TO: FACILITIES AND WATER RESOURCES COMMITTEE

FROM: MARIO E. IGLESIAS GENERAL MANAGER

DATE: APRIL 28, 2017

AGENDA ITEM 2
MAY 3, 2017

REVIEW AND DISCUSS DRAFT BLACKLAKE SEWER MASTER PLAN

ITEM

Review Draft Master Plan for the Blacklake Sewer Enterprise, discuss and modify as necessary, and direct staff to present Master Plan to the Board for consideration. [RECOMMEND CONSIDER INFORMATION, EDIT AS NECESSARY AND DIRECT STAFF].

BACKGROUND

MKN & Associates ("Consultant") was hired by the Nipomo Community Services District ("District") to draft a master plan for the Blacklake Sewer Enterprise ("Enterprise") in February 2013. A public draft of the Blacklake Sewer Master Plan ("Master Plan") is attached. The Board initiated the Master Plan to develop a facilities life-cycle planning tool. The Enterprise is essential to the Blacklake community and planning for future infrastructure replacement and enhancements to control costs and meet changing regulatory requirements is appropriate and necessary.

The last of a five year rate adjustment plan for the Enterprise was implemented in January 2013. The December 2007 Water and Sewer Master Plan Update by Cannon Associates reviewed the capital needs of the Enterprise at that time. As with the current Master Plan, Cannon Associates master plan was used as a planning tool to provide the necessary analysis to determine the appropriate level of infrastructure maintenance and replacement as well as the rates and charges needed to supporting the Enterprise.

FISCAL IMPACT

The cost of the Master Plan is currently $90,580. The final cost of the Master Plan will be determined when the District's Board of Directors adopts the document. Costs were incurred through four years starting in 2013 to present. The current costs are not anticipated to increase as they include public out-reach efforts and producing the Consultant's final draft.

STRATEGIC PLAN

Goal 2. FACILITIES THAT ARE RELIABLE, ENVIRONMENTALLY SENSIBLE AND EFFICIENT. Plan, provide for and maintain District facilities and other physical assets to achieve reliable, environmentally sensible, and efficient District operations.

> 2.3 Manage both treatment facilities with the objective of zero permit violations and long-term preservation of assets.

RECOMMENDATION

Staff recommends the Facilities\Water Resource Committee review and discuss the Blacklake Sewer Master Plan public draft, take comment and direct staff to continue developing the Master Plan or present it to the Board of Directors for adoption at their next Board Meeting.

ATTACHMENTS

A. Draft Blacklake Sewer Master Plan, April 2017

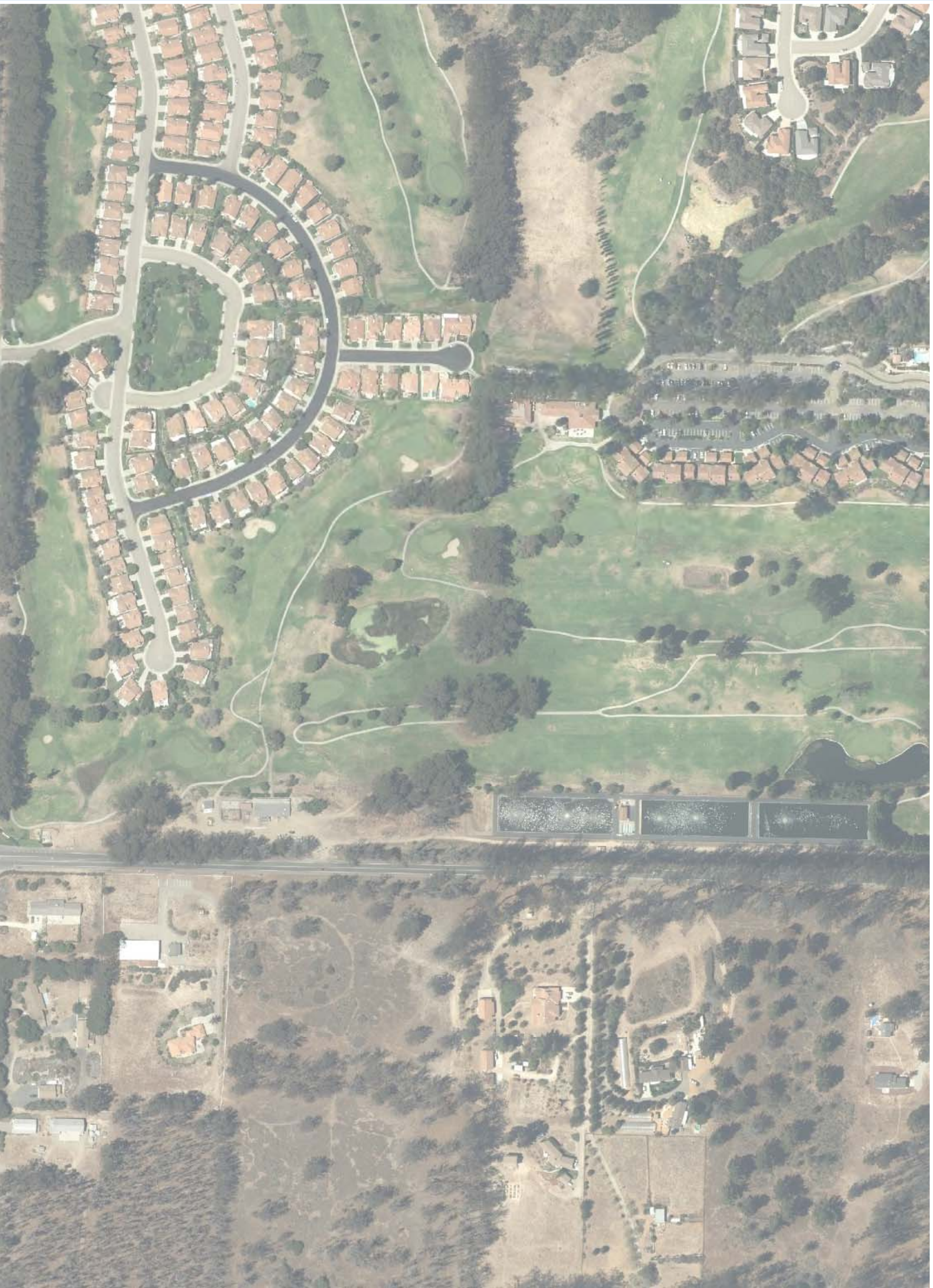
FACILITIES & WATER RESOURCES COMMITTEE

May 3, 2017

ITEM 2

ATTACHMENT A

Nipomo Community Services District
Blacklake Sewer Master Plan



Draft April 2017

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Previous Studies and Reports

The following reports, studies, and other material were reviewed during preparation of this master plan.

1. Blacklake Sewer Master Plan – Technical Memorandum 1 dated July 2016 and prepared by Michael K. Nunley and Associates.

2. Nipomo Community Services District Water and Sewer Master Plan Update dated December 2007 and prepared by Cannon Associates.

3. Nipomo Community Services District Preliminary Screening Evaluation of Southland Wastewater Treatment Facility Disposal Alternatives dated January 2009 and prepared by AECOM.

4. Nipomo Community Services District Southland WWTF Master Plan Amendment #1 dated August 2010 and prepared by AECOM.

List of Acronyms

AAF	Average Annual Flow
ADF	Average Daily Flow
ADWF	Average Dry Weather Flow
ADMMF	Average Dry Maximum Monthly Flow
AWMMF	Average Wet Maximum Monthly Flow
AWWF	Average Wet Weather Flow
BOD	Biological Oxygen Demand
BOD_5	5-day Biological Oxygen Demand
CF	Cubic Foot
CF/day	Cubic Foot per Day
CF/hr	Cubic Foot per Hour
CSD	Community Services District
d/D	Depth over Diameter
District	Nipomo Community Services District
DO	Dissolved Oxygen
Fps	Feet per Second
Ft	Foot/Feet
GIS	Geographic Information System (GIS)
gpd	Gallons per Day
gpd/ac	Gallons per Day per Acre
gpd/conn	Gallons per day per connection
gpd/SF	Gallons per Day per Square Foot
gpm	Gallons per Minute
HDPE	High Density Polyethylene
hp	Horsepower
Hr	Hour
hrs/wk	Hours per Week
HRT	Hydraulic Retention Time
In	Inches
lb/day	Pound per Day
lb/hr	Pound per Hour
lb/SF-hr	Pound per Square Foot per Hour
LF	Linear Foot
MG	Million Gallons
mg/L	Milligram per Liter
MGD	Million Gallons per Day
MKN	Michael K Nunley & Associates
MLSS	Mixed Liquor Suspended Solids
Mm	Millimeter
MMF	Maximum Month Flow
MPN	Most Probable Number
NA	Not Available
NCSD	Nipomo Community Services District
No.	Number
O&M	Operations and Maintenance
PDDF	Peak Day Dry Weather Flow
PDF	Peak Day Flow
PDWF	Peak Day Wet Weather Flow
PHF	Peak Hour Flow
Psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
SCADA	Supervisory Control and Data Acquisition
scfm	Standard Cubic Feet per Minute
SOPs	Standard Operating Procedures
SRT	Solids Retention Time
SS	Settleable Solids
TDH	total dynamic head
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WDR	Waste Discharge Requirements
WRF	Water Reclamation Facility
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

Sewer Master Plan (Section 1)

The Blacklake Sewer Master Plan (Master Plan) was prepared to (1) assess the condition of the Blacklake Water Reclamation Facility (WRF) and collection system, (2) update the collection system model to measure its design capacity against current flow conditions, (3) identify existing and estimate future cost requirements for the WRF and collection system, and (4) evaluate the ability of these systems to meet the wastewater needs of existing and future users under current and emerging regulations. Central to the narrative for these Master Plan objectives is to provide a clear understanding for the necessity and purpose of the proposed recommended expenditures.

The WRF and the first of five phases of the collection system was constructed in 1984 by private developers to serve the Black Lake Specific Plan Area. The specific plan area is approximately 515 acres encompassing a golf course, residential community, and interspersed with significant open space and environmentally sensitive habitat. Originally, the WRF and collection system were operated by San Luis Obispo County Public Works Department. In 1993, the Nipomo Community Services District (NCSD) annexed these facilities into its operations and took responsibility for all aspects of the system. In addition to the Blacklake system, NCSD operates a Wastewater Treatment Facility (WWTF) for the greater Nipomo Township designated as the Southland WWTF, but the two wastewater systems are not physically connected.

NCSD first evaluated the WRF and collection system in the Water and Sewer Master Plan Update dated December 2007 and prepared by Cannon Associates. The 2007 master planning effort reviewed the existing and future operation capacities of the Blacklake wastewater system, Nipomo Township wastewater system and the water distribution system for the entire NCSD service area. NCSD's 2007 Master Plan included the development of collection system hydraulic models for the Blacklake and Nipomo Township systems, a capacity assessment of existing facilities, and development of capital improvements needed for each system. This document provides a comprehensive updated evaluation of the Blacklake wastewater facilities.

In addition to the above mentioned planning efforts, NCSD has continued to develop a detailed Geographic Information System (GIS) of the Blacklake wastewater facilities; performed a video inspection of the collection system; replaced WRF treatment pond linings; replaced the comminutors and associated panels at the headworks; removed sludge from the treatment ponds; and continues to document sampling/analysis and operating procedures to complement the existing WRF operations & maintenance manual (updated in 2014).

Existing Flows (Section 2)

MKN reviewed various County planning documents to determine existing land use and applied this information to estimate future wastewater flows and loadings. Land use on the Nipomo Mesa is defined by the South County Area Plan (SCAP) of the County General Plan Land Use Element, which designates the Black Lake Golf Course Area with the "Recreation" land use category. The SCAP required development of a specific plan for the area: The Black Lake Specific Plan (Plan). The Plan provided detailed guidelines for the construction of 515 Equivalent Residential Units (ERUs) including both multi-family and single family residences, a golf course, clubhouse, and supporting facilities over five development phases. An amendment to the Plan (last revised in 1998) and Land Use Element includes an additional 44 ERUs (for a total buildout of 559 ERUs) within the Village Reserve Boundary established for Black Lake Specific Plan Area.

The WRF consists of a treatment pond system designed to provide reliable, low cost, and relatively low maintenance treatment of municipal wastewater. The WRF does not have an influent meter to measure flows entering the treatment process, however it is equipped with two parallel V-notch weir effluent flowmeters. If influent metering data is not available, effluent flow information will be used to estimate influent flow conditions. However, measuring flows leaving a pond system (effluent flows) are generally less accurate due to potential increases in pond volumes from rainfall during wet weather events and decreases due to evaporation during dry conditions. In addition, treated effluent at the

WRF is not typically released on the weekends. This mode of operation has a direct impact on estimating daily influent flow since the plant is still receiving flows during the weekends, but effluent flow is only measured during discharge.

These factors must be considered when reviewing wastewater flow parameters and peaking factors for the purpose of adjusting operations and planning maintenance routines. The historical flows are summarized in the Table ES-1. It should be noted this master planning effort began in 2013 with development of an updated collection system hydraulic model, review of collection system video inspections and background materials, and condition assessments. Following these initial efforts, the master planning effort was put on hold while the District completed several other major capital improvement projects (Southland WWTF upgrade and Supplemental Water Project). The study was restarted in 2016. MKN reviewed current water billing data and influent wastewater flows records from the WRF and compared those values to the 2011/2012 data originally used for the planning effort. Based on drought conditions for the last several years and water conservation efforts, and due to little recent development in the area, it is assumed that the 2011/2012 data represents reasonably conservative usage estimates.

