse and Disposal	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
		BY :	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	New Pond Excavation	774,361	CY		$ 2.50	1	1.0	1.00	$ 1,940,000	
2	New Pond Liner	1,569,937	SF		$ 0.81	1	1.0	1.00	$ 1,270,000	
2	Existing Pond Sludge Removal (Ponds 1A, 1B, 3, 4, and 5)	80,032	CY		$ 7.00	1	1.0	1.00	$ 560,000	
3	Existing Pond Clay Liner Removal (Ponds 1A, 1B, 3, 4, and 5)	56,437	CY		$ 2.50	1	1.0	1.00	$ 140,000	
4	New Pond Liner (Ponds 1A, 1B, 3, 4, and 5)	1,693,119	SF		$ 0.81	1	1.0	1.00	$ 1,270,000	
	TOTAL DIRECT COST									**$ 5,180,000**
	Estimating Contingency	30	%		$ 1,554,000					
	SUBTOTAL								**$ 6,730,000**	
	Contractor General Conditions	15	%		$ 1,009,500					
	SUBTOTAL								**$ 7,740,000**	
	Contractor Overhead and Profit	12	%		$ 928,800					
	SUBTOTAL								**$ 8,670,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 203,963					
	SUBTOTAL								**$ 8,870,000**	
	Escalation to Midpoint of Construction	3	%		$ 847,638.73					
	SUBTOTAL								**$ 9,720,000**	
	TOTAL CONSTRUCTION COST									**$ 9,720,000**

APPENDIX D – BASIS OF COST TM

APPENDIX D – BASIS OF COST

1.0 PURPOSE

As part of the King City Wastewater Treatment Facilities Plan, several types of cost estimates were developed. This appendix provides procedures and guidelines for estimating construction costs.

2.0 INTRODUCTION

Cost estimates are often prepared at various stages during project planning and design. The cost estimate is one of the most sensitive products prepared for a project. The level of accuracy that can be expected is directly proportional to the level of engineering effort completed. Each cost estimate must be carefully prepared at all levels of the project from the facilities plan through preliminary design and final design (final engineer's estimate).

2.1 SCOPE AND LEVEL OF ACCURACY

The Association for the Advancement of Cost Engineering International (AACE International, formerly known as the American Association of Cost Engineers) has suggested levels of accuracy for five estimate classes. These five estimate classes are presented in the AACE International Recommended Practice No. 18R-97 (Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries). Table D1 presents a summary of these five estimate classes and their characteristics, including expected accuracy ranges.

The quantity and quality of the information required to prepare an estimate depends on the end use for that estimate. Typically, as a project progresses from the conceptual and/or planning phase to the preliminary and final design phases, the quantity and quality of information increases, providing data for development of a progressively more accurate cost estimate. A contingency is often used to compensate for lack of detailed engineering data, oversights, anticipated changes, and imperfection in the estimating methods used. As the project design details are refined, smaller contingency allowances are typically utilized. For the projects developed as a part of the Facilities Plan, cost estimates are developed following the AACE International Recommended Practice No. 18R-97 estimate Class 5.

Table D1	Classes of Cost Estimates[1] Wastewater Treatment Facilities Plan King City				
	Primary Characteristic	**Secondary Characteristic**			
Estimate Class	**Level of Project Definition Expressed as % of complete definition**	**End Usage Typical purpose of estimate**	**Methodology Typical estimating method**	**Expected Accuracy Range Typical variation in low and high ranges[1a]**	**Preparation Effort Typical degree of effort relative to least cost index of 1[1b]**
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: - 15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: - 10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: - 5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: - 3% to -10% H: +3% to +15%	5 to 100

Note:

(1) Table D1 comes from the AACE International Recommended Practices, No. 18R-97:

(a) The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for a given scope.

(b) If the range index value of “1” represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

Class 5 estimates are prepared for any number of strategic business planning purposes, including, but not limited to: project screening, evaluation of resource needs and budgeting, and long-range capital planning. Very limited information is available at the time when a Class 5 estimate is developed. Therefore, Class 5 estimates virtually always use stochastic estimating methods such as cost to capacity curves and various scaling factors. Subsequently, estimated costs have wide accuracy ranges. Typical accuracy ranges for Class 5 estimates are -20 percent to –50 percent on the low side, and +30 percent to +100 percent on the high side, depending on the technological complexity of the project, availability and accuracy of appropriate reference information, and the inclusion of an appropriate contingency determination. Capital costs for the Facilities Plan improvements are prepared using available information that may be Class 4 or 5 estimates.

3.0 BASIS OF COST EVALUATIONS

The costs presented in the Facilities Plan are based on assumptions about equipment useful life and existing conditions, increased capacity, preliminary layouts, preliminary unit process sizes, and conceptual alternative configurations. Construction costs for new capital projects are estimated from unit costs developed from past Carollo construction contracts, estimating guides, unit prices, and construction costs of similar facilities and configurations at other locations. Equipment costs were developed from reference projects and/or vendor budgetary proposals.

A summary of the economic criteria to be used for estimating costs is presented in Table D2.

Table D2 Economic Criteria
Wastewater Treatment Facilities Plan
King City

Item	Assumption
Costs in Time and Place(1)	Costs are based on December 2016 costs in Salinas, California
Inflation Rate	Annual inflation rate is assumed to be 3 percent
Interest Rate	6 percent for amortization purpose
Amortization Period	20 years

Note:
(1) 20 Cities ENR CCI of 10,530 was used to update costs to December 2016. The 2016 R.S. Means location factor for the City of Salinas of 110.4 was used.

4.0 CAPITAL COSTS

While the estimated construction costs represent the average bidding conditions for many projects, variations in bidding climate at the time the facilities are constructed can affect actual construction costs. Further, the size of the facilities may be refined during preliminary design

based on the most current operational information available. For these reasons, the actual construction costs may be lower or higher than originally estimated.

Construction costs have historically escalated with time. This trend is expected to continue in the future. To record these trends in rising costs, several indices have been established for various fields of construction. The standard indicator of changes in heavy construction prices is the ENR CCI. Construction costs in December 2016 are based on the 20 Cities ENR CCI of 10,530. To account for the project location, the corresponding R.S. Means Location Factor of 110.4 was used, which is the location factor for Salinas, California.

The construction costs presented typically include contractor's overhead and profit as well as construction contingencies. Costs to the owner, such as engineering, legal, administrative, project contingencies, and construction management costs are added to the construction costs to get a total project cost. The basis for estimating capital costs for new capital and replacement projects is presented in Table D3.

The new capital cost or replacement estimates for individual assets are estimates of the total project cost to purchase and install similar assets in today's dollars. Capital cost values comprise of both direct and indirect costs. Direct costs are the actual costs of the new equipment and structures, including supporting elements such as sitework, yard piping, electrical, and instrumentation. The indirect construction costs include other factors such as demolition, installation labor, contractor overhead and profit, sales tax, and escalation to midpoint of construction. Descriptions of each project cost factor are presented in Table D3. Unless otherwise noted, direct costs were estimated based on a variety of sources and are costs directly attributed to the physical make-up of the assets (e.g., site development, materials, site dewatering, facilities, equipment, piping, electrical/instrumentation/controls, installation and labor, etc.). A factor is then applied for installation, which ranges from 15 to 50 percent. Because the asset inventory is comprised only of the important and/or high cost assets, remaining components are accounted for in a factor termed "ancillary support." This factor encompasses items such as sump pumps, seal water pumps, small valves, service-air piping, hoses, etc. The lumped value of these assets is adjusted according to best professional judgment and usually ranges from 25 to 45 percent of the sum of the itemized asset costs; therefore, a 75 to 140 percent construction cost factor is applied to each asset. Indirect construction costs are then applied, including general conditions, contractor overhead and profit, and sales tax. The resulting total construction cost factor ranges from 2.2 to 3.5 for simple and complex construction items, respectively. In addition, cost factors to complete the overall project, including engineering, legal, administration, and construction management are added to estimate the overall project cost.

As noted, these factors are adjusted to two levels of project complexity: 1) conducted by external contractors at a simple level, or 2) conducted by external contractors with complexity requiring design services and/or contractor staging. The overall cost factor applied to direct costs then ranges from 2.75 to 4.7 depending on the level of complexity.

Table D3 Project Cost Factors
Wastewater Treatment Facilities Plan
King City

Factor	Description	External Project	
		Simple	**Complex**
Demolition	Destruction and removal of existing asset.	5%	10%
Installation	Installation of new asset such as mechanical equipment.	15%	50%
Ancillary Support(2)	Lumped cost of mechanical piping, electrical cable, conduit and other costs.	25%	45%
Construction and Estimating Contingency	Unforeseen or unanticipated project costs involved in the design details and installation of the new asset.	30%	35%
Subtotal		**75%**	**140%**
General Conditions	All items contained within Division 01 of most project specifications including: mobilization and demobilization, contractor temporary facilities, contractor's field supervision, and bonds and insurance.	10%	15%
Contractor Overhead and Profit Margin	This value includes general contractor home office overheads and profit.	10%	25%
Sales Tax Factor	Sales tax factor applied to approximately half of direct cost.	5%	5%
Subtotal		**25%**	**45%**
Total Construction Cost Factor		**2.2(1)**	**3.5(1)**
Engineering, Legal, Administrative, and Project Contingencies	Engineering (design and services during construction), legal, and administrative costs reflect assistance with permitting and financing.	25%	35%
Total Project Cost Factor		**1.25**	**1.35**
Total Construction and Project Multipliers (Compounded)		**2.75(1)**	**4.7(1)**

Note:
(1) Factor is compounded from both subtotal values.
(2) Ancillary support may be included in Direct Costs instead of Indirect Costs.

4.1 Treatment Plant Cost Estimating Approach

The treatment plant unit process construction cost estimates are developed using past Carollo Engineers project costs and the cost curve approach for estimating. The “cost curve approach” is the use of historical project cost data to estimate planning level costs for capital improvement projects. In this approach, historical project cost data are used to develop plots of total cost versus process capacity, or “cost curves,” for a given unit process. In the development of the cost curves, the project locations and dates of costs are accounted for with the application of “location factors” (R.S. Means Location Factors), and ENR CCI values. The location factors are based upon the R.S. Means national average construction costs.

City-to-City location adjustment factors may be accurately derived by dividing the published factor for one location by the factor for another. By accounting for location factors and ENR CCI values, the cost curves are plots of “location-less” costs and in today’s dollars. Given a known required capacity for a capital improvement project, the estimated cost is extrapolated from the cost curve.

APPENDIX E – CAPITAL COSTS

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CAPITAL COST SUMMARY OF ALL ALTERNATIVES

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

PROJECT : CITY OF KING CITY WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City

Rate of Annual Inflation:	3%
Estimating Contingency:	30%
Sales Tax:	7.875%
Contractor General Conditions:	15%
Contractor Overhead and Profit:	12%

ELEMENT #	DESCRIPTION	TOTAL CONSTRUCTION COST
01	Headworks	$ 7,670,000
02A	Secondary Treatment - Oxidation Ditch	$ 24,120,000
02B	Secondary Treatment - CAS w/ MLE	$ 28,630,000
02C	Secondary Treatment - MBR	$ 23,770,000
03A	Tertiary Treatment - Filters (Continuous Backwash)	$ 13,000,000
03B	Tertiary Treatment - Filters (Cloth Disk)	$ 4,090,000
04A	Tertiary Treatment - Disinfection (Chlorine Contact Basin)	$ 3,090,000
04B	Tertiary Treatment - Disinfection (UV)	$ 4,700,000
05A	Solids Processing - Thickening (RDT)	$ 2,730,000
05B	Solids Processing - Thickening (GBT)	$ 2,390,000
06A	Solids Processing - Stabilization (Aerobic Digester)	$ 6,180,000
06B	Solids Processing - Stabilization (Solids Lagoon)	$ 1,500,000
07A	Solids Processing - Dewatering (Screw Press)	$ 3,720,000
07B	Solids Processing - Dewatering (Drying Bed)	$ 4,090,000
-	Alternative No. 3 - Reuse and Disposal	$ 3,450,000

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Headworks	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	HEADWORKS - 7.8 (peak) MGD including Influent Pumping, Mechanical Bar Screens, Grit Removal, Parshall Flum Metering, Screenings Washer/Dewatering Press Dry Pit	1	LS	$ 3,725,056	1.00	$ 3,730,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING	10	%			$ 370,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,120,000	
	TOTAL DIRECT COST						**$ 5,220,000**
	Estimating Contingency	30	%	$ 1,566,000			
	SUBTOTAL					**$ 6,790,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 6,790,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 6,790,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 205,538			
	SUBTOTAL					**$ 7,000,000**	
	Escalation to Midpoint of Construction	3	%	$668,936.99			
	SUBTOTAL					**$ 7,670,000**	
	TOTAL CONSTRUCTION COST						**$ 7,670,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	ESTIMATED MIDPOINT OF CONSTRUCTION :	4/1/2020
JOB # :	10406A.00	COST ESTIMATE PREPARATION DATE :	3/1/2017
LOCATION :	King City	BY :	TJG
ELEMENT # :	Secondary Treatment - Oxidation Ditch	REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	OXIDATION DITCHES (3, 1.2 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$5,191,634	1.00	$ 5,190,000	
2	CIRCULAR SECONDARY CLARIFIERS (3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$3,454,341	1.00	$ 3,450,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ 478,105	1.00	$ 480,000	
4	SITEWORK	20	%			$ 1,130,000	
5	YARD PIPING	10	%			$ 910,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 2,740,000	
	TOTAL DIRECT COST						**$13,900,000**
	Estimating Contingency	30	%	$4,170,000			
	SUBTOTAL					**$ 18,070,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$1,768,650			
	SUBTOTAL					**$ 19,840,000**	
	Contractor Overhead and Profit - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	12	%	$1,627,158			
	SUBTOTAL					**$ 21,470,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 547,313			
	SUBTOTAL					**$ 22,020,000**	
	Escalation to Midpoint of Construction	3	%	$2,104,285			
	SUBTOTAL					**$ 24,120,000**	
	TOTAL CONSTRUCTION COST						**$24,120,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Secondary Treatment - CAS w/ MLE	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	AERATION BASINS (3+1, 0.73 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$5,598,611	1.00	$ 5,600,000	
2	CIRCULAR SECONDARY CLARIFIERS (3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$3,454,341	1.00	$ 3,450,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ 478,105	1.00	$ 480,000	
4	BLOWER BUILDING	1	LS	$1,542,748	1.00	$ 1,540,000	
5	SITEWORK	20	%			$ 1,220,000	
6	YARD PIPING	10	%			$ 950,000	
7	ELECTRICAL AND INSTRUMENTATION	30	%			$ 2,860,000	
	TOTAL DIRECT COST						**$16,100,000**
	Estimating Contingency	30	%	$4,830,000			
	SUBTOTAL					**$ 20,930,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$2,377,050			
	SUBTOTAL					**$ 23,310,000**	
	Contractor Overhead and Profit - On aeration basin, splitter box/RAS PS/WAS PS, and blower building subtotal only	12	%	$2,186,886			
	SUBTOTAL					**$ 25,500,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 633,938			
	SUBTOTAL					**$ 26,130,000**	
	Escalation to Midpoint of Construction	3	%	$2,497,046			
	SUBTOTAL					**$ 28,630,000**	
	TOTAL CONSTRUCTION COST						**$28,630,000**

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Secondary Treatment - MBR	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	MBR (3+1, Aeration Basins at 0.25 MG EA and 3+1 MBR at 0.0125 MG EA at 2 MGD design flow) - DIRECT COST	1	LS	$7,073,636	1.00	$ 7,070,000	
2	SPLITTER BOX/RAS PS/WAS PS - Included in item 1	0	LS			$ -	
3	BLOWER BUILDING - Included in item 1	0	LS			$ -	
4	SITEWORK	20	%			$ 1,770,000	
5	YARD PIPING	10	%			$ 790,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 3,030,000	
	TOTAL DIRECT COST						**$12,660,000**
	Estimating Contingency	30	%	$3,798,000			
	SUBTOTAL					**$ 16,460,000**	
	Contractor General Conditions	15	%	$2,469,000			
	SUBTOTAL					**$ 18,930,000**	
	Contractor Overhead and Profit	12	%	$2,271,600			
	SUBTOTAL					**$ 21,200,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.88	%	$ 498,488			
	SUBTOTAL					**$ 21,700,000**	
	Escalation to Midpoint of Construction	3	%	$2,073,705			
	SUBTOTAL					**$ 23,770,000**	
	TOTAL CONSTRUCTION COST						**$23,770,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Continuous Backwash) Recycled Water	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - 9 + 3, Continuous Backwash, 3.2 (peak) MGD design flow	1	LS	$4,328,777	1.00	$ 4,330,000	
2	SITEWORK	20	%			$ 870,000	
3	YARD PIPING	10	%			$ 430,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,300,000	
	TOTAL DIRECT COST						**$ 6,930,000**
	Estimating Contingency	30	%	$2,079,000			
	SUBTOTAL					**$ 9,010,000**	
	Contractor General Conditions	15	%	$1,351,500			
	SUBTOTAL					**$ 10,360,000**	
	Contractor Overhead and Profit	12	%	$1,243,200			
	SUBTOTAL					**$ 11,600,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 272,869			
	SUBTOTAL					**$ 11,870,000**	
	Escalation to Midpoint of Construction	3	%	$1,134,326			
	SUBTOTAL					**$ 13,000,000**	
	TOTAL CONSTRUCTION COST						**$13,000,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Cloth Disk) Recycled Water	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - Cloth Media Disk, 3.2 (peak) MGD design flow	1	LS	$1,356,299	1.00	$ 1,360,000	
2	SITEWORK	20	%			$ 270,000	
3	YARD PIPING	10	%			$ 140,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 410,000	
	TOTAL DIRECT COST						**$ 2,180,000**
	Estimating Contingency	30	%	$ 654,000			
	SUBTOTAL					**$ 2,830,000**	
	Contractor General Conditions	15	%	$ 424,500			
	SUBTOTAL					**$ 3,250,000**	
	Contractor Overhead and Profit	12	%	$ 390,000			
	SUBTOTAL					**$ 3,640,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 85,838			
	SUBTOTAL					**$ 3,730,000**	
	Escalation to Midpoint of Construction	3	%	$ 356,448			
	SUBTOTAL					**$ 4,090,000**	
	TOTAL CONSTRUCTION COST						**$ 4,090,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (Chlorine Contact Basin) Recycled Water	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	CHLORINE CONTACT BASINS - 3.2 (peak) MGD, 90 min contact time, 75% efficiency assumed, CT required for Title 22 = 450 mg-min/L	1	LS	$1,005,919	1.00	$ 1,010,000	
2	CHEMICAL METERING AND STORAGE	1	LS	$ 700,000	1.00	$ 700,000	
3	SITEWORK - Included in item 1	20	%			$ -	
4	YARD PIPING	10	%			$ 100,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 300,000	
	TOTAL DIRECT COST						**$2,110,000**
	Estimating Contingency	30	%	$ 633,000			
	SUBTOTAL					**$ 2,740,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 2,740,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 2,740,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 83,081			
	SUBTOTAL					**$ 2,820,000**	
	Escalation to Midpoint of Construction	3	%	$ 269,486			
	SUBTOTAL					**$ 3,090,000**	
	TOTAL CONSTRUCTION COST						**$3,090,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	ESTIMATED MIDPOINT OF CONSTRUCTION :	4/1/2020
JOB # :	10406A.00	COST ESTIMATE PREPARATION DATE :	3/1/2017
LOCATION :	King City	BY :	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (UV) Recycled Water	REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	UV - Backup equipment costs provided by Bill Sotirakis. Construction cost assume to be 4x equipment cost. The 4x multiplier includes sitework, yard piping, EI&C, estimating contigency, contractor general condidtions, contractor overhead and profit, and sales tax - 3+1	1	LS	$4,293,333	1.00	$ 4,290,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING - Included in item 1	10	%			$ -	
4	ELECTRICAL AND INSTRUMENTATION - Included in item 1	30	%			$ -	
	TOTAL DIRECT COST						**$4,290,000**
	Estimating Contingency - Included in item 1	30	%				
	SUBTOTAL					**$ 4,290,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 4,290,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 4,290,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal - Included in ite	7.875	%				
	SUBTOTAL					**$ 4,290,000**	
	Escalation to Midpoint of Construction	3	%	$ 409,963			
	SUBTOTAL					**$ 4,700,000**	
	TOTAL CONSTRUCTION COST						**$4,700,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Thickening (RDT)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	THICKENING EQUIPMENT - DIRECT COST	1	LS	$ 683,070	1.00	$ 680,000	
2	THICKENING/DEWATERING BUILDING - DIRECT COST	1	LS	$ 234,043	1.00	$ 230,000	
3	SITEWORK	20	%			$ 180,000	
4	YARD PIPING	10	%			$ 90,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 270,000	
	TOTAL DIRECT COST						**$1,450,000**
	Estimating Contingency	30	%	$ 435,000			
	SUBTOTAL					**$ 1,890,000**	
	Contractor General Conditions	15	%	$ 283,500			
	SUBTOTAL					**$ 2,170,000**	
	Contractor Overhead and Profit	12	%	$ 260,400			
	SUBTOTAL					**$ 2,430,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 57,094			
	SUBTOTAL					**$ 2,490,000**	
	Escalation to Midpoint of Construction	3	%	$ 237,950			
	SUBTOTAL					**$ 2,730,000**	
	TOTAL CONSTRUCTION COST						**$2,730,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Thickening (GBT)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	THICKENING EQUIPMENT - DIRECT COST	1	LS	$ 557,862	1.00	$ 560,000	
2	THICKENING/DEWATERING BUILDING - DIRECT COST	1	LS	$ 234,043	1.00	$ 230,000	
3	SITEWORK	20	%			$ 160,000	
4	YARD PIPING	10	%			$ 80,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 240,000	
	TOTAL DIRECT COST						**$1,270,000**
	Estimating Contingency	30	%	$ 381,000			
	SUBTOTAL					**$ 1,650,000**	
	Contractor General Conditions	15	%	$ 247,500			
	SUBTOTAL					**$ 1,900,000**	
	Contractor Overhead and Profit	12	%	$ 228,000			
	SUBTOTAL					**$ 2,130,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 50,006			
	SUBTOTAL					**$ 2,180,000**	
	Escalation to Midpoint of Construction	3	%	$ 208,326			
	SUBTOTAL					**$ 2,390,000**	
	TOTAL CONSTRUCTION COST						**$2,390,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Stabilization (Aerobic Digester)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	AEROBIC DIGESTERS (four 38'x38' tanks at 0.215 MG EA at 2 MGD design flow) - DIRECT COST	1	LS	$2,051,505	1.00	$ 2,050,000	
2	SITEWORK	20	%			$ 410,000	
3	YARD PIPING	10	%			$ 210,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 620,000	
	TOTAL DIRECT COST						**$3,290,000**
	Estimating Contingency	30	%	$ 987,000			
	SUBTOTAL					**$ 4,280,000**	
	Contractor General Conditions	15	%	$ 642,000			
	SUBTOTAL					**$ 4,920,000**	
	Contractor Overhead and Profit	12	%	$ 590,400			
	SUBTOTAL					**$ 5,510,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 129,544			
	SUBTOTAL					**$ 5,640,000**	
	Escalation to Midpoint of Construction	3	%	$ 538,972			
	SUBTOTAL					**$ 6,180,000**	
	TOTAL CONSTRUCTION COST						**$6,180,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Stabilization (Solids Lagoon)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	SOLIDS LAGOON - Allowance, assuming can keep current 9" clay liner	1	LS	$ 500,000	1.00	$ 500,000	
2	SITEWORK	20	%			$ 100,000	
3	YARD PIPING	10	%			$ 50,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 150,000	
	TOTAL DIRECT COST						**$ 800,000**
	Estimating Contingency	30	%	$ 240,000			
	SUBTOTAL					**$ 1,040,000**	
	Contractor General Conditions	15	%	$ 156,000			
	SUBTOTAL					**$ 1,196,000**	
	Contractor Overhead and Profit	12	%	$ 143,520			
	SUBTOTAL					**$ 1,340,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 31,500			
	SUBTOTAL					**$ 1,372,000**	
	Escalation to Midpoint of Construction	3	%	$ 131,112			
	SUBTOTAL					**$ 1,500,000**	
	TOTAL CONSTRUCTION COST						**$1,500,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Dewatering (Screw Press)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	THICKENING/DEWATERING BUILDING - DIRECT COST	1	LS	$ 234,043	1.00	$ 230,000	
2	DEWATERING EQUIPMENT - DIRECT COST	1	LS	$1,005,396	1.00	$ 1,010,000	
3	SITEWORK	20	%			$ 250,000	
4	YARD PIPING	10	%			$ 120,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 370,000	
	TOTAL DIRECT COST						**$1,980,000**
	Estimating Contingency	30	%	$ 594,000			
	SUBTOTAL					**$ 2,570,000**	
	Contractor General Conditions	15	%	$ 385,500			
	SUBTOTAL					**$ 2,960,000**	
	Contractor Overhead and Profit	12	%	$ 355,200			
	SUBTOTAL					**$ 3,320,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 77,963			
	SUBTOTAL					**$ 3,400,000**	
	Escalation to Midpoint of Construction	3	%	$ 324,912			
	SUBTOTAL					**$ 3,720,000**	
	TOTAL CONSTRUCTION COST						**$3,720,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	ESTIMATED MIDPOINT OF CONSTRUCTION :	4/1/2020
JOB # :	10406A.00	COST ESTIMATE PREPARATION DATE :	3/1/2017
LOCATION :	King City	BY :	TJG
ELEMENT # :	Solids Processing - Dewatering (Drying Bed)	REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	DRYING BED	1	LS	$1,363,329	1.00	$ 1,360,000	
2	SITEWORK	20	%			$ 270,000	
3	YARD PIPING	10	%			$ 140,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 410,000	
	TOTAL DIRECT COST						**$2,180,000**
	Estimating Contingency	30	%	$ 654,000			
	SUBTOTAL					**$ 2,830,000**	
	Contractor General Conditions	15	%	$ 424,500			
	SUBTOTAL					**$ 3,250,000**	
	Contractor Overhead and Profit	12	%	$ 390,000			
	SUBTOTAL					**$ 3,640,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 85,838			
	SUBTOTAL					**$ 3,730,000**	
	Escalation to Midpoint of Construction	3	%	$ 356,448			
	SUBTOTAL					**$ 4,090,000**	
	TOTAL CONSTRUCTION COST						**$4,090,000**

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PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Alternative No. 3 - Reuse and Disposal

LOCATION FACTOR: 110.4
20 CITIES ENR CCI DEC 2016: 10530

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3, and 5)	65,830	CY		$ 7.00	1	1.0	1.00	$ 460,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3, and 5)	41,464	CY		$ 2.50	1	1.0	1.00	$ 100,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3, and 5)	7,584	CY		$ 103.24	1	1.0	1.00	$ 780,000	
4	Sludge Removal (Pond 4)	14,202	CY		$ 7.00	1	1.0	1.00	$ 100,000	
5	Clay Liner Removal (Pond 4)	14,973	CY		$ 2.50	1	1.0	1.00	$ 40,000	
6	New Pond Liner (Pond 4)	449,188	SF		$ 0.81	1	1.0	1.00	$ 360,000	
	TOTAL DIRECT COST									**$ 1,840,000**
	Estimating Contingency	30	%		$ 552,000					
	SUBTOTAL								**$ 2,390,000**	
	Contractor General Conditions	15	%		$ 358,500					
	SUBTOTAL								**$ 2,750,000**	
	Contractor Overhead and Profit	12	%		$ 330,000					
	SUBTOTAL								**$ 3,080,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 72,450					
	SUBTOTAL								**$ 3,150,000**	
	Escalation to Midpoint of Construction	3	%		$ 301,021.65					
	SUBTOTAL								**$ 3,450,000**	
	TOTAL CONSTRUCTION COST									**$ 3,450,000**

APPENDIX F – OPERATION AND MAINTENANCE COSTS

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COMPARATIVE O&M COST SUMMARY[1)]

PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
JOB # :	10406A.00	**BY :**	TJG
LOCATION :	King City	**REVIEWED BY:**	ETC

	Power[(2)]	Chemical[(3)]	Maintenance	Total
Oxidation Ditch	$ 206,000	$ -	$ -	$ 206,000
CAS w/ MLE	$ 237,400	$ -	$ 8,400	$ 245,800
MBR	$ 321,600	$ 3,000	$ 117,300	$ 441,900
Continuous Backwash Filter	$ 11,800	$ -	$ -	$ 11,800
Cloth Disk Media Filter	$ 1,100	$ -	$ -	$ 1,100
Chlorine Contact Basin	$ 16,500	$ 66,600	$ -	$ 83,100
UV	$ 25,980	$ -	$ 77,267	$ 103,300
RDT	$ 1,200	$ -	$ -	$ 1,200
GBT	$ 11,800	$ -	$ -	$ 11,800
Aerobic Digester	$ 188,400	$ -	$ -	$ 188,400
Solids Lagoon	$ -	$ -	$ 1,120,220	$ 1,120,220
Screw Press	$ 2,900	$ 37,800	$ 188,900	$ 229,600
Sludge Drying Bed	$ -	$ -	$ 47,300	$ 47,300

Notes:

(1) Process elements that are identical throughout alternatives, e.g., identical elements within oxidation ditch vs CAS w/ MLE vs MBR, or RDT vs GBT, are not included in the comparative O&M cost estimate.

(2) Average power cost assumed to be $0.12/kWh.

(3) Chemical costs were assumed to be $2.00/lb for polymer; $0.96/gal for 12.5% sodium hypochlorite solution; $0.96/gal for 50% sodium bisulfite solution; $0.20/lb for 42% alum solution; $1.00/gal for citric acid; $5.00/gal for sulfuric acid.

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RECOMMENDED PROJECT TOTAL O&M COST SUMMARY (WITH CONTINUOUS BACKWASH FILTER)[1]

PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City

COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

	Power[2]	Chemical[3]	Maintenance	Labor[4]	Total
Headworks	$ 39,000	$ -	$ -	$ -	$ 39,000
Oxidation Ditch	$ 207,400	$ -	$ -	$ -	$ 207,400
Continuous Backwash Filter	$ 16,600	$ 27,800	$ 1,800	$ -	$ 46,200
UV	$ 26,000	$ -	$ 77,300	$ -	$ 103,300
Screw Press	$ 2,900	$ 37,800	$ 188,900	$ -	$ 229,600
Labor	$ -	$ -	$ -	$ 500,000	$ 500,000

Notes:

(1) Costs represent total O&M costs, not comparative O&M costs. All elements are included in the total O&M cost estimate.

(2) Average power cost assumed to be $0.12/kWh.

(3) Chemical costs were assumed to be $2.00/lb for polymer; $0.96/gal for 12.5% sodium hypochlorite solution; $0.96/gal for 50% sodium bisulfite solution; $0.20/lb for 42% alum solution; $1.00/gal for citric acid; $5.00/gal for sulfuric acid.

(4) Labor for tertiary treatment facility assumed to require 5 full time equivalents (FTEs) at $100,000 per year per FTE. Labor for secondary treatment only facility assume to require 3 FTEs.

Engineers...Working Wonders With Water®

RECOMMENDED PROJECT TOTAL O&M COST SUMMARY (WITH CLOTH DISK MEDIA FILTER)[1]

PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City

COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

	Power[2]	Chemical[3]	Maintenance	Labor[4]	Total
Headworks	$ 39,000	$ -	$ -	$ -	$ 39,000
Oxidation Ditch	$ 207,400	$ -	$ -	$ -	$ 207,400
Cloth Disk Media Filter	$ 5,900	$ 27,800	$ 34,560	$ -	$ 68,260
UV	$ 26,000	$ -	$ 77,300	$ -	$ 103,300
Screw Press	$ 2,900	$ 37,800	$ 188,900	$ -	$ 229,600
Labor	$ -	$ -	$ -	$ 500,000	$ 500,000

Notes:

(1) Costs represent total O&M costs, not comparative O&M costs. All elements are included in the total O&M cost estimate.

(2) Average power cost assumed to be $0.12/kWh.

(3) Chemical costs were assumed to be $2.00/lb for polymer; $0.96/gal for 12.5% sodium hypochlorite solution; $0.96/gal for 50% sodium bisulfite solution; $0.20/lb for 42% alum solution; $1.00/gal for citric acid; $5.00/gal for sulfuric acid.

(4) Labor for tertiary treatment facility assumed to require 5 full time equivalents (FTEs) at $100,000 per year per FTE. Labor for secondary treatment only facility assume to require 3 FTEs.