Table ES-1: Historical Peak Flow Analysis

Flow Condition (MGD)	2009	2010	2011	2012
ADF	0.064	0.073	0.063	0.055
PHF	0.255	0.291	0.253	0.221
PDF	0.223	0.286	0.222	0.230
Adjusted PDF	0.184	0.245	0.200	0.181
PDDF	0.139	0.171	0.141	0.183
Adjusted PDDF	0.137	0.165	0.141	0.181
PDWF	0.223	0.286	0.222	0.230
Adjusted PDWF	0.184	0.245	0.200	0.152
ADMMF	0.063	0.067	0.062	0.052
AWMMF	0.150	0.110	0.145	0.074
Adjusted AWMMF	0.150	0.084	0.137	0.068

Future Flows and Loadings (Section 3)

Currently 525 units are built and future flows/loadings will consist of an additional 34 ERUs per the 1998 amendment to the Black Lake Specific Plan. However, future flows and loadings on the treatment system may be affected by a change in occupancy within the existing community. Because the system serves a resort community, the number of residents and occupancy throughout the year may vary. To address this inconsistency, MKN developed two alternatives to estimate future ADF conditions:

- Alternative 1: Wastewater production rates based on land use (gpd/ac) from 2007 NCSD Master Plan Update for two occupancy options:
  - 100% Occupancy; and
  - Scenario 1 Occupancy (Existing land use assuming 86% occupancy for the majority of the development)

The wastewater production rates from the 2007 Master Plan Update represent gross recreational-use duty factors and do not include an allowance for flows from the Golf Course clubhouse. Therefore, the 2012 water usage for the clubhouse (1,155 gpd) was multiplied by a factor of 92% to yield an estimated wastewater flow of 1,063 gpd. Calculating flows in this manner is supported in the 2007 Water Master Plan Update. It is assumed the clubhouse will continue operating at current flows through the foreseeable future. Assuming complete buildout of all 559 units and using the Alternative 1 methodology the estimated future flows would range from 91,000 (86% occupancy) to 100,000 gpd (100%

occupancy). The estimated future flow using this methodology is conservative since the wastewater production rates represent gross recreational-use duty factors and may not match existing usage conditions.

- Alternative 2: Existing ADF / Existing Units (gpd/unit) multiplied by Future Units

The 2012 ADF of 54,000 gpd was divided by the number of existing ERUs to determine a flow per unit value (54,000 gpd / 515 ERUs = 105 gpd/unit). Then the 2012 ADF was increased to represent future flows by adding the product of 105 gpd/unit and 34 future ERUs (3,570 gpd) for a total estimated future flow of 58,000 gpd (rounded from 57,570 gpd). Since Alternative 2 utilizes current ADF in the future flow projections, the clubhouse flows are already considered in that method. In Alternative 2 it is assumed the current occupancy rates will continue into the future.

Based on consistency in historical flow data, it is assumed that the current level of occupancy will continue for the foreseeable future. Since the existing community is near buildout the estimated future ADF of 58,000 gpd (a 5% increase over current ADF) is recommended for evaluation of the Blacklake collection, treatment, and disposal system planning.

Peaking factors are used to determine the relationship between average flows and other flow conditions, such as peak hour flow (PHF) or peak day dry weather flow (PDWF), etc. The peaking factor for existing flows were determined by dividing flows by 2012 ADF. (For example, the peaking factor for PDWF = PDWF/2012 ADF). These peaking factors were applied to the future ADF to estimate future design flows as shown in Table ES-2 below.

Table ES-2: Peaking Factors and Future Design Flows

Flow Condition (MGD)	Existing	Peaking Factor	Future
ADF	0.055	--	0.058
PHF	0.221	4.0	0.230
Adj. PDDF	0.077	1.39	0.081
Adj. PDWF	0.127	2.30	0.133
Adj. PDF	0.127	2.30	0.133
ADMMF	0.052	0.95	0.055
AWMMF	0.074	1.34	0.078
MMF	0.074	1.34	0.078

The District does not sample the 5-day biological oxygen demand (BOD_5) or total suspended solids (TSS) in the WRF influent wastewater, since it is not required as part of the permit. These values are important for evaluating the capacity of the system. The District's Southland wastewater treatment facility (WWTF) treats wastewater from the Town collection system, which is primarily residential with some commercial. For this Master Plan, it is assumed that these characteristics will be similar between the systems, since they are both primarily residential. To estimate BOD and TSS influent loading at the WRF, the ratio of BOD_5 and TSS loading to average daily flow (ADF) from the Southland WWTF Master Plan (Amendment #1, AECOM, August, 2010) is used. Table ES-3 below summarizes existing and future design loads for the Blacklake WRF.

Table ES-3: Comparison of Existing Southland WWTF Influent Loads and Blacklake WRF Design Loads

	Southland WWTF - Existing	Blacklake WRF - Existing	Blacklake WRF - Future
Average Annual Flow (MGD)	0.571	0.055	0.058
Average Annual BOD_5 Loading (lb/day)	1,200	120	125
Average Annual TSS Loading (lb/day)	1,200	120	125
Maximum Monthly Flow (MGD)	1,450	180	190
Maximum Monthly BOD_5 Loading (lb/day)	1,450	180	190
Maximum Monthly TSS Loading (lb/day)	1,000	100	105
Minimum Monthly BOD_5 Loading (lb/day)	1000	100	105

Existing Collection System (Section 4)

The Master Plan categorizes the two primary elements of the existing Blacklake wastewater collection system as follows:

1. Gravity sewer pipe (primarily PVC) ranging in size from 6 inches to 12 inches with concrete manholes
2. Three lift stations with force mains ranging in size from 4-inch to 6-inch

1. A condition assessment of the existing gravity sewer pipelines through video inspection and an updated hydraulic model capacity evaluation was completed for the wastewater collection system. The concrete manholes were not inspected as part of this effort. Based on the evaluation the following improvements are recommended to correct deficiencies in the Blacklake gravity sewer pipelines. These improvements are recommended to reduce costs of operation and improve system reliability:

   - ❑ Golf Course Trunk Main Replacement – Install 980 linear feet of 12-inch sewer pipe
   - ❑ Tourney Hill Sewer Main Replacement – Install 690 linear feet of 8-inch sewer pipe
   - ❑ Oakmont Sewer Main Replacement – Install 566 linear feet of 8-inch sewer pipe
   - ❑ Augusta Sewer Main Replacement – Install 185 linear feet of 8-inch sewer pipe
   - ❑ Offset Joint Repair (2 locations)

2. MKN and NCSD staff completed a visual conditional assessment of the three Blacklake lift stations as well as an evaluation of each lift stations hydraulic capacity. It is recommended that the following system improvements be completed to increase system integrity, reduce operations and maintenance costs, and provide for operator and public safety in and around these facilities:

   - ❑ Woodgreen Lift Station – Replace lift station
   - ❑ The Oaks Lift Station – Add ventilation, coat piping in wet-well, replace electrical panels, update instruments & replace cables
   - ❑ Misty Glen Lift Station – Install spring-assisted hatches, replace electrical panels, update instruments & replace cables

Lift station force mains (pressurized sewer pipelines) were included in the updated hydraulic model and evaluated with respect to minimum and maximum velocities during lift station pump operation. There is approximately 1,800 feet of 4-inch and 500 feet of 6-inch PVC force main throughout the Blacklake system. Video inspections were not completed for these pipelines.

Tables ES-4 summarizes the recommended capital projects and associated costs to address existing system deficiencies of the two elements that make up the Blacklake wastewater collection system. In addition, each project has been assigned a priority ranking in the order of when the improvement should be completed. The following describes the priority ranking for capital projects:

- ❑ Priority 1 – Recommended to be completed 1 to 3 years from completion of the Master Plan to replace pieces of equipment that are at the end of their design life, address capacity and /or performance deficiencies, and/or address safety concerns.

- Priority 2 – Recommended to be completed 3 to 5 years from completion of the Master Plan to address operational and maintenance issues.

Table ES-4: Recommended Capital Improvements Projects for Blacklake Wastewater Collection System

Project	Project Name	Existing Facility	Deficiency	Capital Improvement Project (CIP)	Priority/Schedule	Construction Cost ($)	Engineering and Administration Cost ($)	Contingency ($)	Opinion of Cost ($)
CS-CIP-1	Woodgreen Lift Station Improvements	Woodgreen Lift Station	Insufficient access, equipment is aging, corroded, coating is failing, pump is near end of design life	Replace lift station	1 (1-3 yrs)	$410,000	$77,000	$123,000	$610,000
CS-CIP-2	The Oaks Lift Station Improvements	The Oaks Lift Station	No ventilation, no light at controls enclosure, piping is corroded and needs recoating	Add ventilation, coat piping, replace panels, instruments & cables	2 (3-5 yrs)	$51,000	$15,000	$15,000	$81,000
CS-CIP-3	Misty Glen Lift Station Improvements	Misty Glen Lift Station	No light at controls enclosure, hatch lids are not traffic-rated	Replace panels, instruments & cables, etc	2 (3-5 yrs)	$47,000	$14,000	$14,000	$75,000
								Lift Station Existing Deficiency Capital Improvements Subtotal	**$766,000**
CS-CIP-4	Golf Course Trunk Main Replacement	8-inch pipe & 3 manholes	Camera underwater, unable to proceed, unable to see	Replace with 12-in SDR-35 PVC and 3 manholes, 980 LF, 10-20 ft deep (including pipe segments 842, 843, 844)	1 (1-3 yrs)	$294,000	$88,000	$88,000	$470,000
CS-CIP-5	Tourney Hill Sewer Main Replacement	6-inch PVC	Sags, camera underwater	Replace with 8-in SDR-35 PVC, 690 LF (including pipe segments 633, 634, 635, 685)	1 (1-3 yrs)	$168,000	$50,000	$50,000	$268,000
CS-CIP-6	Oakmont Sewer Main Replacement	8-inch pipe	Roots, sags	Remove plants and replace with 8-in SDR-35 PVC, 566 LF (including pipe segments 545 & 550)	2 (3-5 yrs)	$97,000	$29,000	$29,000	$155,000
CS-CIP-7	Augusta Sewer Main Replacement	8-inch pipe	Sags	Replace with 8-in SDR-35 PVC, 185 LF (including pipe segment 729)	2 (3-5 yrs)	$33,000	$10,000	$10,000	$53,000
CS-CIP-8	Repair Offset Joints	6-inch and 8-inch pipes	Offset joints, 2 locations	Repair offset joints at 2 locations (including pipe segments 656 & 834)	2 (3-5 yrs)	$16,000	$5,000	$5,000	$26,000
								Gravity Collection System Existing Deficiency Capital Improvements Subtotal	**$972,000**
								Blacklake Collection System – Capital Improvements Total	**$1,738,000**

Notes: Costs rounded to the nearest $1,000.
Engineering and Administration costs estimated at 30%. Construction contingency estimated at 30%

Water Reclamation Facility (Section 5)

The Blacklake WRF was constructed as part of the Blacklake development (1984) to process raw wastewater produced by the development and provide beneficial reuse of the treated effluent for the golf course to use for irrigation. Treated water is sent to a holding pond on the golf course, where it is utilized to water the roughs around three holes. The water would need to be treated to a higher level to allow unrestricted irrigation at the golf course.

The facility consists of multiple structures equipped with electrical, mechanical and chemical systems to support the wastewater treatment process. Physical features of the WRF include a manual bypass bar screen, two comminutors, three (3) ponds with surface aerators, two (2) chlorine contact basins, a sodium hypochlorite storage and feed system, and a citric acid storage and feed system that can be used to maintain pH within effluent limitations. System component descriptions are summarized below. A process flow diagram for the existing system is included as Figure 5-1, page 5-4.

Headworks:

The headworks was constructed in 1984 and consists mainly of a concrete structure with two parallel comminuters. The structure shows extensive corrosion, cracks, and crumbled concrete and is near the end of its design life. The District is currently in process of a rehabilitation and repair project to reduce risk of failure.

A 12-inch influent PVC gravity sewer line delivers sewage to the plant where flow is divided to two parallel comminutors The original design directed flow through a coarse bar screen (not currently in place) before reaching the comminutors. The comminutors are designed to grind large solids that pass through a bar screen and are operated continuously. Grinding trash and larger solids into smaller pieces can reduce potential to impact high-cost aeration equipment, but can add to the volume of sludge accumulation in the ponds. Both comminutors and their electrical control panels were replaced, in 2011. If one or both comminutors becomes clogged or is out of service water level will rise in the influent channel and flow over a slide gate into a bypass channel containing a manual bar screen.

Aerated Ponds:

The aerated ponds are the only source of biological treatment of the raw wastewater entering the WRF and must be maintained to meet effluent regulatory requirements and provide recycled water to the golf course. The ponds are lined with plastic to reduce potential for infiltration and protect groundwater. The pond liners have an anticipated life of 10 to 20 years, before requiring replacement. The liner for Pond 1 was replaced in 2011. Ponds 2 and 3 are expected to need new liners soon.

Flow continues from the headworks channels to the aerated ponds by gravity through an 8-inch pipe. Three HDPE-lined aerated ponds, operated in series, provide biological treatment of the wastewater. The ponds are considered partially mixed since the aerators mix the pond volume in their vicinity, but the remainder of the pond volume has no mixing and solids can settle to the bottom of the ponds. Water levels are controlled at a depth of 9.5 feet utilizing an effluent weir in the third pond. Conventional splasher-type mechanical aerators placed in each pond provide mixing and oxygen for biological treatment. The number and size of the aerators vary depending on aerator condition and availability. Replacement of aerators, some of the larger pieces of mechanical equipment at the WRF, is an ongoing maintenance task, and should be planned for in a regular repair and replacement budget. A five year replacement cycle is recommended for budgeting purposes.

Chlorine Contact Basins:

The chlorine contact basins provide final disinfection of the treated effluent from the WRF and allow for the beneficial reuse of wastewater for irrigation of the roughs at the adjacent golf course. The basins were constructed in 1984 and show signs of corrosion and cracks. The concrete needs repair and re-coating to reduce the risk of failure.

An 8-inch SDR-35 PVC pipeline carries flow from the Pond 3 effluent weir box to the chlorine contact basin for disinfection. Chlorine solution is injected into the mixing chamber where an air sparger provides mixing. Flow can then be split into two chlorine contact basins. Each contact chamber is baffled and designed for a minimum of 20 minutes contact time at 200,000 gpd, to provide redundancy during peak flows. The effluent flow rate is measured at the end of each contact basin with a v-notch flume flow meter. Each contact chamber has a dedicated flow meter. Grab samples are collected and analyzed to measure chlorine levels.

Additional Chemical Treatment:

High pH in the effluent is controlled with citric acid, fed into the treated wastewater at the chlorine contact basin with a metering pump. Algae growth in the ponds is reduced with the addition of copper sulfate. The operators determine when algae growth is higher than normal based on pond appearance and pH readings.

Based on a field condition assessment of the WRF with District staff, evaluation of the hydraulic and treatment capacities of the WRF the following improvements are recommended to address existing system deficiencies and future improvements to increase system efficiencies and reduce operational costs:

The following improvements are recommended based on existing system deficiencies associated with the Blacklake WRF facility:

- Headworks Rehabilitation – Repair and recoat concrete channels, install safety rails, chains and gates, replace stop plates with slide gates, recoat piping, perform miscellaneous improvements, and rehabilitate influent manhole (concrete repair, coating, and replace rim and lid).
- Treatment Pond Rehabilitation – Replace HDPE liner on Pond 1, rebuild failing CMU wall, and install safety railing.
- Sludge Removal for existing flows and loadings.
- Chlorine Contact Chamber Rehabilitation – Repair and recoat concrete channels, replace steel support beams, and install effluent flow meter, mechanical mixer, composite sampler, and online chlorine analyzer.
- WRF Site Improvements – Miscellaneous control building repairs, install building security alarms, replace temporary retaining wall with permanent wall, drainage improvements.
- WRF Electrical Improvements – Add automation and SCADA interfacing, install permanent generator, effluent lift station improvements, and various electrical site improvements.

The following improvements are recommended to reduce operational costs at the Blacklake WRF facility:

- Headworks Improvements – Add a mechanical self-cleaning screening system and appurtenances. Mechanical self-cleaning screens will remove and wash trash and large solids, protecting downstream equipment, which reduces risk of treatment violations; and reducing the volume of sludge in the ponds, which is more costly to remove and dispose of than screenings.
- Aeration System Improvements – Replace surface splasher aerators with brush aerators or diffused aeration system for reduced electrical costs. Refer to Figure 5-2 in Section 5 for the 30-year life cycle cost comparison between the aeration systems. Diffused aeration has a higher initial capital cost than brush aerators, but lower annual power costs. The operational differences could be considered significant. Alternative aeration systems should be evaluated in detail to develop recommendations for which aeration system to implement during preliminary design.

Tables ES-5 summarizes the recommended capital improvements for the WRF to address identified system deficiencies and increase treatment system performance and efficiencies. In addition, each project has been assigned a priority ranking in the order of when the improvement should be completed. The following describes the priority ranking for capital projects:

- Priority 1 – Recommended to be completed 1 to 3 years from completion of the Master Plan to replace pieces of equipment that are at the end of their design life, address capacity and /or performance deficiencies, and/or address safety concerns.

- Priority 2 – Recommended to be completed 3 to 5 years from completion of the Master Plan to address operational and maintenance issues.
- Priority 3 – May be completed in 5 years or more from completion of the Master Plan to address system improvements that increase efficiencies and reduce operational costs.

Table ES-5: Recommended Capital Improvements Projects for Blacklake WRF									
Project	**Project Name**	**Existing Facility**	**Deficiency**	**Capital Improvement Project (CIP)**	**Priority/Schedule**	**Construction Cost ($)**	**Engineering and Construction Management Cost ($)**	**Contingency ($)**	**Opinion of Cost ($)**
WRF-CIP-1	WRF Headworks Rehabilitation	WRF Headworks	Deterioration, safety concern	Rehab influent manhole, headworks structure, misc. improvements	1 (1-3 yrs)	$186,000	-	-	$186,000
WRF-CIP-2	WRF Treatment Pond Rehabilitation	WRF Treatment Ponds	Deterioration, safety concern	New liner, CMU wall repair, safety railing	1 (1-3 yrs)	$195,000	$59,000	$59,000	$313,000
WRF-CIP-3	WRF Sludge Removal	WRF Treatment Ponds	Reduced treatment due to sludge buildup	Contract dredging, dewatering, and hauling to Santa Maria Landfill	2 (3-5 yrs)	$288,000	$24,000	$87,000	$399,000
WRF-CIP-4	WRF Chlorine Contact Chamber Rehabilitation	WRF Chlorine Contact Chamber	Deterioration, inefficiencies	Rehab structure, add automation	2 (3-5 yrs)	$194,000	$59,000	$59,000	$312,000
WRF-CIP-5	WRF Site Improvements	WRF	Old and temporary elements	Repair building & retaining wall, improve drainage	2 (3-5 yrs)	$124,000	$38,000	$38,000	$200,000
WRF-CIP-6	WRF Electrical Improvements	WRF electrical	Inefficiencies, corrosion, vulnerabilities	Repairs, improvements, automation, standby power	2 (3-5 yrs)	$269,000	$81,000	$81,000	$431,000
								Existing Deficiency Capital Improvements Subtotal	**$1,841,000**
WRF-CIP-7	WRF Headworks Improvements	WRF Headworks	No screening system and aging equipment	Install mechanical self-cleaning screen, flow meter and appurtenances	3 (>5 yrs)	$469,000	$141,000	$141,000	$751,000
WRF-CIP-8	WRF Aeration Improvements	Surface aerators	Higher power requirements	Install brush aerators or diffused air system	3 (>5 yrs)	$215,000	$65,000	$65,000	$345,000
								Future System Efficiency Capital Improvements Subtotal	**$1,096,000**
								Blacklake WRF – Capital Improvements Total	**$2,937,000**

Note: Costs rounded to the nearest $1,000.

Future Process Alternatives (Section 7)

As technologies improve over time, it is important for the District to evaluate alternative processes. Several alternative treatment processes that could potentially lead to improved efficiency and cost savings for the WRF were evaluated. As systems wear and need replacing, new technologies can be applied to meet or exceed the desired performance requirements. The existing WRF aerated pond system is an example of a treatment process that could benefit from improved technology. The existing treatment process is adequate to treat existing and projected future flows and loadings. However, there are other variables that drive the decision to replace existing systems. Improving effluent quality, improved system reliability, and reducing energy requirements by installing higher efficiency equipment must be analyzed.

Section 7 of the Master Plan, Future Process Alternatives, not only considers future process alternatives including extended aeration systems, tertiary treatment for improved system efficiencies, it also evaluates sewer regionalization scenarios. MKN developed preliminary sizing and associated estimated costs of the proposed alternatives.

Capital Improvement Summary (Section 7)

The capacity evaluations presented in Sections 4 and 5 determined that the existing collection system and WRF have sufficient hydraulic capacity to process existing and future flows. However, based on the condition assessment of existing facilities (though video inspection and visual assessments) a number of deficiencies and/or efficiency improvements were identified. Table ES-6 provides a summary of the recommended capital improvements with opinion of costs for the Blacklake sewer collection system and WRF (as presented in Section 10). A total of approximately $4.7 million in capital improvements are recommended to meet existing deficiencies and improve process efficiencies.

Table ES-6: Recommended Capital Improvements Summary

	Opinion of Cost
Blacklake Collection System – Existing Deficiency Capital Improvements	$1,738,000
Blacklake WRF – Existing Deficiency Capital Improvements	$1,835,000
Blacklake WRF – Future System Efficiency Capital Improvements	$1,093,000
Total Blacklake Wastewater Capital Improvements	**$4,666,000**

Regionalization of Blacklake and Southland Treatment Facilities (Section 7)

MKN analyzed the cost of decommissioning the WRF and directing Blacklake WRF flows to the Southland WWTF. The 20-year lifecycle costs for continued treatment at the WRF was compared to the 20-year lifecycle costs for regionalizing sewer treatment at the Southland WWTF. While elements that make up the WWTF have a longer lifecycle, many of the mechanical and electrical components supporting plant processes have a much shorter lifecycle. In general, industry practice when evaluating wastewater facilities suggest planning around a 20-year lifecycle.

The regionalization alternative consists of removing the WRF and replacing it with a lift station and force main to send raw wastewater from the Blacklake collection system to the Southland WWTF for treatment. It is assumed the new force main would connect to the Town Sewer system near Camino Caballo and Crosby Way. Potential impacts to the Town sewer system, including planned improvements already scheduled, were evaluated. Of note, planned improvements that would be undertaken by the District with or without regionalizing the two WWTPs, are upsizing pipeline downstream of the connection point where Blacklake sewer would be introduced and improvements to the Southland WWTF. Due to the relatively small flow from Blacklake, when compared to the Town system flows, sufficient capacity may exist in the already planned sewer improvements and at the planned Southland WWTF. However, detailed evaluation is recommended to confirm these assumptions if regionalization is pursued. Costs for the Town System capital improvements were reviewed and allocated between the two systems based on proportion of flow. The total estimated capital cost for regionalization option over a 20-year life cycle is estimated to be $8,353,000. The annual operations and maintenance costs for the first year is estimated at $150,000. Not taking inflationary factors into consideration and simply multiplying first-year costs by 20 years resulting in $3,000,000. This amount is added to the capital costs resulting in the $11,353,000 estimate in Table ES-7.

Table ES-7: Estimated 20-year Life Cycle Costs for Regionalization	
Capital Costs	
Blacklake Lift Station	$7,433,000
Share of Town System Capital Improvements	$168,000
Share of Southland Phase 1 & 2 Improvements	$752,000
Estimated Capital Costs	**$8,353,000**
Annual Operating and Maintenance Costs	
Share of Southland WWTF – Labor, admin, operating & replacement[1]	$52,000
Blacklake Lift Station – Labor, power and replacement[2]	$98,000
Estimated Annual Operating and Maintenance Costs	**$150,000**
Total Estimated 20-year Life Cycle Costs	**$11,353,000**

Notes:
Costs are rounded to the nearest $1,000.
[1] Southland WWTF O&M costs are estimated by assuming 75% of the Town Sewer Fund budget for FY16-17, and 4% cost share for Blacklake.
[2] Assumes average maintenance/operations of 2 hours per day, 5 days per week at fully-burdened labor rate of $110/hr.

To compare the cost of regionalization to maintaining treatment at the WRF, the following estimated 20-year life cycle costs were developed. The total estimated capital costs of $2,937,000 are far less than the estimated capital costs of the regionalization option. However, the estimated annual costs to operate and maintain the WRF greatly exceeds these same costs for the regionalization option. As with the regionalization operation and maintenance costs, the first year's costs did not include inflationary factors, but was simply multiplied by 20 years to result in $10,880,000. Adding the $10,880,000 to the capital needs of $2,937,000 results in the $13,817,000 estimate for the 20-year lifecycle costs in Table ES-8.

Table ES-8: Estimated 20-year Life Cycle Costs for Treatment at Blacklake WRF	
Capital Costs	
Blacklake WRF - Existing Deficiency Capital Improvements[1]	$1,841,000
Blacklake WRF – Future System Efficiency Capital Improvements[1]	$1,096,000
Total Estimated Capital Costs	**$2,937,000**
Annual Operating and Maintenance Costs	
Blacklake WRF – Labor, admin, operating, replacement[2]	$464,000
Blacklake WRF Sludge removal[3]	$80,000
Total Estimated Annual Operating and Maintenance Costs	**$544,000**
Total Estimated 20-year Life Cycle Costs	**$13,817,000**

Notes:
Costs are rounded to the nearest $1,000.
[1] Assumes capital improvements are implemented based on Table 10-2.
[2] Blacklake WRF costs are estimated by assuming 75% of the Blacklake Sewer Fund budget for FY16-17, with Labor increased by 50% assuming an added 0.5 FTE per staffing evaluation (Section 9.1).
[3] Sludge removal costs estimated by assuming $397,000 for contract dredging, dewatering, hauling and final disposal as Santa Maria Landfill once every 5 years.

The 20-year lifecycle cost comparison indicates regionalizing the sewer treatment systems would be less expensive over time than continuing to improve, operate and maintain the WRF ($11.3 million, compared to $13.8 million). As stated, inflationary factors were excluded from the operations and maintenance costs. With the major difference in the costs of these two options in operations and maintenance, $150,000 versus $544,000, with inflation factors considered and added into the equation it is anticipated that the estimated 20-year life cycle costs will increase for both options. However, it is logical to conclude that the option of retaining the WRF will be subject to greater cost impacts as a result of inflation widening the 20-year lifecycle cost difference between the two options.

Recycled Water Alternative (Section 7)

Currently the Blacklake Golf Course receives 50 AFY of secondary disinfected-23 recycled water from the WRF for limited golf course irrigation (the roughs of three holes). If the District proceeds with regionalization without the recycled water project, the golf course would be required to change their irrigation operations, increase water conservation and/or pursue an alternative supplemental water source.

Currently treated effluent from the Southland WWTF is percolated onsite for final treatment through the soil column. Theoretically, the beneficial reuse of the water for irrigation at Blacklake golf course could continue with some additional improvements at the Southland WWTF and construction of a recycled water lift station and dedicated force main back to the Blacklake area. At a minimum, disinfection would be required. However, if a recycled water pipeline is constructed nearly seven miles back to Blacklake Golf Course, additional treatment would be recommended to produce tertiary disinfected recycled water to allow for additional recycled water opportunities.

In January 2009 the District completed a disposal alternatives evaluation for the Southland WWTF called the "Preliminary Screening Evaluation of Southland Wastewater Treatment Facility Disposal Alternatives." The alternatives are described to a level sufficient for preliminary screening and identification of fatal flaws, and are based on a review of hydro-geologic information and models provided by District consultants, regulatory guidance from the Regional Board, wastewater quantity and quality data provided by the District, and other pertinent information. With respect to potential recycled water was use for the Blacklake area, Alternative 5B from the evaluation was assumed. The Alternative consists of improvements at Southland WWTF to produce recycled water and a recycled water distribution system to Blacklake Golf Course. It is assumed that other turf or landscape users along the recycled water pipeline alignment, such as Nipomo Community Park or Woodlands golf course, may also take part in the project if constructed.

If a recycled water system is constructed, it would be most efficient to design it to process and deliver the entire wastewater flow amount. It is our understanding that the Southland WWTF users would not pay for any improvements to a recycled water system unless there is a demonstrated value to the users. These alternatives and cost opinions also assumed the entire future flow from Southland will be treated and utilized for recycled water, an average annual flow (AAF) of 1.67 MGD. Adding wastewater from the WRF would increase this by approximately four percent, to 1.73 MGD. The recycled water project capital and O&M costs were allocated based on recycled water usage. With a higher level of treatment and a greater volume available, it is estimated Blacklake golf course use of recycled water could exceed 900,000 gpd or approximately 54% of the 1.73 MGD produced at Southland WWTF. The estimated costs of recycled water are summarized in Table ES-9. Identification of specific recycled water users and determination of the cost shares was outside this scope of work, but would need to be defined if the recycled water project were pursued.