KING CITY - O&M COST DETAIL

	PROCESS							POWER						CHEMICAL					REPLACEMENT				HAULING/DREDGING			LABOR		
	Flow, mgd or scfm	No. of Operating Units	No. of Standby Units	Flow/pump, gpm	Flow/pump, mgd	TDH, ft (or Pressure Differential)	Operating Motor Power, hp	Req'd Pump, bhp	Total Operating Motor Power, hp	% Annual Use	Total, hp	Power Input, kW	Power Cost, $/yr	Required dose, mg/L/ lb/DT	Chemical Usage, gal/d, DT/d, lb/d (for CBW)	Chemical Usage, gal/yr/ lb/yr	Unit Cost, $/gal (or $/lb for polymer and alum)	Chemical Cost, $/yr	Total No. Diffusers or Membrane Area	No. Replaced per year, diffusers, sf, cy	$/diffuser (CAS & MBR) or $/sf (MBR) or $/cy (CBW)	Annual Replacement, $/yr	WT/yr	$/ton	$/yr	Full Time Equivalents (FTE)	$/FTE-yr	$/yr
Headworks																												
Climber screen	7.8	2	1		4		1	-	2	50%	1	1	$ 800															
Screenings washer/compactor	7.8	2	1		4		5	-	10	50%	5	4	$ 4,000															
Grit classifier	7.8	1	0				1	-	1	100%	1	1	$ 800															
Grit pump/impeller	7.8	1	1				7.5	-	7.5	100%	7.5	6	$ 5,900															
Influent pumps	1.72	1	1		2	10	35	5.40	35	100%	35	26	$ 27,500															
MBR-specific																												
Rotary drum fine screen	7.8	2	1				2	-	4	100%	4	3	$ 3,200															
CAS																												
Anoxic mixers		8	0				5	-	40	100%	40	30	$ 31,400															
RAS pumps	1.5	3	1		0.5	25	15	-	45	100%	45	33.6	$ 35,400															
WAS pumps		1	1	50		25	5	-	5	33%	2	1.24	$ 1,400															
MLR pumps	6.0	3	0		2	5	10	2.70	30.0	100%	30.0	22.4	$ 23,600															
Secondary clarifier mechanism		3	1				0.75	-	2.25	100%	2.25	1.68	$ 1,800															
Secondary clarifier scum pump		3	1				5	-	15	33%	4.95	3.69	$ 3,900															
Aeration blowers	3,093	3	1				60	-	180	100%	180	134	$ 141,300															
Aeration diffusers		1,395	0																1,395	20%	$ 30.00	$ 8,400						
MBR																												
Anoxic mixers		8	0				5	-	40	100%	40	30	$ 31,400															
RAS pumps	8	3	1	1,851	2.7	25	25	-	75	100%	75	56	$ 58,900															
WAS pumps		1	1	50		25	5	-	5	33%	2	1.24	$ 1,400															
Membrane air scour blowers	1,574	3	1				25	-	75	100%	75	56	$ 58,900															
Aeration blowers	3,138	3	1				60	-	180	100%	180	134	$ 141,300															
Aeration diffusers		1,572	0																1,572	20%	$ 30.00	$ 9,500						
Permeate pumps	2	3	1		0.7		10	-	30	100%	30	22	$ 23,600															
CIP pumps	2	1	1				20	-	20	2%	0.40	0.30	$ 400															
Membrane drain pumps	2	2	1				15	-	30	1%	0.30	0.22	$ 300															
Instrument air system	2	1	1				25	-	25	33%	8	6.16	$ 6,500															
Chemical cleaning system																												
Sodium hypochlorite dosing pump	2	2	1				1	-	2	3%	0.06	0.04	$ 100		2	2,397	$ 0.96	$ 2,301										
Citric acid dosing pump	2	2	1				1	-	2	1%	0.02	0.01	$ 100		2	525	$ 1.00	$ 525										
Sulfuric acid dosing pump	2	2	1				1	-	2	1%	0.02	0.01	$ 100		2	18	$ 5.00	$ 89										
Membrane replacement																			213,120	14%	$ 3.54	$ 107,800						
Other																												
OXIDATION DITCH																												
Secondary clarifier mechanism		3	0				0.75		2.25	100%	2.25	1.68	$ 1,800															
Secondary clarifier scum pump		3	0				5	-	15	33%	4.95	3.69	$ 3,900															
Anoxic mixers	-	6	0				5	-	30	100%	30	22	$ 23,600															
Surface aerator	-	6	0				60	-	360	50%	180	134	$ 141,300															
WAS pumps		1	1	50		25	5	-	5	33%	2	1.24	$ 1,400															
RAS pumps	1.5	3	1		0.5	25	15	-	45	100%	45	33.6	$ 35,400															
FILTER (Assumed flow by gravity)																												
CLOTH MEDIA DISK FILTER		2	1																									
Filter drive assembly	2.0	2	1				0.75	-	1.5	25%	0.38	0.28	$ 300															
Backwash/sludge pump	2.0	2	1				2	-	4	25%	1	0.75	$ 800															
Media replacement	2.0							-	0	100%	-	-	$ -							3.2	$ 10,800	$ 34,560						
Flash mixer		1	0				5	-	5	100%	5	4	$ 4,000															
Chemical																												
Polymer dosing pump	1.72	1	0				0.5	-	0.5	100%	1	0.37	$ 400	1.0	20	7,300	2	$ 14,600										
Alum (42%) dosing pump	1.72	1	0				0.5	-	0.5	100%	1	0.37	$ 400	5.0	180	65,700	0.2	$ 13,200										
CONTINUOUS BACKWASH FILTER																												
Air compressor	2.0	1	0				15	-	15	100%	15	11	$ 11,800															
Backwash pump																												
Media replacement																				7	300	$ 2,100						
Flash mixer		1	0				5	-	5	100%	5	4	$ 4,000															
Chemical																												
Polymer dosing pump	1.72	1	0				0.5	-	0.5	100%	1	0.37	$ 400	1.0	20	7,300	2	$ 14,600										
Alum (42%) dosing pump	1.72	1	0				0.5	-	0.5	100%	1	0.37	$ 400	5.0	180	65,700	0.2	$ 13,200										

KING CITY - O&M COST DETAIL

	PROCESS							POWER						CHEMICAL					REPLACEMENT				HAULING/DREDGING			LABOR		
	Flow, mgd or scfm	No. of Operating Units	No. of Standby Units	Flow/pump, gpm	Flow/pump, mgd	TDH, ft (or Pressure Differential)	Operating Motor Power, hp	Req'd Pump, bhp	Total Operating Motor Power, hp	% Annual Use	Total, hp	Power Input, kW	Power Cost, $/yr	Required dose, mg/L/ lb/DT	Chemical Usage, gal/d, DT/d, lb/d (for CBW)	Chemical Usage, gal/yr/ lb/yr	Unit Cost, $/gal (or $/lb for polymer and alum)	Chemical Cost, $/yr	Total No. Diffusers or Membrane Area	No. Replaced per year, diffusers, sf, cy	$/diffuser (CAS & MBR) or $/sf (MBR) or $/cy (CBW)	Annual Replacement, $/yr	WT/yr	$/ton	$/yr	Full Time Equivalents (FTE)	$/FTE-yr	$/yr
DISINFECTION																												
CCB (CT req'd = 450 mg-min/L)																												
Chemical disinfection																												
Sodium hypochlorite dosing pump	1.72	1					1	-	1	100%	1	0.75	$ 800	13.8	190	69,309	0.96	$ 66,600										
Sodium bisulfite dosing pump	1.72	1					1	-	1	100%	1	0.75		5.0	25	9,166	0.96											
Chemical mixer		2	0				10	-	20	100%	20	15	$ 15,700															
UV																												
Lamp replacement																												
Ballast replacement																												
Wiper replacement																												
Sleeve replacement																												
Chemical usage																												
UV sensor replacement																												
Sensor calibration																												
REPLACEMENT SUBTOTAL																						$ 115,900						
Maximum power consumption												41.2	$ 43,300															
UV SUBTOTAL																												
THICKENING																												
GBT																												
Motor		2	1				15		30	50%	15.00	11	$ 11,800															
Chemical																												
Polymer dosing pump	0.00012	1	1				0.5		0.5	50%	0.25	0	$ 200	5.0	1.9	3,498	2	$ 7,000										
Polymer mixer		1	1				0.5		0.5	50%	0.25	0	$ 200															
RDT																												
Motor		2	1				1.5		3	50%	1.50	1.12	$ 1,200															
Chemical																												
Polymer dosing pump	0.00012	1	1				0.5		0.5	50%	0.25	0	$ 200	5.0	1.9	3,498	2	$ 7,000										
Polymer mixer		1	1				0.5		0.5	50%	0.25	0	$ 200															
STABILIZATION																												
AEROBIC DIGESTER																												
Blower	2,400	2	1				60	-	120	100%	120	90	$ 94,200															
Mixer		4	0				30	-	120	100%	120	90	$ 94,200															
SOLIDS LAGOON																												
Solids dredging																								$ 1,120,220				
DEWATERING																												
SCREW PRESS (assumes 2 screw presses)																												
Motor		2	0				2	-	4	29%	1.14	0.85	$ 900															
Air compressor		2	0				2	-	4	29%	1.14	0.85	$ 900															
Cake conveyor		1	1				3	-	3	29%	0.86	0.64	$ 700															
Hauling of dried sludge (conveyance and disposal)																							3148	$ 60.00	$ 188,887.50			
Chemical																												
Polymer dosing pump	0.00002	1	1				0.5		0.5	29%	0.15	0.11	$ 200	30.0	1.7	18,889	2	$ 37,800										
Polymer mixer		1	1				0.5		0.5	29%	0.15	0.11	$ 200															
DRYING BED		2	0																									
Hauling of dried sludge (conveyance and disposal)																							787	$ 60.00	$ 47,221.88			
EPS																												
Effluent pumps	1.7	1	1		2			-	35	100%	35	26	$ 27,500															
LABOR																												
Labor																										5	$ 100,000	$ 500,000

APPENDIX G – MEETING MINUTES

Kick-Off Meeting Minutes
Collection System and Wastewater Treatment Plant Master Plans
King City

Project:	Collection System and Wastewater Treatment Plant Master Plan	**Conf. Date:**	September 7, 2016
Client:	City of King City	**Issue Date:**	September 19, 2016
Location:	City Hall, 212 South Vanderhurst Avenue	**Project No.:**	10406A.00
Attendees:	**King City:** Octavio Hurtado, Steven Adams, Sal Morales		
	Carollo: Eric Casares, Ryan Orgill		
Distribution:	Attendees, Tim Loper, Danielle Bertini, Elaine Simmons, Tyler Grossheim		

Discussion:

The following is our understanding of the subject matter covered in this conference. If this differs from your understanding, please notify us.

1. Introductions
   a. O. Hurtado will be Carollo's main point of contact for the project. E. Casares will be the City's main point of contact with Carollo.

2. Project Objectives
   a. E. Casares reviewed the project objectives for the Wastewater Treatment Plant (WWTP) Master Plan, as well as the Collection System Master Plan. The City agreed with the project goals outlined in the meeting agenda, and O. Hurtado noted that an additional objective of the project would be to determine what to do with the existing WWTP facilities.
   b. The City agreed with the objectives of the Collection System Master Plan.

3. General Overview
   a. Northern property at the WWTP site is currently being sold.
   b. Recycled water should be delivered to San Antonio Park.
   c. Current flows to the WWTP are 1.2 mgd
      1) 850,000 gpd (domestic)
      2) 350,000 gpd (industrial)
   d. There are known capacity issues in the "flat" 15-inch and 18-inch diameter sewer main at Ellis Street

4. Review Project Scope
   a. E. Casares reviewed the project scope for the WWTP Master Plan.
   b. R. Orgill reviewed the project scope for the Collection System Master Plan.

5. Discuss Planned Developments
   a. O. Hurtado described the planned developments in the City. These include:
      1) Creek Bridge (60 to 70-percent build-out currently)
      2) Mills Ranch (first phase currently constructed)
      3) Downtown Addition (640 units, will be constructed within 10 to 15 years)

4) Commercial area near Highway 101
5) Industrial area growth related to medical marijuana dispensaries
6) Smith Monterey Winery currently only discharges wastewater associated with domestic uses. They are considering discharging industrial waste to the City's collection system.

b. The City is interested in understanding the available capacity of the line downstream of the proposed Lone Oak extension (which would be an 8-inch diameter line) that would serve a few customers outside of the City limits.
c. The City wants to consider flows from Little Bear CSD in the master planning effort from both the existing Pine Canyon development (current flows and build-out) and future "Lot 71" development.

6. Identify Recent/Planned Sewer Improvements, and Review Existing Collection System Map
   a. O. Hurtado identified the locations of new sewer mains that have been recently constructed or are currently in construction. The largest is the new King City Trunk Main Project, which extends from the WWTP to the intersection of Lone Oak/First. There is a new lift station associated with this project.
   b. The City recently replaced some additional 6-inch pipelines in the downtown area with new 12-inch diameter mains.
   c. The City will provide record drawings for all recently constructed facilities, and improvement plans for planned/recently development areas ***(Action Item)***.
   d. There is a dedicated industrial line from an existing industrial customer (i.e., cogeneration plant) that discharges directly into the WWTP. There is a flow meter installed on this line, with a discharge rate of approximately 350,000 gpd. Currently, distilled water from a cooling tower is being discharged into the line. In the future, however, the flow rate and quality of the discharge into the line may change.

7. Review Data Collection Needs
   a. R. Orgill/E. Casares reviewed the initial data collection list. The following items were noted:
      1) The City does not have access to the SewerCAD model from the 2007 Wastewater Master Plan.
      2) The City is being flown and will be receiving detailed topographic data soon. This information will be provided to Carollo when it is available ***(Action Item)***.
      3) The City may not have a shapefile for vacant parcels, but a hard copy map may be available. O. Hurtado will look into this further ***(Action Item)***.
      4) Carollo will coordinate directly with Cal Water to obtain historical metered consumption data, and the 2015 Urban Water Management Plan ***(Action Item)***.
      5) S. Morales stated that there is a flow meter on the industrial pipeline.
      6) S. Morales noted that the City's collection system is very tight in regards to infiltration and inflow (I/I), and that the population in the City varies seasonally related to farming operations. Peak flows are typically observed at the plant between May through July. The City will provide a traffic study that includes information related to the seasonal population of the City ***(Action Item)***.
      7) Carollo will review the City's historical daily flow data, as well as historical rainfall, to determine which days would be appropriate to obtain hourly flow data for (circle charts) ***(Action Item)***. The hourly flow data will help Carollo determine if I/I is a significant issue for the City, and will help Carollo to schedule the flow monitoring program.

8) It was noted that many of the parcels in the City have a higher density of units than depicted in the City's zoning designations.
9) The City does not have SCADA information for its lift stations.
10) The only CCTV inspection that has been performed by the City is for newly constructed sewer pipelines.
11) There is a geotechnical report available for the City's recent solar panel project at the WWTP.
12) The City will work on providing Carollo with the requested data ***(Action Item).***
13) The City will provide existing and future, build-out flows for the existing Little Bear CSD and Lot 71/land company.

8. Hydraulic Modeling Software Selection
   a. The City has not maintained a SewerCAD license, and does not have a preference on which software platform will be used for the Collection System Master Plan.
   b. It was agreed that Carollo would develop a Hydraulic Model Software Evaluation Technical Memorandum ***(Action Item).***

9. Upcoming Deliverables
   a. Carollo will provide a Project Work Plan for the WWTP and Collection System Master Plan projects ***(Action Item).***

City Action Items

1. Provide record drawings for all recently constructed facilities, and improvement plans for planned/recently development areas

2. Provide detailed topographic data to Carollo when it is available

3. Provide traffic study that includes information related to the seasonal population of the City

4. Provide available data included in the data collection table

Carollo Action Items

1. Coordinate with Cal Water to obtain historical metered consumption data, and the 2015 Urban Water Management Plan

2. Coordinate with Little Bear CSD to obtain current and future, anticipated flows associated with the Pine Canyon development and other planned developments

3. Review the City's historical daily flow data (when it is provided by the City), as well as historical rainfall, to determine which days would be appropriate to obtain hourly flow data for (circle charts). This data will be formally requested by Carollo.

4. Develop a Hydraulic Model Software Evaluation Technical Memorandum

5. Provide a Project Work Plan for the WWTP and Collection System Master Plan projects

Prepared By:

Eric Casares

Ryan Orgill

RFO:rfo

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CONFERENCE MEMORANDUM

Project:	Wastewater Facilities Plan and Collection System Master Plan	**Conf. Date:**	February 2, 2017
Client:	King City, CA	**Issue Date:**	February 21, 2017
Location:	City Hall, 212 S. Vanderhurst Ave., King City		
Attendees:	City: Octavio Hurtado Sal Morales	Carollo: Eric Casares Ryan Orgill Elaine Simmons Tyler Grossheim	
Purpose:	Wastewater Collection System Master Plan and Facilities Plan: Progress Meeting No. 1		
Distribution:	Attendees, Danielle Bertini	**File:**	10406A.00

Discussion:
The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

1. Discussion Items
   A. Collection System Master Plan
      1) Carollo used the City's GIS database, record drawings, and field observations to confirm sewer information for constructing the hydraulic model in InfoSWMM (Innovyze).
      2) Blue wastewater flow was determined to be from A&G Pumping – a portable sanitation and septic service provider – draining into the sewers.
      3) Large Inflow/Infiltration peaks in meters 1, 7, and 8 may be due to septic or agricultural washdown activities from A&G Pumping, Rava Ranches, and/or LA Hearn.
      4) City wants to know capacity of sewer from Collegeville (farm labor camp) for future development planning purposes.
      5) City confirmed that cannabis is still planned as an agricultural crop.
   B. Facilities Plan
      1) Wastewater Treatment Plant (WWTP) influent flow in January 2017 due to wet weather was approximately 2.2 mgd.
      2) Facilities Plan covers a 20-year planning horizon which includes only approved developments (infill and annexations, not future annexations).
      3) The Facilities Plan will increase the rated capacity of the plant from 1.2 mgd to 2.0 mgd.

4) Previous master plans estimated future flow projections based on population growth. Carollo is currently estimating future flow projections based on land use, not population growth.
5) Carollo recommends the City perform an influent sampling plan to develop a baseline for typical influent wastewater constituents and recycled water constituents. Influent wastewater constituent data will be used for process sizing. Influent recycled water constituent data will be used for both process sizing and for determination of potential recycled water uses.
    a) The 2-week initial sampling plan should include weekends.
    b) Weekends are peak flows according to the City.
    c) Seasonal agricultural population comes back into the City around April 1st.
    d) Carollo also recommends quarterly sampling continuing through preliminary design.
    e) Currently, Sal collects samples and Monterey Bay Analytical Services (MBAS) picks up and analyzes the samples. The City would prefer MBAS both collect and analyze samples for the influent sampling plan.
6) Sal confirmed that the Parshall flume at the headworks does not have a flow signal.
7) The City already sold vacant parcel to the north-east of the plant. City would like to sell the entire vacant parcel to the east of the plant as well, pending siting requirements for the future facility. The eastern parcel is currently leased to a farmer for growing edible crops.
8) Sal and Octavio estimate there is approximately 4 feet of freeboard at ponds 1A and 1B and approximately 3 feet of sludge accumulated within the ponds (since the 2010 improvement project).
9) City indicated that odor issues/complaints are a major concern for the existing facultative ponds, especially during pond turnover, and that aerators are turned on to address odors. Ponds' stratification can turn over within a day depending on the wind conditions and ambient temperature.
10) Odors are also a high priority concern for the future facility, as odors travel to neighboring residential areas due to strong winds.
11) In the past, the screens from the ponds to the sprayfields needed to be cleaned due to algae build-up. Currently, the screens have not had to be cleaned due to little to no algae build-up. Sal is not sure what caused this change.
12) Sal coordinates with nearby farmers of edible crops to determine which sprayfields are appropriate to use during farming season. When Title 22 unrestricted recycled water is produced, the water will be safe for all crops. Irrigation disposal on City property and/or adjacent properties should be considered.
13) Sal mentioned that clogging of sprayfields is an issue.
14) City mentioned that flood control levees at WWTP are not certified. In the past (c. 1995), ponds 3, 4, 5, and 6 were washed out due to flooding of the Salinas River.
15) Off-site disposal options include Synagro, North American Digester Cleaning Services, Wastewater Solids Management, Co., Engel & Grey, Inc., Liberty Composting, and McCarthy Farming.
16) Carollo gave an update on discussions with Cal Water. Cal Water is interested in pursuing an initial feasibility study for recycled water as part of their current contract

with Carollo, and is negotiating the scope of work. Cal Water is aware of the City's timing on the facility plan.

2. Decisions
   A. More farm labor housing will be constructed at Lone Oak. City stated Lone Oak will consist of >500 apartments. Carollo estimated that the 10% contingency for projected Average Annual Flow accounts for approximately 900 homes, and is assumed to include Lone Oak.
   B. Carollo assumed a 10-year, 24-hour design storm for the collection system planning and the City is in agreement with this assumption. This is typical of other agencies throughout California.
   C. City agreed to not incorporate flow from the industrial WDR (only from the CAG 45 industrial facility) in the facilities plan or design. Carollo will continue to only plan for flows regulated by the domestic WDR.
   D. Carollo will use an influent WWTP BOD concentration of 313 mg/L and an influent WWTP TSS concentration of 266 mg/L for planning and sizing purposes, which are conservative values based on 1990 Facility Expansion project (as cited in the 2007 Master Plan). These values will be confirmed with results from the recommended influent sampling program and updated accordingly.
   E. City confirmed all 7 facultative ponds are clay lined and that the soils beneath are sandy.
   F. Sal confirmed that during the 2000 Ponds 1A and 1B upgrade project, both ponds were offline for a year with no impact to the facility performance. As construction sequencing decisions are made, may want to confirm with Regional Board how long the ponds can be kept out of service.

3. Action items
   A. Carollo will determine the storm recurrence interval corresponding to the Jan 2017 storms using the influent WWTP circle chart data provided by the City.
   B. City will confirm whether they have sewer design minimum slope standards that Carollo should use.
   C. Octavio will forward Contractor’s Record Drawings of the crosstown sewer (intersection of Broadway Circle and Broadway Street) to Carollo by February 17, 2017 in order to confirm inverts and flow directions for hydraulic model calibration.
   D. City stated that collection system pumps in the southeast quadrant of the City were recently replaced. Sal will forward to Carollo the pumps’ rated capacities, pump sizes, and pump curves by February 17, 2017.
   E. City stated that on Jan 14, 2017 and/or Jan 15, 2017, flow on Villa Drive backed up and could not make it to the San Lorenzo Creek. Staff manually pumped the flow directly to the sewer with a 4-inch trash pump for approximately 3 to 4 hours. This can happen during large storm events. Sal will forward the trash pump capacity information to Carollo.
   F. City will provide Carollo with any geotechnical information of the plant site.
   G. City will provide Carollo with recent LAFCO topographical LIDAR data for incorporation into the hydraulic model.
   H. Carollo to provide City with a wall-sized copy of the collection system network indicating locations of City survey desired by February 15, 2017.

I. City will survey manhole dips and manhole cover elevations (to easiest datum) and forward to Carollo for incorporation into the hydraulic model by February 28, 2017

J. Carollo to update the land use designations of the southeast lot on the General Plan Land Use map (Slide 22) to “commercial” from “planned development (PD)” and north-east lots (Slide 24) to “business.”

K. Carollo to confirm the Grade operator certification needed for the future tertiary recycled water plant. According to CCR Title 23, Division 3, Chapter 26, a Class IV water recycling treatment plant producing tertiary effluent with design flow between 1.0 to 10.0 mgd may be operated by either a T4 -certified Water Treatment Plant Operator or a Grade 4 -certified Wastewater Treatment Plant Operator. A Class III water recycling treatment plant producing tertiary effluent with design flow less than 1.0 mgd may be operated by either a T3 -certified Water Treatment Plant Operator or a Grade 3 -certified Wastewater Treatment Plant Operator.

L. Carollo recommends that the City begin an influent sampling plan in April 2017 to coincide with the return of the seasonal agricultural population.

M. City would like to incorporate a septage receiving station with the new wastewater treatment plant facilities plan and design.

N. City should begin the EIR process at the conclusion of the facilities planning phase or start of preliminary design (June or July 2017). The EIR process could take a year or longer. Carollo recommends procuring an environmental consultant through an RFP/RFQ process with selection criteria to include approach to an EIR phasing process.

O. Eric will confirm whether a contract for a City Sewer Rate Analysis has been executed.

P. Carollo will arrange for site visits to nearby facilities such as: Pismo Beach (oxidation ditch), Hollister (MBR), Windsor (sludge lagoon).

Q. City will let Carollo know when to schedule an initial meeting with the Central Coast Regional Water Quality Control Board.

Prepared By:

Eric Casares

Attachment: Meeting Presentation Slides

Wastewater Collection System Master Plan and Facilities Plan - Progress Meeting #1

King City
February 2, 2017

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Agenda

Introductions
Collection System Master Plan
- Hydraulic Model Development
- Temporary Flow Monitoring
- Planning Parameters (Land Use)
- Evaluation Criteria
- Next Steps

Facilities Plan
- Goals and Objectives
- Historical and Projected Flows
- Loads Assumptions
- Recommended Influent Sampling Plan
- Treatment Plant Process Overview
- Overview of Alternatives Analysis
- Preliminary Sizing and Layouts
- Project Schedule
- Action Items and Next Steps

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Wastewater Collection System Update

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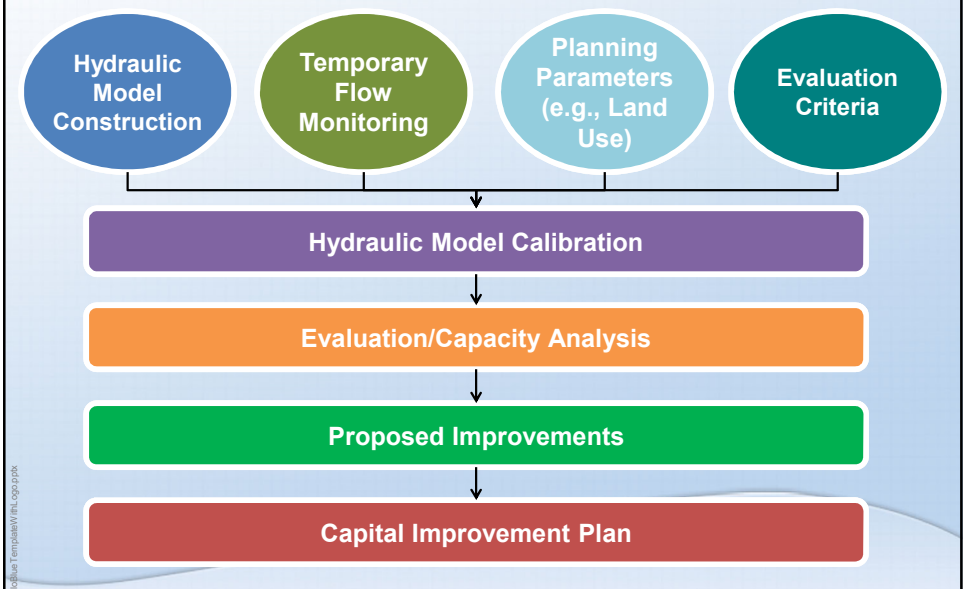
Collection System Planning Approach



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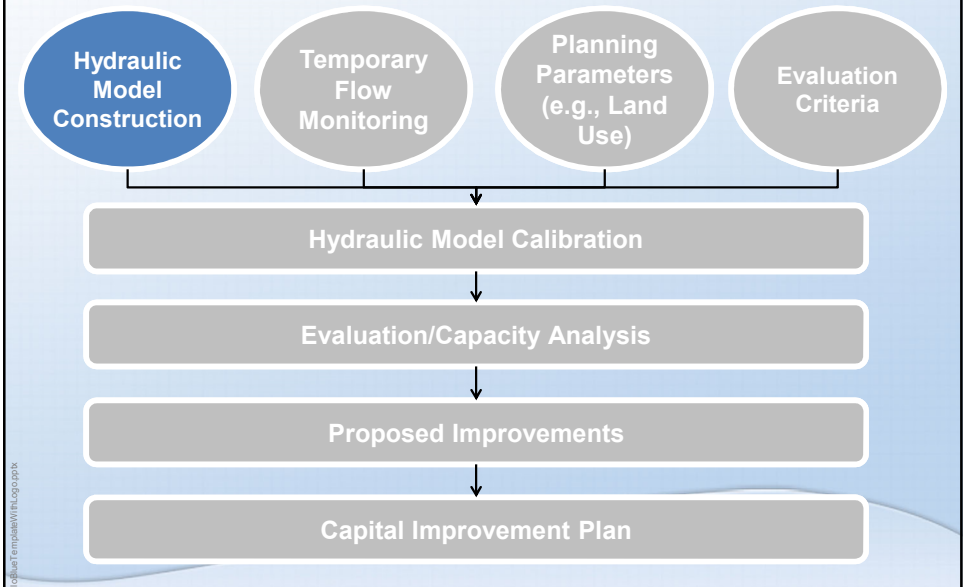
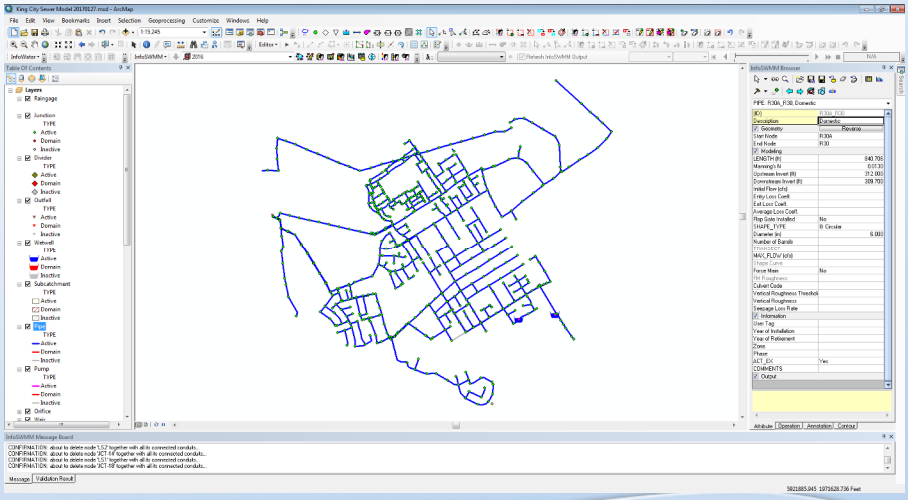


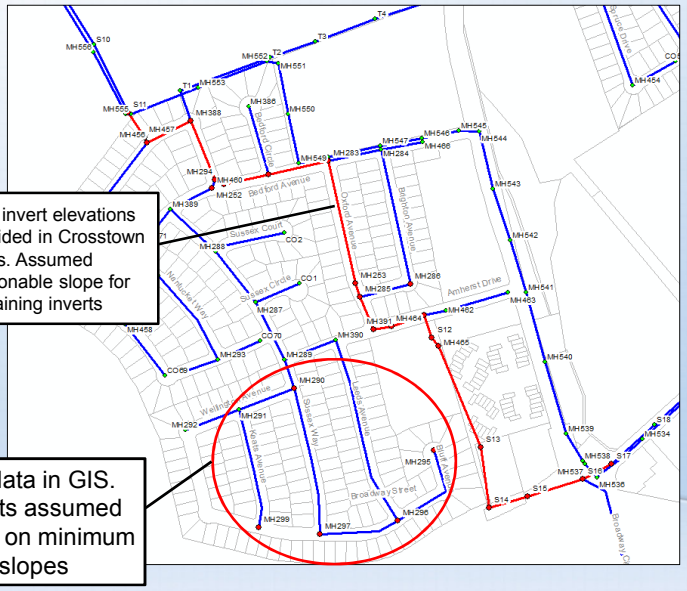
Hydraulic Model Construction

- InfoSWMM (Innovyze)
- Built from City's GIS database
- Record drawings for new developments and Crosstown pipeline
- Modeled Facilities
  - 33 miles of pipeline
  - Diameters ranging from 6 to 27 inches in diameter
  - 4 lift stations

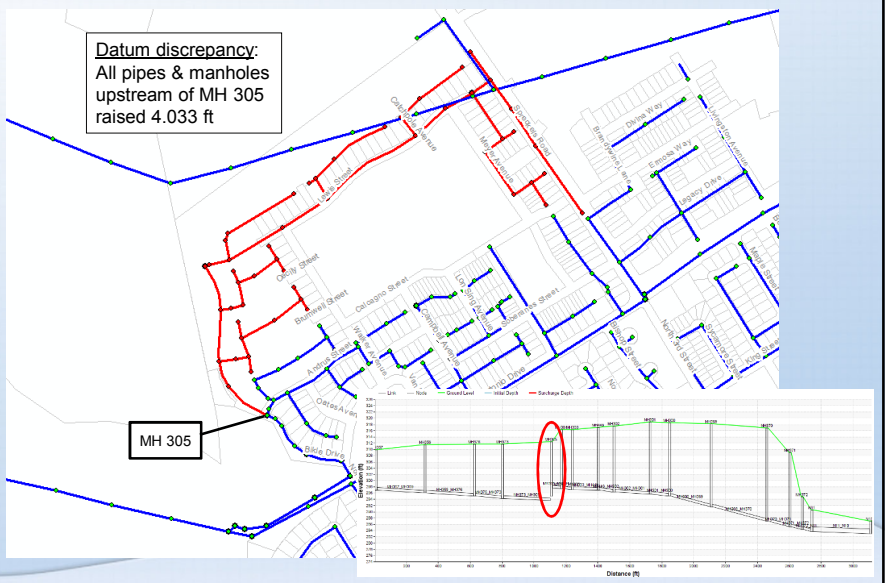
Hydraulic Model



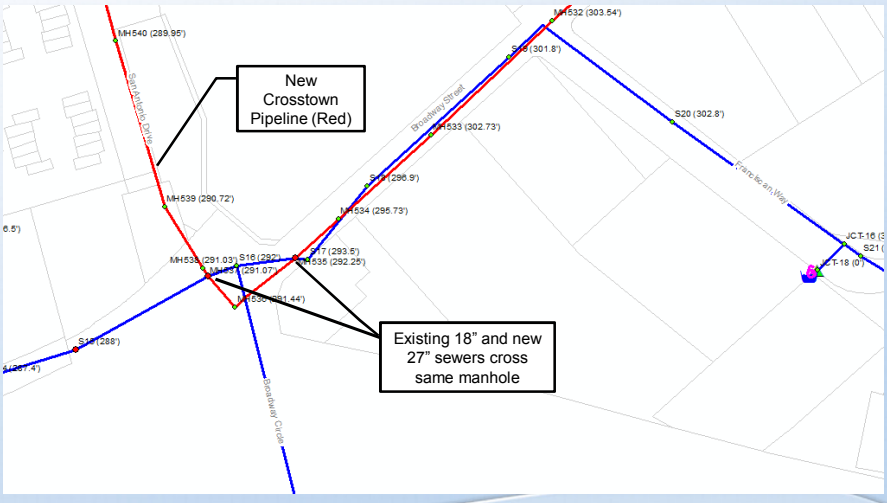
Discrepancies/Unknown Elevations



Discrepancies



Confirm Inverts/Flow Direction



Locations to Measure Dips

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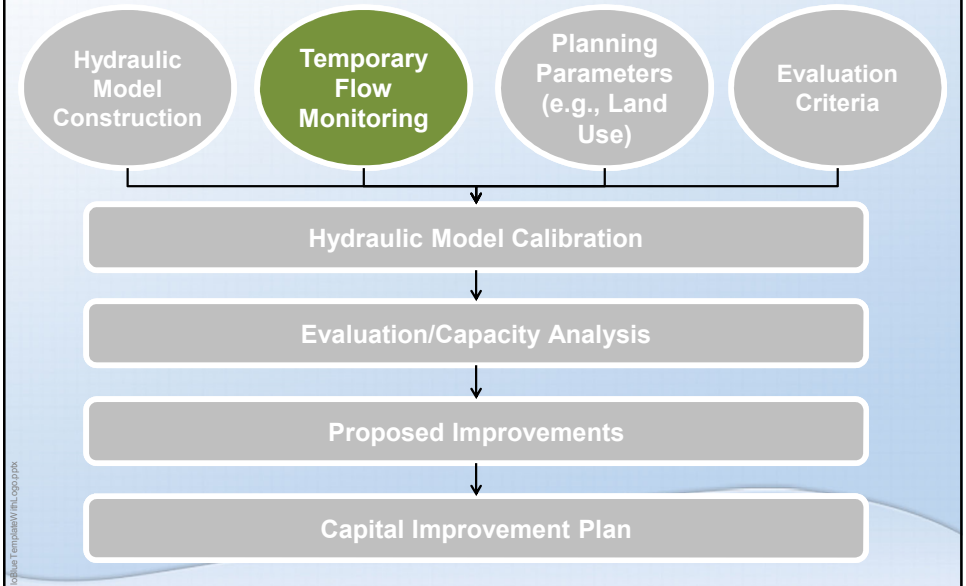
Collection System Planning Approach