Table ES-9: Estimated Capital, Operating and 20-year Life Cycle Costs for Recycled Water

	Estimated Capital /Annual Cost
Estimated Recycled Water Project Capital Cost (assuming Alternative 5B)	$14,267,000
Estimated Annual Recycled Water Project O&M Costs	$151,000
Total Estimated 20-year Life Cycle Costs for Recycled Water	**$17,287,000**

Notes:
Based on Alternative 5B (AECOM, 2009).
Total estimated 20-year life cycle costs are rounded to the nearest $1,000.

The costs associated with developing and delivering recycled water are independent of the regionalization cost outlined in Table ES-7 to the extent this source is excluded from the project. The Master Plan evaluates both options, regionalizing the two systems and continued operations at the WRF, but assumes recycled water use is discontinued under the regionalization option. If the District is required to provide recycled water to Blacklake in any amount, the cost assumptions for regionalizing the two facilities will be significantly higher.

Sludge Management and Disposal (Section 8)

Sludge management is an ongoing challenge at Blacklake WRF. The options for sludge management, assuming the District maintains its current treatment process, were reviewed and summarized in Section 5.4 of the Master Plan. Prior to the Southland WWTF upgrade and new discharge permit, the District has taken a pond offline to remove sludge, then hauled the wet sludge to Southland WWTF for drying at their sludge drying beds. The costs for this work are unknown, as staff time has not been tracked separately. This method is no longer an option as the waste site disposal contractor that receives the biosolids will no longer accept a commingled Southland and Blacklake sludge for composting. In addition, there is not sufficient drying bed space to dry the sludge from both the Blacklake WRF and Southland WWTF. Ultimately, the Southland WWTF is neither permitted nor funded to receive unscreened biosolids from the Blacklake facility.

The Master Plan includes sludge management cost estimates. Based on historical plant operations, sludge buildup in the ponds at the WRF must be emptied on a 5-year cycle. Sludge buildout reduces the available volume for treatment and, when not managed, could lead to violations of water quality in the effluent. Hauling and disposing of biosolids requires the District to secure contracts to dredge, dewater, and haul material to the Santa Maria Landfill. The estimated annual cost allocation of $80,000 is rounded up for budgetary purposes, and calculated by dividing the 5 year cycle into the $397,000 sludge removal and disposal estimate from Table 5-5: Budgetary Cost for Contract Sludge Removal and Disposal.

SECTION 1 INTRODUCTION

1.1 Background and Objective

The Blacklake Sewer Master Plan (Master Plan) was prepared to (1) assess the condition of the Blacklake Water Reclamation Facility (WRF) and collection system, (2) update the collection system model to measure its design capacity against current flow conditions, (3) identify existing and estimate future cost requirements for the WRF and collection system, and (4) evaluate the ability of these systems to meet the wastewater needs of existing and future users under current and emerging regulations. Central to the narrative for these Master Plan objectives is to provide a clear understanding for the necessity and purpose of the proposed recommended expenditures.

The WRF and the first of five phases of the collection system was constructed in 1984 by private developers to serve the Black Lake Specific Plan Area. The specific plan area is approximately 515 acres encompassing a golf course, residential community, and interspersed with significant open space and environmentally sensitive habitat. Originally, the WRF and collection system were operated by San Luis Obispo County Public Works Department. In 1993, the Nipomo Community Services District (NCSD) annexed these facilities into its operations and took responsibility for all aspects of the system. In addition to the Blacklake system, NCSD operates a Wastewater Treatment Facility (WWTF) for the greater Nipomo Township designated as the Southland WWTF, but the two wastewater systems are not physically connected.

NCSD first evaluated the WRF and collection system in the Water and Sewer Master Plan Update dated December 2007 and prepare by Cannon Associates. The 2007 master plan effort reviewed the existing and future operation capacities of the Blacklake wastewater system, Nipomo Township wastewater system and the water distribution system for the entire NCSD service area. NCSD's 2007 Master Plan included the development of collection system hydraulic models for the Blacklake and Nipomo Township systems, a capacity assessment of existing facilities, and development of capital improvements needed for each system. This document provides a comprehensive updated evaluation of the Blacklake wastewater facilities.

In addition to the above mentioned planning efforts, NCSD has continued to develop a detailed Geographic Information System (GIS) of the Blacklake wastewater facilities; performed a video inspection of the collection system; replaced WRF treatment pond linings; replaced the comminutors and associated panels at the headworks; removed sludge from the treatment ponds; and continues to document sampling/analysis and operating procedures to complement the existing WRF operations & maintenance manual (updated in 2014).

1.2 Scope of Work

The scope of work for this master planning project included the evaluation of the existing Blacklake wastewater collection, treatment and disposal systems and included the following tasks:

- Collection system evaluation including:
  - Condition assessment and hydraulic analysis of the collection system and lift stations
  - Hydraulic model update and GIS integration of pipeline inspection data
- Reclamation facility evaluation including:
  - Condition assessment and recommendations
  - Near-term sludge removal, improvements and repairs
  - Future treatment expansion recommendations
  - Salt management analysis
  - Development of short-term and long-term strategies for managing biosolids
  - Review of potential impacts of future regulations with proposed improvements

- Development of a Capital Improvement Program (CIP) including:
  - Staffing evaluation
  - Grant and loan research

1.3 Sewer Master Plan

This sewer master plan includes the following items:

- Historical WRF flow analysis
- Historical and future flow and loading projections
- Hydraulic analysis and condition assessment of the existing wastewater collection system
- Hydraulic and treatment analysis and condition assessment of the existing WRF
- Effluent disposal and salts management for the existing WRF
- Wastewater collection system and WRF repairs and recommended improvements
- Biosolids management for existing WRF process
- Summary of water and biosolids quality goals
- Review of salts removal strategy using reverse osmosis
- Assessment of potential future process improvements for improved water quality
- Staffing evaluation
- Grant and loan research
- Capital improvement plan (CIP)

1.4 Operation and Maintenance Manual for the WRF

An Operations and Maintenance (O&M) Manual is required for wastewater treatment plant dischargers per the State Water Resources Control Board and Regional Water Quality Control Board. An up-to-date O&M Manual will establish routine and emergency operations and maintenance requirements, track O&M activities, and maintain compliance with State regulations. MKN performed the following tasks:

- Reviewed existing O&M materials, including logs and records
- Prepared draft O&M Manual outline and list of Standard Operation Procedures (SOPs)
- Met with WRF Operators to collect feedback on O&M Manual outline and list of SOPs

The O&M Manual was provided as a separate deliverable to the District and will not be included with the master plan.

SECTION 2 WASTEWATER FLOW ANALYSIS

2.1 Water Usage Evaluation

As mentioned in the introduction, NCSD owns and operates two separate wastewater collection and treatment systems: the Blacklake system and the Town system. The District also owns and operates a water distribution system for both areas, which is supplied by a blend of groundwater and surface water. Water usage was reviewed and compared to wastewater flow records to analyze the existing and anticipated wastewater flows.

MKN acquired water billing records for the Blacklake area water customers from the District for fiscal years (FY) 2010/2011 and 2011/2012 to compare water demands to wastewater flows throughout the collection system and WRF. Since the District reads meters on a bimonthly basis, it is difficult to assess monthly water usage. A summary of FY 2010/2011 and 2011/2012 water usage totals are provided below. As shown, neither the total usage nor the pattern of usage for different meter types changed significantly between the two fiscal years.

Table 2-1: Water Billing Summary for FY 2010/2011 and 2011/2012

Meter Type	Number of Connections (conn)		Water Usage (gpd)		Water Usage per Connection (gpd/conn)		Percentage of Total Usage	
	2010/ 2011	2011/ 2012	2010/ 2011	2011/ 2012	2010/ 2011	2011/ 2012	2010/ 2011	2011/ 2012
Landscape	30	30	67,988	72,068	2,266	2,402	23%	24%
Multifamily Residential	69	67	5.326	5,099	77	76	2%	2%
Residential	509	517	214,360	217,639	421	421	74%	73%
Commercial	4	4	1,853	2,105	463	526	1%	1%
Total	**612**	**618**	**289,527**	**296,911**	**473 (AVG)**	**480 (AVG)**	**100%**	**100%**

It should be noted this master planning effort began in 2013 with development of an updated collection system hydraulic model, review of collection system video inspections and background materials, and condition assessments. Following these initial efforts, the master planning effort was put on hold while the District completed several other major capital improvement projects (Southland WWTF upgrade and Supplemental Water Project). The study was restarted in 2016. MKN reviewed current water billing data and influent wastewater flows records from the WRF and compared those values to the 2011/2012 data originally used for the planning effort. Based drought conditions for the last several years and water conservation efforts, and due to little recent development in the area, it is assumed that the 2011/2012 data represents reasonably conservative usage estimates.

Figure 2-1: FY 2010/2011 Water Billing by Meter Type

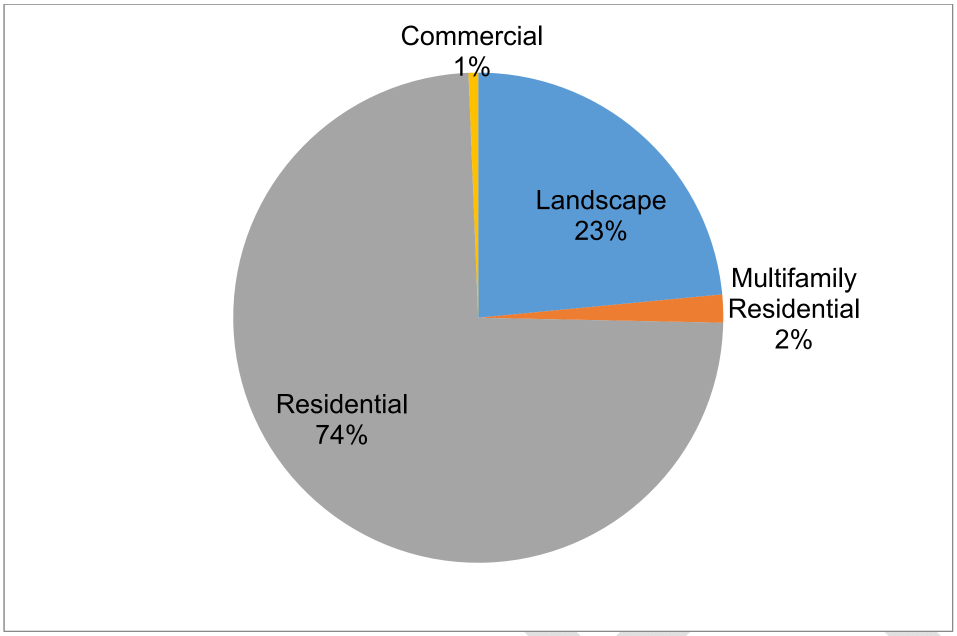
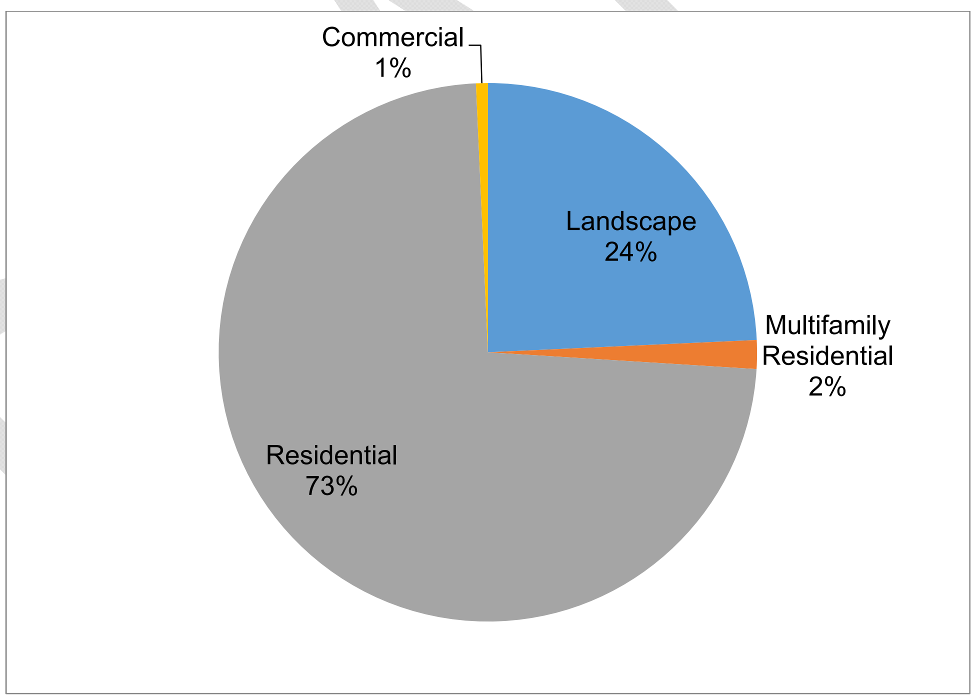


Figure 2-2: FY 2011/2012 Water Billing by Meter Type



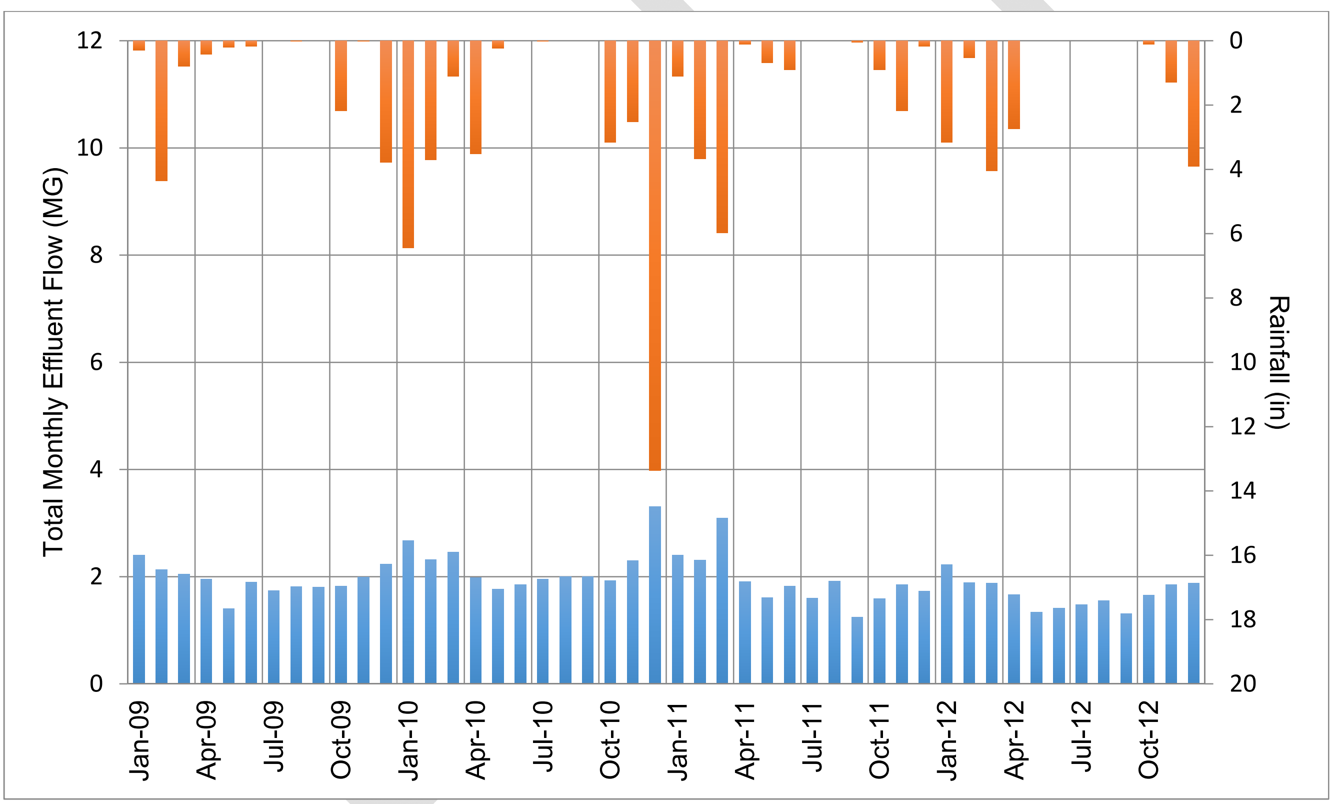
2.2 Water Reclamation Facility Flow Records

2.2.1 Annual Flows and Rainfall

The WRF consists of a treatment pond system designed to provide reliable, low cost, and relatively low maintenance treatment of municipal wastewater. The WRF does not have an influent meter to measure flows entering the treatment process, however it is equipped with two parallel V-notch weir effluent flowmeters. If influent metering data is not available, effluent flow information will be used to estimate influent flow conditions. However, measuring flows leaving a pond system (effluent flows) are generally less accurate due to potential increases in pond volumes from rainfall during wet weather events and decreases due to evaporation during dry conditions. In addition, treated effluent at the WRF is not typically released on the weekends. This mode of operation has a direct impact on estimating daily influent flow since the plant is still receiving flows during the weekends, but effluent flow is only measured during discharge.

Flow and precipitation data for the period of record are summarized in Appendix B. Monthly effluent flow records (in million gallons per month or MGM) and rainfall data from NCSD records are shown in Figure 2-3 below for the period between January 2009 and December 2012.

Figure 2-3: Monthly Blacklake WRF Effluent Flow and Nipomo Rainfall data 2009-2012



As shown, months of high rainfall appear to generally correlate with higher plant flows. However, as described above, the impact of pond area and weather conditions to flow records could be significant.

2.2.2 Flow Conditions

MKN reviewed daily treatment plant flow records provided by the District between January 2009 and December 2012. Average and peak flows were calculated from each year's data set. The peak flows used throughout the report are defined below:

Average Daily Flow (ADF): The total wastewater flow received at the WRF averaged over the number of days per year. Since influent flow is not available, it is assumed the effluent flow approximates influent flow. Some of the complicating factors are described in the preceding annual flow analysis discussion.

Average Wet Weather (AWWF) and Dry Weather (ADWF) Flow: The average of daily flow rates experienced during wet and dry weather months, respectively. Consideration of average wet and dry weather flows allows analysis of treatment systems at appropriate flow rates and temperatures for the wet and dry seasons. Precipitation of 0.25 inches or more per month has been assumed to identify wet weather months. Seasonal wastewater patterns indicated higher flows occurred during the wet weather or winter months, although rainfall at the plant itself will have some impact.

Maximum Month Flow (MMF): The average daily flow during the month with the maximum cumulative flow. MMF is often the regulated flow parameter for a WRF's Discharge Permit. The current waste discharge requirements for the District's WRF, as specified in Regional Water Quality Control Board (RWQCB) Reclamation Order No.94-14, limit plant effluent to a maximum average monthly flow of 200,000 gpd.

Maximum Month Wet and Dry Weather (AWMMF and ADMMF): The average daily flow rates experienced at the WRF during the maximum wet and dry months, respectively.

Peak Day Flow (PDF): The maximum daily flow rate experienced at the WRF and is used to design or evaluate hydraulic retention times for certain treatment processes.

Peak Day Wet and Dry Weather (PDWF and PDDF): The maximum daily flow rates experienced at the WRF during wet and dry months, respectively.

Peak Hour Flow (PHF): The maximum one-hour flow experienced by the system is typically used for sizing collection system piping, lift stations, flow meters, interceptors, and headworks systems. Peak hour flow is typically derived from WRF influent records, flow monitoring, or empirical equations used to estimate PHF based on service area population. A peaking factor[1] of 2.89 was considered based on flow records[2] at Southland WWTF. However, this peaking factor would yield flows that are lower than the recorded peak day flows at Blacklake WRF. When peak hour information is not available, an acceptable approach is to apply empirical relationships based on population and wastewater flows from other domestic systems. Figure 5-1 of Wastewater Engineering: Treatment, Disposal, and Reuse (Metcalf & Eddy, 3rd Ed., 1991) suggests a peak hour factor of 4.0 for wastewater flow rates from communities with less than 5000 residents.

Since infiltration and inflow data were not available in hourly increments, no attempt was made to distinguish between wet weather and dry weather peak hour flows. Current wastewater flow parameters and peaking factors are summarized in the table below.

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[1] Peaking factors, as described herein, are assigned to ADF.

[2] AECOM (2010), Southland WWTF Master Plan Amendment #1.

Table 2-2: Historical Peak Flow Analysis				
Flow Condition (MGD)	**2009**	**2010**	**2011**	**2012**
ADF	0.064	0.073	0.063	0.055
PHF	0.255	0.291	0.253	0.221
PDF	0.223	0.286	0.222	0.230
Adjusted PDF	0.184	0.245	0.200	0.181
PDDF	0.139	0.171	0.141	0.183
Adjusted PDDF	0.137	0.165	0.141	0.181
PDWF	0.223	0.286	0.222	0.230
Adjusted PDWF	0.184	0.245	0.200	0.152
ADMMF	0.063	0.067	0.062	0.052
AWMMF	0.150	0.110	0.145	0.074
Adjusted AWMMF	0.150	0.084	0.137	0.068

In order to attempt to minimize the impact of rainfall at the WRF on AWMMF, MKN reduced the AWMMF by the average volume of rainfall recorded by NCSD over the approximately 94,000 square feet (sf) WRF that month. This is represented in the table above by the Adjusted AWMMF row. As shown, the most significant reduction (23%) occurred in December of 2010 when 13.34 inches of rainfall were recorded by NCSD. The impact of this storm event contributed to the AWMMF recorded for 2010 (shown in the table above). The other rainfall volumes had less than a 10% impact on AWMMF.

In a similar attempt to reduce the impact of higher effluent flows during weekly startup and shutdown of the plant, MKN selected Adjusted PDWF and PDDF values from the "middle" operating days. Middle days were defined as the days in the operating cycles that were neither startup nor shutdown days.

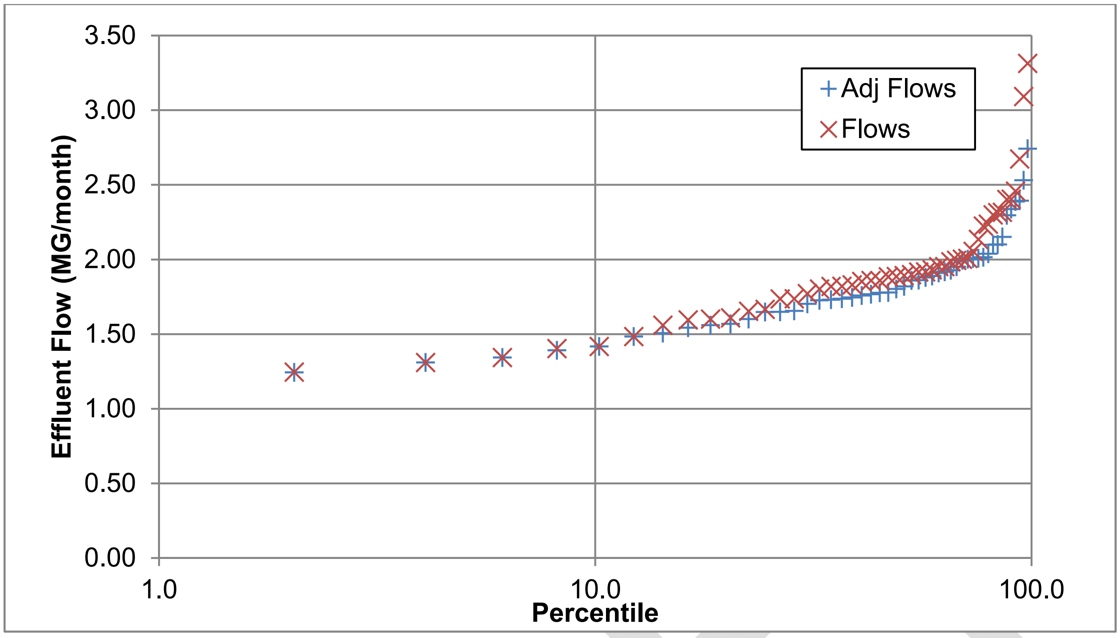
2.2.3 Infiltration and Inflow

Infiltration is typically defined as groundwater that enters a collection system through manhole cracks, failing manhole or pipe gaskets, root intrusion, joint offsets, or other penetrations. Inflow includes stormwater or drainage that directly enters the collection system through illicit drainage discharges, damaged manhole covers, or other connections. Both can increase risk of sanitary sewer overflows and both result in increased pumping and treatment cost for wastewater collection and treatment system owners.

A detailed evaluation of Infiltration and Inflow (I&I) requires flow monitoring throughout a collection system in addition to rainfall information in order to identify a correlation based on data from both sources. The Blacklake WRF has flow totalizers but does not record instantaneous flows. No flow monitoring has been performed in the collection system. Therefore, there is insufficient data to identify short-term (hourly or instantaneous) peaks and to correlate those short-term peaks to rainfall or infiltration. The daily flow data is also not adequate, since only effluent flow is monitored. As described in the previous section, the daily effluent flow data is affected by the current plant operating schedule and the impact of rainfall on the treatment ponds themselves.

In order to provide a brief overview and determine if inflow or infiltration could be a factor in plant flows, MKN developed an arithmetic plot of the metered monthly flows and the adjusted flows as described in the previous section (See Figure 2-4 below). It is assumed the monthly data would be more accurate than daily records since the impact of the weekly operating schedule would not be significant over a 30-day period.

Figure 2-4: Arithmetic Probability Plot of Monthly Effluent Flows



The figure indicates the data is skewed at higher flows. The source of skewness cannot be identified, but normal ("non-skewed") flow data is associated with low infiltration and inflow in collection systems. Skewed data can be a sign of infiltration or inflow. Determining whether infiltration, inflow, or both are significant would require an infiltration/inflow analysis including initial flow metering on an hourly basis at a minimum. The analysis must be performed during both dry and wet weather to identify wet weather impacts.

SECTION 3 FLOW AND LOADING PROJECTIONS

3.1 Land Use

MKN reviewed various County planning documents to determine existing land use and applied this information to estimate future wastewater flows and loadings. Land use on the Nipomo Mesa is defined by the South County Area Plan (SCAP) of the County General Plan Land Use Element, which designates the Black Lake Golf Course Area with the "Recreation" land use category. The SCAP required development of a specific plan for the area: The Black Lake Specific Plan (Plan). The Plan provided detailed guidelines for the construction of 515 Equivalent Residential Units (ERUs) including both multi-family and single family residences, a golf course, clubhouse, and supporting facilities over five development phases. An amendment to the Plan (last revised in 1998) and Land Use Element includes an additional 44 ERUs (for a total buildout of 559 ERUs) within the Village Reserve Boundary established for Black Lake Specific Plan Area.

Figure 8 of the Specific Plan defines development areas A through Z. While the development areas do not exactly match the community layout as constructed, MKN overlaid the development areas on an aerial photograph and counted the residences that were constructed within or near each area for comparison to the Specific Plan. The summary table provided below includes the number of residences per area. The map and house count information are included in Appendix C. As shown in the table below, 525 of the allowable 559 residences have been constructed.