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Temporary Flow Monitoring Program

- Nov 14 – Dec 29
- 10 flowmeters placed
- Circle charts needed

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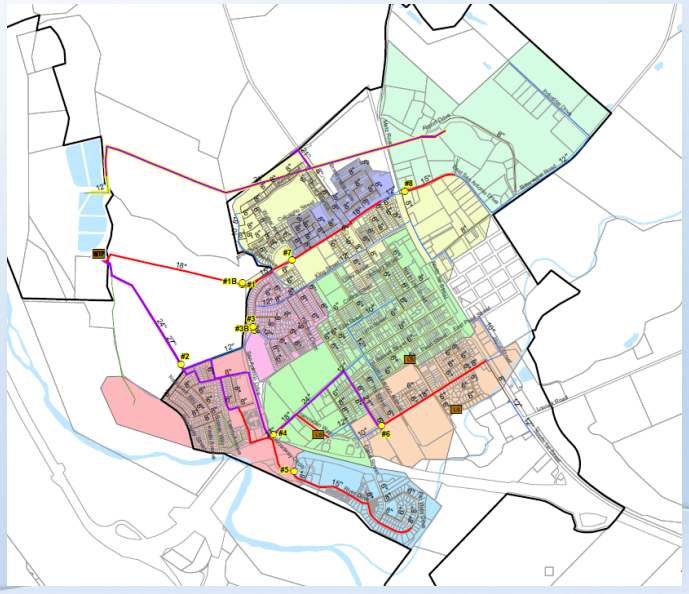
Temporary Flow Monitoring Locations



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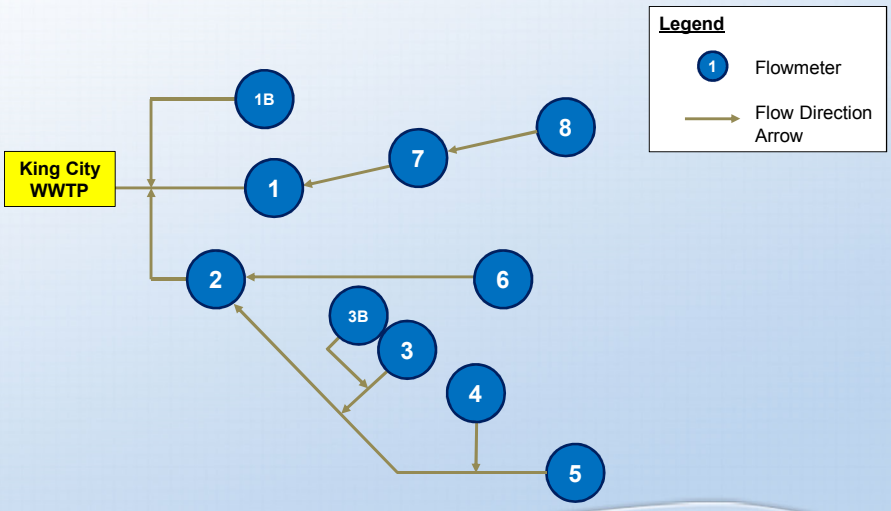
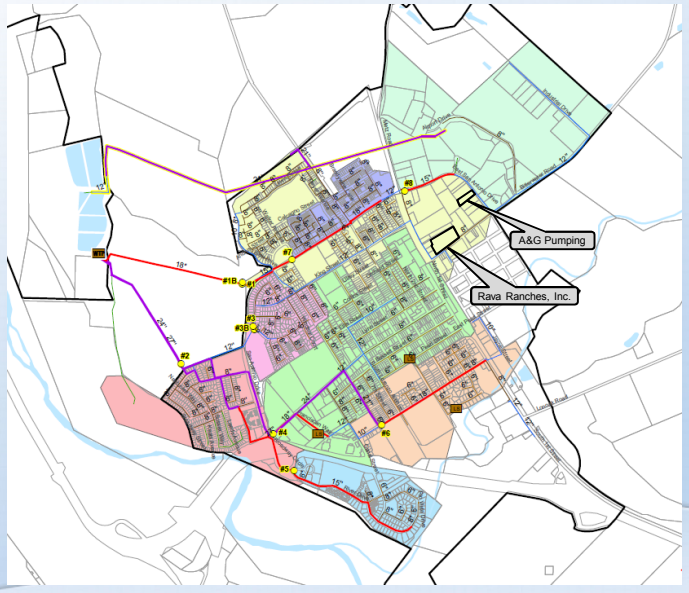
Flow Monitoring Locations Schematic



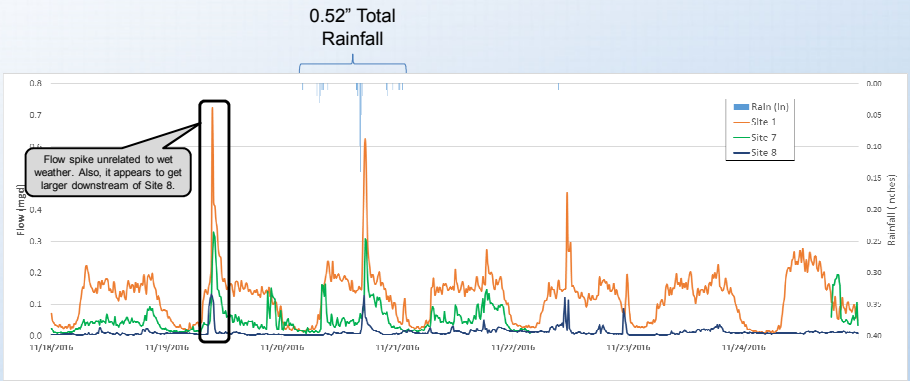
Flow Monitoring Observations

- Large inflow peaks in flow at Meters 1, 7, and 8
  - Additional flow spikes not related to wet weather (industrial discharges)
- Minimal I/I response at the remaining flow meters
- Blue wastewater flow noted at Meter 8

Temporary Flow Monitoring Locations



Flow Monitoring – Sites 1, 7, and 8



Temporary Flow Monitoring Program Data Summary

Site Name	Diameter (in)	ADWF (mgd)	Peak Flow (mgd)	Peaking Factor
Site 1	18	0.117	0.225	1.92
Site 1b	10	0.018	0.038	2.11
Site 2	27	0.571	0.966	1.69
Site 3a	12	0.062	0.111	1.79
Site 3b	12	0.041	0.081	1.98
Site 4	18	0.076	0.161	2.12
Site 5	15	0.107	0.208	1.94
Site 6	18	0.095	0.194	2.04
Site 7	18	0.055	0.153	2.78
Site 8	15	0.008	0.033	4.13

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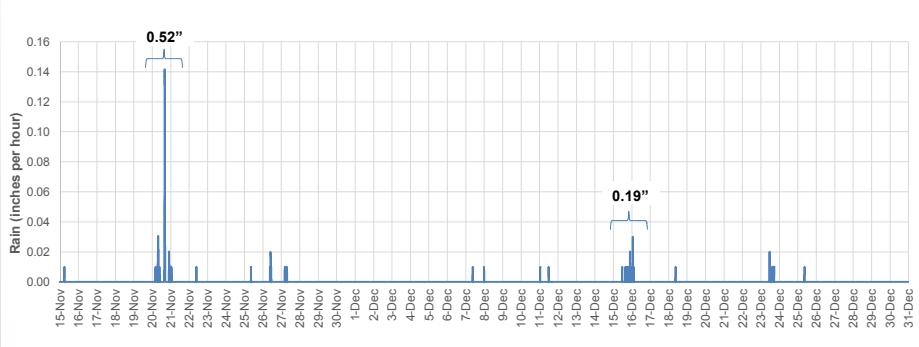
Summary of Rainfall Events

- Largest 24-hour rainfall = 0.49” (Nov 20, 2016)



- Large Historical Storm
  - November 18, 2010 = 1.56” Rainfall

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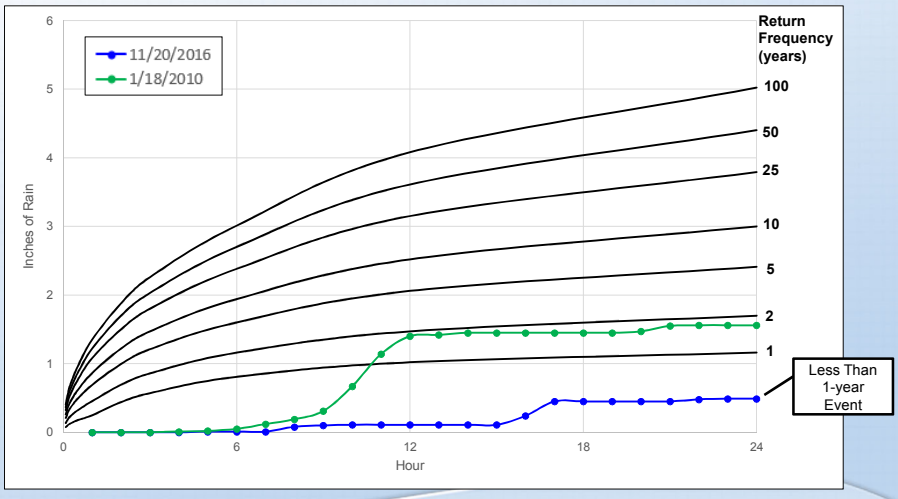
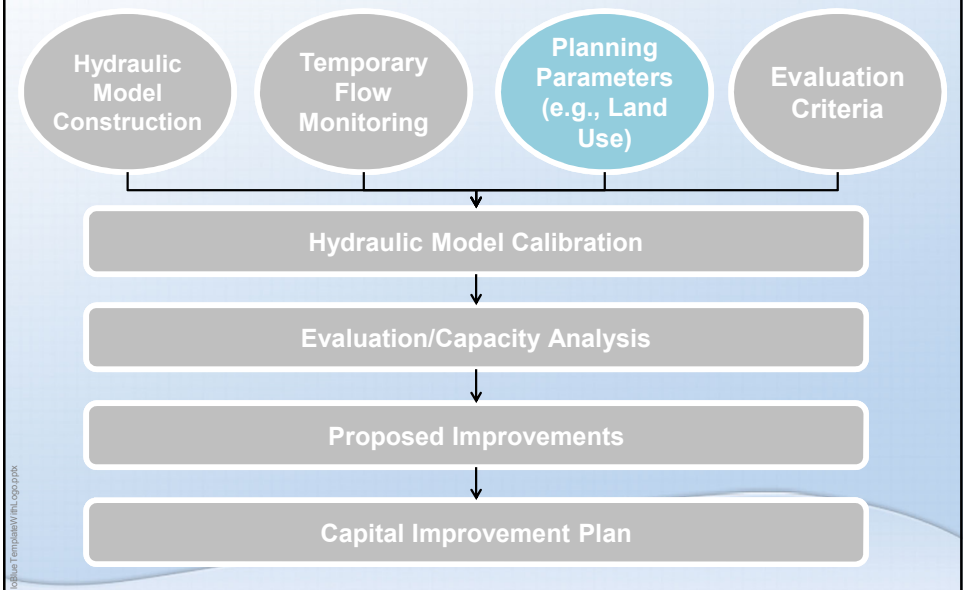
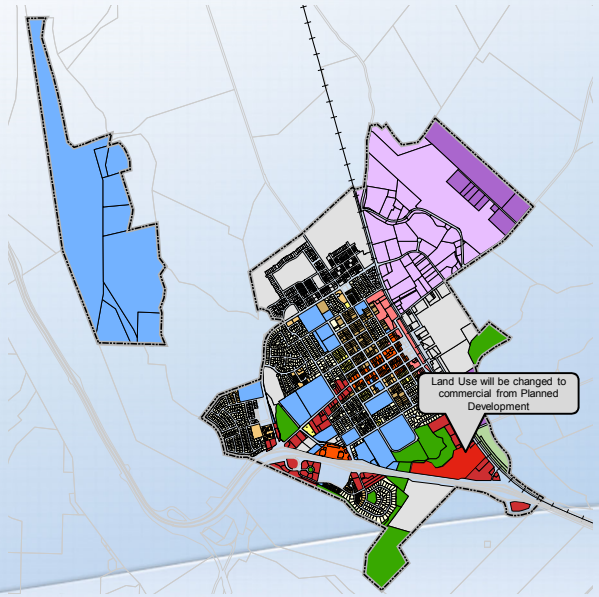
Classification of Rainfall Events



Collection System Planning Approach



General Plan Land Use



Land-Use Classification

- LDR
- MDR
- MDR/MHP
- MHP
- MHDR
- HDR
- PD
- AG
- OS
- CN
- GC
- RC
- RC/T
- HSC
- PQ
- LI
- GI

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Flow Projection Methodology

Land Use Based Flow Projections

Existing Flow	+	New Development	+	Industrial	+	Infill
• Flow factors • LU analysis • Developed vs. Vacant • Flow monitoring data		• LU Acreage adjustments • Number of units		• LU Acreage adjustments • Wastewater generation		• Vacant land within current service area • Build-out Land use

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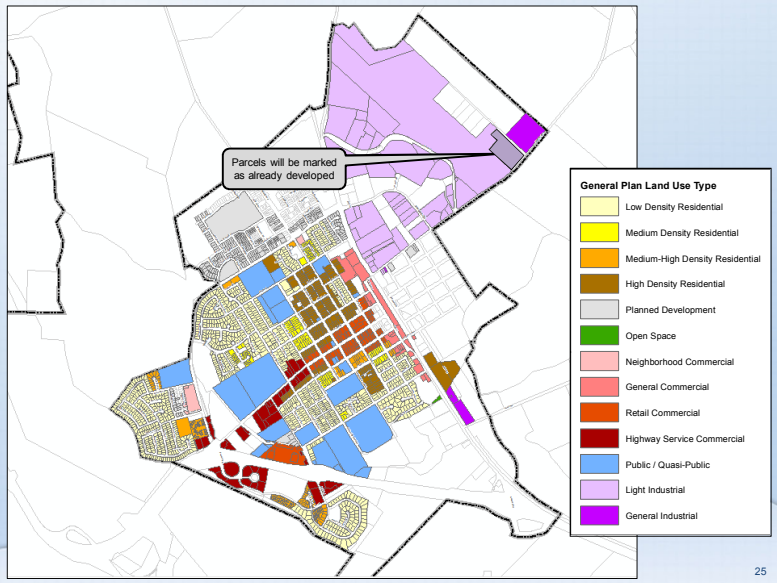
Developed Parcels (Land Use Type)



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Existing Wastewater Flow Factors

- Developed parcels and water consumption data grouped by land use type
- Flow factors calculated based on wastewater produced per acre (for each land use type)
- Flow factors adjusted until wastewater flow matched historical

Land Use Type	Acres	Wastewater Flow Factor (gpd/acre)	Wastewater Flow (gpd)
Single Family	327	1,200	392,700
Multi-Family	59	2,000	117,100
Commercial	103	750	77,600
Industrial	342	550(1)	188,000
Institutional/ Governmental	144	600	86,600
Total	**975**	**-**	**862,000**

Notes:
1. Flow factor of 1,000 gpd/acre used for projecting wastewater flow for vacant industrial land.

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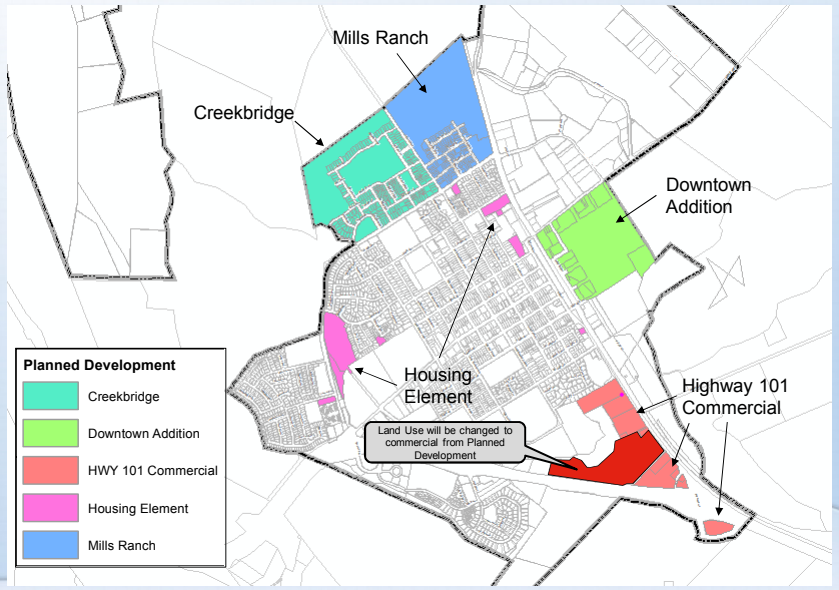
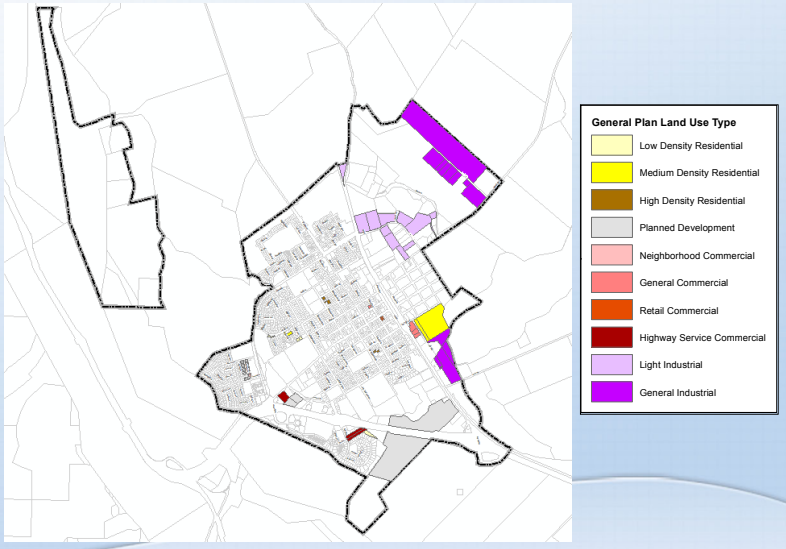
Planned Developments



Vacant Infill (Land Use Type)



Wastewater Flow Projections

Component	AAF (mgd)		
	Phase 1	Phase 2	Phase 3
Existing	0.86		
Planned Developments(1)	0.18	0.40	1.86
Vacant Infill (Including Industrial)	0.14	0.29	0.29
Total	**1.18**	**1.56**	**3.01**

Notes:
1. Includes Housing Element, Creekbridge, Mills Ranch, Downtown Addition, Highway 101 Commercial, Silva, Smith-Monterey, San Bernabe, and Little Bear CSD.

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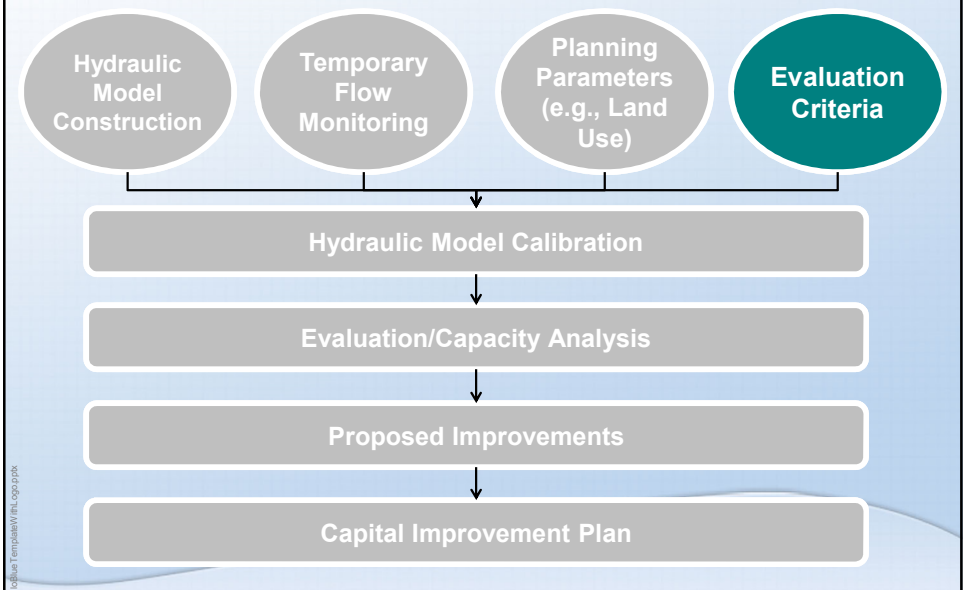
Collection System Planning Approach



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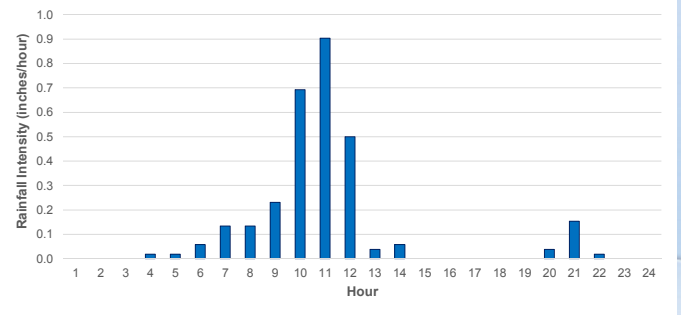
Design Storm

- 10-year, 24-hour design storm
  - 3 inches in 24 hours
- Distribution based on historical event (1/18/2010)



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Evaluation Criteria

- Max HGL criteria will determine the risk and capital costs for the City
- Max d/D Criteria :

Existing Sewers	
Scenario	**Max d/D**
ADWF	0.75
PWWF	0.9
New Sewers	
Pipe Diameter (Inches)	**Max d/D (during PWWF)**
Less than 12	0.50
12 to 18	0.67
Larger than 18	0.75

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Previous Master Plan Evaluation Criteria

- Gravity Mains

Table 5.1 – Collection System Design Criteria

Pipe Diameter	Maximum d/D	Minimum Pipe Velocity	Maximum Pipe Velocity
10-in and less	0.60	2 fps	10 fps
Greater than 10-in	0.75	2 fps	10 fps

- Force Mains
  - Velocity between 2-6 ft/s
- Lift Stations
  - Pump capacity during PHF with one out of service

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Evaluation Criteria

- Headloss:
  - Gravity Pipes: Manning's n = 0.013
  - Pressure Pipes: Hazen William's C = 120
- Minimum Slopes:

Minimum Slopes for New Sewers

Pipe Size (inches)	Minimum Slope[1] (ft/ft)	Calculated Flow at Maximum d/D	
		d/D	Maximum Flow (mgd)
8	0.0033	0.50	0.226
10	0.0025	0.50	0.353
12	0.0019	0.67	0.796
15	0.0014	0.67	1.243
18	0.0011	0.67	1.791
21	0.0009	0.75	2.835
24	0.0008	0.75	3.703
27	0.0007	0.75	4.687
30	0.0006	0.75	5.786

Notes:
1. Recommended minimum slope for flows at a velocity greater than or equal to 2 feet/second. Manning's n =0.013

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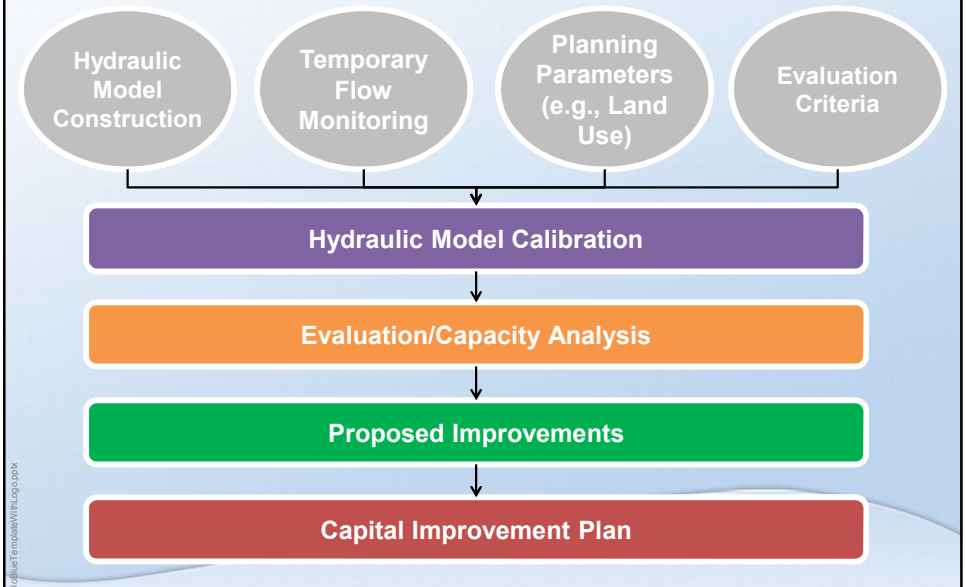
Next Steps



Wastewater Treatment Facility Plan

Facility Plan Goals and Objectives

- Update King City's Wastewater Facilities Plan for a new tertiary treatment facility producing unrestricted reuse quality effluent meeting Title 22 requirements
- Deliverables include 4 TMs:
  - Current and Future Regulatory Requirements ☆
  - Flows and Load Evaluation ☆
  - Effluent Reuse and Disposal
  - Treatment Alternatives Analysis

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Historical and Projected Flows

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Definitions

- Average Daily Flow (ADF)
  - Average flow during 1-day period
- Average Annual Flow (AAF)
  - Average of ADFs during a calendar year
- Average Day Maximum Month Flow (ADMMF)
  - Largest flow anticipated over a calendar month
- Peak Hour Flow (PHF)
  - Largest flow anticipated over a 1-hour period

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WWTP Permit Influent Flows

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
1102-A Laurel Lane
San Luis Obispo, California 93401

ORDER No. 91-05

WASTE DISCHARGE REQUIREMENTS
FOR
CITY OF KING DOMESTIC WASTEWATER FACILITY
MONTEREY COUNTY

Domestic WDR:
ADMMF
1.2 mgd

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5414

ORDER NO. 91-84

WASTE DISCHARGE REQUIREMENTS
FOR
CITY OF KING INDUSTRIAL WASTEWATER FACILITY
MONTEREY COUNTY

Industrial WDR:
ADMMF
May 1 to Nov 30: 2.4 mgd
Dec 1 to Apr 30: 1.0 mgd

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Flow Basis of WWTP Sizing

Flow Parameter	Element
ADMMF, mgd	• Secondary Treatment Processes • Chemical Storage Facilities • Solids Handling Facilities
PHF, mgd	• Influent Pump Station • Headworks (bar screens and grit removal) • Secondary Clarifiers • Tertiary Filtration • Disinfection • Effluent Pump Station

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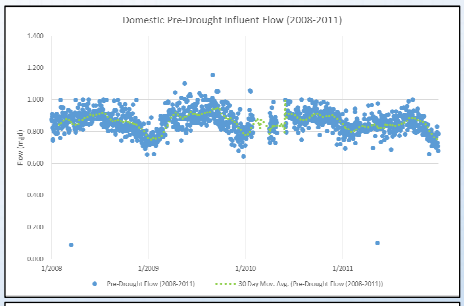
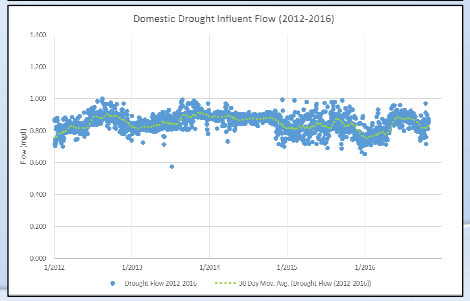
Historical Flow





- Pre-drought (2008-2011)
  - Annual peak occurs in dry weather months
  - Due to transient agricultural population?
- Drought (2012-2016)
  - Consistent flow throughout the years
  - Lower AAF than in pre-drought period, presumably due to conservation

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Historical Flow Analysis

Year	AAF, mgd	ADMMF, mgd	ADMMF/AAF, Peaking Factor
2008	0.861	0.944	1.10
2009	0.871	0.981	1.13
2010	0.877	0.950	1.08
2011	0.830	0.905	1.09
2012	0.848	0.915	1.08
2013	0.861	0.925	1.07
2014	0.871	0.908	1.04
2015	0.826	0.910	1.10
2016	0.828	0.901	1.09
Non-Drought Average (2008-2011)	0.860	0.945	1.10
Drought Average (2012-2016)	0.847	0.912	1.08

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Existing Wastewater Flow Factors

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Wastewater Flow Projections

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Total	**1.18**	**1.56**	**3.01**

Notes:
1. Includes Housing Element, Creekbridge, Mills Ranch, Downtown Addition, Highway 101 Commercial, Silva, Smith-Monterey, San Bernabe, and Little Bear CSD.

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Flow Projection by Growth Area

Growth Area	Dwelling Units, con	Flow Factor, gal/con-d	Aerial Analysis, acre	Generation Factor, gpd/acre	Anticipated Flow, mgd
Current AAF, mgd	-	-	-	-	0.86
In-Fill Development	396	190	120	1,170	0.21
Creek Bridge(1)	170	185	-	-	0.03
Mills Ranch	368	185	-	-	0.07
Downtown Addition	650	185	-	-	0.12
New Commercial	-	-	35.3	750	0.03
Undeveloped Industrial	-	-	155	1,000	0.16
Lone Oak	-	-	-	-	- (4)
Little Bear CSD, existing(2)	569	140	-	-	0.08
Proposed Annexations	Beyond 20-yr Planning Horizon				
Little Bear CSD, future/planned(3)	Beyond 20-yr Planning Horizon				
				Subtotal	1.56 mgd
				Contingency	10 %
				PROJECTED AAF	**1.72 mgd**

Notes:
(1) Includes Arboleda.
(2) Only existing flows from Pine Canyon and Royal Estates (including septic and will-serve) are included in this estimate.
(3) Future/planned flows from Pine Canyon, Royal Estates, Marisoli, and Lot 71 are beyond the 20-year planning horizon of this Facility Plan.
(4) Estimation for Lone Oak included in 10% contingency.

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Projected Design Flows

Flow Parameter	Current Flows, mgd	Design Peaking Factor (From AAF)	Anticipated 20-year Design Flows, mgd
AAF, mgd	0.86(1)	-	1.72(2)
ADMMF, mgd	0.98(3)	1.13(4)	2.00(5)
PHF, mgd	3.90(6)	4.53(7)	7.80(8)

Notes:
(1) From GIS land use analysis
(2) From Flow Projection Table. Includes 10% contingency
(3) Maximum historical ADMMF from 2008 to 2016, occurred in 2009
(4) Maximum peaking factor from 2008 to 2016, occurred in 2009
(5) Rounded up from 1.94 mgd
(6) Equivalent to a 10-yr, 24-hr storm for King City routed through a SCS Type 1 curve
(7) Current PHF divided by current AAF
(8) Rounded up from 7.79 mgd

Need to increase rated capacity from 1.2 mgd to 2.0 mgd.

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Comparison of Historical Flow Analyses

- 2017 Wastewater Treatment Facility Plan (by Carollo)
- 2010 Pond 1A and Pond 1B Improvements Project (by Carollo)
- 2007 Wastewater Master Plan - Draft (by Boyle)
- 2004 Wastewater Facilities Plan (by Carollo)

Source	ADF, mgd	ADMMF, mgd	AAF, mgd	PHF, mgd
2017 Carollo	-	0.98	0.86	3.9
2010 Carollo	1.2	-	-	3.0
2007 Boyle	-	0.93	0.86	2.6
2004 Carollo	-	0.88	0.82	-

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Comparison of Future Flow Analyses

- 2017 Wastewater Treatment Facility Plan (by Carollo)
- 2007 Wastewater Master Plan - Draft (by Boyle)
- 2004 Wastewater Facilities Plan (by Carollo)

Source	ADMMF, mgd	AAF, mgd	PHF, mgd
2017 Carollo	2.0	1.7	7.8
2007 Boyle	2.3(1)	2.1	6.4
2004 Carollo	-	2.6(2)	-

Notes:
(1) Based on an assumed growth rate of 3.81%
(2) Based on an assumed growth rate of 3.9%
(3) 2000-2010 growth rate was 1.5%; Carollo analysis based on land use not growth rate

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Loads Assumptions

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Plant Influent Loads Overview

- Influent loads
  - Biological Oxygen Demand 5-day test (BOD_5)
  - Total Suspended Solids (TSS)
  - Used for process sizing
- Plant influent sampling not required or routinely conducted
- Monthly monitoring reports (from WDR)
  - Require only effluent sampling
- Assumptions for influent loads will be made for current process sizing

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Comparison of Historical Load Analyses

- 2010 Pond 1A and Pond 1B Improvements Project (by Carollo)
- 2007 Wastewater Master Plan - Draft (by Boyle)
- 2004 Wastewater Facilities Plan (by Carollo)
- 1990 Facility Expansion Project (cited by Boyle)

Source	BOD, mg/L	TSS, mg/L
2010 Carollo	313	266
2007 Boyle	239	-
2004 Carollo	225	225
1990	313	266

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Recommended Influent Sampling Plan

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Recommended Influent Sampling Plan

- To establish baseline wastewater characteristics
- To refine initial assumptions and analysis
- Initial 2-week influent sampling plan
  - Samples collected by City or MBAS staff
  - Samples analyzed by MBAS
  - Continuous automatic sampler provided by MBAS (timer-based, single setpoint)
- Recommend periodic monitoring (e.g. quarterly) through preliminary design for data history
  - Consider time-weighted samplers programmed with a non-uniform, time-weighted frequency to simulate the approximate flow characteristics

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Influent Sampling Plan

Sample Parameter	Sample Type	Frequency
Influent Flow, mgd	Measured at time of sampling	7d/wk
pH	Measured at time of sampling	7d/wk
Temp, °F	Measured at time of sampling	7d/wk
COD, mg/L	24-hr composite	7d/wk
BOD_5, mg/L	24-hr composite	7d/wk
Total Solids, mg/L	24-hr composite	7d/wk
Volatile Solids, mg/L	24-hr composite	7d/wk
TKN, mg/L	24-hr composite	7d/wk
Total Phosphorus, mg/L	24-hr composite	7d/wk
Alkalinity, ppm $CaCO_3$	24-hr composite	7d/wk
Ammonia-N, mg/L	24-hr composite	7d/wk
Nitrate-N, mg/L	24-hr composite	7d/wk
Nitrate + Nitrite, mg/L	24-hr composite	7d/wk
TSS, mg/L	24-hr composite	7d/wk
VSS, mg/L	24-hr composite	7d/wk

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Influent Sampling Plan for Recycled Water

Sample Parameter	Sample Type	Frequency(1)
Sulfate, mg/L	24-hr composite	3x/wk
Sodium, mg/L	24-hr composite	3x/wk
Chloride, mg/L	24-hr composite	3x/wk
Boron, mg/L	24-hr composite	3x/wk
EC, µS/cm	24-hr composite	3x/wk
Calcium, mg/L	24-hr composite	3x/wk
Magnesium, mg/L	24-hr composite	3x/wk
Bicarbonate, mg/L	24-hr composite	3x/wk
SAR	Calculated	3x/wk

Note:
(1) Sampling recommended on alternate days including one weekend day.

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Recommended Influent Sampling Plan

Sample Parameter	Cost per Sample	No. of Samples	Total Cost Estimate
Field Measurements			
Influent Flow	$15	14	$210
pH	$15	14	$210
Temperature	-	14	-
		Field Measurements Subtotal	$420
		Routine Influent Wastewater Analysis Subtotal	$4,620
		Recycled Water Constituents Subtotal	$990
		Sampling Collection and Drive Time Fee(1) Subtotal	$4,480
		Total Cost (per 14 days)	$10,510

Note:
(1) Based on $80/h, 4 hours/day, for 14 days

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Treatment Plant Process Overview

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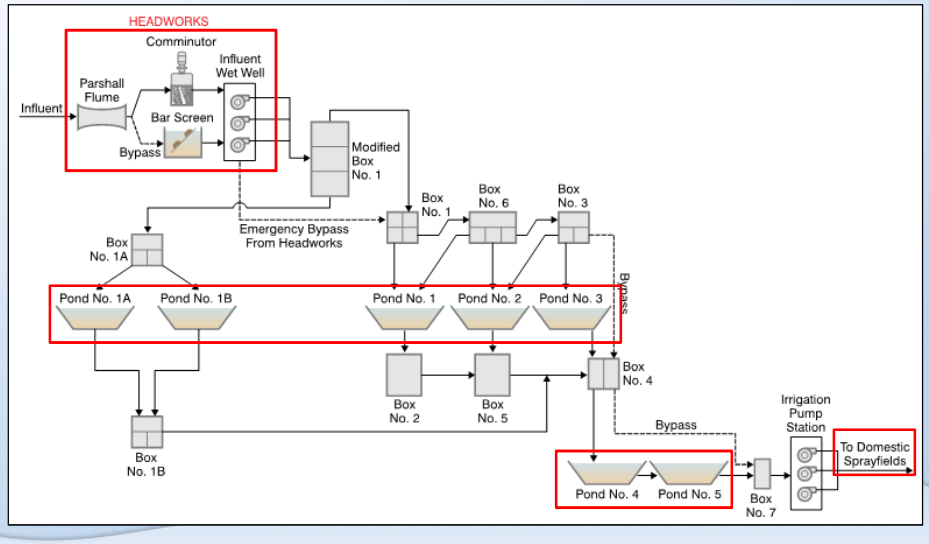
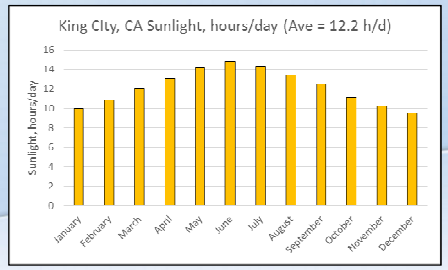
Existing Flow Schematic



Oxidation Ponds – Limitations of Existing Ponds

- Temperature and sunlight dependent
- Issues with wind
- Hard to nitrify in winter
- Solids accumulation affects treatment and hydraulic capacity
- Difficult to comply with increasingly restrictive limits. Algae issues? Nutrients?



Oxidation Ponds – Limitations of Existing Ponds (con't)

- Difficulty meeting current BOD and TSS limits
  - 24 BOD exceedances (2008-2016)
  - 40 TSS exceedances (2008-2016)

Parameter	Current Domestic WDR Limits	Probable Future Secondary Effluent Limits (2)	Probable Future Tertiary Effluent Limits (2)
BOD_5, mg/L	100	30	10
TSS, mg/L	100	30	10
Ammonia-N, mg/L	-	-	5
Nitrate-N, mg/L	8(1)	10	5

Note:
(1) Discharge shall not cause concentration in downgradient groundwater to exceed this value.
(2) From City of Soledad's RWQCB Master Reclamation Permit (2008).

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Oxidation Pond – Typical Wastewater Treatment Pond Design Criteria

Type	Depth, ft	Design Detention Time, d	Design Loading, ppd/ac	Actual Effluent BOD, mg/L	Actual Effluent TSS, mg/L
City Facultative Ponds 1, 2, 3	10	54 - 56	135	50 - 200(1)	70 - 100(1)
City Facultative Ponds 1A, 1B	10	63	135	50 - 200(1)	70 - 100(1)
Oxidation Pond(2)	3 - 4.5	10 - 40	35 - 125	20 - 40	80 - 140
Facultative Pond(2)	4.5 - 7.5	25 - 180(3)	20 - 60	30 - 40	40 - 100
Partial Mix Aerated Lagoon(1)	6 - 18	7 - 20	45 - 180	30 - 40	30 - 60

Note:
(1) Annual averages from 2008 through 2016 data.
(2) Natural System for Waste Management and Treatment, Reed et al.
(3) State of Wisconsin recommends loading of 20 ppd/ac, 150 day minimum detention time.

- Carollo recommends 25 ppd/ac for Northern California

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Treatment Plant Goals and Objectives

- Update King City's Wastewater Facilities Plan for a new tertiary treatment facility producing unrestricted reuse quality effluent meeting Title 22 requirements
- Depending on recycled water demands, consider storage requirements and/or continue sprayfield disposal
- Facility siting allows City to sell adjacent parcel
- Assume Industrial WDR requirements will not change

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Additional Parcels

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Recycled Water Analysis

- Conduct recycled water market analysis (with Cal Water)
  - Identify all irrigation users in Project Area
  - Analyze available consumption data for these users
  - Determine peak day and peak hour demands for sizing of tertiary treatment facility and distribution system

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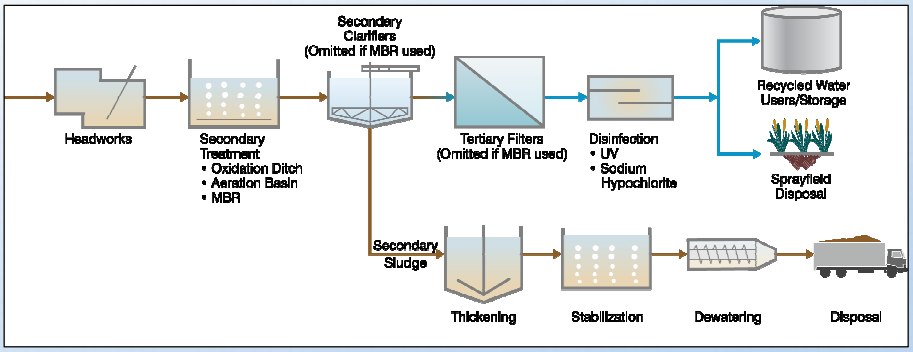
Typical Tertiary Treatment Plant Flow Schematic



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Treatment Options to Reach Title 22 Unrestricted Use Water Quality

Preliminary	Primary	Secondary	Filtration	Disinfection
Headworks	N/A	Oxidation Ditch	•Cloth Media •Granular Media •Membrane	•UV •NaOCl
	N/A	CAS w/ MLE	•Cloth Media •Granular Media •Membrane	•UV •NaOCl
	N/A	MBR	MBR	UV

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Headworks/Grit Removal

- Removes large inorganic material
  - Manual Bar Racks
  - Mechanical Bar Screens ★
  - Comminutors
- Removes small inorganic material
  - Vortex grit basins
- Protects and reduces wear on downstream equipment/processes

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Secondary Treatment: Stage 1

- Organics and nutrient removal through biological processes
- Design
  - Dissolved oxygen, MLSS, sludge generation or sloughing
- Equipment required
  - Aeration basins – blowers, diffusers/aerators, and process control
  - Trickling filters – pumps, ventilation, and odor control

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Secondary Treatment: Stage 2

- Removes TSS and some BOD through settling
  - Secondary clarifiers
  - Membrane filtration (specific to MBR)
- Equipment required
  - Return activated sludge (RAS) pumps
  - Waste activated sludge (WAS) pumps
  - Mixed liquor return (MLR) pumps

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Secondary Treatment Alternatives

- Suspended growth processes
  - Oxidation Ponds (Existing)
  - Oxidation Ditch
  - Conventional Activated Sludge (CAS) with Modified Ludzack-Ettinger (MLE) Process
- Fixed film processes
  - Trickling Filter (Nitrification/Denitrification)
- Membrane Bioreactor (MBR)

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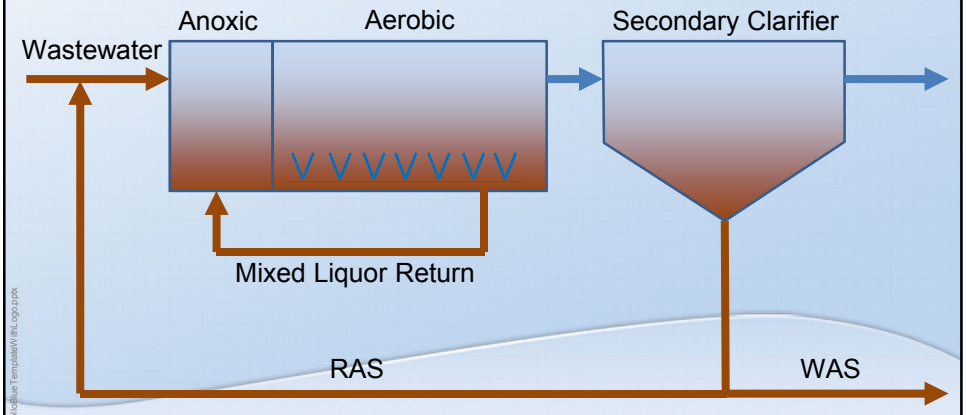
Suspended Growth

- Oxidation ditches
- CAS w/ MLE



*Anoxic = no dissolved oxygen

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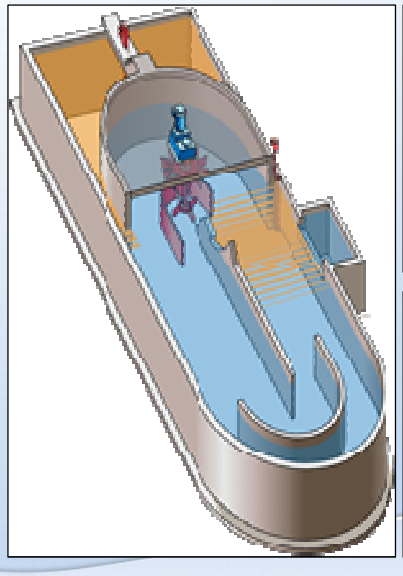
Oxidation Ditch



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Conventional Activated Sludge w/ MLE

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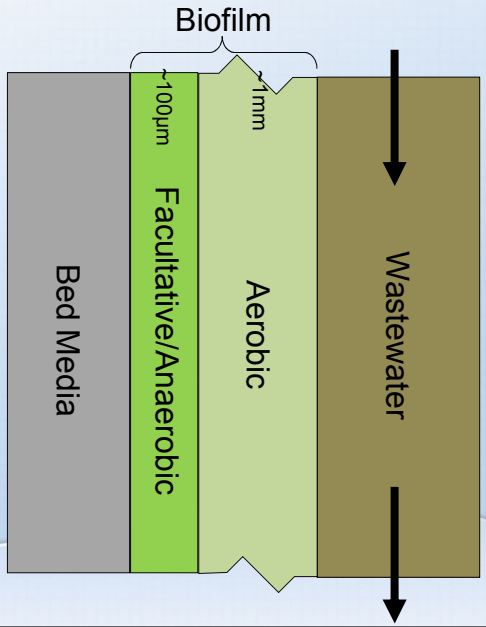
Fixed Film

- Trickling Filters
  - BOD removal
  - Nitrification
  - Denitrification
- Uses biofilm to remove BOD and nitrify/denitrify



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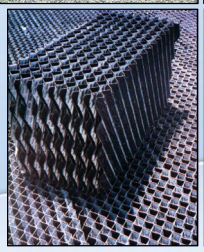
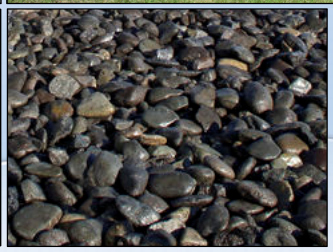
Trickling Filters





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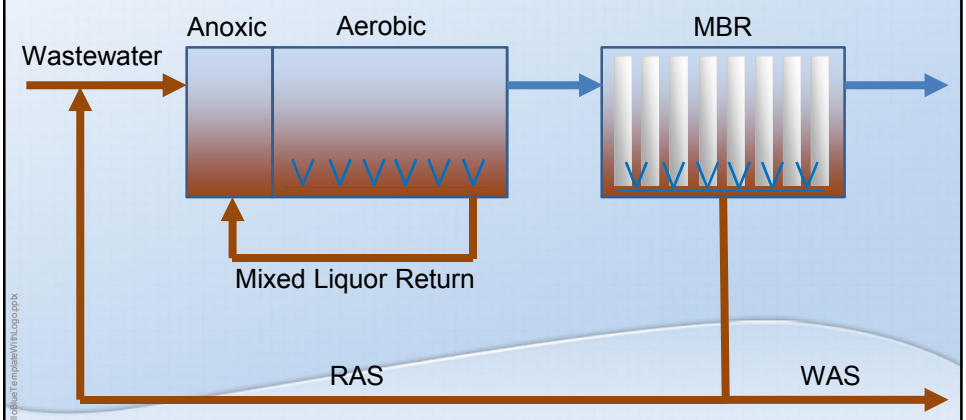
Membrane Bioreactor

- Membrane Bioreactor (MBR)



*Anoxic = no dissolved oxygen

Membrane Bioreactors

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Secondary Treatment Options Meeting Discharge Requirements

Process	Removal of…		
	Organics (BOD)	Ammonia	Total Nitrogen
Suspended Growth			
Oxidation Ditch	✓	✓	✓
CAS w/ MLE	✓	✓	✓
MBR	✓	✓	✓
Attached Growth			
Trickling Filters, BOD Only	✓		
Nitrifying Trickling Filters		✓	
Denitrifying Trickling Filters			✓
Land Based System			
Facultative Pond (Existing)	✓	Summer Only	

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Secondary Treatment Ranking Criteria

- Non-economic
  - Safety
  - Meets permit
  - Constructability
  - Reliability
  - Impact on GHG emissions
  - Odor
- Economic
  - Construction cost
  - Footprint
  - Operator attention
  - Power cost
  - Sludge production
  - Maintenance requirements

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Secondary Treatment Options Evaluation of Non-Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)		
	CAS w/ MLE	Oxidation Ditches	MBR
Safety	2	2	1
Meets Permit	3	3	3
Ease of O&M	2	3	1
Constructability	2	2	3
Reliability	3	3	3
Ammonia Removal	3	3	3
Odor	2	2	3
Total Score	**17**	**18**	**17**

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Secondary Treatment Options Evaluation of Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)		
	CAS w/ MLE	Oxidation Ditches	MBR
Construction Costs	2	1	2
Footprint	2	1	3
Operator Attention	2	3	1
Power Cost	1	3	2
Sludge Production	1	3	1
Maintenance Requirement	2	3	1
Total Score	**10**	**14**	**10**

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Preliminary Secondary Treatment Sizing and Layouts

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Design Criteria for Secondary Treatment Alternatives

Design Parameter	CAS w/ MLE	Oxidation Ditches	MBR
ADMMF, mgd	2.0	2.0	2.0
PHF, mgd	7.8	7.8	7.8
MLSS, mg/L	3,000	3,000	8,000
SRT, d	10	25	10
Clarifier Overflow Rate, gpd/sf	780	780	N/A

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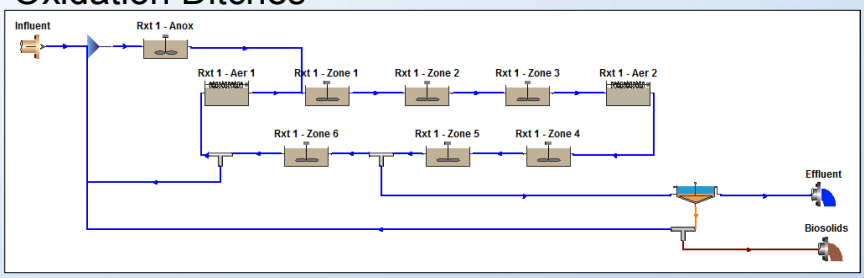
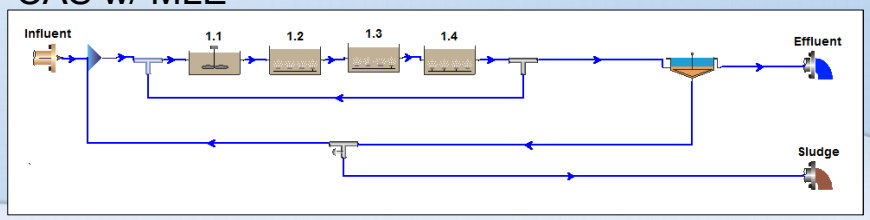
Steady-state simulation using flow and load data from 2010 Carollo report

Oxidation Ditches



CAS w/ MLE



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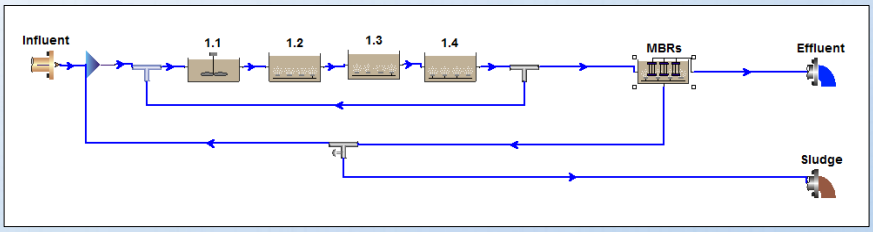
Steady-state simulation using flow and load data from 2010 Carollo report

MBR



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Existing Facilities

Domestic Spray Fields

Industrial Spray Fields

Pond 5

Pond 4

Pond 3

Pond 2

Pond 1

Pond 1B

Pond 1A

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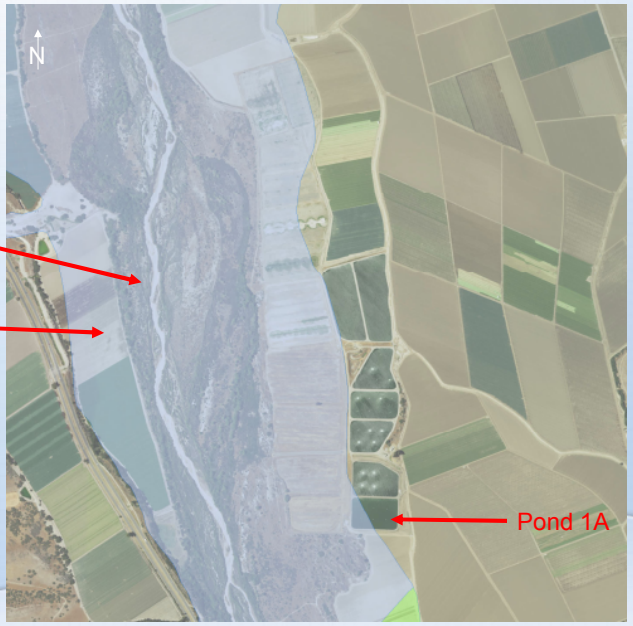
Flood Map



Salinas River

Zone A Flood Zone

Pond 1A

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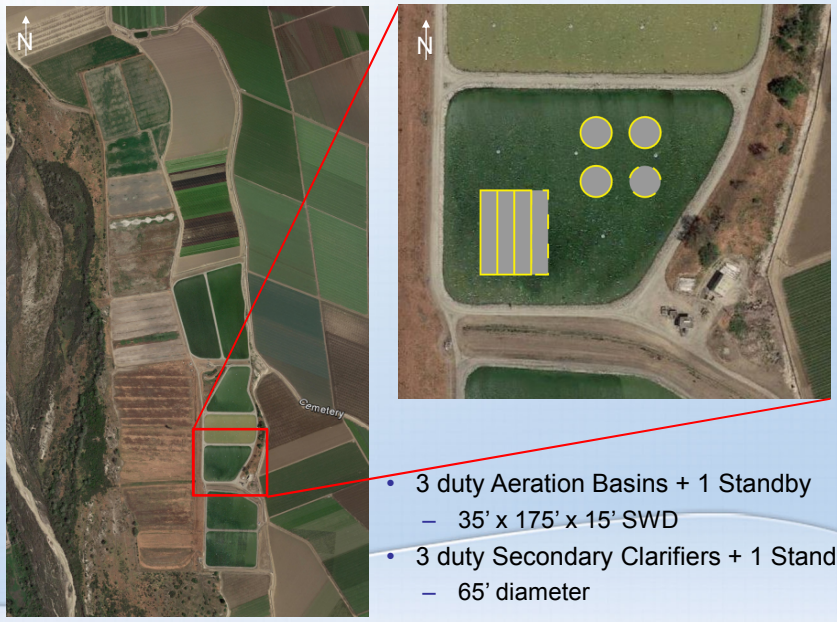
Preliminary Layout – CAS w/ MLE



- 3 duty Aeration Basins + 1 Standby
  - 35' x 175' x 15' SWD
- 3 duty Secondary Clarifiers + 1 Standby
  - 65' diameter

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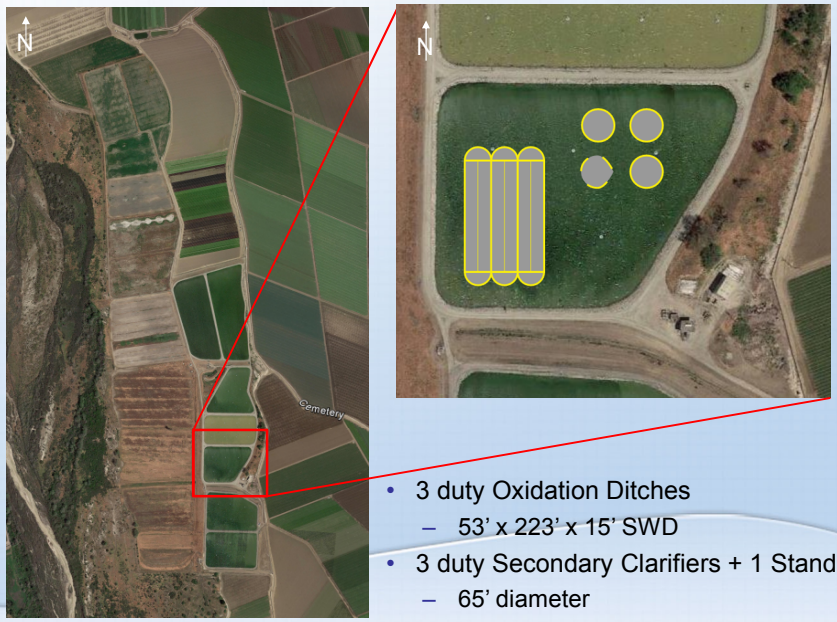
Preliminary Layout – Oxidation Ditches



- 3 duty Oxidation Ditches
  - 53' x 223' x 15' SWD
- 3 duty Secondary Clarifiers + 1 Standby
  - 65' diameter

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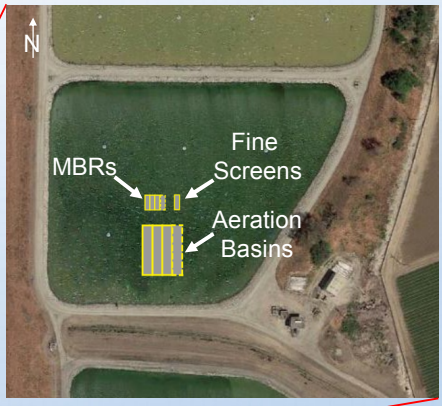
Proposed Layout – MBRs



- 3 duty Aeration Basins + 1 Standby
  - 20' x 100' x 15' SWD
- 3 duty MBRs + 1 Standby
  - 10' x 30' x 9.5' SWD

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Tertiary Processes

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Tertiary Processes

- Filtration
  - Removes very small particles including some disease-causing organisms
  - Required for proper disinfection
- Disinfection
  - Required to protect public and environmental health
  - Partial destruction/inactivation of disease-causing organisms

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Filtration

- Removal of small particles through physical processes
- Alternatives
  - Granular Media Filter
    - Continuous Backwash Filters
    - Dual Media Filters
  - Cloth Media Filter
  - Hollow-Fiber Membrane Filter

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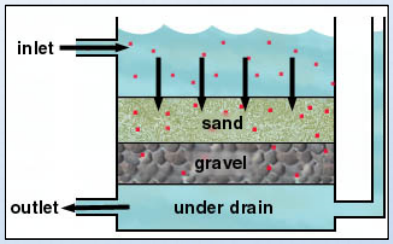
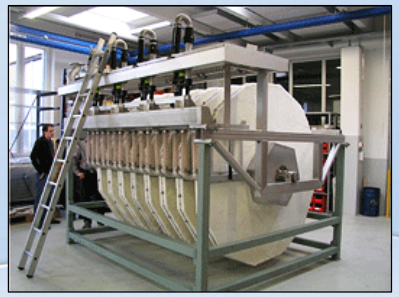
Filtration Alternatives





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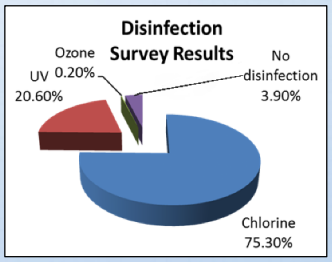
Disinfection Alternatives

- Sodium hypochlorite (Chlorine)
  - Chlorine contact time
  - DBP
  - Dechlorination required
- UV
  - Performance based on filter performance
  - Design parameters: UVT, Dose



Survey of Disinfection practices for 4,450 POTWs in the US was conducted (WERF)

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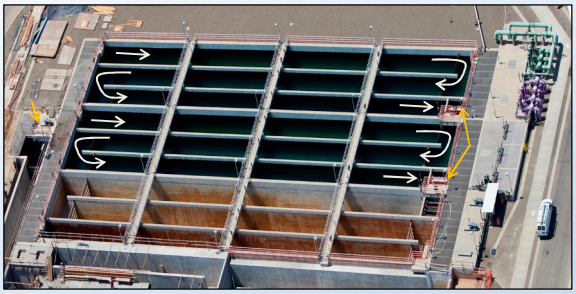
Sodium hypochlorite (Chlorine)



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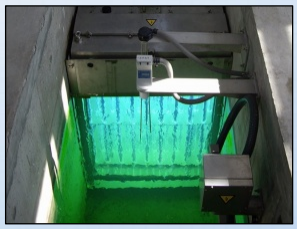
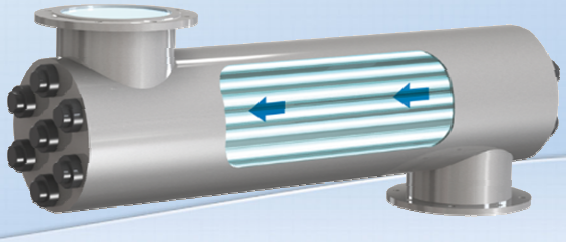
UV Disinfection





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Disinfection Options Evaluation

Option	Criteria Scale: 1 (least favorable) to 5 (most favorable)		
	Sodium Hypochlorite (Delivered)	Sodium Hypochlorite (On-site Generation)	UV
Safety	3	2	4
Chemicals	2	2	5
Lifecycle Cost	3	3	2
DBPs	1	1	5
Future Permit	5	5	5
Total Score	**14**	**13**	**21**

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Solids Handling

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Typical Solids Flow Chart

Thickening	Stabilization	Dewatering	
Gravity Thickener GBT DAFT RDT	Aerobic Digester	Screw Press Belt Filter Press Centrifuge Drying Beds	Hauling
	Sludge Lagoon	Screw Press Belt Filter Press Centrifuge Drying Beds	
	Drying Beds	Drying Beds	

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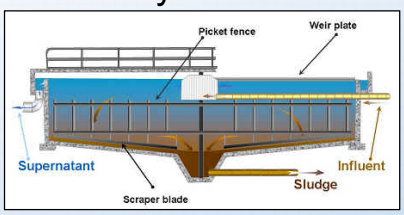
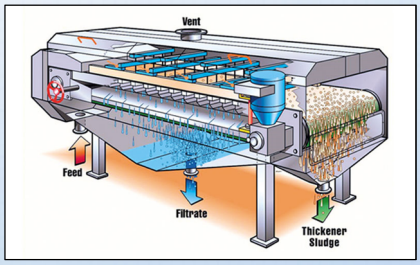
Thickening

Gravity Thickener



GBT



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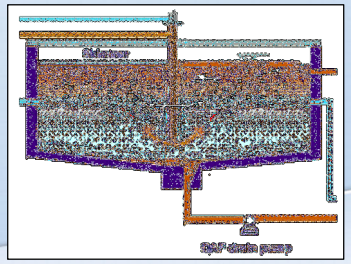
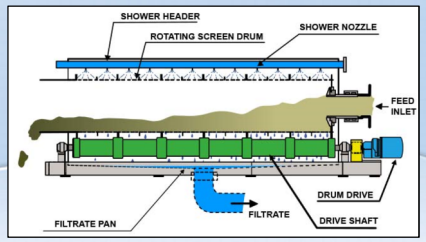


RDT



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Stabilization

Aerobic digesters

Sludge lagoon

Drying beds

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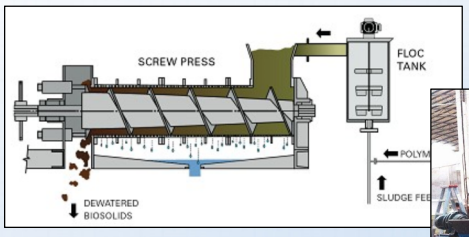
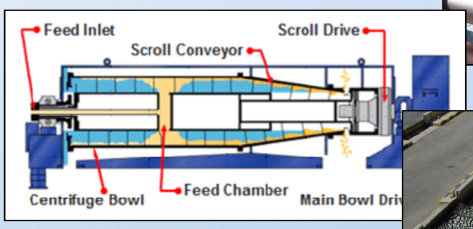
Dewatering



Screw press

Belt filter press



Centrifuge

Drying beds

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Disposal

- On-site land application (likely City-owned land)
- Off-site land application (outside of Monterey County)

SYNAGRO

North American Digester Cleaning Services

WASTEWATER SOLIDS MANAGEMENT CO.
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Project Schedule

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Overall Tertiary Facility Schedule

Task Description	2017	2018	2019	2020
Facility Plan				
Recycled Water Study				
RWQCB Meetings				
Preliminary Design				
EIR/Permitting				
Final design/Bidding				
Construction				
Start up				

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Action Items/ Next Steps

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Engineers...Working Wonders With Water™

CONFERENCE MEMORANDUM

Project:	Wastewater Facilities Plan and Collection System Master Plan	**Conf. Date:**	March 30, 2017
Client:	King City, CA	**Issue Date:**	April 14, 2017
Location:	City Hall, 212 S. Vanderhurst Ave., King City		
Attendees:	City: Octavio Hurtado Sal Morales	Carollo: Eric Casares Ryan Orgill Elaine Simmons Tyler Grossheim	
Purpose:	Wastewater Collection System Master Plan and Facilities Plan: Progress Meeting No. 2		
Distribution:	Attendees, Danielle Bertini	**File:**	10406A.00

Discussion:
The following is our understanding of the subject matter covered in this conference. If this differs with your understanding, please notify us.