Table 3-1: Comparison of Actual Equivalent Residential Units to Black Lake Specific Plan

Area	Acreage	Residential Units from Figure 8 of BL Specific Plan	Existing Units	Comments
A	12	60	34	17 duplex units with 2 ERUs/unit
B	36	90	97	
C,D,M,N	30.5	40	43	
E,F	10.25	10	10	
G	10	50	164	G,H counted together on the map
H	20	100	--	
I	6.4	16	31	
J	6	15		
K	7	35	20	
P	9	9		Potential development area
Q	3.8	19	6	
R	21	21	64	
S	6	6	16	
O,T,U,V,X,Y	24.5	30	14	Potential development area in U,V
W,Z	15	14	26	Includes W,Z
V	1.9			
F	1.8			
Additional Units from Development Credits		44		The additional units were discussed in the Specific Plan but not defined in areas per Figure 8
Total	**221.15**	**559**	**525**	

Therefore, it appears an additional 34 residential units could be constructed within the Black Lake area. Phase V of the Specific Plan included the development of areas P, U, and V. After reviewing the Specific Plan and unit counts with District staff, it was determined that future flows and loads would be allocated to areas P, U, and V as described below:

- Areas U and V – 16 units per Specific Plan (30 planned for areas O, T, U, V, X, Y minus 14 existing units)
- Area P – 18 units (34 units minus the 16 units for Areas U and V)

3.2 Future Flows and Loadings

Currently 525 units are built and future flows/loadings will consist of an additional 34 ERUs per the 1998 amendment to the Black Lake Specific Plan. However, future flows and loadings on the treatment system may be affected by a change in occupancy within the existing community. Because the system serves a resort community, the number of residents and occupancy throughout the year may vary. To address this inconsistency, MKN developed two alternatives to estimate future ADF conditions:

- Alternative 1: Wastewater production rates based on land use (gpd/ac) from 2007 NCSD Master Plan Update for two occupancy options:
    - 100% Occupancy; and
    - Scenario 1 Occupancy (Existing land use assuming 86% occupancy for the majority of the development)

The wastewater production rates from the 2007 Master Plan Update represent gross recreational-use duty factors and do not include an allowance for flows from the Golf Course clubhouse. Therefore, the 2012 water usage for the clubhouse (1,155 gpd) was multiplied by a factor of 92% to yielding an estimated wastewater flow of 1,063 gpd. Calculating flows in this manner is supported in the 2007 Water Master Plan Update. It is assumed the clubhouse will continue operating at current flows through the foreseeable future. Assuming complete buildout of all 559 units and using the Alternative 1 methodology the estimated future flows would range from 91,000 (86% occupancy) to 100,000 gpd (100% occupancy). The estimated future flow using this methodology is conservative since the wastewater production rates represent gross recreational-use duty factors and may not match existing usage conditions.

- Alternative 2: Existing ADF / Existing Units (gpd/unit) multiplied by Future Units

The 2012 ADF of 54,000 gpd was divided by the number of existing ERUs to determine a flow per unit value (54,000 gpd / 515 ERUs = 105 gpd/unit). Then the 2012 ADF was increased to represent future flows by adding the product of 105 gpd/unit of 34 future ERUs (3,570 gpd) for a total estimated future flow of 58,000 gpd (rounded from 57570 gpd). Since Alternative 2 utilizes current ADF in the future flow projections, the clubhouse flows are already considered in that method. In Alternative 2 it is assumed the current occupancy rates will continue into the future. The results of both alternatives and occupancy assumptions are included in Table 3-2.

Based on consistency in historical flow data, it is assumed that the current level of occupancy will continue for the foreseeable future. Since the existing community is near buildout the estimated future ADF of 58,000 gpd (a 5% increase over current ADF) is recommended for evaluation of the Blacklake collection, treatment, and disposal system planning.

Table 3-2: Future Flows Estimated by Alternatives 1 and 2

			Alternative 1 - Master Plan Methodologies				Alternative 2 - Flow Record-Based Methodology		
Area	**Acreage**	**Units**	**Wastewater Production Rate (2007 NCSD Master Plan Update)**	**100% Occupancy - Subtotal**	**Scenario 1 Occupancy (Existing Land Use - 2007 Master Plan)**	**Subtotal**	**Existing Units**	**2012 ADF - 105 gpd/Unit Subtotal**	**Comments**
			gpd/AC						
A	12	60	2,634	31,608	100%	31,608	34	3,502	Assume duplex units
B	36	90	330	11,880	86%	10,217	97	9,991	
C,D,M,N	30.5	40	330	10,065	86%	8,656	43	4,429	
E,F	10.25	10	330	3,383	86%	2,909	10	1,030	
G	10	50	330	3,300	86%	2,838	164	16,892	G,H
H	20	100	330	6,600	86%	5,676	--		
I*	6.4	16	330	2,112	86%	1,816	31	3,193	
J	6	15	330	1,980	86%	1,703		-	Potential
K*	7	35	330	2,310	86%	1,987	20	2,060	
P	9	9	330	2,970	86%	2,554		-	Potential
Q	3.8	19	330	1,254	86%	1,078	6	618	
R	21	21	330	6,930	86%	5,960	64	6,592	
S	6	6	330	1,980	86%	1,703	16	1,648	
O,T,U,V,X,Y	24.5	30	330	8,085	86%	6,953	14	1,442	Potential U,V
W,Z	15	14	330	4,950	86%	4,257	26	2,678	Incl W,Z
V	1.9								
F	1.8								
	221.15	515		99,407		89,915	525	54,075	
*Add'l Units from Development Credits									
(I,J,Q)		44					34	3,502	
Total		559					559	57,577	
Clubhouse	Water Usage (gpd)=		1,063						From 2012 billing records
	Sewer Flow =			978		978			Included in AAF
	92% usage per Water Master Plan								
Total				**100,000**		**91,000**		**58,000**	Rounded to nearest 1,000 gpd

Production Rate duty factors from Master Plan (Technical Memorandum 1 - Tables 4.5-4.7)
RMF duty factor and occupancy used for Area A
RS duty factor and occupancy used for all other residential

3.3 Future Peak Flows

MKN determined peaking factors for existing dry weather flows by dividing the flows by 2012 ADF. These peaking factors were applied to the future ADF to estimate future design flows as shown below.

Table 3-3: Peaking Factors and Future Design Flows			
Flow Condition (MGD)	**Existing**	**Peaking Factor**	**Future**
ADF	0.055	--	0.058
PHF	0.221	4.0	0.230
Adj. PDDF	0.077	1.39	0.081
Adj. PDWF	0.127	2.30	0.133
Adj. PDF	0.127	2.30	0.133
ADMMF	0.052	0.95	0.055
AWMMF	0.074	1.34	0.078
MMF	0.074	1.34	0.078

3.4 Wastewater Loads and Concentrations

The District is not required to monitor influent 5-day Biological Oxygen Demand (BOD_5) or Total Suspended Solids (TSS) for compliance with their Reclamation Orders. Therefore, this information is not available. The design loading for the existing WRF is not listed in the existing Operations and Maintenance Manual or on the as built plans. Water conservation measures have been implemented in the area since the design, which often increase loading concentrations. The wastewater flows and loadings within the District's Southland WWTF service area are primarily generated by domestic usage with minor contribution from commercial and industrial activity which is similar to the Blacklake system. It is assumed the ratio of design loads (lb/day) to ADF for the new Southland WWTF can be used as a basis for estimating existing and future loads to the Blacklake WRF. Table 6 from the Southland WWTF Master Plan Amendment #1 (August, 2010) is provided below:

Table 3-4: Existing and Projected Influent Loading Rates for Southland WWTF		
	Existing	Buildout
Average Annual Flow (MGD)	0.571	1.67
Average Annual BOD_5 Loading (lb/day)	1,200	3,520
Average Annual TSS Loading (lb/day)	1,200	3,520
MMF (MGD)	0.611	1.79
Maximum Monthly BOD_5 Loading (lb/day)	1,450	4,260
Maximum Monthly TSS Loading (lb/day)	1,450	4,260
Minimum Monthly BOD_5 Loading (lb/day)	1,000	2,930
Minimum Monthly TSS Loading (lb/day)	1,000	2,930
*Table 6 from Southland WWTF Master Plan Amendment #1, August 2010		

For the Master Plan, it is assumed the ratio of BOD_5 and TSS loading to average daily flow (ADF) from the Southland Master Plan Amendment can be applied to Blacklake ADF. The table below summarizes existing and future design loads for the Blacklake WRF.

Table 3-5: Comparison of Existing Southland WWTF Influent Loads and Blacklake WRF Design Loads			
	Southland WWTF - Existing	Blacklake WRF - Existing	Blacklake WRF - Future
Average Annual Flow (MGD)	0.571	0.055	0.058
Average Annual BOD_5 Loading (lb/day)	1,200	120	125
Average Annual TSS Loading (lb/day)	1,200	120	125
MMF (MGD)	1,450	180	190
Maximum Monthly BOD_5 Loading (lb/day)	1,450	180	190
Maximum Monthly TSS Loading (lb/day)	1,000	100	105
Minimum Monthly BOD_5 Loading (lb/day)	1000	100	105

A 90th percentile influent BOD_5 concentration of 300 mg/L was calculated from influent plant data for Southland WWTF and it was assumed that TSS would also be 300 mg/L. This is within the expected range for domestic wastewater systems such as the Blacklake service area. Therefore, design concentrations of 300 mg/L will be assumed for BOD_5 and TSS.

SECTION 4 WASTEWATER COLLECTION SYSTEM

This section provides summary of the existing wastewater collection system, results of the condition assessment, and hydraulic analysis. Cost evaluation tables in this section are listed below:

List of Tables with Cost Implications			
Table	**Description**	**Cost**	**Page**
4-2	Collection System Improvements Cost Opinion	$972,000	4-5
4-5	Woodgreen Lift Station Replacement	$610,000	4-9
4-6	The Oaks Lift Station Improvements	$81,000	4-9
4-7	Misty Glen Lift Station Improvements	$75,000	4-10

4.1 Existing Collection System

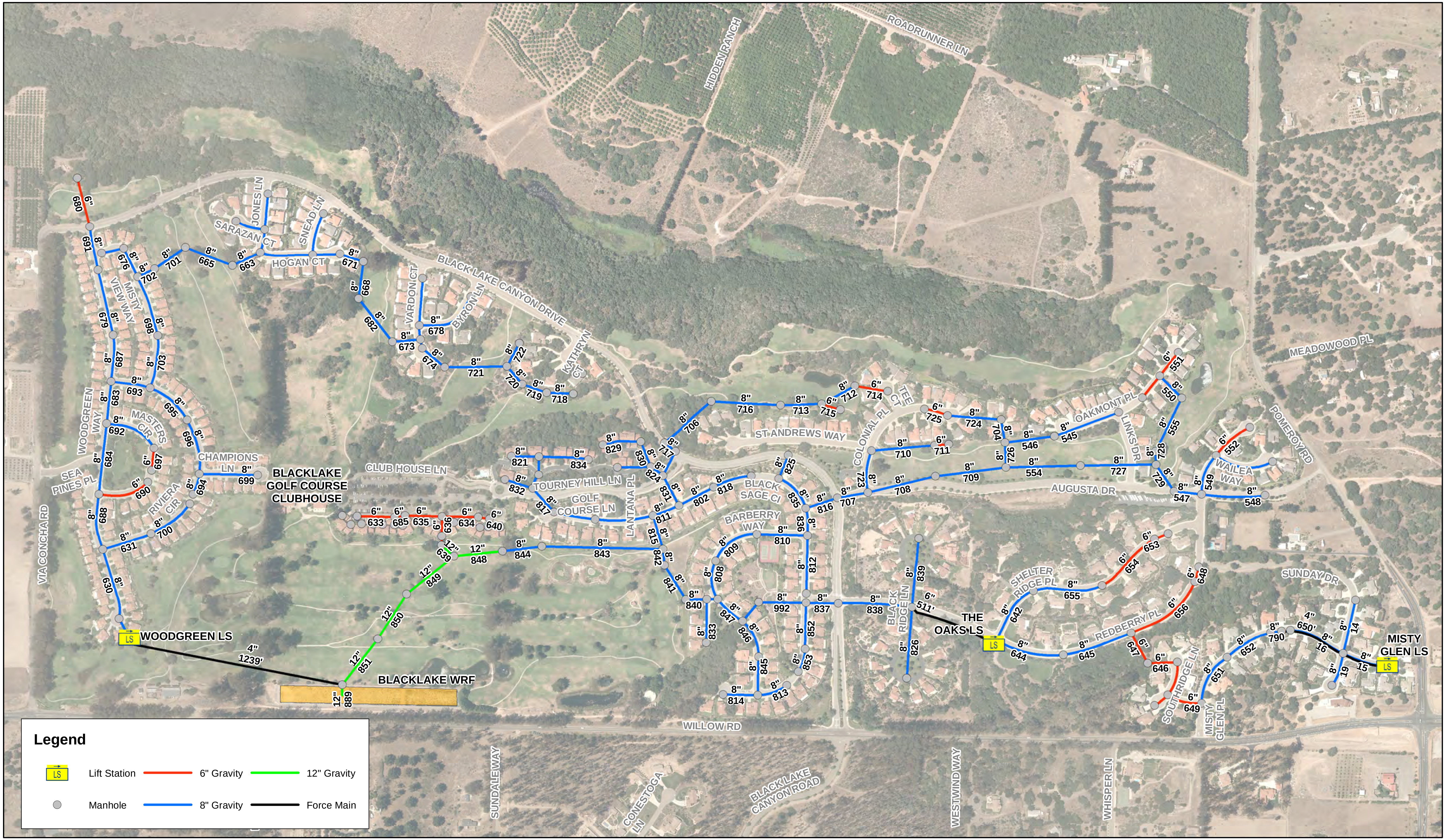
The existing Blacklake wastewater collection system consists of the following facilities:

- Gravity sewer pipe (primarily PVC) ranging in size from 6 inches to 12 inches with concrete manholes
- Three lift stations with 4-inch or 6-inch force mains

The collection system and lift stations were initially installed by private developers. Table 4-1 summarizes information on the existing lift stations. Figure 4-1 identifies major components of the Blacklake collection system.