1. Discussion Items
   A. Collection System Master Plan
      1) Overall the dry and wet weather hydraulic model calibration looks good and matches up well with measured meter data (from temporary flow monitoring) at most locations.
      2) City believes the connections shown on San Antonio Dr, Sandringham St, and Willow St (Meter #2 site) are modeled incorrectly and may need to be revised.
      3) The collection system experiences little groundwater infiltration. The majority of the flow is inflow. Meter #8 experienced the most inflow possibly due to localized dumping in that area.
      4) The trash pump used in the January 2017 storm event is rarely used – only in emergency situations, and does not need to be included in model per Octavio and Sal.
      5) For the calibrations, Carollo used the WaPUG calibration standards.
      6) Carollo noticed an odd peak in wastewater flow most likely from the area surrounding Meter #1. City thinks it may be due to some industrial or commercial activity in that area.
      7) Simulated wastewater treatment plant average flow at current conditions was 1.09 mgd and peak flow was 4.54 mgd. Peak flow will be a little lower if the trash pump is excluded.
      8) Not a lot of areas have capacity exceedances. Only area of deficiency noted is the collection lines along Bitterwater Rd.

9) Carollo recommends that minimum sewer size be 8-inch, and that the City consider a replacement program for old 6-inch sewers. The City would like this to be included in the Master Plan.

B. Facilities Plan

1) The property to the north of the wastewater treatment plant (WWTP) has been sold (closed escrow on 3/31/2017).
2) The WWTP is currently applying domestic effluent to both the domestic and industrial sprayfields as needed for additional capacity.
3) City informed Carollo that the industrial sprayfields consist of approximately 65 acres. Approximately 10 acres of the industrial sprayfield, just west of ponds 1, 2, and 3, is not being used.
4) City suggested allocating the 10 unused acres of the industrial sprayfield as a future laydown/staging and/or stockpile area during construction.
5) Plant staff informed Carollo that currently a lot of grit drops out before the comminutor. Carollo has included a grit removal process in the new headworks recommendation.
6) City generates approximately $16,000/mo from solar energy.
7) ConAgra used a Gravity Belt Thickener for industrial pretreatment.
8) Sal heard that CalPine (cogeneration facility) may be shutting down in 1-2 years, but does not know what else will take its place.

2. Decisions

A. City confirmed Meter #4 is on the new sewer line.
B. Carollo advised the City to not sell the plot of land to the east of the WWTP since it may need to be used as a laydown/staging or stockpile area during construction. It may also be needed for future facility effluent storage or disposal. More analysis is required to determine if the land is needed for the future.
C. City confirmed that using a power cost of $0.12/kwh is appropriate for planning purposes.
D. City prefers continuous backwash filter over cloth disk filter.
E. City prefers UV disinfection over sodium hypochlorite disinfection.

3. Action items

A. Carollo (Ryan) to verify the modeled location of Meter #2 and which line it connects to, and send to City for confirmation.
B. Carollo (Ryan) to verify the flow path and connections of Meters #3A/3B.
C. Carollo (Ryan) to remove the trash pump flow from the model for current wet weather flow.
D. Carollo will include recommendations for replacement of the existing 6” sewer lines with new 8” sewer lines in the Master Plan.
E. Carollo will determine the capacity of the collection system near Lone Oak to ensure there is available capacity for future connections.
F. Carollo to finish “Effluent Reuse and Disposal” and “Treatment Alternatives Analysis” TMs.

G. Carollo will include the water balance analysis as part of the appendix to the “Effluent Reuse and Disposal” TM.

H. Carollo will look into construction stockpile locations for pond sludge and/or excavated clay liner in the next phase of work.

I. Carollo to determine the approximate number of operators required to run proposed new WWTP.

J. Carollo will arrange for site visits to nearby facilities with oxidation ditch, UV, and screw press processes.

K. Carollo will coordinate with Monterey Bay Analytical Services to start wastewater plant influent sampling in April.

L. Discussed in afternoon meeting with City and Cal Water after Progress Meeting #2:
   1) Carollo will evaluate what staff services are required at new facility (e.g. Administration Building, potable water supply, etc.)
   2) Carollo will look into site access requirements for new treatment plant, including chemical delivery truck routes.
   3) Carollo will consider CIP recommendations in phases for bringing secondary treatment components and tertiary treatment components online.

Prepared By:

Eric Casares

Attachment: Meeting Presentation Slides

Wastewater Collection System Master Plan and Facilities Plan - Progress Meeting #2

King City
March 30, 2017

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Agenda

- Introductions
- Collection System Master Plan
  - Hydraulic Model Development
  - Temporary Flow Monitoring
  - Planning Parameters (Land Use)
  - Evaluation Criteria
  - Next Steps
- Wastewater Treatment Plant Facilities Plan
  - Goals and Objectives
  - Workshop Goals and Objectives
  - Overview of Projected Flows
  - Overview of Alternatives Analysis
  - Preliminary Sizing and Layouts
  - Project Schedule
  - Action Items and Next Steps

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Wastewater Collection System Update

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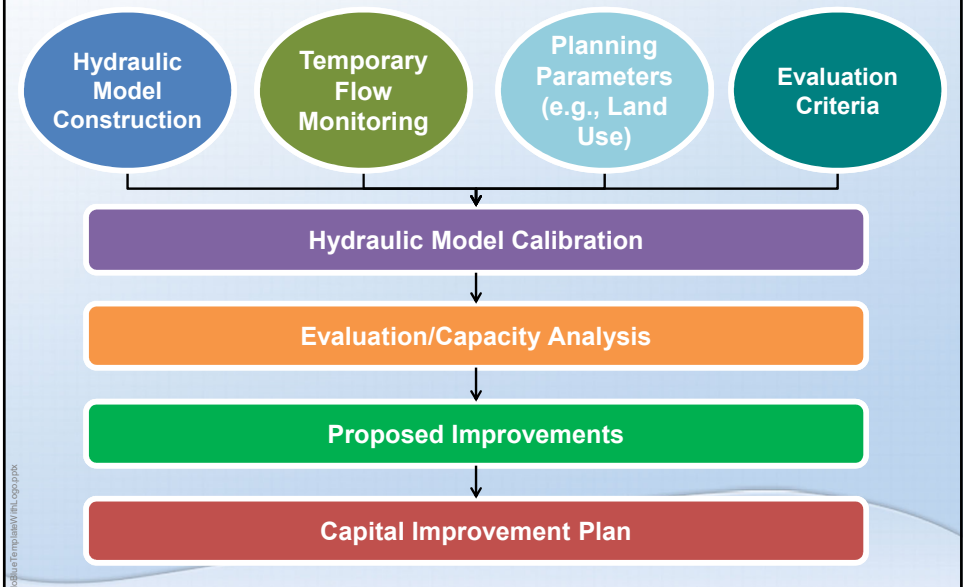
Collection System Planning Approach



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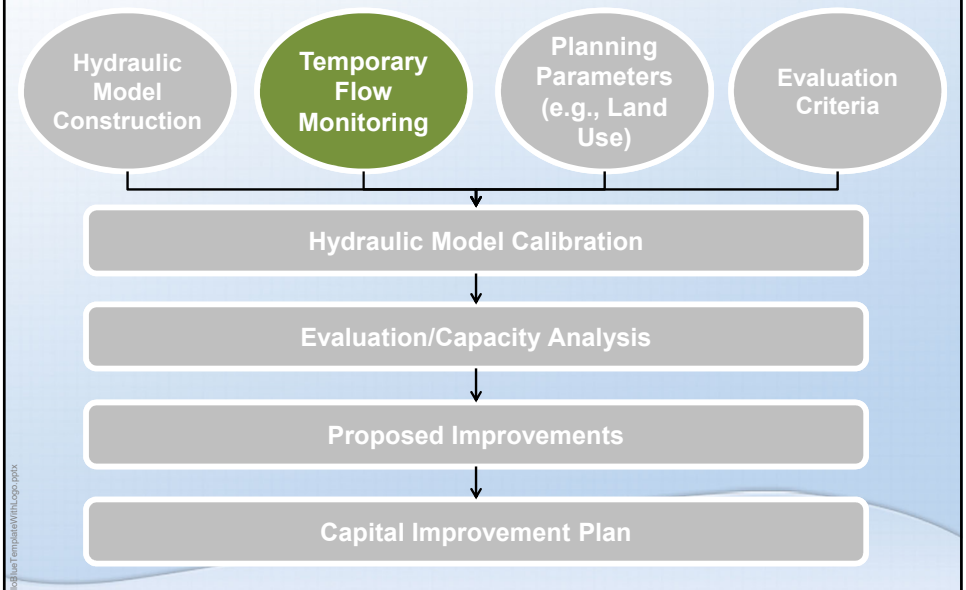
Collection System Planning Approach



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Temporary Flow Monitoring Program

- November 14th to December 29th
- 10 flowmeters placed
- Average Dry Weather Flow (ADWF) patterns for each meter
  - Weekday (Mon-Thu), Friday, and Weekend
- Two small rainfall events:
  - November 20, 2016 (0.52” total)
  - December 15, 2016 (0.2” total)

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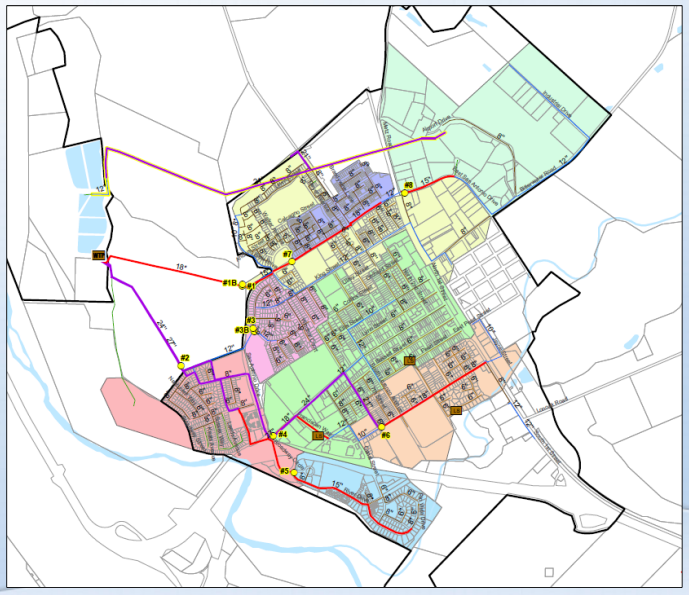
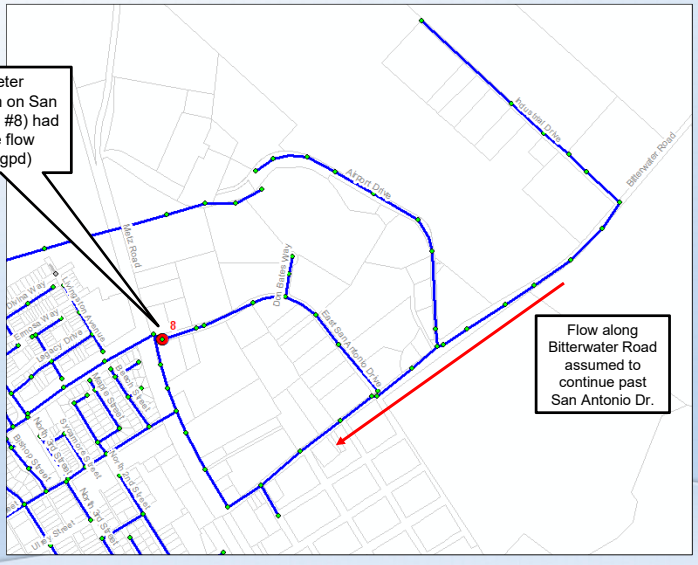
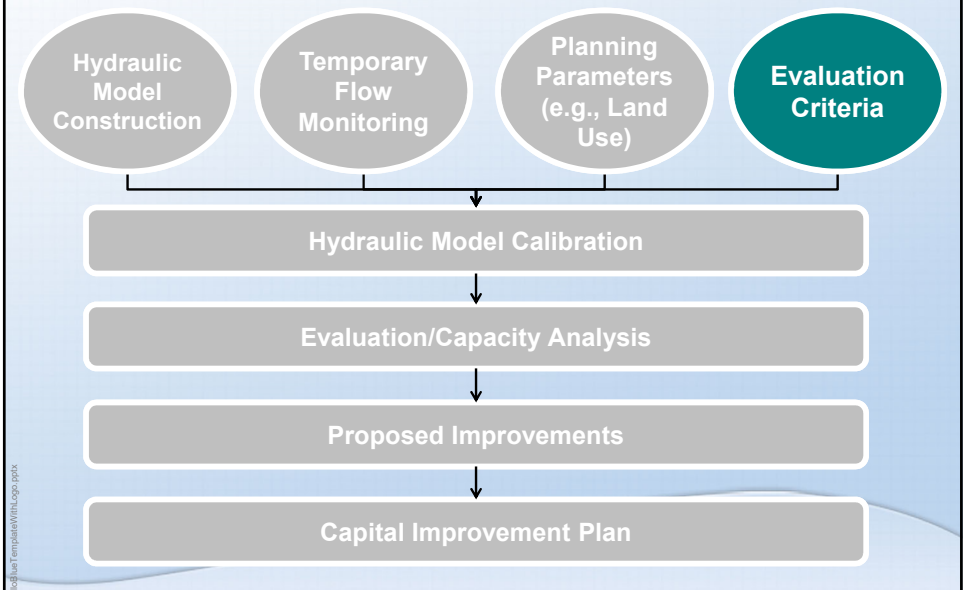
Temporary Flow Monitoring Locations



Assumptions Made Based on Flow Monitoring Results

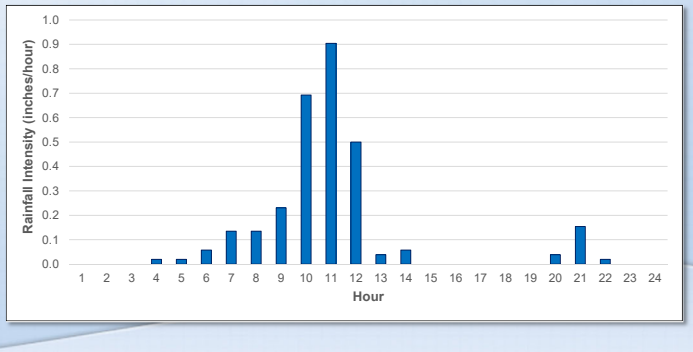


Collection System Planning Approach



Design Storm

- 10-year, 24-hour design storm
  - 3 inches in 24 hours
- Distribution based on historical event (1/18/2010)



Evaluation Criteria

- Max HGL criteria will determine the risk and capital costs for the City
- Max d/D Criteria :

Existing Sewers	
Scenario	**Max d/D**
ADWF	0.75
PWWF	0.9
New Sewers	
Pipe Diameter (Inches)	**Max d/D (during PWWF)**
Less than 12	0.50
12 to 18	0.67
Larger than 18	0.75

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Evaluation Criteria

- Headloss:
  - Gravity Pipes: Manning's n = 0.013
  - Pressure Pipes: Hazen William's C = 120
- Minimum Slopes:

Minimum Slopes for New Sewers			
Pipe Size (inches)	**Minimum Slope[1] (ft/ft)**	**Calculated Flow at Maximum d/D**	
		d/D	**Maximum Flow (mgd)**
8	0.0033	0.50	0.226
10	0.0025	0.50	0.353
12	0.0019	0.67	0.796
15	0.0014	0.67	1.243
18	0.0011	0.67	1.791
21	0.0009	0.75	2.835
24	0.0008	0.75	3.703
27	0.0007	0.75	4.687
30	0.0006	0.75	5.786

Notes:
1. Recommended minimum slope for flows at a velocity greater than or equal to 2 feet/second. Manning's n =0.013

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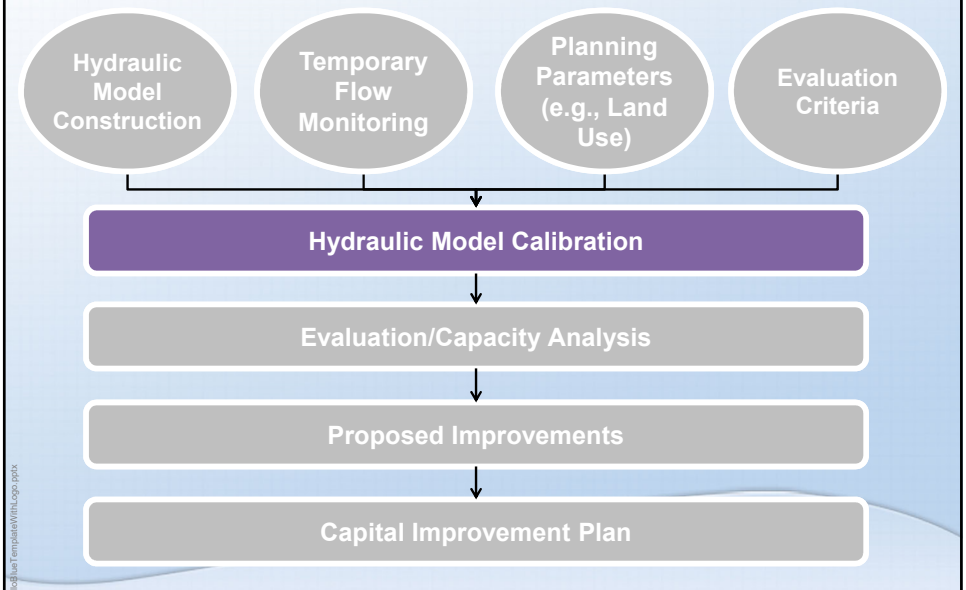
Collection System Planning Approach



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Dry Weather Flow Calibration

- Flow monitoring data used to develop wastewater flow factors used calculate average wastewater loads
- Loading polygons used to allocate wastewater loads to individual model nodes (manholes)
- Wastewater loading adjusted by basin to match field-measured base (average dry weather) flows from flow monitoring period

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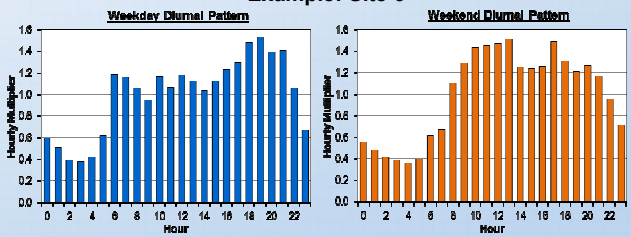
Dry Weather Flow Calibration Process

- Develop and adjust weekday and weekend diurnal patterns for each flow monitoring site
- Apply the diurnal pattern to base flows tributary to each meter site

Example: Site 6



- Other model parameters (e.g., Manning's n, sediment buildup) input and refined

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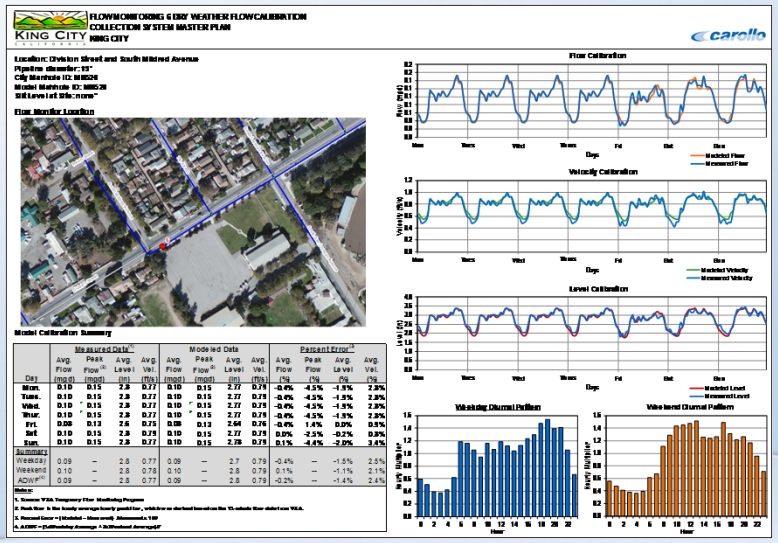
Example Dry Weather Calibration

- See handout



FLOW MONITORING & DRY WEATHER FLOW CALIBRATION
COLLECTION SYSTEM MASTER PLAN
KING CITY

carollo

Location: Division Street and South Mildred Avenue
Pipeline diameter: 15"
City Manhole ID: MH526
Model Manhole ID: MH526
Sill Level of Site: none*

Flow Monitor Location

Model Calibration Summary

Day	Measured Data[1] Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Modeled Data Avg. Flow (mgd)	Peak Flow[2] (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Percent Error[3] Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Mon.	0.10	0.15	2.8	0.77	0.10	0.15	2.77	0.78	-0.4%	-4.5%	-1.5%	2.8%
Tues.	0.10	0.15	2.8	0.77	0.10	0.15	2.77	0.78	-0.4%	-4.5%	-1.5%	2.8%
Wed.	0.10	0.15	2.8	0.77	0.10	0.15	2.77	0.78	-0.4%	-4.5%	-1.5%	2.8%
Thur.	0.10	0.15	2.8	0.77	0.10	0.15	2.77	0.78	-0.4%	-4.5%	-1.5%	2.8%
Fri.	0.08	0.13	2.6	0.75	0.08	0.13	2.64	0.76	-0.4%	1.4%	0.0%	0.5%
Sat.	0.10	0.15	2.8	0.78	0.10	0.15	2.77	0.79	0.0%	-2.5%	-0.2%	0.8%
Sun.	0.10	0.15	2.8	0.77	0.10	0.15	2.78	0.79	0.1%	-4.4%	-2.0%	3.4%
Summary												
Weekday	0.09	–	2.8	0.77	0.09	–	2.7	0.79	-0.4%	–	-1.5%	2.5%
Weekend	0.10	–	2.8	0.78	0.10	–	2.8	0.79	0.1%	–	-1.1%	2.1%
ADWF[4]	0.09	–	2.8	0.77	0.09	–	2.8	0.79	-0.2%	–	-1.4%	2.4%

Notes:
1. Source: VTA Temporary Flow Monitoring Program
2. Peak flow is the hourly average hourly peak flow, which is a defined location for VTA-wide flow data from VTA.
3. Percent Error = [Modeled – Measured] / Measured x 100
4. ADWF = [Tuesday Average + Wednesday Average]/2

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Dry Weather Calibration Standards

- Wastewater Planning Users Group (WaPUG) provides international guidelines for model calibration
  - Flow peaks and troughs timed within one-hour
  - Modeled peak flow should be within ±10% of measured peak flow
  - Modeled flow volume (average flow) should also be within ±10% of measured flow volume

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Dry Weather Calibration Summary

- See handout

TABLE 1 DRY WEATHER FLOW CALIBRATION
WASTEWATER COLLECTION SYSTEM MASTER PLAN
KING CITY

		Weekday									Weekend									Overall ADWF		
		Measured Data[1]			Modeled Data[2]			Percent Error[3]			Measured Data[1]			Modeled Data[2]			Percent Error[3]					
Meter Number	Pipe Diameter (in)	Avg. Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Avg. Velocity (%)	Avg. Level (%)	Avg. Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Avg. Velocity (%)	Avg. Level (%)	Measured (mgd)	Modeled (mgd)	Percent Error (%)
1	18	0.11	1.47	2.1	0.119	1.58	2.0	3.9%	7.6%	-5.4%	0.12	1.48	2.2	0.13	1.60	2.0	2.9%	7.8%	-5.1%	0.12	0.12	3.6%
1B	9.625	0.02	0.67	1.2	0.018	0.69	1.2	0.3%	2.6%	-1.8%	0.02	0.69	1.3	0.02	0.70	1.2	-0.4%	2.3%	-1.4%	0.02	0.02	0.1%
2	30	0.56	1.69	4.7	0.513	1.87	4.3	-8.4%	10.2%	-7.9%	0.60	1.72	4.8	0.54	1.89	4.4	-9.6%	9.9%	-8.4%	0.57	0.52	-8.7%
3A	11.5	0.06	1.20	1.9	0.059	1.08	1.9	-4.5%	-10.0%	3.4%	0.06	1.17	1.9	0.06	1.05	2.0	-1.7%	-9.8%	4.0%	0.06	0.06	-3.7%
3B	11.5	0.04	0.41	2.9	0.039	0.42	2.9	-1.6%	1.3%	-2.0%	0.04	0.45	2.9	0.04	0.44	3.0	-1.4%	-2.7%	0.3%	0.04	0.04	-1.6%
4	18	0.08	2.28	1.2	0.078	2.30	1.2	0.4%	0.7%	0.0%	0.07	2.32	1.1	0.07	2.26	1.1	0.6%	-2.8%	3.0%	0.08	0.08	0.5%
5	16	0.11	0.75	3.5	0.107	0.72	3.5	0.3%	-3.9%	1.6%	0.11	0.73	3.4	0.11	0.71	3.5	-0.5%	-3.5%	0.5%	0.11	0.11	0.1%
6	19	0.09	0.77	2.8	0.093	0.79	2.7	-0.4%	2.5%	-1.5%	0.10	0.78	2.8	0.10	0.79	2.8	0.1%	2.1%	-1.1%	0.09	0.09	-0.2%
7	18	0.06	0.87	1.8	0.061	0.85	1.9	3.7%	-2.0%	6.1%	0.05	0.79	1.7	0.05	0.80	1.7	3.2%	1.4%	1.8%	0.06	0.06	3.6%
8	14	0.01	0.34	1.1	0.010	0.33	1.2	-1.8%	-3.1%	9.7%	0.00	0.21	0.8	0.00	0.23	0.8	-1.3%	8.7%	-5.8%	0.01	0.01	-1.7%

Notes:
1. Source: City of Modesto 2014 Temporary Flow Monitoring Program, V&A Consulting Engineers
2. Average flows are calculated from flow monitoring data. Maximum flow values are hourly peaks.
3. Percent Difference = (Modeled - Measured)/Measured*100.

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Wet Weather Calibration

- Infiltration/Inflow (I/I) Analysis:
  - Assigning areas tributary to each manhole in the hydraulic model (excluding vacant areas and other areas not expected to contribute to I/I)
  - Development of custom RDII Unit Hydrographs for each flow monitoring basin

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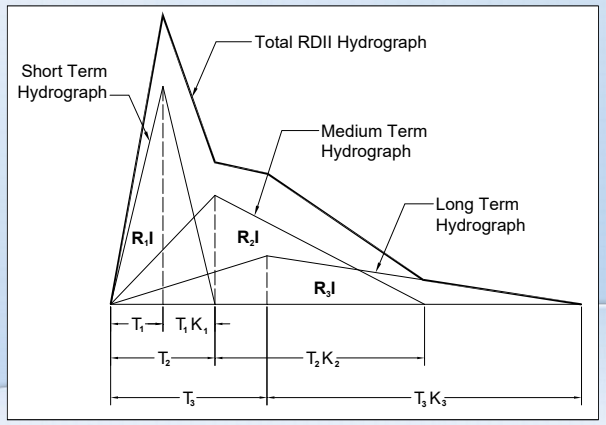
Infiltration/Inflow (I/I) Analysis

- Each unit hydrograph is a combination of three triangular hydrographs
- Each unit hydrograph contains 9 separate variables to characterize system response to rainfall



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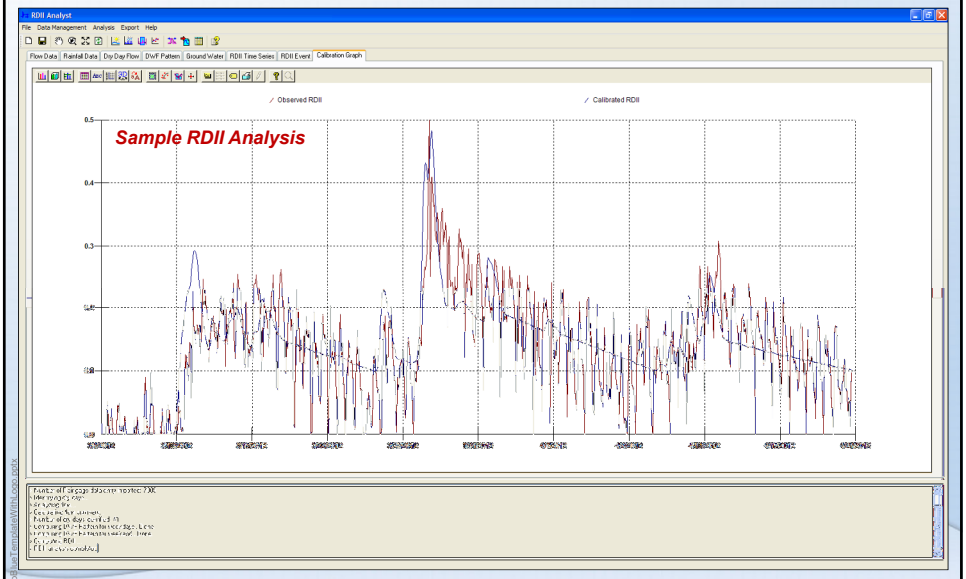
Infiltration/Inflow (I/I) Analysis



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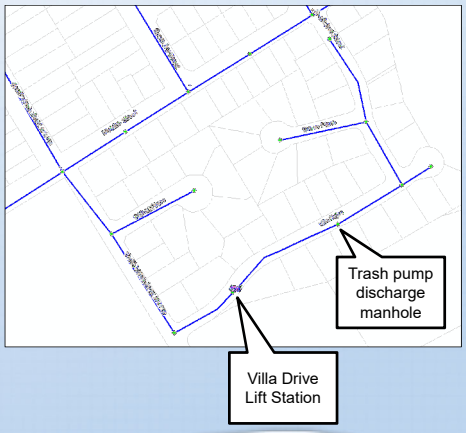
Modeling the Trash Pump during Large Wet Weather Events

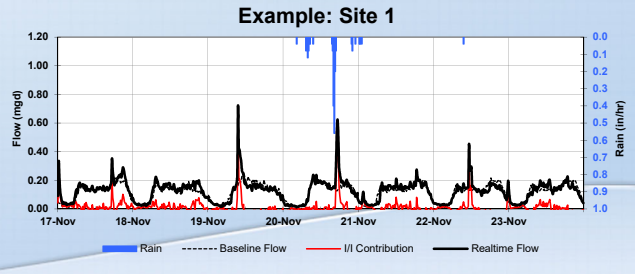
- Modeled as an external flow
- Trash pump assumptions:
  - 350 gpm constant flowrate
  - Starts about 2 hours after peak rainfall and runs for approximately 3 hours
  - Discharges to nearby manhole (Villa Drive)



22

Determine calibration storm events and develop rainfall hyetographs

- November 20, 2016 selected for model calibration
- Additional storm events used to verify calibration:
  - January 2010
  - January 2017



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Wet Weather Calibration Process

- Adjust RTK parameters for each flow monitor unit hydrograph until model simulated flows match well with field measured flows
- Check model simulated levels and velocities to verify if any additional model parameters (e.g., Manning's n, etc.) need to be further refined from the dry weather flow calibration

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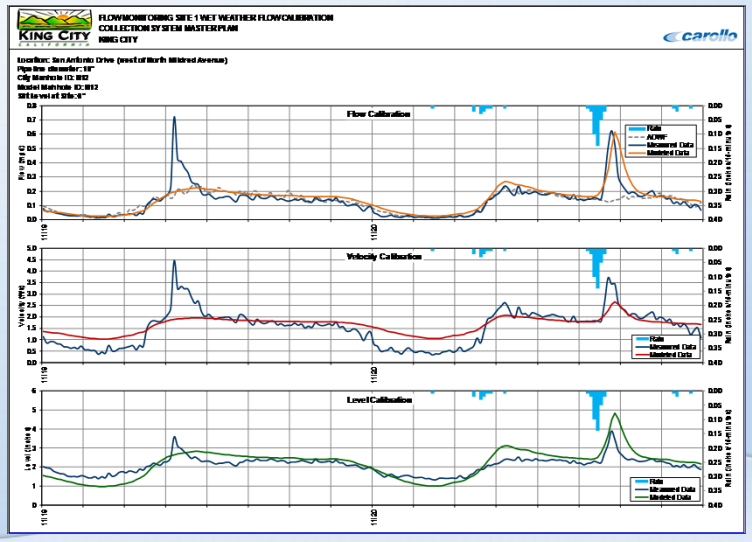
Example Wet Weather Calibration

- See handout



Wet Weather Calibration Standards

- WaPUG provides additional guidelines for wet weather model calibration
  - Flow peaks and troughs should be similarly timed given the duration of the storm event
  - Modeled peak flow should be within +25% to -15% of measured peak flow
  - Modeled flow volume (average flow) should be within +20% and -10% of measured flow volume

Wet Weather Calibration Summary

- See handout

Table 2 WET WEATHER FLOW CALIBRATION
COLLECTION SYSTEM MASTER PLAN
KING CITY

		Storm 1 (11/20/2016-11/20/2016)											
		Measured Data[1]				Modeled Data[2]				Percent Error[3]			
Meter Number	Pipe Diameter (in)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (%)	Peak Flow (%)	Avg. Velocity (%)	Avg. Level (%)
1	18	0.134	0.625	1.56	2.1	0.161	0.616	1.69	2.3	19.8%	-1.4%	8.3%	9.7%
1B	9.625	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	30	0.613	1.059	1.72	4.8	0.571	1.015	1.91	4.5	-6.9%	-4.1%	11.2%	-7.1%
3A	11.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3B	11.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	18	0.076	0.137	2.24	1.1	0.078	0.135	2.28	1.2	2.2%	-1.6%	1.4%	1.7%
5	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	18	0.059	0.309	0.80	1.9	0.070	0.304	0.87	2.0	19.6%	-1.6%	7.7%	4.5%
8	14	0.011	0.128	0.35	1.0	0.013	0.130	0.33	1.2	16.5%	1.7%	-7.1%	12.6%
WRF	18	0.872	1.950	N/A	N/A	1.020	2.142	N/A	N/A	17.0%	9.8%	N/A	N/A

Notes:
1. Source: King City 2016 Temporary Flow Monitoring Program, V&A Consulting Engineers
2. Average flows are calculated from flow monitoring data. Maximum flow values are hourly peaks. Averages were adjusted to account for data not recorded.
3. Percent Difference = (Modeled - Measured)/Measured*100.