Table 4-1: Existing Lift Stations

Lift Station	Wetwell	Design Flow Rate (from 2007 Master Plan Update)	Pump Information	Force Main Diameter and Material	Manifold
Misty Glen	5 ft diameter 12 ft depth	150 gpm	Both Pumps: ABS XFP 100C (4.7 hp)	4" DIP (AWWA C150) 4" PVC (AWWA C900)	(2) 4" Check valves (2) 4" Plug valves (2) 4" 45° elbows and DI spools 4" DI wye
The Oaks	5 ft diameter 21.7 ft depth	150 gpm	Both Pumps: ABS XFP 100C (4.7 hp)	4" CIP 4" PVC (C900 assumed but not confirmed on as-builts)	(2) 4" Check valves (2) 4" Gate valves (2) 4" 45° elbows 4" DI wye Flow meter
Woodgreen	6 ft diameter 16 ft depth	200 gpm	Flygt Model 3102 (5 hp) Flygt Model 3172 (10 hp)	4" CIP (125 psi) 4" PVC (C900 assumed but not confirmed on as-builts)	(2) 4" Check valves (2) 4" Plug valves (2) 4" CI spools and 45° elbows 4" CI wye



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NIPOMO COMMUNITY SERVICES DISTRICT
BLACKLAKE SEWER MASTER PLAN

FIGURE 4-1: EXISTING COLLECTION SYSTEM

1 inch :500 feet

NIPOMO COMMUNITY SERVICES DISTRICT

4.1.1 Collection System Hydraulic Analysis and Condition Assessment

Hydraulic Analysis

The hydraulic performance assessment of the wastewater collection system included the following:

- Existing System and Average Daily Flows
  - 2012 ADF flows assigned to manholes
  - All lift stations operating with largest pump in service
  - Existing Blacklake sewer network is active
- Existing System and Peak Hour Flows
  - 2012 PHF assigned to manholes
  - All lift stations operating with largest pump in service
  - Existing Blacklake sewer network is active
- Existing System Future and Average Daily Flows
  - Future ADF flow assigned to manholes (including future demand in Specific Plan Areas P, U, and V)
  - All lift stations operating with largest pump in service
  - Existing Blacklake sewer network is active
- Existing System Future and Peak Hour Flows
  - Future PHF assigned to manholes (including future demand in Specific Plan Areas P, U, and V)
  - All lift stations operating with largest pump in service
  - Existing Blacklake sewer network is active

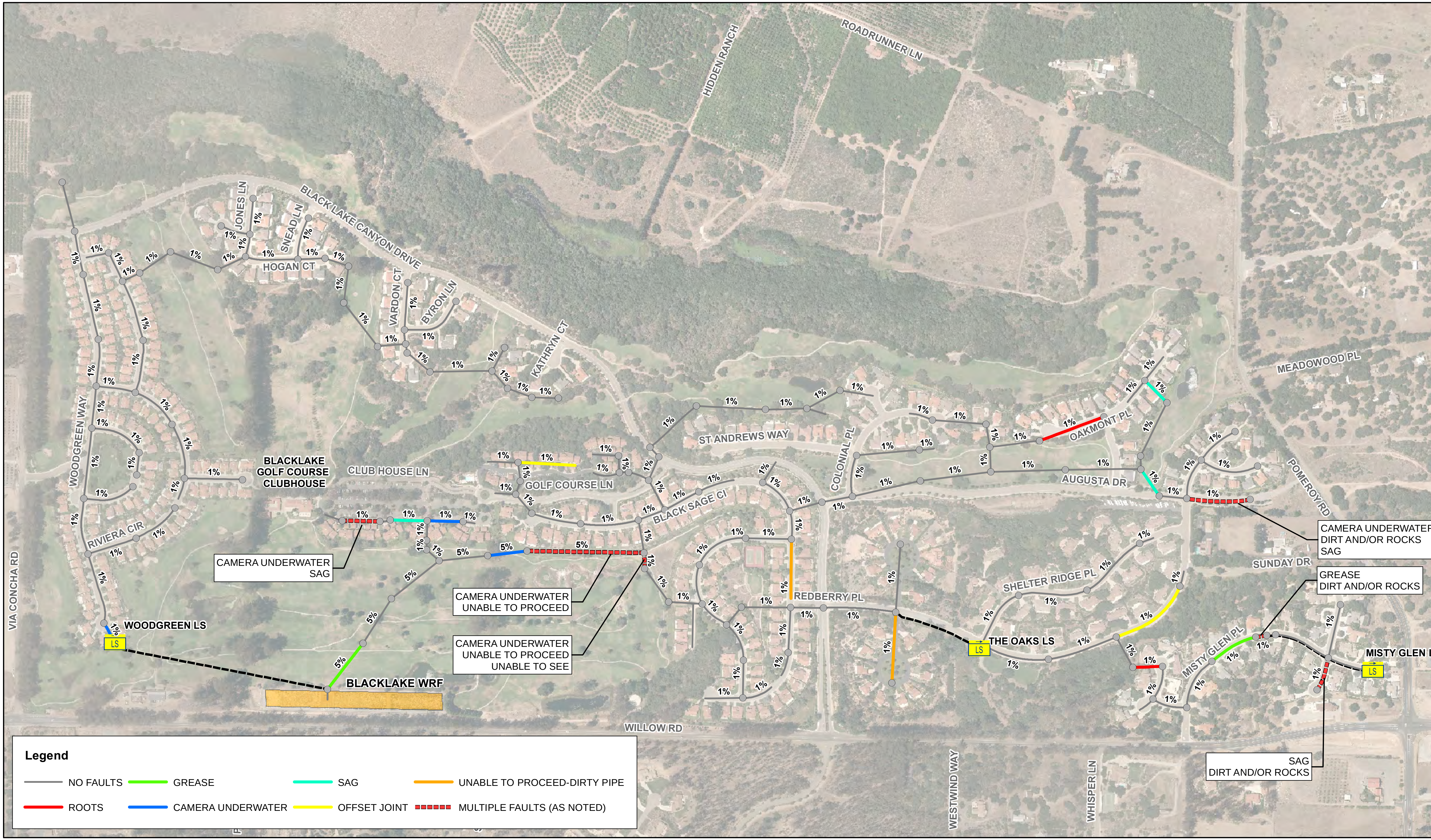
The hydraulic model was evaluated based on the ability of the system to carry flow with a depth/diameter (d/D) ratio of less than 75% at peak hour flow and maintaining velocities within a range of 2 to 20 feet per second (fps). Velocities less than 2 feet per second are typically not sufficient to flush pipes and prevent solids and grease accumulation. Velocities higher than 20 feet per second are associated with concrete erosion and most designers attempt to keep maximum velocities below 10 fps or 15 fps.

During existing and future PHF conditions, with all lift stations in operation, the majority of the collection system operates at a velocity of less than 2.0 fps, with a few segments operating between 2 and 7 fps. With lower velocity conditions there is a significant risk of clogged pipes and overflows unless the collection system is regularly cleaned in lieu of being able to rely on scouring velocities. With respect to pipe flow capacity, the existing collection system conveyed existing and future flows without exceeding the d/D ratio specified above.

Condition Assessment

MKN reviewed the results of the collection system video inspection and used the District's GIS to summarize the findings shown on Figure 4-2. The major problem area within the collection system is the 12-inch trunk main upstream of the WRF. District operations staff have noted the presence of sags along the pipeline and also noted that manholes along the pipeline were buried in the past.

Sags and other obstructions were observed during the video inspection. If not corrected, these could result in system overflows.



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BLACKLAKE SEWER MASTER PLAN

FIGURE 4-2: VIDEO INSPECTION REVIEW

COMMUNITY SERVICES DISTRICT NIPOMO

4.1.2 Collection System Repairs and Improvements

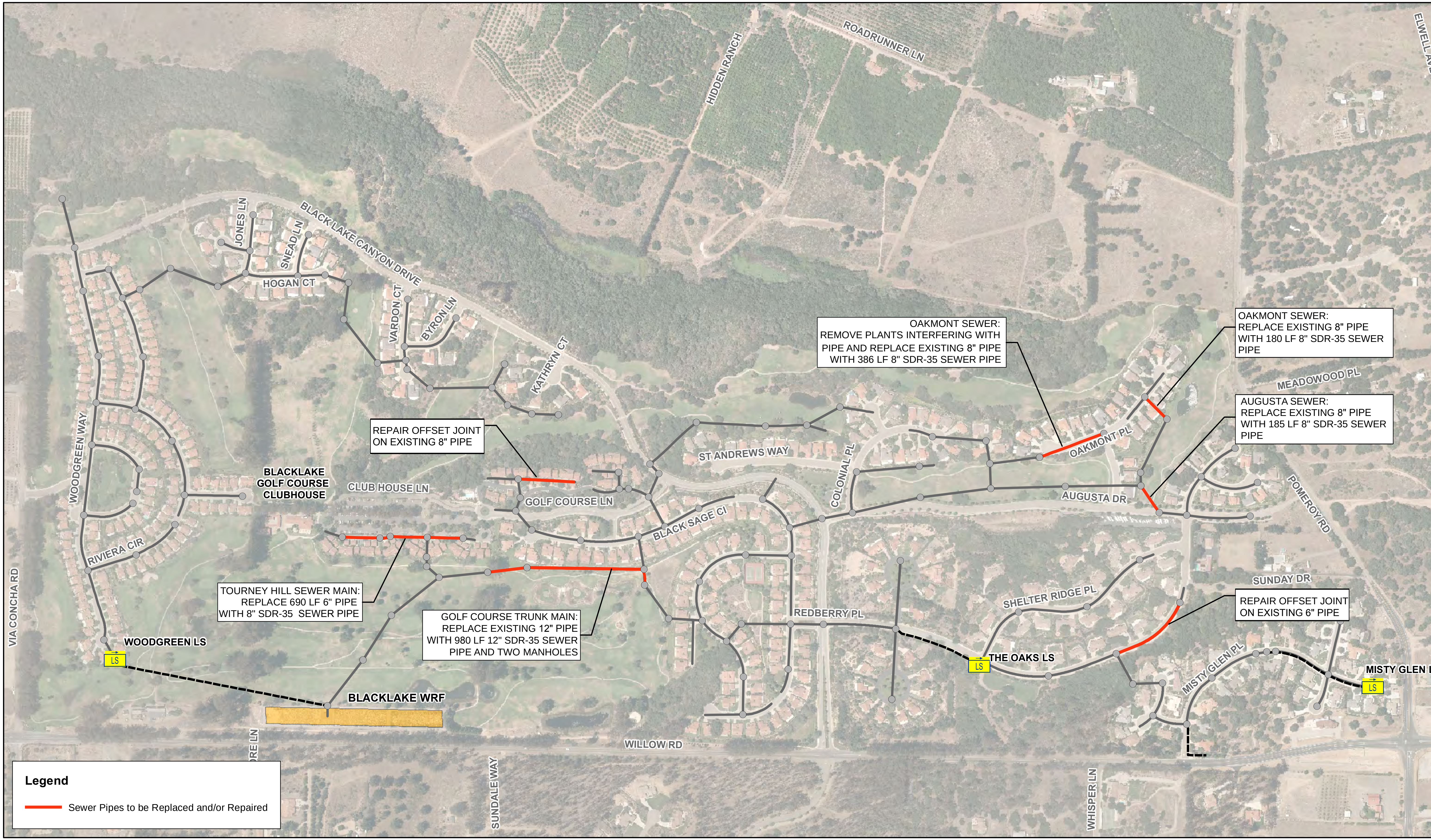
Based on the condition assessment, MKN identified system improvements for the gravity collection system, which include the following pipe segments as shown in Figure 4-3:

- Golf Course Trunk Main Replacement (12-in, 980 LF, 10-20 feet depth)
- Tourney Hill Sewer Main Replacement (8-in, 690 LF)
- Oakmont Sewer Main Replacement (8-in, 566 LF)
- Augusta Sewer Main Replacement (8-in, 185 LF)
- Offset Joint Repair (2 locations)

Table 4-2 summarizes the opinion of costs for the deficient pipe segments identified above. These projects are included in the Capital Improvements Plan in Section 10 of this Master Plan. MKN recommends prioritizing these repairs according to potential risk of overflows.

Table 4-2: Collection System Improvements Cost Opinion

Description	Estimated Installed Cost
Golf Course Trunk Main Replacement (12-in, 980 LF, 10-20 ft depth)	$294,000
Tourney Hill Sewer Main Replacement (8-in, 690 LF)	$168,000
Oakmont Sewer Main Replacement (8-in, 566 LF)	$97,000
Augusta Sewer Main Replacement (8-in, 185 LF)	$33,000
Repair Offset Joints (2 locations)	$16,000
Subtotal Construction Cost Opinion	**$608,000**
Engineering & Administration (30%)	$182,000
Contingency (30%)	$182,000
Total Construction Cost Opinion	**$972,000**
Note: Costs are rounded to the nearest $1,000.	



NIPOMO COMMUNITY SERVICES DISTRICT
BLACKLAKE SEWER MASTER PLAN

FIGURE 4-3: COLLECTION SYSTEM IMPROVEMENTS

1 inch :500 feet

4.1.3 Lift Station Hydraulic Analysis and Condition Assessment

Hydraulic Analysis

The Blacklake lift stations were evaluated based on pumping capacity and pump cycle times. The pump capacity evaluation included development of system curves and drawdown tests (for lift stations with unknown impeller sizes). A range of system curves were developed to represent simplex and duplex pump operation and wetwell low/high levels. Table 4-3 provides a summary of the calculated flow rate of each pump for the existing Blacklake lift stations and estimated future inflows into the lift stations.

Table 4-3: Calculated Pumping Capacity of Existing Lift Stations

Lift Station/ Pump No.	Calculated Flow (gpm)	Future PHF Inflow (gpm)
Woodgreen 1	110	62
Woodgreen 2	200	
The Oaks 1	160	66
The Oaks 2	130	
Misty Glen 1	40	9
Misty Glen 2	50	

As identified in Table 4-3, the calculated capacity of all pumps are significantly higher than the projected future PHF, therefore it is estimated that the lift station have sufficient pumping capacity to serve existing and future flow conditions.

In addition, the lift stations were evaluated for pump cycle times based on future inflows into the wetwells. To protect pumps from overheating, the recommended minimum cycle time is 10 minutes per pump, meaning the pump on/off cycle does not occur more than six times per hour. The Table 4-4 summarizes the cycle time estimates at future PHF, which was determined from the updated collection system model. Since each wetwell has two pumps with automated lead/lag operation, the time between each pump operating would be as shown below. In the case of the Woodgreen Lift Station a cycle time of 7.4 minutes means each pump has a 14.8-min cycle time since each pump is alternating. At future PHF, as shown below, the existing wetwells meet the recommended cycle time.

Table 4-4: Pump Cycle Times for Future Inflows

Lift Station	Wetwell Diameter	Volume	Operating Depth	q =Calc'd Flow	i = Inflow (PHF + Pumped Flow)	V = Operating Volume	T (per pump)
Units	**feet**	**Gal/ft**	**feet**	**gpm**	**gpm**	**gal**	**min**
Woodgreen	6	211	1.5	200	62	317	7.4
The Oaks	5	147	2	160	66	294	7.6
Misty Glen	5	147	2.5	50	9	367	50

Condition Assessment

Staff from MKN and Thoma Electric met with operations staff and developed a list of observations and recommendations based on a field visit. A few general observations that apply to all the lift stations include the following:

- Lift station levels can be observed through the District's SCADA system. Bubblers are used to control the Misty Glen and Woodgreen Lift Station pumps and a float system is used at The Oaks. District staff have installed backup transducers at all lift stations in the event that the bubblers or floats fail. The transducers act as backup level indicators that are redundant for alarm purposes.