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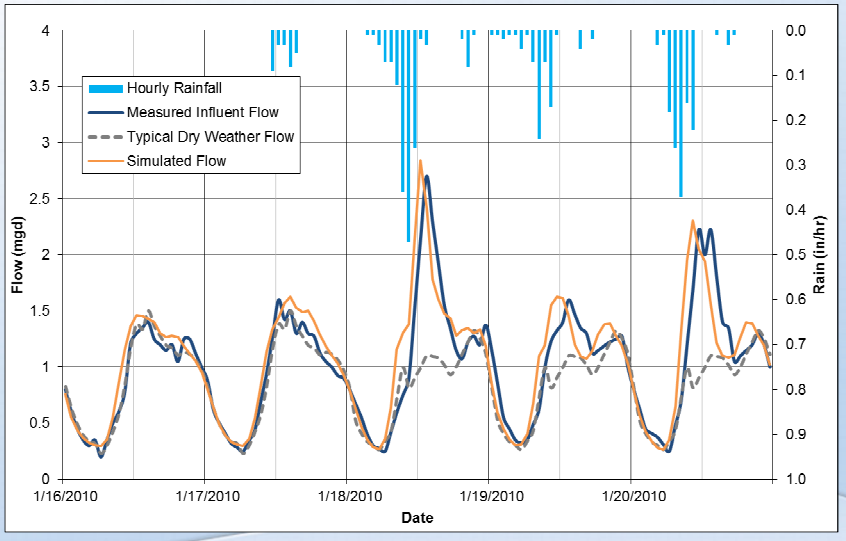
January 2010 Storm Event



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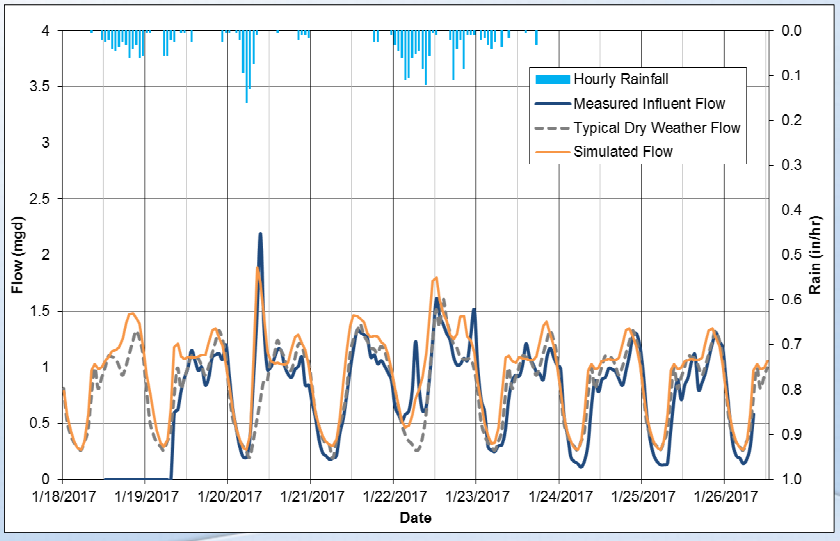
January 2017 Storm Event



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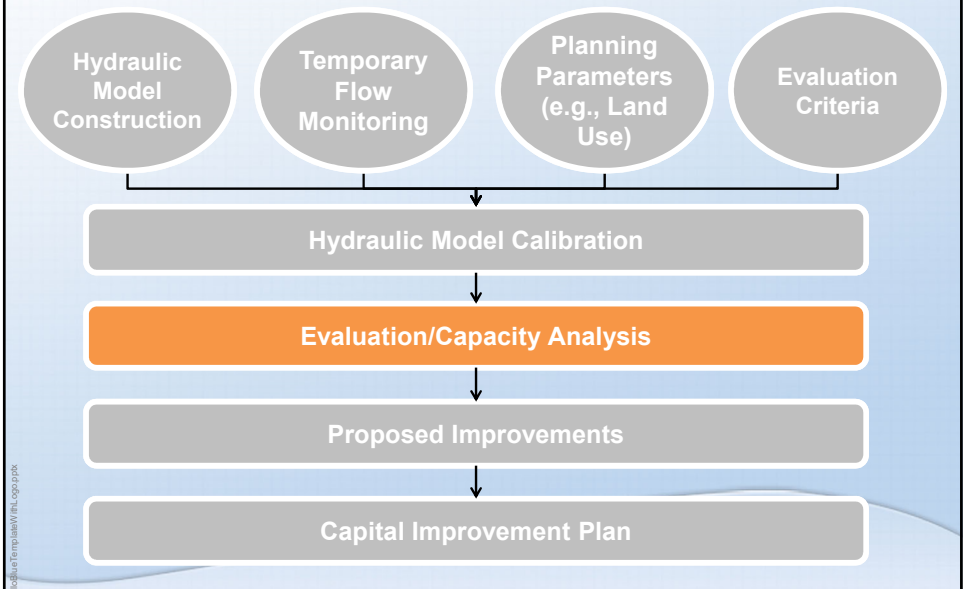
Collection System Planning Approach



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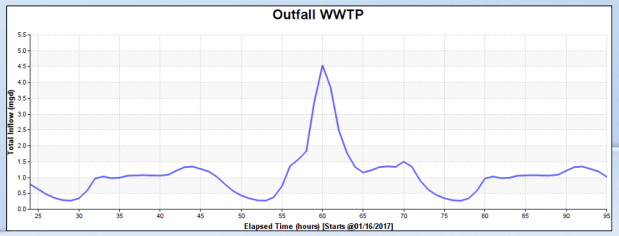
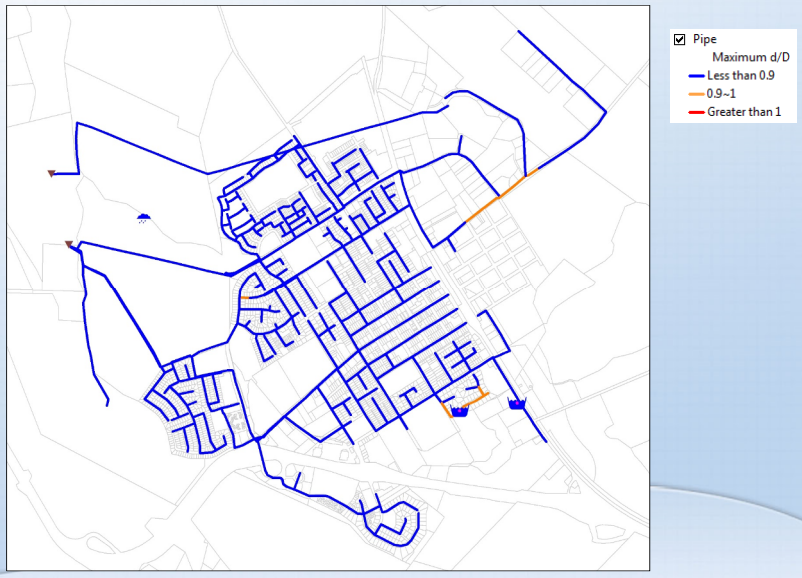
Existing PWWF Scenario

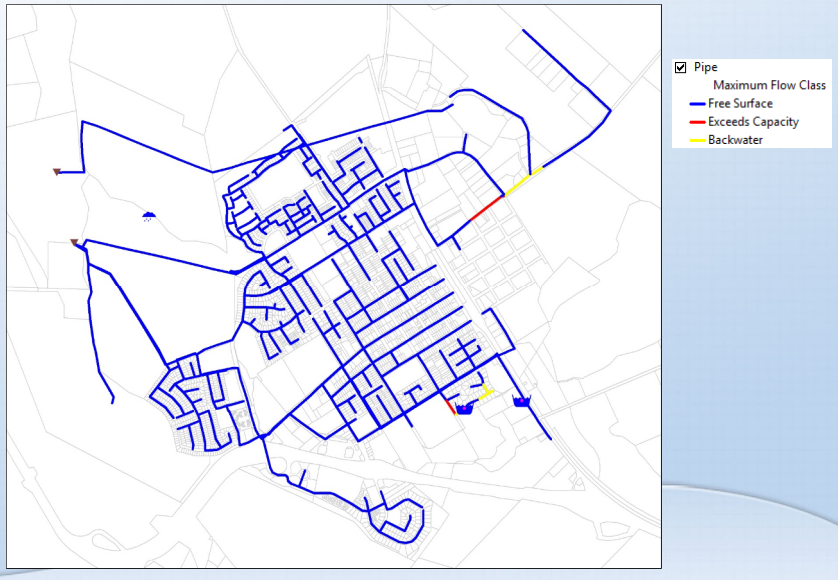
- Run with 24-hour design storm
- Includes trash pump flow
- Simulated Flow at Plant:
  - 1.09 mgd (Average)
  - 4.54 mgd (Peak)
- No simulated overflows



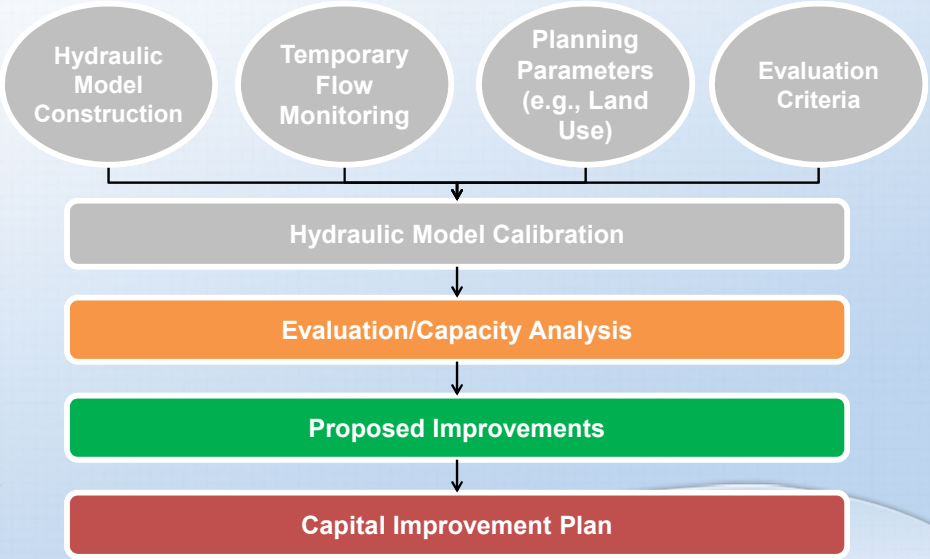
Existing PWWF – Max d/D Results



Existing PWWF – Max Flow Class



Next Steps



Wastewater Treatment Facility Plan

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Facility Plan Goals and Objectives

- Update King City's Wastewater Facilities Plan for a new tertiary treatment facility producing unrestricted reuse quality effluent meeting Title 22 requirements
- Deliverables include 4 TMs:
  - Current and Future Regulatory Requirements ☆
  - Flows and Load Evaluation ☆
  - Effluent Reuse and Disposal ☆
  - Treatment Alternatives Analysis ☆

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Workshop Goals and Objectives

- Discuss potential future effluent reuse and disposal strategies
- Discuss potential for selling adjacent parcel
- Discuss treatment process alternatives:
  - Secondary Treatment
  - Tertiary Filtration
  - Disinfection
  - Biosolids Thickening/Stabilization
  - Biosolids Dewatering
- Receive direction from City in order to develop final recommended project

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Overview of Projected Flows

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Definitions

- Average Daily Flow (ADF)
  - Average flow during 1-day period
- Average Annual Flow (AAF)
  - Average of ADFs during a calendar year
- Average Day Maximum Month Flow (ADMMF)
  - Largest flow anticipated over a calendar month
- Peak Hour Flow (PHF)
  - Largest flow anticipated over a 1-hour period

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WWTP Permit Influent Flows

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
1102-A Laurel Lane
San Luis Obispo, California 93401

ORDER No. 91-05

WASTE DISCHARGE REQUIREMENTS
FOR
CITY OF KING DOMESTIC WASTEWATER FACILITY
MONTEREY COUNTY

Domestic WDR:
ADMMF
1.2 mgd

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5414

ORDER NO. 91-84

WASTE DISCHARGE REQUIREMENTS
FOR
CITY OF KING INDUSTRIAL WASTEWATER FACILITY
MONTEREY COUNTY

Industrial WDR:
ADMMF
May 1 to Nov 30: 2.4 mgd
Dec 1 to Apr 30: 1.0 mgd

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Flow Projection by Growth Area

Growth Area	Dwelling Units, con	Flow Factor, gal/con-d	Aerial Analysis, acre	Generation Factor, gpd/acre	Anticipated Flow, mgd
Current AAF, mgd	-	-	-	-	0.86
In-Fill Development	396	190	120	1,170	0.21
Creek Bridge(1)	170	185	-	-	0.03
Mills Ranch	368	185	-	-	0.07
Downtown Addition	650	185	-	-	0.12
New Commercial	-	-	35.3	750	0.03
Undeveloped Industrial	-	-	155	1,000	0.16
Lone Oak	-	-	-	-	- (4)
Little Bear CSD, existing(2)	569	140	-	-	0.08
Proposed Annexations	Beyond 20-yr Planning Horizon				
Little Bear CSD, future/planned(3)	Beyond 20-yr Planning Horizon				
				Subtotal	1.56 mgd
				Contingency	10 %
				PROJECTED AAF	**1.72 mgd**

Notes:
(1) Includes Arboleda.
(2) Only existing flows from Pine Canyon and Royal Estates (including septic and will-serve) are included in this estimate.
(3) Future/planned flows from Pine Canyon, Royal Estates, Marisoli, and Lot 71 are beyond the 20-year planning horizon of this Facility Plan.
(4) Estimation for Lone Oak included in 10% contingency.

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Projected Design Flows

Flow Parameter	Current Flows, mgd	Design Peaking Factor (From AAF)	Anticipated 20-year Design Flows, mgd
AAF, mgd	0.86(1)	-	1.72(2)
ADMMF, mgd	0.98(3)	1.13(4)	2.00(5)
PHF, mgd	3.90(6)	4.53(7)	7.80(8)

Notes:
(1) From GIS land use analysis
(2) From Flow Projection Table. Includes 10% contingency
(3) Maximum historical ADMMF from 2008 to 2016, occurred in 2009
(4) Maximum peaking factor from 2008 to 2016, occurred in 2009
(5) Rounded up from 1.94 mgd
(6) Equivalent to a 10-yr, 24-hr storm for King City routed through a SCS Type 1 curve
(7) Current PHF divided by current AAF
(8) Rounded up from 7.79 mgd

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20-Year Design Influent Flows and Loads

Parameter	Value
Average Annual Flow, mgd	1.7
Average Day Max Month Flow, mgd	2.0
Peak Hour Flow, mgd	7.8
Design Influent BOD_5 Load, ppd	5,220
Design Influent TSS Load, ppd	4,440

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Flow Basis of WWTP Sizing

Flow Parameter	Element
ADMMF, mgd	• Secondary Treatment Processes • Chemical Storage Facilities • Biosolids Handling Facilities
PHF, mgd	• Influent Pump Station • Headworks (bar screens and grit removal) • Secondary Clarifiers • Tertiary Filtration • Disinfection • Effluent Pump Station

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Effluent Reuse and Disposal Alternatives

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Effluent Reuse and Disposal Alternatives Evaluation

Determine Future Flows

↓

Develop Disposal Reuse/Alternatives

↓

Develop Water Balances

↓

Identify Necessary Improvements/Modifications

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Effluent Reuse and Disposal Options

- Sprayfields
  - Continued use of Domestic sprayfields
  - Conversion of Industrial sprayfields
  - Addition of new sprayfield area
- Percolation Storage
  - Conversion of existing treatment ponds to percolation (i.e., liner removal)
  - Addition of new lined storage ponds
  - Addition of new unlined percolation ponds
- Reuse
  - Non-potable agricultural irrigation
  - Non-potable landscape irrigation (assumed nominal for analysis)

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Effluent Reuse and Disposal Components

- Alternative No. 1 – Sprayfields/Percolation
- Alternative No. 2 – Percolation
- Alternative No. 3 – Percolation/Reuse
- Alternative No. 4 – Sprayfields/Storage
- Alternative No. 5 – Reuse/Storage

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Example Water Balance

Hydrologic Balance - Alternative No. 1 — Avg Annual Flow = 1.72 mgd (54.0 acres) — Total of 65 acres
Wastewater Treatment Plant Master Plan
City of King City

Month	Flow[1] mgd	Flow[1] (AF/mo)	Crop[2]	Sprayfield Irrigation (in/day)	Sprayfield Sprayfield Application (in/day)	Sprayfield Irrigation Distribution	Sprayfield Acres[3]	Estimated Use[4] (AF)	Title 22 Reuse Ag. Reuse (Acres)	Title 22 Reuse Ag. Reuse (AF)	Title 22 Reuse Urban Reuse (Acres)	Title 22 Reuse Urban Reuse (AF)	All Irrigation (AF)	Recycled Water Excess (AF/mo)	Ponds Area (acres)	Ponds Perc. Rate (in/day)	Ponds Perc. Rate (AF/mo)	Ponds Evapr Precip[5,6] (in/mo)	Ponds Evapr Precip (AF/mo)	Monthly Storage (AF)	Cumulative Storage (AF)	Cumulative Storage (MG)	Imported Water (AF)
November	1.68	154.5	Mix	0.05	0.80	3.3%	54.0	114.5													START SEASONAL STORAGE		
	Subtotal							114.5	0.0	0.0	0.0	0.0	114.5	40.0	23.2	0.80	-46.4	-1.12	-2.2	0.0	**0.0**	**0.0**	0.0
December	1.54	146.8	Mix	0.00	0.80	0.0%	54.0	108.0															
	Subtotal							108.0	0.0	0.0	0.0	0.0	108.0	38.8	23.2	0.80	-47.9	0.89	1.7	-7.5	**0.0**	**0.0**	7.5
January	1.49	142.0	Mix	0.00	0.80	0.0%	54.0	108.0															
	Subtotal							108.0	0.0	0.0	0.0	0.0	108.0	34.0	23.2	0.80	-47.9	6.03	11.6	-2.3	**0.0**	**0.0**	2.3
February	1.58	136.1	Mix	0.01	0.80	0.4%	54.0	108.8															
	Subtotal							108.8	0.0	0.0	0.0	0.0	108.8	27.2	23.2	0.80	-43.3	4.33	8.4	-7.7	**0.0**	**0.0**	7.7
March	1.77	168.9	Mix	0.08	0.80	5.7%	54.0	119.2															
	Subtotal							119.2	0.0	0.0	0.0	0.0	119.2	49.6	23.2	0.80	-47.9	1.05	2.0	3.7	**3.7**	**1.2**	0.0
April	1.77	163.1	Mix	0.16	0.80	10.7%	54.0	129.3															
	Subtotal							129.3	0.0	0.0	0.0	0.0	129.3	33.8	23.2	0.80	-46.4	-2.99	-5.8	-18.4	**0.0**	**0.0**	14.7
May	1.78	169.1	Mix	0.21	0.80	14.1%	54.0	136.0															
	Subtotal							136.0	0.0	0.0	0.0	0.0	136.0	33.2	23.2	0.80	-47.9	-5.92	-11.4	-26.2	**0.0**	**0.0**	26.2
June	1.80	166.2	Mix	0.23	0.80	15.5%	54.0	138.7															
	Subtotal							138.7	0.0	0.0	0.0	0.0	138.7	27.5	23.2	0.80	-46.4	-7.37	-14.2	-33.2	**0.0**	**0.0**	33.2
July	1.81	171.8	Mix	0.24	0.80	16.5%	54.0	140.6															
	Subtotal							140.6	0.0	0.0	0.0	0.0	140.6	31.2	23.2	0.80	-47.9	-8.46	-16.4	-33.1	**0.0**	**0.0**	33.1
August	1.86	176.7	Mix	0.22	0.80	14.9%	54.0	137.6															
	Subtotal							137.6	0.0	0.0	0.0	0.0	137.6	39.1	23.2	0.80	-47.9	-7.80	-15.1	-24.0	**0.0**	**0.0**	24.0
September	1.82	167.8	Mix	0.17	0.80	11.9%	54.0	131.6															
	Subtotal							131.6	0.0	0.0	0.0	0.0	131.6	36.2	23.2	0.80	-46.4	-5.79	-11.2	-21.4	**0.0**	**0.0**	21.4
October	1.73	164.6	Mix	0.10	0.80	7.0%	54.0	121.8															
	Subtotal							121.8	0.0	0.0	0.0	0.0	121.8	42.9	23.2	0.80	-47.9	-3.39	-6.6	-11.6	**0.0**	**0.0**	11.6
Total (AF)		**1,327.4**		**1.5**		**100.0%**		**1,494.0**		**0.0**		**0.0**		**433.4**			**-564.5**		**-59.1**		**3.7**	**1.2**	**101.6**
Check (AF)		**1,553.1**																					

Notes
(1) Effluent flow values based on an average annual flow at build-out conditions.
(2) Crop make-up assumed.
(3) Area of sprayfields based on Alternative scenario.
(4) Average ETo - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average ETo from June 1993 to September 2016.
(5) Pan Evaporation - Western Regional Climate Center (WRCC) for Nacimiento Dam (http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA). Represents monthly average data from 1957 to 1978. A 0.75 pan coefficient was applied to obtain evaporation rates.
(6) Precipitation - California Irrigation Management Information System (CIMIS) Station 113 – King City-Oasis Rd (www.cimis.water.ca.gov). Represents monthly average precipitation from June 1993 to September 2016.

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Existing Facilities

Domestic Spray Fields

Industrial Spray Fields

Pond 5

Pond 4

Pond 3

Pond 2

Pond 1

Pond 1B

Pond 1A

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Additional Parcels

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Impacts to Adjacent Property – Alternative No. 1

- Remove liner from Ponds 1A, 1B, 3, and 5
- Utilize existing domestic sprayfield
- All adjacent property and Pond 4 available for sale

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Impacts to Adjacent Property – Alternative No. 2

- Remove liner from Ponds 1A, 1B, 3, 4, and 5
- Retire existing domestic sprayfield
- Add 45 acres of percolation ponds in adjacent City-owned land
- Area north of Pond 4 and 5 needed for effluent disposal

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Impacts to Adjacent Property – Alternative No. 3

- Remove liner from Ponds 1A, 1B, 3, 4, and 5
- Retire existing domestic sprayfield
- Identify 325 acres of agricultural land for reuse
- All adjacent property available for sale

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Impacts to Adjacent Property – Alternative No. 4

- Utilize existing sprayfield area
- Add an additional 20 acres of sprayfields in Pond 4 and 5 area
- All adjacent property available for sale

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Impacts to Adjacent Property – Alternative No. 5

- Retire existing domestic sprayfield
- Add 37 acres of percolation ponds in adjacent City-owned land
- Identify 575 acres of agricultural land for reuse
- Area north of Pond 4 and 5 needed for storage

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Next Step…Recycled Water Feasibility Study

- Preliminary feasibility study with Cal Water
- Conduct recycled water market analysis (with Cal Water)
  - Identify all irrigation users in Project Area
  - Analyze available consumption data for these users
  - Determine peak day and peak hour demands for sizing of distribution system
- Contract with Cal Water signed; work to begin in April.
- Workshop with City in May prior to Cal Water go/no-go decision.
- Next step would be Feasibility Study meeting State funding requirements; consider cost-sharing with Cal Water

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Liquid Treatment Process Alternatives

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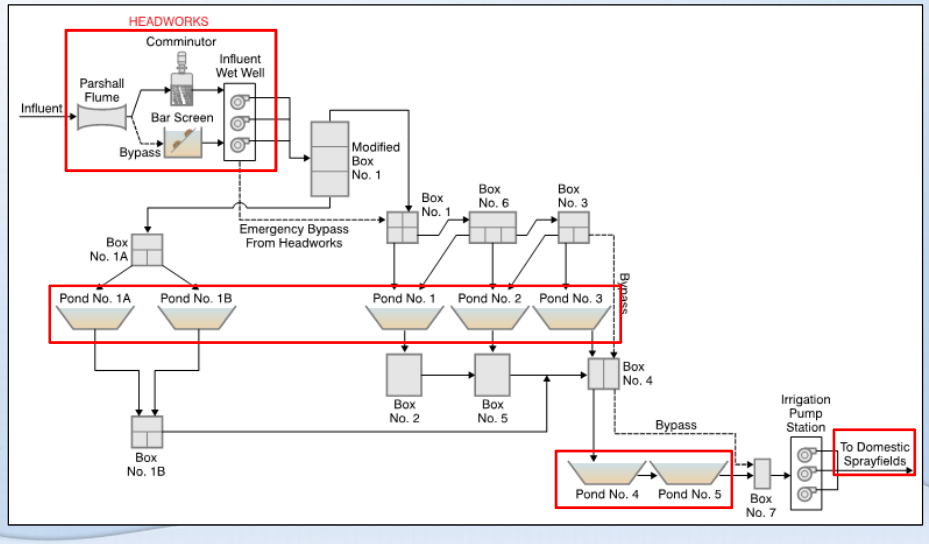
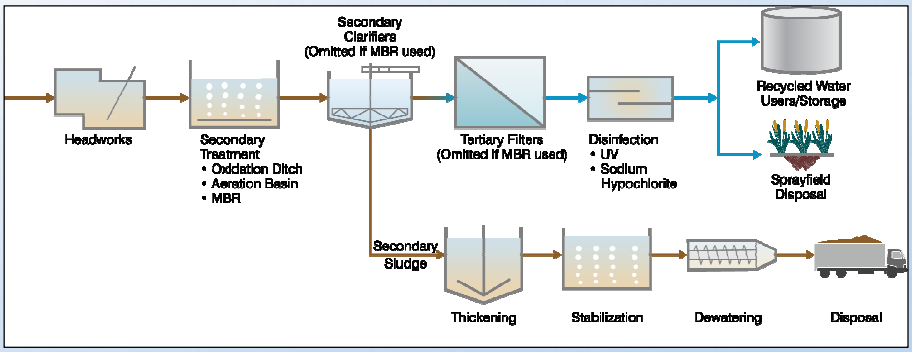
Existing Flow Schematic



Typical Tertiary Treatment Plant Flow Schematic



Treatment Options to Reach Title 22 Unrestricted Use Water Quality

Preliminary	Primary	Secondary	Filtration	Disinfection
Headworks	N/A	Oxidation Ditch	• Cloth Media • Granular Media (CBW)	• UV • NaOCl
	N/A	CAS w/ MLE	• Cloth Media • Granular Media (CBW)	• UV • NaOCl
	N/A	MBR		• UV • NaOCl

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Preliminary Treatment Processes

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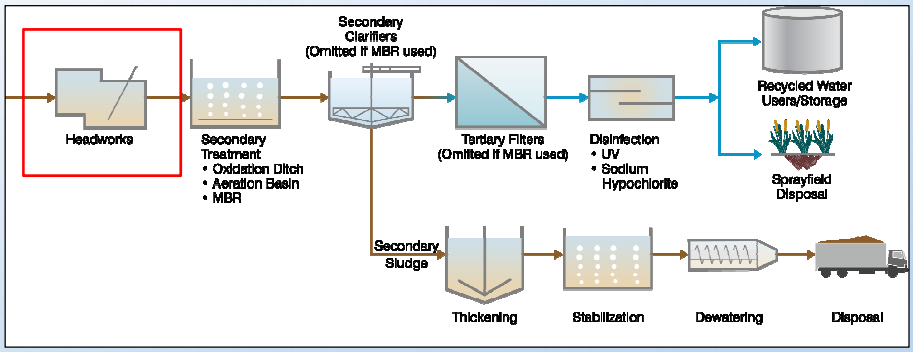

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Headworks/Grit Removal

- Removes large inorganic material
  - Manual Bar Racks
  - Mechanical Bar Screens ☆
  - Comminutors
- Removes small inorganic material
  - Vortex grit basins ☆
- Protects and reduces wear on downstream equipment/processes

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Headworks Schematic

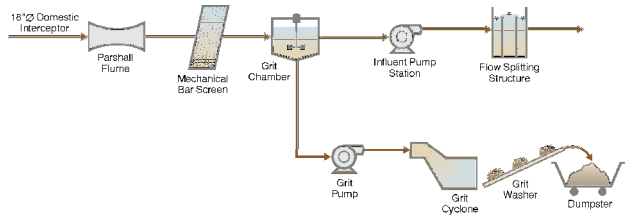
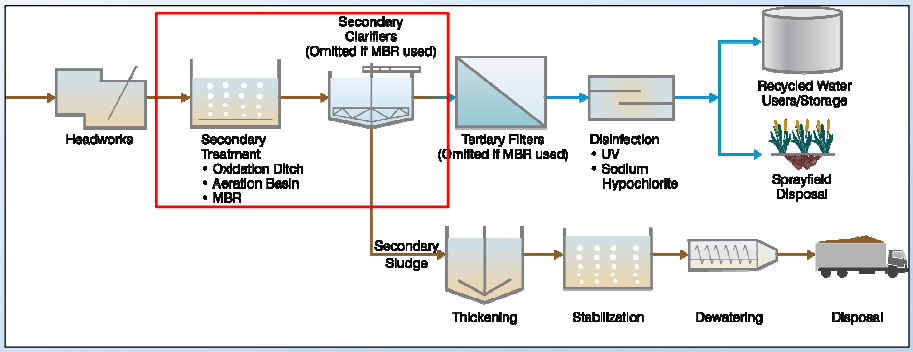


Figure 5.#
PROPOSED HEADWORKS
FLOW SCHEMATIC
WASTEWATER TREATMENT FACILITIES PLAN
KING CITY

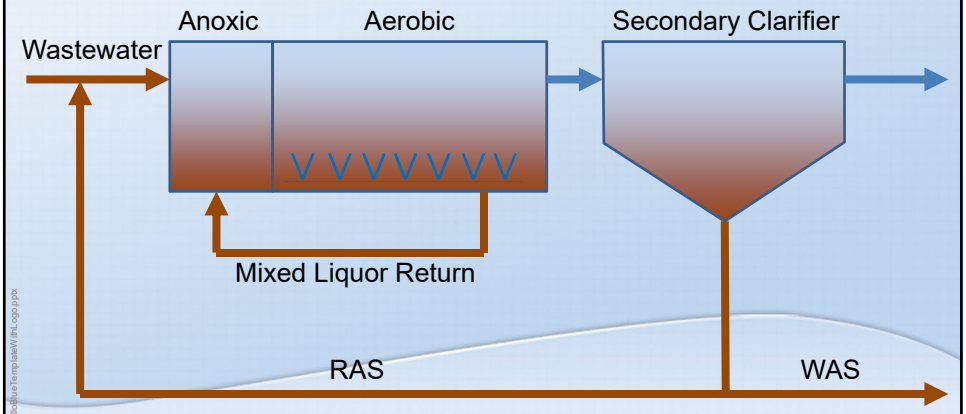
Secondary Treatment Processes

Typical Tertiary Treatment Plant Flow Schematic



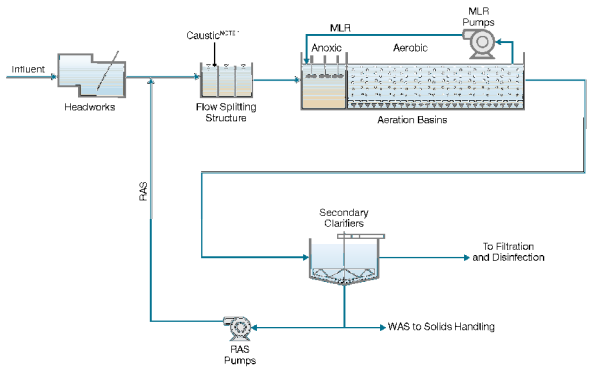
Suspended Growth

- Oxidation ditches
- CAS w/ MLE



*Anoxic = no dissolved oxygen

CAS with MLE Schematic



NOTES:
1. Caustic may be required for supplemental alkalinity. Caustic feed system would include storage tanks, metering pumps, and containment areas.

Figure 5.#
SECONDARY TREATMENT ALTERNATIVE 1
CAS WITH MLE SCHEMATIC
WASTEWATER TREATMENT FACILITIES PLAN
KING CITY

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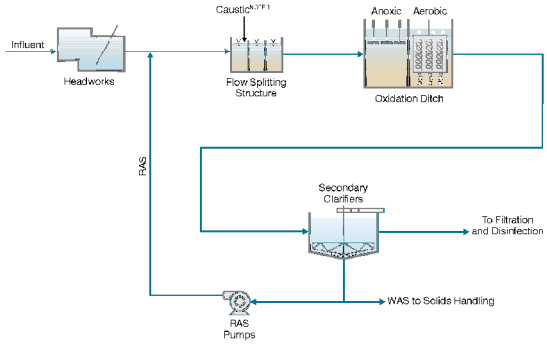
Oxidation Ditch Schematic



NOTES:
1. Caustic may be required for supplemental alkalinity. Caustic feed system would include storage tanks, metering pumps, and containment areas.

Figure 5.#
SECONDARY TREATMENT ALTERNATIVE 2
OXIDATION DITCH SCHEMATIC
WASTEWATER TREATMENT FACILITIES PLAN
KING CITY

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Design Criteria for Secondary Treatment Alternatives

Design Parameter	CAS w/ MLE	Oxidation Ditches	MBR
ADMMF, mgd	2.0	2.0	2.0
PHF, mgd	7.8	7.8	7.8
MLSS, mg/L	3,000	3,000	8,000
SRT, d	10	25	10
Target Effluent BOD & TSS, mg/L	20	20	20
Target Effluent TN/ NO_3, mg/L	8/5	8/5	8/5
Clarifier Overflow Rate, gpd/sf	780	780	N/A

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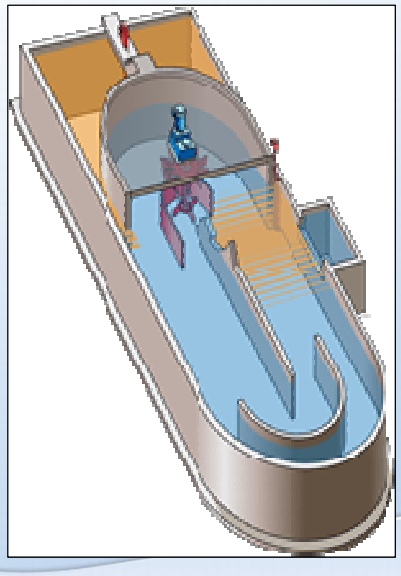
Oxidation Ditch



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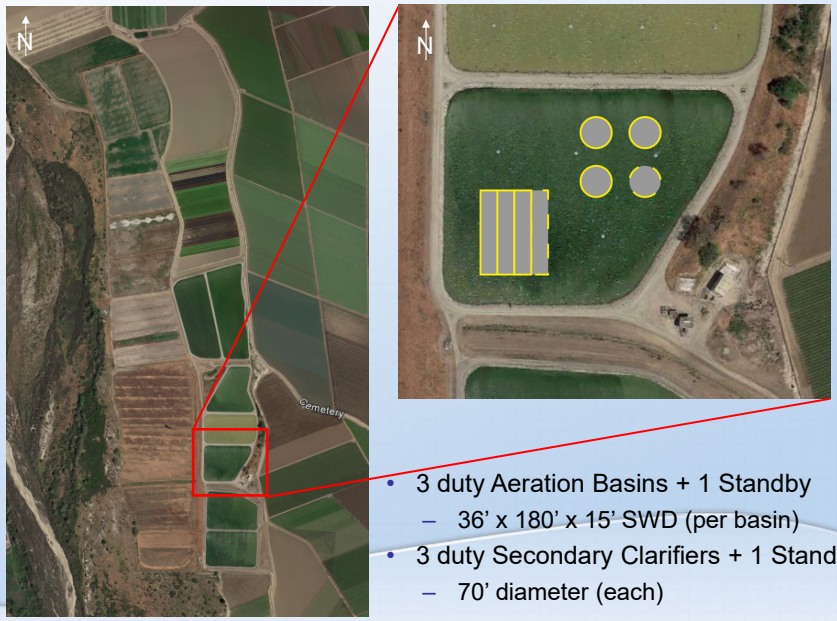
Preliminary Layout – Oxidation Ditches

- 3 duty Oxidation Ditches
  - 53' x 223' x 15' SWD (per basin)
- 3 duty Secondary Clarifiers + 1 Standby
  - 70' diameter (each)

Conventional Activated Sludge w/ MLE

Preliminary Layout – CAS w/ MLE

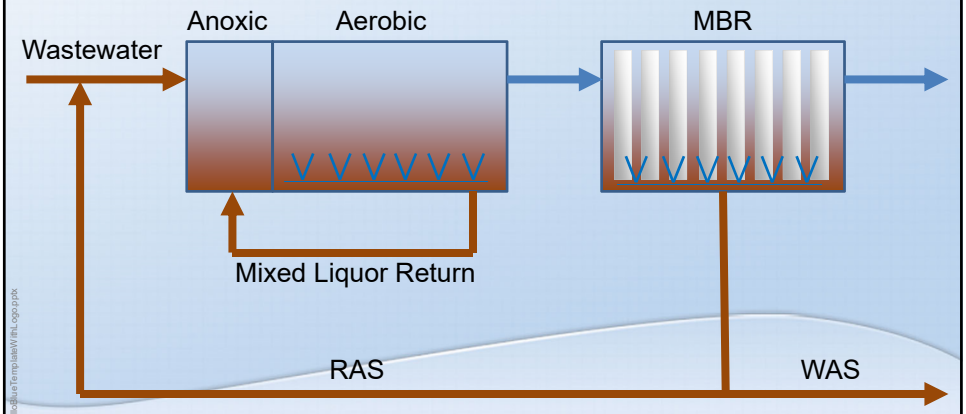


- 3 duty Aeration Basins + 1 Standby
  - 36' x 180' x 15' SWD (per basin)
- 3 duty Secondary Clarifiers + 1 Standby
  - 70' diameter (each)

75

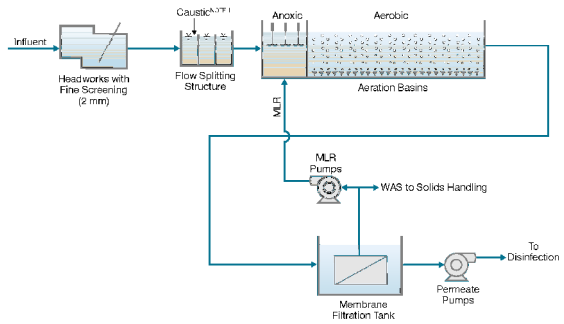
Membrane Bioreactor

- Membrane Bioreactor (MBR)



*Anoxic = no dissolved oxygen

MBR Schematic

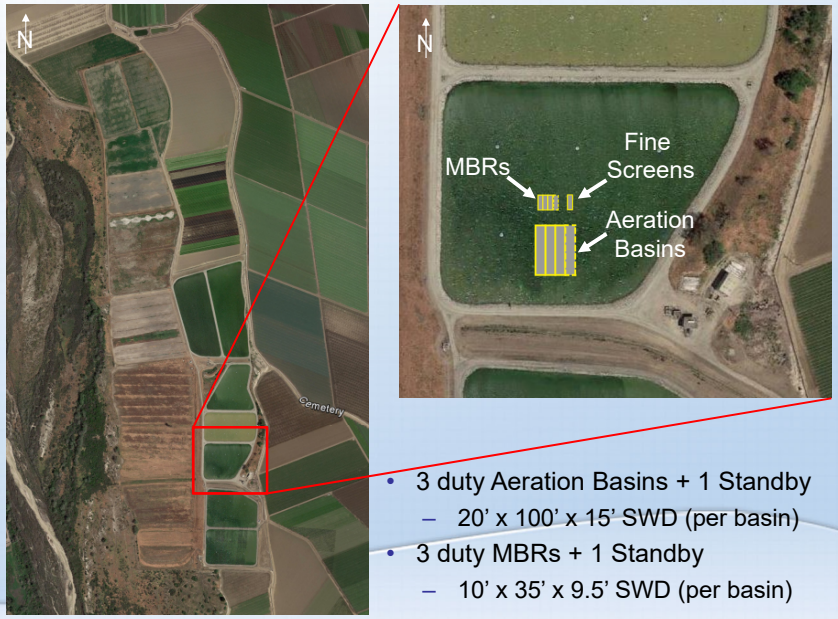


NOTES:
1. Caustic may be required for supplemental alkalinity. Caustic feed system would include storage tanks, metering pumps, and containment areas.

Figure 5.#
SECONDARY TREATMENT ALTERNATIVE 3
MBR SCHEMATIC
WASTEWATER TREATMENT FACILITIES PLAN
KING CITY

Membrane Bioreactors

Proposed Layout – MBRs



- 3 duty Aeration Basins + 1 Standby
  - 20' x 100' x 15' SWD (per basin)
- 3 duty MBRs + 1 Standby
  - 10' x 35' x 9.5' SWD (per basin)

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Secondary Treatment Ranking Criteria

- Non-economic
  - Safety
  - Meets permit
  - Constructability
  - Reliability
  - Impact on GHG emissions
  - Odor
- Economic
  - Construction cost
  - Footprint
  - Operator attention
  - Power cost
  - Sludge production
  - Maintenance requirements

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Basis of Cost Development

- Capital Construction Cost
  - Total Direct Cost:
    - Structural, equipment, and piping (ENR December 2016, Location factor for Salinas)
    - Facility Sitework (20% allowance)
    - Yard piping (10% allowance)
    - EI&C (30% allowance)
    - Contingency (30% of Total Direct Cost)
    - General Conditions (15% on top of Subtotal with Contingency)
    - Contractor Overhead & Profit (12% on top of Subtotal with General Conditions)
    - Sales Tax (50% of Total Direct Cost at Rate of 7.875%)
    - Escalation to Midpoint of Construction (April 1, 2020)
  - Capital Cost Economic Factors:
    - Footprint
    - Process-specific sitework (Foundation or Skid-Mounted)
    - Building or Canopy Requirements
    - Standby/Redundancy Units Required (Process-Dependent)
  - To get to Project Cost, add Engineering, Legal, Admin, Permitting, & Construction Management

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Basis of Cost Development (con't)

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CIP Budgetary Cost Estimate
LOCATION FACTOR: 110.4
20 CITIES ENR CCI NOV 2016: 10443

PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Tertiary Treatment - Filters (Continuous Backwash)

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - Continuous Backwash, 7.8 (peak) MGD	1	LS	$ 2,302,218	1	1.0	1.000	$ 2,300,000	
2	SITEWORK	20	%					$ 460,000	
3	YARD PIPING	10	%					$ 230,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%					$ 690,000	
	TOTAL DIRECT COST								**$ 3,680,000**
	Estimating Contingency	30	%	$ 1,104,000					
	SUBTOTAL							**$ 4,780,000**	
	Contractor General Conditions	15	%	$ 717,000					
	SUBTOTAL							**$ 5,500,000**	
	Contractor Overhead and Profit	12	%	$ 660,000					
	SUBTOTAL							**$ 6,160,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 144,900					
	SUBTOTAL							**$ 6,300,000**	
	Escalation to Midpoint of Construction	3	%	$ 602,043					
	SUBTOTAL							**$ 6,900,000**	
	TOTAL CONSTRUCTION COST								**$ 6,900,000**
	Design, Legal, Administrative Fees and Construction Management	35	%	$ 2,415,000					
	SUBTOTAL							**$ 9,315,000**	
	TOTAL PROJECT COST								**$ 9,320,000**

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Basis of Cost Development (con't)

- O&M Cost
  - Comparative Annual Cost Between Alternatives
  - Bring to Present Worth over 20-Year Life Cycle
    - 6% Interest
    - 3% Inflation
  - O&M Cost Economic Factors:
    - Power ($0.12/KWH)
    - Maintenance Requirement (e.g., parts replacement)
    - Chemical Usage/Delivery
    - Sludge Dredging and/or Hauling
    - Labor requirements not included (will be determined for final recommended project)

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Secondary Treatment Options Evaluation of Non-Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)		
	CAS w/ MLE	Oxidation Ditches	MBR
Safety	2	2	1
Meets Permit	3	3	3
Ease of O&M	2	3	1
Constructability	2	2	3
Reliability	3	3	3
Ammonia/Nitrate Removal	3	3	3
Odor	2	2	3
Total Score	**17**	**18**	**17**

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Secondary Treatment Options Evaluation of Economic Factors

Option	CAS w/ MLE	Oxidation Ditches	MBR
Capital (Construction) Costs	$26,340,000	$22,670,000	$23,770,000
Comparative Annual O&M Costs	$245,800	$297,700	$441,900
Present Worth of Comparative 20-year O&M Cost	$3,794,000	$4,596,000	$6,821,000
Present Worth of Comparative Life-Cycle Cost	**$30,134,000**	**$27,266,000**	**$30,591,000**

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Tertiary Filtration Processes

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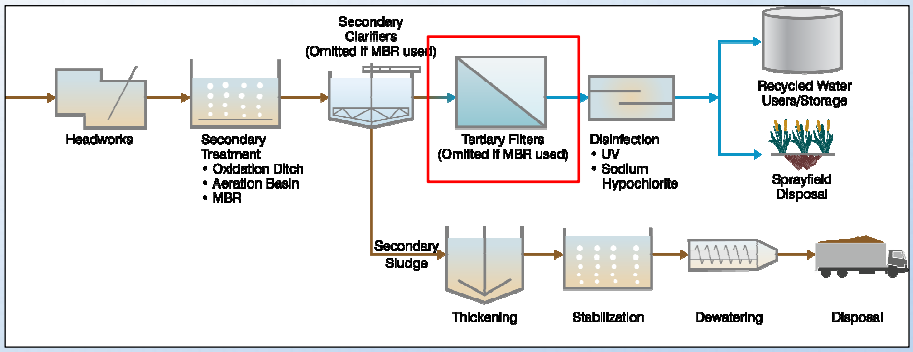

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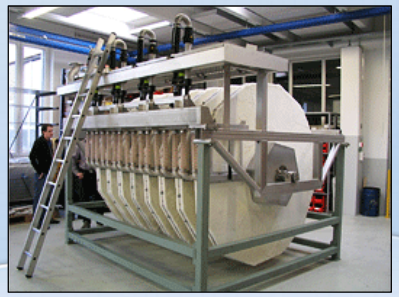
Filtration Alternatives



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Tertiary Filtration Options Evaluation of Non-Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)	
	Cloth Media Disk	Continuous Backwash
Safety	2	2
Meets Permit	3	3
Ease of O&M	2	3
Constructability	2	2
Reliability	3	3
Odor	2	2
Total Score	**14**	**15**

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Tertiary Filtration Options Evaluation of Economic Factors

Option	Cloth Media Disk	Continuous Backwash
Capital Costs	$8,520,000	$6,900,000
Comparative Annual O&M Costs	$1,100	$11,800
Present Worth of Comparative 20-year O&M Cost	$17,000	$183,000
Present Worth of Comparative Life-Cycle Cost	**$8,537,000**	**$7,083,000**

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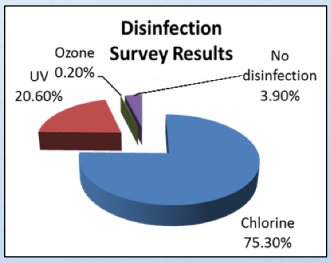
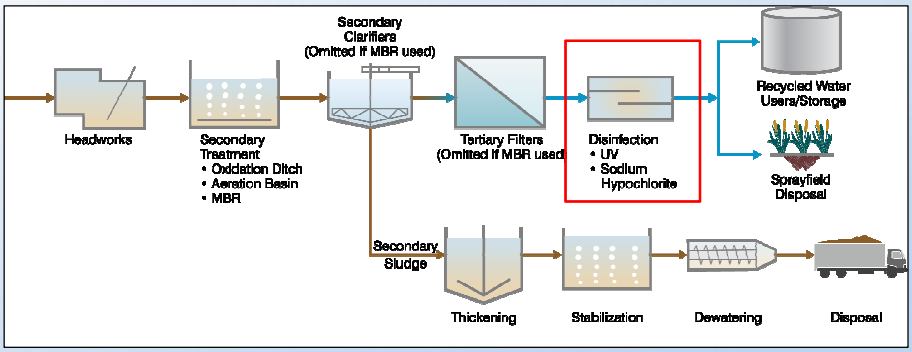
Disinfection Alternatives

- Sodium hypochlorite (Chlorine)
  - Chlorine contact time
  - DBP
  - Dechlorination required
- UV
  - Performance based on filter performance
  - Design parameters: UVT, Dose



Survey of Disinfection practices for 4,450 POTWs in the US was conducted (WERF)



Sodium hypochlorite (Chlorine)

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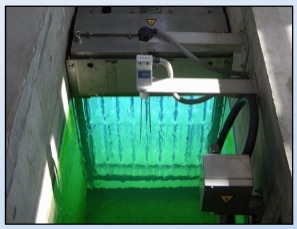
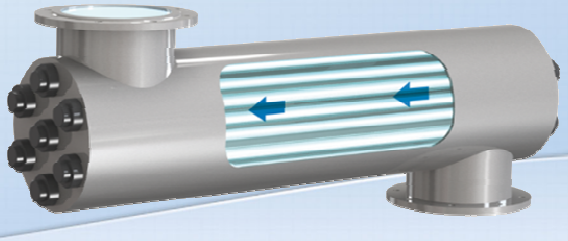
UV Disinfection





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Disinfection Options Evaluation of Non-Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)	
	Sodium Hypochlorite	UV
Safety	2	3
Meets Permit	3	3
Ease of O&M	3	1
Constructability	2	3
Reliability	3	3
Odor	2	3
Total Score	**15**	**16**

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Disinfection Options Evaluation of Economic Factors

Option	Sodium Hypochlorite	UV
Capital Costs	$6,070,000	$7,060,000
Comparative Annual O&M Costs	$318,300	$179,200
Present Worth of Comparative 20-year O&M Cost	$4,914,000	$2,766,000
Present Worth of Comparative Life-Cycle Cost	**$10,984,000**	**$9,826,000**

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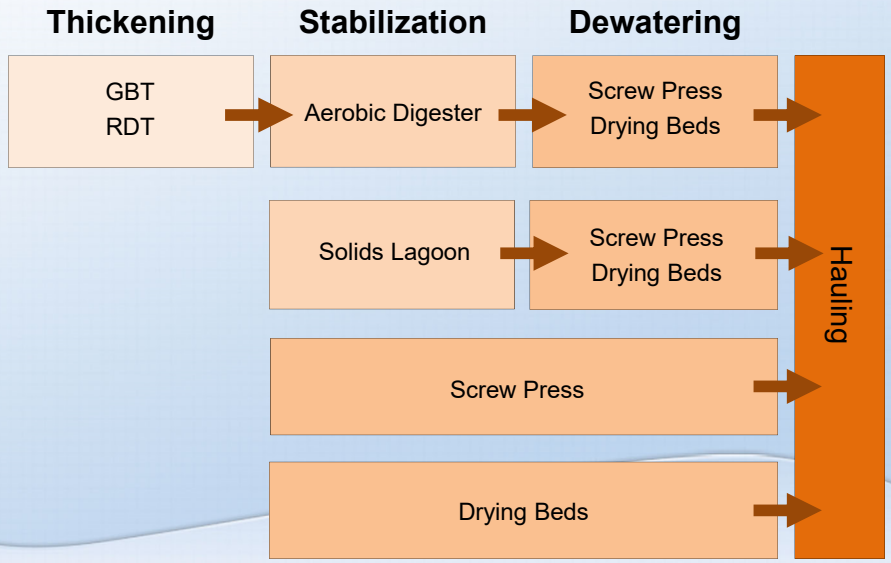
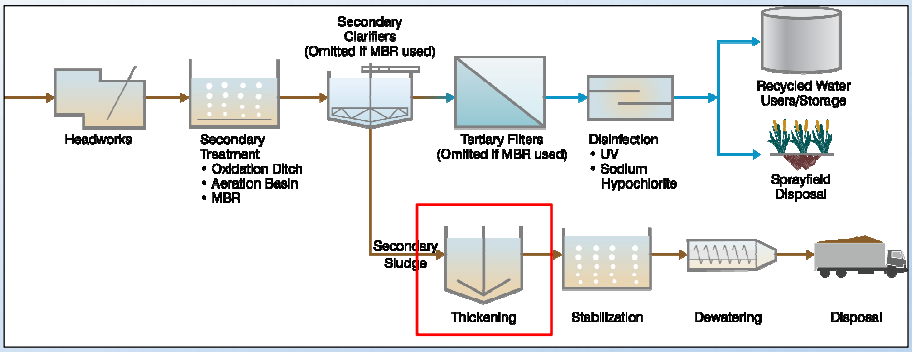
Biosolids Treatment

Typical Solids Flow Chart





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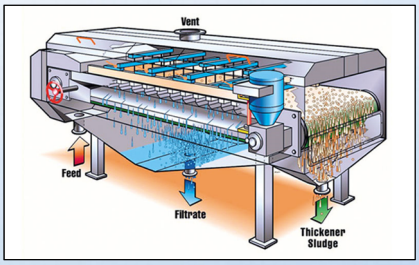
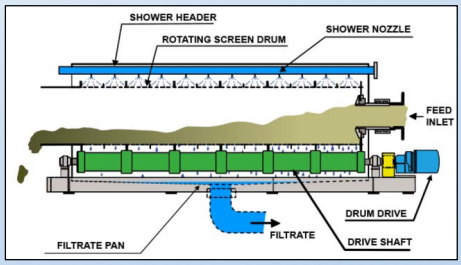
Solids Thickening

GBT



RDT



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Gravity Belt Thickener

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Rotary Drum Thickener

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Solids Thickening Options Evaluation of Non-Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)	
	GBT	RDT
Safety	2	3
Meets Permit	3	3
Ease of O&M	1	3
Constructability	2	3
Reliability	3	3
Odor	1	3
Total Score	**12**	**15**

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Solids Thickening Options Evaluation of Economic Factors

Option	GBT	RDT
Capital Costs	$2,180,000	$1,710,000
Comparative Annual O&M Costs	$11,800	$1,200
Present Worth of Comparative 20-year O&M Cost	$183,000	$19,000
Present Worth of Comparative Life-Cycle Cost	**$2,363,000**	**$1,729,000**

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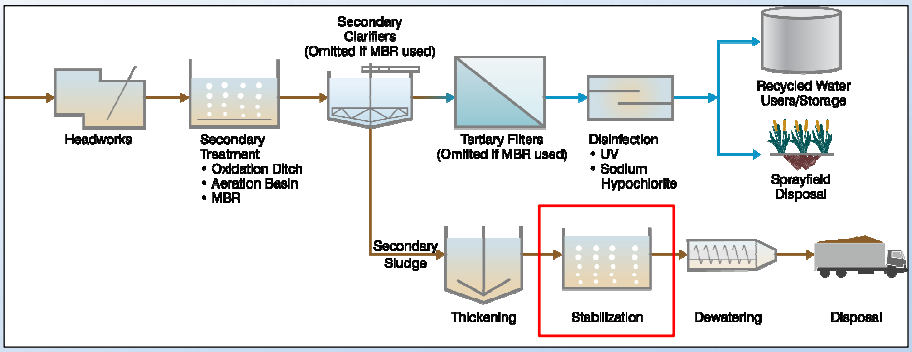

Solids Stabilization

Aerobic digester

Solids lagoon

Solids Stabilization Options Evaluation of Non-Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)	
	Aerobic Digester	Solids Lagoon
Safety	3	2
Meets Permit	3	2
Ease of O&M	1	3
Constructability	1	2
Reliability	3	2
Odor	3	1
Total Score	**14**	**12**

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Solids Stabilization Options Evaluation of Economic Factors

Option	Aerobic Digester	Solids Lagoon
Capital Costs	$6,180,000	$1,500,000
Comparative Annual O&M Costs	$188,400	$1,120,300
Present Worth of Comparative 20-year O&M Cost	$2,908,000	$17,293,000
Present Worth of Comparative Life-Cycle Cost	**$9,088,000**	**$18,793,000**

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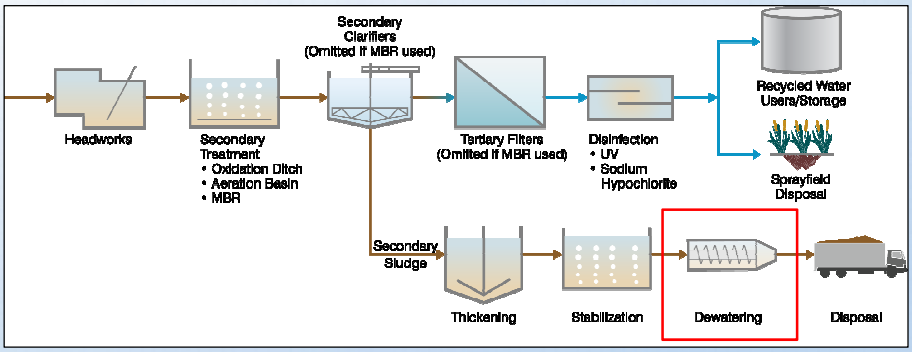
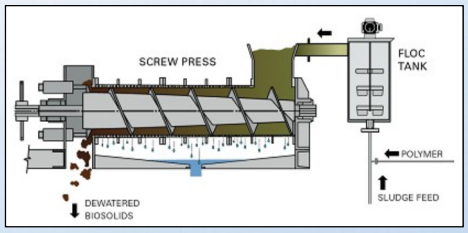


Solids Dewatering

Screw press



Drying beds

Solids Dewatering Options Evaluation of Non-Economic Factors

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)	
	Screw Press	Drying Beds
Safety	2	2
Meets Permit	3	3
Ease of O&M	3	2
Constructability	3	3
Reliability	3	3
Odor	3	1
Total Score	**17**	**14**

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Dewatering Options Evaluation of Economic Factors

Option	Screw Press	Drying Beds
Capital Costs	$3,720,000	$4,090,000
Comparative Annual O&M Costs	$229,600	$47,300
Present Worth of Comparative 20-year O&M Cost	$3,544,000	$731,000
Present Worth of Comparative Life-Cycle Cost	**$7,264,000**	**$4,821,000**

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Disposal

- Off-site land application (outside of Monterey County)

SYNAGRO

Engel & Gray, Inc.

LIBERTY COMPOST

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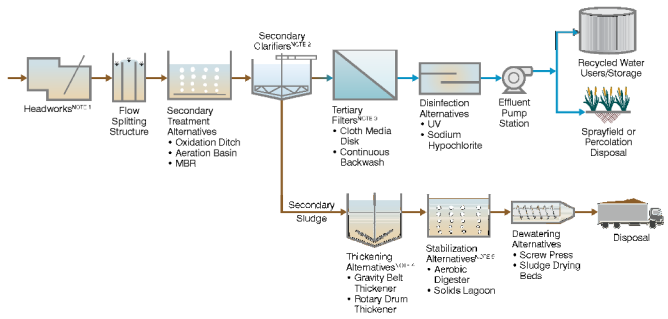
Tertiary Treatment Plant Flow Schematic



NOTES:
1. See proposed flow schematic.
2. Omitted if MBR used.
3. Omitted if MBR used.
4. Omitted if oxidation ditch or solids lagoon used.
5. Omitted if oxidation ditch used.

Figure 5.#
PROPOSED TERTIARY FACILITY
FLOW SCHEMATIC
WASTEWATER TREATMENT FACILITIES PLAN
KING CITY

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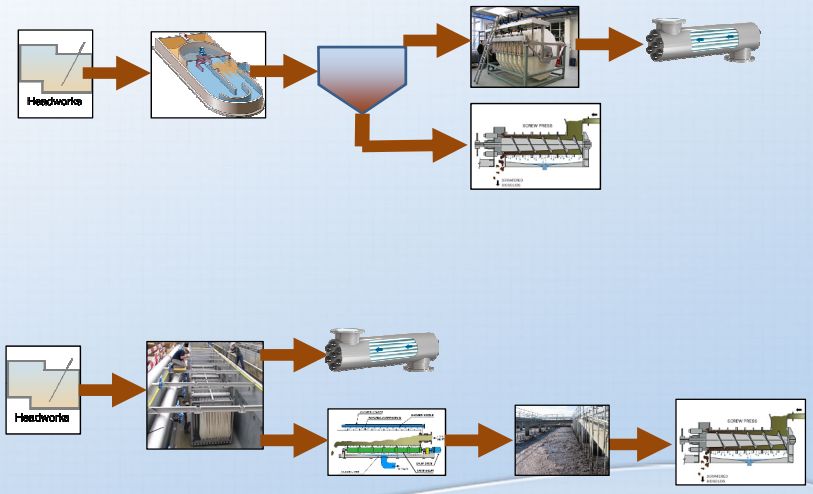
Potential WWTP Configurations



Capital (Construction) Costs of Overall Tertiary Facility

Option	Oxidation Ditch Configuration Cost	MBR Configuration Cost
Headworks	$7,670,000	$7,670,000
Secondary Treatment (Includes splitter box, RAS/WAS pumping, blower building, and secondary clarifier if required)	$22,670,000	$23,770,000
Cloth Media Disk Filters	$8,520,000	N/A
UV	$7,060,000	$7,060,000
Rotary Drum Thickener	N/A	$1,710,000
Aerobic Digester	N/A	$6,180,000
Screw Press	$3,720,000	$3,720,000
Effluent Pump Station	$2,310,000	$2,310,000
Total	**$51,950,000**	**$52,420,000**

Project Schedule

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Overall Tertiary Facility Schedule

Task Description	2017	2018	2019	2020
Facility Plan				
Recycled Water Study				
Rate Study				
RWQCB Meetings				
Preliminary Design				
EIR/Permitting				
Final design/Bidding				
Construction				
Start up				

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Action Items/ Next Steps

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Next Steps

- Near-term deliverables
  - TM No. 4 – Effluent Reuse and Disposal
  - TM No. 5 – Alternatives Analysis
- Develop recommended project
  - Amend TM No. 5 with information for recommended project
    - Site layout
    - Total construction, program, and annual O&M costs
    - Hydraulic profile
- Begin work on Recycled Water Feasibility Studies
- Scope Rate Study
- Scope Preliminary/Final Design
- Investigate funding opportunities

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Questions?

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APPENDIX H – TOTAL OXIDATION DITCH RECOMMENDED ALTERNATIVE COST

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CAPITAL COST SUMMARY - TERTIARY FACILITY AT BUILDOUT WITH CONTINUOUS BACKWASH FILTER

ESTIMATED MIDPOINT OF CONSTRUCTION :	4/1/2020
COST ESTIMATE PREPARATION DATE :	3/1/2017
BY :	TJG
REVIEWED BY:	ETC

PROJECT : CITY OF KING CITY WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City

Rate of Annual Inflation:	3%
Estimating Contingency:	30%
Sales Tax:	7.875%
Contractor General Conditions:	15%
Contractor Overhead and Profit:	12%

ELEMENT #	DESCRIPTION	TOTAL CONSTRUCTION COST
01	Headworks	$ 7,670,000
02A	Secondary Treatment - Oxidation Ditch	$ 24,120,000
03A	Tertiary Treatment - Filters (Continuous Backwash)	$ 13,000,000
04B	Tertiary Treatment - Disinfection (UV)	$ 4,700,000
07A	Solids Processing - Dewatering (Screw Press)	$ 3,720,000
-	Alternative No. 3 - Reuse and Disposal	$ 3,450,000
	Total Estimated Capital Cost without Reuse and Disposal =	**$ 53,210,000**
	Total Estimated Capital Cost with Reuse and Disposal =	**$ 56,660,000**

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Engineers...Working Wonders With Water®

PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Headworks	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	HEADWORKS - 7.8 (peak) MGD including Influent Pumping, Mechanical Bar Screens, Grit Removal, Parshall Flum Metering, Screenings Washer/Dewatering Press Dry Pit	1	LS	$ 3,725,056	1.00	$ 3,730,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING	10	%			$ 370,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,120,000	
	TOTAL DIRECT COST						**$ 5,220,000**
	Estimating Contingency	30	%	$ 1,566,000			
	SUBTOTAL					**$ 6,790,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 6,790,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 6,790,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 205,538			
	SUBTOTAL					**$ 7,000,000**	
	Escalation to Midpoint of Construction	3	%	$668,936.99			
	SUBTOTAL					**$ 7,670,000**	
	TOTAL CONSTRUCTION COST						**$ 7,670,000**

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Engineers...Working Wonders With Water®

PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Secondary Treatment - Oxidation Ditch	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	OXIDATION DITCHES (3, 1.2 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$5,191,634	1.00	$ 5,190,000	
2	CIRCULAR SECONDARY CLARIFIERS (3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$3,454,341	1.00	$ 3,450,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ 478,105	1.00	$ 480,000	
4	SITEWORK	20	%			$ 1,130,000	
5	YARD PIPING	10	%			$ 910,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 2,740,000	
	TOTAL DIRECT COST						**$13,900,000**
	Estimating Contingency	30	%	$4,170,000			
	SUBTOTAL					**$ 18,070,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$1,768,650			
	SUBTOTAL					**$ 19,840,000**	
	Contractor Overhead and Profit - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	12	%	$1,627,158			
	SUBTOTAL					**$ 21,470,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 547,313			
	SUBTOTAL					**$ 22,020,000**	
	Escalation to Midpoint of Construction	3	%	$2,104,285			
	SUBTOTAL					**$ 24,120,000**	
	TOTAL CONSTRUCTION COST						**$24,120,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Continuous Backwash) Recycled Water	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - 9 + 3, Continuous Backwash, 3.2 (peak) MGD design flow	1	LS	$4,328,777	1.00	$ 4,330,000	
2	SITEWORK	20	%			$ 870,000	
3	YARD PIPING	10	%			$ 430,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,300,000	
	TOTAL DIRECT COST						**$ 6,930,000**
	Estimating Contingency	30	%	$2,079,000			
	SUBTOTAL					**$ 9,010,000**	
	Contractor General Conditions	15	%	$1,351,500			
	SUBTOTAL					**$ 10,360,000**	
	Contractor Overhead and Profit	12	%	$1,243,200			
	SUBTOTAL					**$ 11,600,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 272,869			
	SUBTOTAL					**$ 11,870,000**	
	Escalation to Midpoint of Construction	3	%	$1,134,326			
	SUBTOTAL					**$ 13,000,000**	
	TOTAL CONSTRUCTION COST						**$13,000,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (UV) Recycled Water	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	UV - Backup equipment costs provided by Bill Sotirakis. Construction cost assume to be 4x equipment cost. The 4x multiplier includes sitework, yard piping, EI&C, estimating contigency, contractor general condidtions, contractor overhead and profit, and sales tax - 3+1	1	LS	$4,293,333	1.00	$ 4,290,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING - Included in item 1	10	%			$ -	
4	ELECTRICAL AND INSTRUMENTATION - Included in item 1	30	%			$ -	
	TOTAL DIRECT COST						**$4,290,000**
	Estimating Contingency - Included in item 1	30	%				
	SUBTOTAL					**$ 4,290,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 4,290,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 4,290,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal - Included in ite	7.875	%				
	SUBTOTAL					**$ 4,290,000**	
	Escalation to Midpoint of Construction	3	%	$ 409,963			
	SUBTOTAL					**$ 4,700,000**	
	TOTAL CONSTRUCTION COST						**$4,700,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Dewatering (Screw Press)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	THICKENING/DEWATERING BUILDING - DIRECT COST	1	LS	$ 234,043	1.00	$ 230,000	
2	DEWATERING EQUIPMENT - DIRECT COST	1	LS	$1,005,396	1.00	$ 1,010,000	
3	SITEWORK	20	%			$ 250,000	
4	YARD PIPING	10	%			$ 120,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 370,000	
	TOTAL DIRECT COST						**$1,980,000**
	Estimating Contingency	30	%	$ 594,000			
	SUBTOTAL					**$ 2,570,000**	
	Contractor General Conditions	15	%	$ 385,500			
	SUBTOTAL					**$ 2,960,000**	
	Contractor Overhead and Profit	12	%	$ 355,200			
	SUBTOTAL					**$ 3,320,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 77,963			
	SUBTOTAL					**$ 3,400,000**	
	Escalation to Midpoint of Construction	3	%	$ 324,912			
	SUBTOTAL					**$ 3,720,000**	
	TOTAL CONSTRUCTION COST						**$3,720,000**

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PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Alternative No. 3 - Reuse and Disposal

LOCATION FACTOR: 110.4
20 CITIES ENR CCI DEC 2016: 10530

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3, and 5)	65,830	CY		$ 7.00	1	1.0	1.00	$ 460,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3, and 5)	41,464	CY		$ 2.50	1	1.0	1.00	$ 100,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3, and 5)	7,584	CY		$ 103.24	1	1.0	1.00	$ 780,000	
4	Sludge Removal (Pond 4)	14,202	CY		$ 7.00	1	1.0	1.00	$ 100,000	
5	Clay Liner Removal (Pond 4)	14,973	CY		$ 2.50	1	1.0	1.00	$ 40,000	
6	New Pond Liner (Pond 4)	449,188	SF		$ 0.81	1	1.0	1.00	$ 360,000	
	TOTAL DIRECT COST									**$ 1,840,000**
	Estimating Contingency	30	%		$ 552,000					
	SUBTOTAL								**$ 2,390,000**	
	Contractor General Conditions	15	%		$ 358,500					
	SUBTOTAL								**$ 2,750,000**	
	Contractor Overhead and Profit	12	%		$ 330,000					
	SUBTOTAL								**$ 3,080,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 72,450					
	SUBTOTAL								**$ 3,150,000**	
	Escalation to Midpoint of Construction	3	%		$ 301,021.65					
	SUBTOTAL								**$ 3,450,000**	
	TOTAL CONSTRUCTION COST									**$ 3,450,000**

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CAPITAL COST SUMMARY - TERTIARY FACILITY AT BUILDOUT WITH CLOTH MEDIA DISK FILTER

ESTIMATED MIDPOINT OF CONSTRUCTION :	4/1/2020
COST ESTIMATE PREPARATION DATE :	3/1/2017
BY :	TJG
REVIEWED BY:	ETC

PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City

Rate of Annual Inflation:	3%
Estimating Contingency:	30%
Sales Tax:	7.875%
Contractor General Conditions:	15%
Contractor Overhead and Profit:	12%

ELEMENT #	DESCRIPTION	TOTAL CONSTRUCTION COST
01	Headworks	$ 7,670,000
02A	Secondary Treatment - Oxidation Ditch	$ 24,120,000
03A	Tertiary Treatment - Filters (Cloth Disk)	$ 4,090,000
04B	Tertiary Treatment - Disinfection (UV)	$ 4,700,000
07A	Solids Processing - Dewatering (Screw Press)	$ 3,720,000
	Alternative No. 3 - Reuse and Disposal	$ 3,450,000
	Total Estimated Capital Cost without Reuse and Disposal =	**$ 44,300,000**
	Total Estimated Capital Cost with Reuse and Disposal =	**$ 47,750,000**

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Headworks	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	HEADWORKS - 7.8 (peak) MGD including Influent Pumping, Mechanical Bar Screens, Grit Removal, Parshall Flum Metering, Screenings Washer/Dewatering Press Dry Pit	1	LS	$ 3,725,056	1.00	$ 3,730,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING	10	%			$ 370,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,120,000	
	TOTAL DIRECT COST						**$ 5,220,000**
	Estimating Contingency	30	%	$ 1,566,000			
	SUBTOTAL					**$ 6,790,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 6,790,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 6,790,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 205,538			
	SUBTOTAL					**$ 7,000,000**	
	Escalation to Midpoint of Construction	3	%	$668,936.99			
	SUBTOTAL					**$ 7,670,000**	
	TOTAL CONSTRUCTION COST						**$ 7,670,000**

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Secondary Treatment - Oxidation Ditch	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	OXIDATION DITCHES (3, 1.2 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$5,191,634	1.00	$ 5,190,000	
2	CIRCULAR SECONDARY CLARIFIERS (3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$3,454,341	1.00	$ 3,450,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ 478,105	1.00	$ 480,000	
4	SITEWORK	20	%			$ 1,130,000	
5	YARD PIPING	10	%			$ 910,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 2,740,000	
	TOTAL DIRECT COST						**$13,900,000**
	Estimating Contingency	30	%	$4,170,000			
	SUBTOTAL					**$ 18,070,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$1,768,650			
	SUBTOTAL					**$ 19,840,000**	
	Contractor Overhead and Profit - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	12	%	$1,627,158			
	SUBTOTAL					**$ 21,470,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 547,313			
	SUBTOTAL					**$ 22,020,000**	
	Escalation to Midpoint of Construction	3	%	$2,104,285			
	SUBTOTAL					**$ 24,120,000**	
	TOTAL CONSTRUCTION COST						**$24,120,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Cloth Disk) Recycled Water	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - Cloth Media Disk, 3.2 (peak) MGD design flow	1	LS	$1,356,299	1.00	$ 1,360,000	
2	SITEWORK	20	%			$ 270,000	
3	YARD PIPING	10	%			$ 140,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 410,000	
	TOTAL DIRECT COST						**$ 2,180,000**
	Estimating Contingency	30	%	$ 654,000			
	SUBTOTAL					**$ 2,830,000**	
	Contractor General Conditions	15	%	$ 424,500			
	SUBTOTAL					**$ 3,250,000**	
	Contractor Overhead and Profit	12	%	$ 390,000			
	SUBTOTAL					**$ 3,640,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 85,838			
	SUBTOTAL					**$ 3,730,000**	
	Escalation to Midpoint of Construction	3	%	$ 356,448			
	SUBTOTAL					**$ 4,090,000**	
	TOTAL CONSTRUCTION COST						**$ 4,090,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (UV) Recycled Water	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	UV - Backup equipment costs provided by Bill Sotirakis. Construction cost assume to be 4x equipment cost. The 4x multiplier includes sitework, yard piping, EI&C, estimating contigency, contractor general condidtions, contractor overhead and profit, and sales tax - 3+1	1	LS	$4,293,333	1.00	$ 4,290,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING - Included in item 1	10	%			$ -	
4	ELECTRICAL AND INSTRUMENTATION - Included in item 1	30	%			$ -	
	TOTAL DIRECT COST						**$4,290,000**
	Estimating Contingency - Included in item 1	30	%				
	SUBTOTAL					**$ 4,290,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 4,290,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 4,290,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal - Included in ite	7.875	%				
	SUBTOTAL					**$ 4,290,000**	
	Escalation to Midpoint of Construction	3	%	$ 409,963			
	SUBTOTAL					**$ 4,700,000**	
	TOTAL CONSTRUCTION COST						**$4,700,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Dewatering (Screw Press)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	THICKENING/DEWATERING BUILDING - DIRECT COST	1	LS	$ 234,043	1.00	$ 230,000	
2	DEWATERING EQUIPMENT - DIRECT COST	1	LS	$1,005,396	1.00	$ 1,010,000	
3	SITEWORK	20	%			$ 250,000	
4	YARD PIPING	10	%			$ 120,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 370,000	
	TOTAL DIRECT COST						**$1,980,000**
	Estimating Contingency	30	%	$ 594,000			
	SUBTOTAL					**$ 2,570,000**	
	Contractor General Conditions	15	%	$ 385,500			
	SUBTOTAL					**$ 2,960,000**	
	Contractor Overhead and Profit	12	%	$ 355,200			
	SUBTOTAL					**$ 3,320,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 77,963			
	SUBTOTAL					**$ 3,400,000**	
	Escalation to Midpoint of Construction	3	%	$ 324,912			
	SUBTOTAL					**$ 3,720,000**	
	TOTAL CONSTRUCTION COST						**$3,720,000**

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PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Alternative No. 3 - Reuse and Disposal

LOCATION FACTOR: 110.4
20 CITIES ENR CCI DEC 2016: 10530

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3, and 5)	65,830	CY		$ 7.00	1	1.0	1.00	$ 460,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3, and 5)	41,464	CY		$ 2.50	1	1.0	1.00	$ 100,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3, and 5)	7,584	CY		$ 103.24	1	1.0	1.00	$ 780,000	
4	Sludge Removal (Pond 4)	14,202	CY		$ 7.00	1	1.0	1.00	$ 100,000	
5	Clay Liner Removal (Pond 4)	14,973	CY		$ 2.50	1	1.0	1.00	$ 40,000	
6	New Pond Liner (Pond 4)	449,188	SF		$ 0.81	1	1.0	1.00	$ 360,000	
	TOTAL DIRECT COST									**$ 1,840,000**
	Estimating Contingency	30	%		$ 552,000					
	SUBTOTAL								**$ 2,390,000**	
	Contractor General Conditions	15	%		$ 358,500					
	SUBTOTAL								**$ 2,750,000**	
	Contractor Overhead and Profit	12	%		$ 330,000					
	SUBTOTAL								**$ 3,080,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 72,450					
	SUBTOTAL								**$ 3,150,000**	
	Escalation to Midpoint of Construction	3	%		$ 301,021.65					
	SUBTOTAL								**$ 3,450,000**	
	TOTAL CONSTRUCTION COST									**$ 3,450,000**

APPENDIX I – PHASED OXIDATION DITCH RECOMMENDED ALTERNATIVE COST

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CAPITAL COST SUMMARY - PHASED TERTIARY FACILITY WITH CONTINUOUS BACKWASH FILTER

ESTIMATED MIDPOINT OF CONSTRUCTION (PHASE 1):	4/1/2020
ESTIMATED MIDPOINT OF CONSTRUCTION (PHASE 2):	1/1/2023
COST ESTIMATE PREPARATION DATE :	3/1/2017
BY :	TJG
REVIEWED BY:	ETC

PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City

Rate of Annual Inflation:	3%
Estimating Contingency:	30%
Sales Tax:	7.875%
Contractor General Conditions:	15%
Contractor Overhead and Profit:	12%

ELEMENT #	DESCRIPTION	TOTAL CONSTRUCTION COST	
		PHASE 1	PHASE 2
01	Headworks	$ 7,670,000	$ -
02A	Secondary Treatment - Oxidation Ditch (PHASE 1)	$ 17,160,000	$ -
02A	Secondary Treatment - Oxidation Ditch (PHASE 2)	$ -	$ 7,570,000
03A	Tertiary Treatment - Filters (Continuous Backwash) (PHASE 1)	$ 8,690,000	$ -
03A	Tertiary Treatment - Filters (Continuous Backwash) (PHASE 2)	$ -	$ 4,680,000
04B	Tertiary Treatment - Disinfection (UV) (PHASE 1)	$ 3,530,000	$ -
04B	Tertiary Treatment - Disinfection (UV) (PHASE 2)	$ -	$ 1,270,000
07A	Solids Processing - Dewatering (Screw Press)	$ 3,720,000	$ -
-	Alternative No. 3 - Reuse and Disposal	$ 3,450,000	$ -
	Total Estimated Capital Cost without Reuse and Disposal =	**$ 40,770,000**	**$ 13,520,000**
	Total Estimated Capital Cost with Reuse and Disposal =	**$ 44,220,000**	**$ 13,520,000**

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Headworks	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	HEADWORKS - 7.8 (peak) MGD including Influent Pumping, Mechanical Bar Screens, Grit Removal, Parshall Flum Metering, Screenings Washer/Dewatering Press Dry Pit	1	LS	$ 3,725,056	1.00	$ 3,730,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING	10	%			$ 370,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,120,000	
	TOTAL DIRECT COST						**$ 5,220,000**
	Estimating Contingency	30	%	$ 1,566,000			
	SUBTOTAL					**$ 6,790,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 6,790,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 6,790,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 205,538			
	SUBTOTAL					**$ 7,000,000**	
	Escalation to Midpoint of Construction	3	%	$668,936.99			
	SUBTOTAL					**$ 7,670,000**	
	TOTAL CONSTRUCTION COST						**$ 7,670,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Secondary Treatment - Oxidation Ditch (PHASE 1)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	OXIDATION DITCHES (2 of 3, 1.2 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$3,461,089	1.00	$ 3,460,000	
2	CIRCULAR SECONDARY CLARIFIERS (2+1 of 3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$2,590,756	1.00	$ 2,590,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ 478,105	1.00	$ 480,000	
4	SITEWORK	20	%			$ 790,000	
5	YARD PIPING	10	%			$ 650,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,960,000	
	TOTAL DIRECT COST						**$ 9,930,000**
	Estimating Contingency	30	%	$2,979,000			
	SUBTOTAL					**$ 12,910,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$1,228,500			
	SUBTOTAL					**$ 14,140,000**	
	Contractor Overhead and Profit - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	12	%	$1,130,220			
	SUBTOTAL					**$ 15,270,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 390,994			
	SUBTOTAL					**$ 15,660,000**	
	Escalation to Midpoint of Construction	3	%	$1,496,508			
	SUBTOTAL					**$ 17,160,000**	
	TOTAL CONSTRUCTION COST						**$17,160,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	1/1/2023
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Secondary Treatment - Oxidation Ditch (PHASE 2)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	OXIDATION DITCHES (1 of 3, 1.2 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$1,730,545	1.00	$ 1,730,000	
2	CIRCULAR SECONDARY CLARIFIERS (1 of 3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$ 863,585	1.00	$ 860,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ -	1.00	$ -	
4	SITEWORK	20	%			$ 350,000	
5	YARD PIPING	10	%			$ 260,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 780,000	
	TOTAL DIRECT COST						**$ 3,980,000**
	Estimating Contingency	30	%	$1,194,000			
	SUBTOTAL					**$ 5,170,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$ 540,150			
	SUBTOTAL					**$ 5,710,000**	
	Contractor Overhead and Profit - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	12	%	$ 496,938			
	SUBTOTAL					**$ 6,210,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 156,713			
	SUBTOTAL					**$ 6,370,000**	
	Escalation to Midpoint of Construction	3	%	$1,200,471			
	SUBTOTAL					**$ 7,570,000**	
	TOTAL CONSTRUCTION COST						**$ 7,570,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Continuous Backwash) Recycled Water (PHASE 1)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - 6 + 2 of 12, Continuous Backwash, 3.2 (peak) MGD design flow	1	LS	$2,885,851	1.00	$ 2,890,000	
2	SITEWORK	20	%			$ 580,000	
3	YARD PIPING	10	%			$ 290,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 870,000	
	TOTAL DIRECT COST						**$ 4,630,000**
	Estimating Contingency	30	%	$1,389,000			
	SUBTOTAL					**$ 6,020,000**	
	Contractor General Conditions	15	%	$ 903,000			
	SUBTOTAL					**$ 6,920,000**	
	Contractor Overhead and Profit	12	%	$ 830,400			
	SUBTOTAL					**$ 7,750,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 182,306			
	SUBTOTAL					**$ 7,930,000**	
	Escalation to Midpoint of Construction	3	%	$ 757,810			
	SUBTOTAL					**$ 8,690,000**	
	TOTAL CONSTRUCTION COST						**$ 8,690,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	1/1/2023
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Continuous Backwash) Recycled Water (PHASE 2)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - 4 of 12, Continuous Backwash, 3.2 (peak) MGD design flow	1	LS	$1,442,926	1.00	$ 1,440,000	
2	SITEWORK	20	%			$ 290,000	
3	YARD PIPING	10	%			$ 140,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 430,000	
	TOTAL DIRECT COST						**$ 2,300,000**
	Estimating Contingency	30	%	$ 690,000			
	SUBTOTAL					**$ 2,990,000**	
	Contractor General Conditions	15	%	$ 448,500			
	SUBTOTAL					**$ 3,440,000**	
	Contractor Overhead and Profit	12	%	$ 412,800			
	SUBTOTAL					**$ 3,850,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 90,563			
	SUBTOTAL					**$ 3,940,000**	
	Escalation to Midpoint of Construction	3	%	$ 742,520			
	SUBTOTAL					**$ 4,680,000**	
	TOTAL CONSTRUCTION COST						**$ 4,680,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (UV) Recycled Water (PHASE 1)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	UV - Backup equipment costs provided by Bill Sotirakis. Construction cost assume to be 4x equipment cost. The 4x multiplier includes sitework, yard piping, EI&C, estimating contigency, contractor general condidtions, contractor overhead and profit, and sales tax - 2 + 1 of 4	1	LS	$3,220,000	1.00	$ 3,220,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING - Included in item 1	10	%			$ -	
4	ELECTRICAL AND INSTRUMENTATION - Included in item 1	30	%			$ -	
	TOTAL DIRECT COST						**$3,220,000**
	Estimating Contingency - Included in item 1	30	%				
	SUBTOTAL					**$ 3,220,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 3,220,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 3,220,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal - Included in ite	7.875	%				
	SUBTOTAL					**$ 3,220,000**	
	Escalation to Midpoint of Construction	3	%	$ 307,711			
	SUBTOTAL					**$ 3,530,000**	
	TOTAL CONSTRUCTION COST						**$3,530,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	1/1/2023
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (UV) Recycled Water (PHASE 2)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	UV - Backup equipment costs provided by Bill Sotirakis. Construction cost assume to be 4x equipment cost. The 4x multiplier includes sitework, yard piping, EI&C, estimating contigency, contractor general condidtions, contractor overhead and profit, and sales tax - 1 of 4	1	LS	$1,073,333	1.00	$ 1,070,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING - Included in item 1	10	%			$ -	
4	ELECTRICAL AND INSTRUMENTATION - Included in item 1	30	%			$ -	
	TOTAL DIRECT COST						**$1,070,000**
	Estimating Contingency - Included in item 1	30	%				
	SUBTOTAL					**$ 1,070,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 1,070,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 1,070,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal - Included in ite	7.875	%				
	SUBTOTAL					**$ 1,070,000**	
	Escalation to Midpoint of Construction	3	%	$ 201,649			
	SUBTOTAL					**$ 1,270,000**	
	TOTAL CONSTRUCTION COST						**$1,270,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Dewatering (Screw Press)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	THICKENING/DEWATERING BUILDING - DIRECT COST	1	LS	$ 234,043	1.00	$ 230,000	
2	DEWATERING EQUIPMENT - DIRECT COST	1	LS	$1,005,396	1.00	$ 1,010,000	
3	SITEWORK	20	%			$ 250,000	
4	YARD PIPING	10	%			$ 120,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 370,000	
	TOTAL DIRECT COST						**$1,980,000**
	Estimating Contingency	30	%	$ 594,000			
	SUBTOTAL					**$ 2,570,000**	
	Contractor General Conditions	15	%	$ 385,500			
	SUBTOTAL					**$ 2,960,000**	
	Contractor Overhead and Profit	12	%	$ 355,200			
	SUBTOTAL					**$ 3,320,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 77,963			
	SUBTOTAL					**$ 3,400,000**	
	Escalation to Midpoint of Construction	3	%	$ 324,912			
	SUBTOTAL					**$ 3,720,000**	
	TOTAL CONSTRUCTION COST						**$3,720,000**

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PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Alternative No. 3 - Reuse and Disposal

LOCATION FACTOR: 110.4
20 CITIES ENR CCI DEC 2016: 10530

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3, and 5)	65,830	CY		$ 7.00	1	1.0	1.00	$ 460,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3, and 5)	41,464	CY		$ 2.50	1	1.0	1.00	$ 100,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3, and 5)	7,584	CY		$ 103.24	1	1.0	1.00	$ 780,000	
4	Sludge Removal (Pond 4)	14,202	CY		$ 7.00	1	1.0	1.00	$ 100,000	
5	Clay Liner Removal (Pond 4)	14,973	CY		$ 2.50	1	1.0	1.00	$ 40,000	
6	New Pond Liner (Pond 4)	449,188	SF		$ 0.81	1	1.0	1.00	$ 360,000	
	TOTAL DIRECT COST									**$ 1,840,000**
	Estimating Contingency	30	%		$ 552,000					
	SUBTOTAL								**$ 2,390,000**	
	Contractor General Conditions	15	%		$ 358,500					
	SUBTOTAL								**$ 2,750,000**	
	Contractor Overhead and Profit	12	%		$ 330,000					
	SUBTOTAL								**$ 3,080,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 72,450					
	SUBTOTAL								**$ 3,150,000**	
	Escalation to Midpoint of Construction	3	%		$ 301,021.65					
	SUBTOTAL								**$ 3,450,000**	
	TOTAL CONSTRUCTION COST									**$ 3,450,000**

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CAPITAL COST SUMMARY - PHASED TERTIARY FACILITY WITH CLOTH DISK MEDIA FILTER

ESTIMATED MIDPOINT OF CONSTRUCTION (PHASE 1):	4/1/2020
ESTIMATED MIDPOINT OF CONSTRUCTION (PHASE 2):	1/1/2023
COST ESTIMATE PREPARATION DATE :	3/1/2017
BY :	TJG
REVIEWED BY:	ETC

PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City

Rate of Annual Inflation:	3%
Estimating Contingency:	30%
Sales Tax:	7.875%
Contractor General Conditions:	15%
Contractor Overhead and Profit:	12%

ELEMENT #	DESCRIPTION	TOTAL CONSTRUCTION COST	
		PHASE 1	PHASE 2
01	Headworks	$ 7,670,000	$ -
02A	Secondary Treatment - Oxidation Ditch (PHASE 1)	$ 17,160,000	$ -
02A	Secondary Treatment - Oxidation Ditch (PHASE 2)	$ -	$ 7,570,000
03A	Tertiary Treatment - Filters (Cloth Disk) (PHASE 1)	$ 3,060,000	$ -
03A	Tertiary Treatment - Filters (Cloth Disk) (PHASE 2)	$ -	$ 1,110,000
04B	Tertiary Treatment - Disinfection (UV) (PHASE 1)	$ 3,530,000	$ -
04B	Tertiary Treatment - Disinfection (UV) (PHASE 2)	$ -	$ 1,270,000
07A	Solids Processing - Dewatering (Screw Press)	$ 3,720,000	$ -
-	Alternative No. 3 - Reuse and Disposal	$ 3,450,000	$ -
	Total Estimated Capital Cost without Reuse and Disposal =	**$ 35,140,000**	**$ 9,950,000**
	Total Estimated Capital Cost with Reuse and Disposal =	**$ 38,590,000**	**$ 9,950,000**

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PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**LOCATION FACTOR:**	110.4
		20 CITIES ENR CCI DEC 2016:	10530
JOB # :	10406A.00	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
LOCATION :	King City	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
ELEMENT # :	Headworks	**BY :**	TJG
		REVIEWED BY:	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	HEADWORKS - 7.8 (peak) MGD including Influent Pumping, Mechanical Bar Screens, Grit Removal, Parshall Flum Metering, Screenings Washer/Dewatering Press Dry Pit	1	LS	$ 3,725,056	1.00	$ 3,730,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING	10	%			$ 370,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,120,000	
	TOTAL DIRECT COST						**$ 5,220,000**
	Estimating Contingency	30	%	$ 1,566,000			
	SUBTOTAL					**$ 6,790,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 6,790,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 6,790,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 205,538			
	SUBTOTAL					**$ 7,000,000**	
	Escalation to Midpoint of Construction	3	%	$668,936.99			
	SUBTOTAL					**$ 7,670,000**	
	TOTAL CONSTRUCTION COST						**$ 7,670,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Secondary Treatment - Oxidation Ditch (PHASE 1)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	OXIDATION DITCHES (2 of 3, 1.2 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$3,461,089	1.00	$ 3,460,000	
2	CIRCULAR SECONDARY CLARIFIERS (2+1 of 3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$2,590,756	1.00	$ 2,590,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ 478,105	1.00	$ 480,000	
4	SITEWORK	20	%			$ 790,000	
5	YARD PIPING	10	%			$ 650,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 1,960,000	
	TOTAL DIRECT COST						**$ 9,930,000**
	Estimating Contingency	30	%	$2,979,000			
	SUBTOTAL					**$ 12,910,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$1,228,500			
	SUBTOTAL					**$ 14,140,000**	
	Contractor Overhead and Profit - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	12	%	$1,130,220			
	SUBTOTAL					**$ 15,270,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 390,994			
	SUBTOTAL					**$ 15,660,000**	
	Escalation to Midpoint of Construction	3	%	$1,496,508			
	SUBTOTAL					**$ 17,160,000**	
	TOTAL CONSTRUCTION COST						**$17,160,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	1/1/2023
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Secondary Treatment - Oxidation Ditch (PHASE 2)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	OXIDATION DITCHES (1 of 3, 1.2 MG EA at 2 MGD design flow) - DIRECT COSTS	1	LS	$1,730,545	1.00	$ 1,730,000	
2	CIRCULAR SECONDARY CLARIFIERS (1 of 3+1, 70 ft diameter ea, 15 ft depth) - CONSTRUCTION COSTS	1	LS	$ 863,585	1.00	$ 860,000	
3	SPLITTER BOX/RAS PS/WAS PS	1	LS	$ -	1.00	$ -	
4	SITEWORK	20	%			$ 350,000	
5	YARD PIPING	10	%			$ 260,000	
6	ELECTRICAL AND INSTRUMENTATION	30	%			$ 780,000	
	TOTAL DIRECT COST						**$ 3,980,000**
	Estimating Contingency	30	%	$1,194,000			
	SUBTOTAL					**$ 5,170,000**	
	Contractor General Conditions - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	15	%	$ 540,150			
	SUBTOTAL					**$ 5,710,000**	
	Contractor Overhead and Profit - On oxidation ditch and splitter box/RAS PS/WAS PS subtotal only	12	%	$ 496,938			
	SUBTOTAL					**$ 6,210,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 156,713			
	SUBTOTAL					**$ 6,370,000**	
	Escalation to Midpoint of Construction	3	%	$1,200,471			
	SUBTOTAL					**$ 7,570,000**	
	TOTAL CONSTRUCTION COST						**$ 7,570,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Cloth Disk) (PHASE 1)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - 6 + 6 of 16, Cloth Media Disk, 3.2 (peak) MGD design flow	1	LS	$1,017,224	1.00	$ 1,020,000	
2	SITEWORK	20	%			$ 200,000	
3	YARD PIPING	10	%			$ 100,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 310,000	
	TOTAL DIRECT COST						**$ 1,630,000**
	Estimating Contingency	30	%	$ 489,000			
	SUBTOTAL					**$ 2,120,000**	
	Contractor General Conditions	15	%	$ 318,000			
	SUBTOTAL					**$ 2,440,000**	
	Contractor Overhead and Profit	12	%	$ 292,800			
	SUBTOTAL					**$ 2,730,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 64,181			
	SUBTOTAL					**$ 2,790,000**	
	Escalation to Midpoint of Construction	3	%	$ 266,619			
	SUBTOTAL					**$ 3,060,000**	
	TOTAL CONSTRUCTION COST						**$ 3,060,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	1/1/2023
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Filters (Cloth Disk) (PHASE 2)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	FILTERS - 2 + 2 of 16, Cloth Media Disk, 3.2 (peak) MGD design flow	1	LS	$ 339,075	1.00	$ 340,000	
2	SITEWORK	20	%			$ 70,000	
3	YARD PIPING	10	%			$ 30,000	
4	ELECTRICAL AND INSTRUMENTATION	30	%			$ 100,000	
	TOTAL DIRECT COST						**$ 540,000**
	Estimating Contingency	30	%	$ 162,000			
	SUBTOTAL					**$ 700,000**	
	Contractor General Conditions	15	%	$ 105,000			
	SUBTOTAL					**$ 810,000**	
	Contractor Overhead and Profit	12	%	$ 97,200			
	SUBTOTAL					**$ 910,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 21,263			
	SUBTOTAL					**$ 930,000**	
	Escalation to Midpoint of Construction	3	%	$ 175,265			
	SUBTOTAL					**$ 1,110,000**	
	TOTAL CONSTRUCTION COST						**$ 1,110,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (UV) Recycled Water (PHASE 1)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	UV - Backup equipment costs provided by Bill Sotirakis. Construction cost assume to be 4x equipment cost. The 4x multiplier includes sitework, yard piping, EI&C, estimating contigency, contractor general condidtions, contractor overhead and profit, and sales tax - 2 + 1 of 4	1	LS	$3,220,000	1.00	$ 3,220,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING - Included in item 1	10	%			$ -	
4	ELECTRICAL AND INSTRUMENTATION - Included in item 1	30	%			$ -	
	TOTAL DIRECT COST						**$3,220,000**
	Estimating Contingency - Included in item 1	30	%				
	SUBTOTAL					**$ 3,220,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 3,220,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 3,220,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal - Included in ite	7.875	%				
	SUBTOTAL					**$ 3,220,000**	
	Escalation to Midpoint of Construction	3	%	$ 307,711			
	SUBTOTAL					**$ 3,530,000**	
	TOTAL CONSTRUCTION COST						**$3,530,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	1/1/2023
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Tertiary Treatment - Disinfection (UV) Recycled Water (PHASE 2)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	UV - Backup equipment costs provided by Bill Sotirakis. Construction cost assume to be 4x equipment cost. The 4x multiplier includes sitework, yard piping, EI&C, estimating contigency, contractor general condidtions, contractor overhead and profit, and sales tax - 1 of 4	1	LS	$1,073,333	1.00	$ 1,070,000	
2	SITEWORK - Included in item 1	20	%			$ -	
3	YARD PIPING - Included in item 1	10	%			$ -	
4	ELECTRICAL AND INSTRUMENTATION - Included in item 1	30	%			$ -	
	TOTAL DIRECT COST						**$1,070,000**
	Estimating Contingency - Included in item 1	30	%				
	SUBTOTAL					**$ 1,070,000**	
	Contractor General Conditions - Included in item 1	15	%				
	SUBTOTAL					**$ 1,070,000**	
	Contractor Overhead and Profit - Included in item 1	12	%				
	SUBTOTAL					**$ 1,070,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal - Included in ite	7.875	%				
	SUBTOTAL					**$ 1,070,000**	
	Escalation to Midpoint of Construction	3	%	$ 201,649			
	SUBTOTAL					**$ 1,270,000**	
	TOTAL CONSTRUCTION COST						**$1,270,000**

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		LOCATION FACTOR:	110.4
		20 CITIES ENR CCI DEC 2016:	10530
PROJECT :	CITY OF KING CITY WWTP MASTER PLAN	**ESTIMATED MIDPOINT OF CONSTRUCTION :**	4/1/2020
JOB # :	10406A.00	**COST ESTIMATE PREPARATION DATE :**	3/1/2017
LOCATION :	King City	**BY :**	TJG
ELEMENT # :	Solids Processing - Dewatering (Screw Press)	**REVIEWED BY:**	ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	THICKENING/DEWATERING BUILDING - DIRECT COST	1	LS	$ 234,043	1.00	$ 230,000	
2	DEWATERING EQUIPMENT - DIRECT COST	1	LS	$1,005,396	1.00	$ 1,010,000	
3	SITEWORK	20	%			$ 250,000	
4	YARD PIPING	10	%			$ 120,000	
5	ELECTRICAL AND INSTRUMENTATION	30	%			$ 370,000	
	TOTAL DIRECT COST						**$1,980,000**
	Estimating Contingency	30	%	$ 594,000			
	SUBTOTAL					**$ 2,570,000**	
	Contractor General Conditions	15	%	$ 385,500			
	SUBTOTAL					**$ 2,960,000**	
	Contractor Overhead and Profit	12	%	$ 355,200			
	SUBTOTAL					**$ 3,320,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%	$ 77,963			
	SUBTOTAL					**$ 3,400,000**	
	Escalation to Midpoint of Construction	3	%	$ 324,912			
	SUBTOTAL					**$ 3,720,000**	
	TOTAL CONSTRUCTION COST						**$3,720,000**

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PROJECT : CITY OF KING CITY
WWTP MASTER PLAN
JOB # : 10406A.00
LOCATION : King City
ELEMENT # : Alternative No. 3 - Reuse and Disposal

LOCATION FACTOR: 110.4
20 CITIES ENR CCI DEC 2016: 10530

ESTIMATED MIDPOINT OF CONSTRUCTION : 4/1/2020
COST ESTIMATE PREPARATION DATE : 3/1/2017
BY : TJG
REVIEWED BY: ETC

ITEM	DESCRIPTION	QUAN	UNIT	UNIT COST	UNIT COST	SOURCE ENR	SOURCE LOCATION	ENR, LOCATION ADJUSTMENT FACTOR	SUBTOTAL	TOTAL
1	Sludge Removal (Ponds 1A, 1B, 3, and 5)	65,830	CY		$ 7.00	1	1.0	1.00	$ 460,000	
2	Clay Liner Removal (Ponds 1A, 1B, 3, and 5)	41,464	CY		$ 2.50	1	1.0	1.00	$ 100,000	
3	Rip Rap Placement (Ponds 1A, 1B, 3, and 5)	7,584	CY		$ 103.24	1	1.0	1.00	$ 780,000	
4	Sludge Removal (Pond 4)	14,202	CY		$ 7.00	1	1.0	1.00	$ 100,000	
5	Clay Liner Removal (Pond 4)	14,973	CY		$ 2.50	1	1.0	1.00	$ 40,000	
6	New Pond Liner (Pond 4)	449,188	SF		$ 0.81	1	1.0	1.00	$ 360,000	
	TOTAL DIRECT COST									**$ 1,840,000**
	Estimating Contingency	30	%		$ 552,000					
	SUBTOTAL								**$ 2,390,000**	
	Contractor General Conditions	15	%		$ 358,500					
	SUBTOTAL								**$ 2,750,000**	
	Contractor Overhead and Profit	12	%		$ 330,000					
	SUBTOTAL								**$ 3,080,000**	
	Sales Tax on 50% of Total Direct Cost Subtotal	7.875	%		$ 72,450					
	SUBTOTAL								**$ 3,150,000**	
	Escalation to Midpoint of Construction	3	%		$ 301,021.65					
	SUBTOTAL								**$ 3,450,000**	
	TOTAL CONSTRUCTION COST									**$ 3,450,000**