- The District may want to consider installing bypass fittings and a valve to simplify bypass pumping operations when wetwells or equipment must be repaired or maintained in the future.
- All lift stations have connections for portable generators but permanent generators have not been installed.

In addition to the general conditions described additional observations were noted as summarized below for the three Blacklake lift stations:

Woodgreen Lift Station:

- The operators noted that ragging has been a significant issue and they must often pull pumps for maintenance.
- Add all-weather surface from the end of Woodgreen to and around the lift station (either base course or pavement).
- Add pole mounted task light at controls enclosure.
- Replace existing power panel enclosure. Bottom of enclosure is severely corroded and is nearly separated from the vertical supporting walls of the enclosure. Mount new enclosure with type 316 stainless steel hardware on new 4" extended height concrete housekeeping pad.
- Power and controls cabling at wetwell should be properly coiled and racked to allow servicing without cable damage.
- Replace existing Pump 2 (10 hp Flygt 3127) which is nearing the end of its design life.
- Replace existing valve vault with traffic-rated vault.
- The existing variable width County easement (identified in the record drawings for Tract 1542) should be researched and surveyed prior to constructing a driveway. District staff noted they were concerned that the easement may not be large enough or may not be in the right location for construction of a driveway. Additional easement area may be required.
- Exposed aggregate was observed beneath the top slab and lining failure was observed at the ring interfaces. Top slab and wetwell should be relined.
- Mild corrosion was observed around the hatchway.
- Pipes and valves in the wetwell and discharge vault should be recoated. Corrosion was observed.

The Oaks Lift Station

- No ventilation was observed.
- Add pole mounted task light at controls enclosure.
- Separate power and controls cabling inside cabinet and provide barriers.
- Existing SCADA antenna cable is exposed to damage; protect in metallic conduit from antenna to enclosure.
- Recoat the cast iron pipe and fittings in the wetwell and valve vault.

Misty Glen Lift Station

- Operations staff noted that grease and grit in the wetwell are frequently observed and cleaning the wetwell is on their high maintenance area list. The wetwell is washed down two times per week.
- Add pole mounted task light at controls enclosure.
- Eliminate step-down transformer and provide 240-volt generator distribution system similar to other lift station generator power provisions.

- A spring-assist hatch should be installed on the wetwell and valve vault to improve access (the District is in the process of installing a new cover because the existing cover has failed).

4.1.4 Lift Station Repairs and Improvements

Based on the condition assessment, MKN identified system improvements for the lift stations, which include various civil, mechanical and electrical improvements to address the deficiencies. Tables 4-5 through 4-7 summarize the recommended improvements for the three Blacklake lift stations. These projects are also included in the Capital Improvements Plan in Section 10 of this Master Plan.

Table 4-5: Woodgreen Lift Station Replacement

Description	Estimated Installed Cost
Pumps and Wet Well	$125,000
Piping, Valves and Appurtenances	$54,000
Bypass Pumping	$23,500
Demolition	$15,000
Site work and grading	$22,500
Gravity sewer line and manhole	$17,500
Electrical and Instrumentation	$127,500
Mobilization	$25,000
Subtotal Construction Cost Opinion	**$410,000**
Engineering & Administration	$77,000
Contingency (30%)	$123,000
Total Construction Cost Opinion	**$610,000**
Note: From Woodgreen Lift Station Rehabilitation Options Memo (Cannon, March 25, 2016), Option 4	

Table 4-6: The Oaks Lift Station Improvements

Description	Estimated Installed Cost
Add ventilation	$1,000
Recoat cast iron piping and fittings in wet well and valve vault	$5,000
Replace power and controls panel	$35,000
New Instruments and cabling	$5,000
Pole mount task light	$2,000
Separate power & controls cabling, add barriers	$1,500
Protect SCADA antenna	$1,500
Subtotal Construction Cost Opinion	**$51,000**
Engineering & Administration (30%)	$15,000
Contingency (30%)	$15,000
Total Construction Cost Opinion	**$81,000**
Note: Costs are rounded to the nearest $1,000.	

Table 4-7: Misty Glen Lift Station Improvements	
Description	**Estimated Installed Cost**
Replace power and controls panel	$35,000
New Instruments and cabling	$5,000
Pole mount task light	$2,000
Replace step-down transformer with generator distribution system	$5,000
Subtotal Construction Cost Opinion	**$47,000**
Engineering & Administration (30%)	$14,000
Contingency (30%)	$14,000
Total Construction Cost Opinion	**$75,000**
Note: Costs are rounded to the nearest $1,000.	

SECTION 5 WATER RECLAMATION FACILITY

This section provides an overview of the existing wastewater treatment systems, effluent water quality requirements, historical influent and effluent water quality, and results of the treatment system assessments. Cost evaluation tables in this section are listed below:

List of Tables with Cost Implications			
Table	**Description**	**Cost**	**Page**
5-5	Budgetary Cost for Contract Sludge Removal and Disposal	$397,000	5-8
5-6	WRF Headworks Rehabilitation Cost Opinion	$186,000	5-8
5-7	Treatment Pond Rehabilitation Cost Opinion	$313,000	5-9
5-8	Chlorine Contact Chamber Rehabilitation Cost Opinion	$310,000	5-9
5-9	WRF Site Improvements	$198,000	5-10
5-10	WRF Electrical Improvements	$431,000	5-10
5-11	Influent Flow Metering Manhole Cost Opinion	$144,000	5-11
5-12	Self-cleaning Screening System Cost Opinion	$607,000	5-12
5-13 and 5-14	Aeration Alternatives Cost Opinions	$230,000 - $342,000	5-14 and 5-15

5.1 Effluent Requirements and Quality

Effluent requirements for Blacklake WRF are set forth in Water Reclamation Requirements Order No. 94-14 (Appendix A). The permitted capacity of the plant is 200,000 gpd which is based on the average day flow for the maximum month, or ADMMF. Table 5-1 summarizes the permit requirements.

Table 5-1: Water Reclamation Quality Requirements		
	Maximum 30-day Mean	**Maximum Daily**
5-day Biological Oxygen Demand (BOD_5), mg/L	40	100
Total Suspended Solids (TSS), mg/L	30	100
Total Dissolved Solids (TDS), mg/L	WS + 250*	
Sodium, mg/L	WS + 70*	
Chloride, mg/L	WS + 65*	
Settleable Solids (SS), mg/L	0.1	0.3
pH	Within the range 6.5 to 8.4	
Dissolved Oxygen (DO), mg/L	Minimum 1.0	
Coliform, MPN per 100 mL	23, as median in 7 days	240 any single sample
Free chlorine in effluent, mg/L	Minimum 1.0	
Groundwater limitations	Discharge shall not cause nitrate concentrations in groundwater downgradient of reclamation area to exceed 10 mg/L as N, or cause a significant increase of mineral constituent concentrations as determined by a comparison of samples from wells upgradient and downgradient of the disposal area.	
Notes per WDR Order: WS = Water Supply		
* Incremental limits do not account for use of water conserving fixtures which will tend to increase salts concentrations by reducing diluting flows. If after implementing best salts management practices, the Discharger is unable to comply with the incremental limits specified in B.2., these limits may be revised to reflect increased salts concentrations resulting from water conservation practices. Revised limits may be approved by the Executive Officer after adequate justification has been presented by the Discharger.		

Table 5-2 summarizes the WRF effluent monitoring results for 2011 and 2012[3]. Results exceeding reclamation quality requirements are underlined. One potential cause for the increased settleable solids is high algae and microbial plant growth in the aerated ponds. A byproduct of plant growth is elevated pH in pond effluent. High salts concentrations are a result of salts in the source water and salts contributed from customers via self-regenerating water softeners and other mechanisms.

Table 5-2: Effluent Quality Monitoring Results 2011 and 2012

Month/ Year	BOD_5			TSS			DO			SS
	Min (mg/L)	Max (mg/L)	Avg (mg/L)	Min (mg/L)	Max (mg/L)	Avg (mg/L)	Min (mg/L)	Max (mg/L)	Avg (mg/L)	Avg (mg/L)
Jan/11	3	8	6.3	3	4	3.3	9.9	10.7	10.3	0.05
Feb/11	5	9	7.0	2	5	3.5	8.1	10.1	9.2	0.05
Mar/11	3	13	6.6	5	9	6.6	7.6	9.1	8.3	0.05
Apr/11	3	12	6.5	8	12	9.8	7.1	8.0	7.6	0.05
May/11	8	16	11.0	5	14	9.5	6.9	8.3	7.7	0.05
Jun/11	3	6	3.6	5	9	6.4	7.3	7.9	7.6	0.05
Jul/11	3	8	5.3	5	12	7.3	7.7	7.8	7.7	0.05
Aug/11	10	16	13.5	5	7	5.5	6.2	9.0	8.1	0.07
Sep/11	14	22	17.0	5	13	9.3	7.7	8.5	8.2	0.05
Oct/11	7	12	10.8	7	13	10.8	8.4	9.2	8.8	0.1
Nov/11	< 3	6	5.0	9	10	10.0	9.8	11.0	10.6	0.1
Dec/11	3	5	3.5	6	7	6.5	12.3	12.5	12.4	**< 0.14**
Jan/12	3	4	3.3	7	11	8.0	10.8	12.6	12.0	**< 0.2**
Feb/12	3	7	4.4	7	10	8.0	10.6	11.1	10.8	< 0.05
Mar/12	3	7	4.0	9	16	12.5	9.5	10.3	9.9	< 0.05
Apr/12	6	16	10.3	17	21	19.3	8.7	9.8	9.3	< 0.05
May/12	6	16	11.2	7	17	11.0	8.4	10.6	9.4	0.05
Jun/12	3	8	5.5	12	15	13.0	8.9	10.4	9.5	0.05
Jul/12	3	13	9.0	9	10	9.3	8.7	9.3	8.9	0.05
Aug/12	16	38	26.4	5	12	9.0	7.5	9.1	8.4	0.05
Sep/12	21	41	30.3	4	9	6.5	8.7	9.6	9.3	0.05
Oct/12	23	32	25.6	6	13	8.8	8.6	10.0	9.4	0.05
Nov/12	14	18	15.8	10	23	16.3	10.2	10.8	10.4	0.05
Dec/12	6	28	19.0	7	9	8.0	9.2	10.4	9.9	0.05
Avg.			**10.9**			**9.08**			**9.32**	**0.06**
Max.		**41**			**23**			**12.6**		
Min.	**3**			**2**			**6.15**			

[3] See Section 2.1 for discussion of water usage and flow data sources, and reasoning for using 2011/2012 data.

5.2 Treatment Process Description

The Blacklake WRF was constructed as part of the Blacklake development (1984) to process raw wastewater produced by the development and provide beneficial reuse of the treated effluent for the golf course to use for irrigation.

The facility consists of multiple structures equipped with electrical, mechanical and chemical systems to support the wastewater treatment process. Physical features of the WRF include a manual bypass bar screen, two comminutors, three (3) ponds with surface aerators, two (2) chlorine contact basins, a sodium hypochlorite storage and feed system, and a citric acid storage and feed system that can be used to maintain pH within effluent limitations. System component descriptions are summarized below. A process flow diagram for the existing system is included as Figure 5-1, page 5-4.

5.2.1 Headworks:

The headworks consists mainly of a concrete structure with two parallel comminuters. The structure shows extensive corrosion, cracks, and crumbled concrete and is near the end of its design life. The District is currently in process of a rehabilitation and repair project to reduce risk of failure.

A 12-inch influent PVC gravity sewer line delivers sewage to the plant where flow is divided to two parallel comminutors The original design directed flow through a coarse bar screen (not currently in place) before reaching the comminutors.. The comminutors are designed to grind large solids that pass through a bar screen and are operated continuously. Both comminutors and their electrical control panels were replaced, in 2011. If one or both comminutors becomes clogged or is out of service water level will rise in the influent channel and flow over a slide gate into a bypass channel containing a manual bar screen.

5.2.2 Aerated Ponds:

The aerated ponds are the only source of biological treatment of the raw wastewater entering the WRF and must be maintained to meet effluent regulatory requirements and provide recycled water to the golf course for restricted irrigation. The ponds are lined with plastic to reduce potential for infiltration and protect groundwater. The pond liners have an anticipated life of 10 to 20 years, before requiring replacement. The liner for Pond 1 was replaced in 2011. Ponds 2 and 3 are expected to need new liners soon.

Flow continues from the headworks channels to the aerated ponds by gravity through an 8-inch pipe. Three HDPE-lined aerated ponds, operated in series, provide biological treatment of the wastewater. The ponds are considered partially mixed since the aerators mix the pond volume in their vicinity, but the remainder of the pond volume has no mixing and solids can settle to the bottom of the ponds. Water levels are controlled at a depth of 9.5 feet utilizing an effluent weir in the third pond. Conventional splasher-type mechanical aerators placed in each pond provide mixing and oxygen for biological treatment. The number and size of the aerators vary depending on aerator condition and availability.

5.2.3 Chlorine Contact Basins:

The chlorine contact basins provide final disinfection of the treated effluent from the WRF and allow for the beneficial reuse of wastewater for irrigation of the roughs at the adjacent golf course. The basins show signs of corrosion and cracks. The concrete needs repair and re-coating to reduce the risk of failure.

An 8-inch SDR-35 PVC pipeline carries flow from the Pond 3 effluent weir box to the chlorine contact basin for disinfection. Chlorine solution is injected into the mixing chamber where an air sparger provides mixing. Flow can then be split into two chlorine contact basins. Each contact chamber is baffled and designed for a minimum of 20 minutes contact time at 200,000 gpd, to provide redundancy during peak flows. The effluent flow rate is measured at the end of each contact basin with a v-notch flume flow meter. Each contact chamber has a dedicated flow meter. Grab samples are collected and analyzed to measure chlorine levels.

5.2.4 Additional Chemical Treatment:

Since the pond treatment system is a biological treatment process there are system conditions that require the additional of chemical treatment to control/improve the biological process.

High pH in the effluent is controlled with citric acid, fed into the treated wastewater at the chlorine contact basin with a metering pump. Algae growth in the ponds is reduced with the addition of copper sulfate. The operators determine when algae growth is higher than normal based on pond appearance and pH readings.

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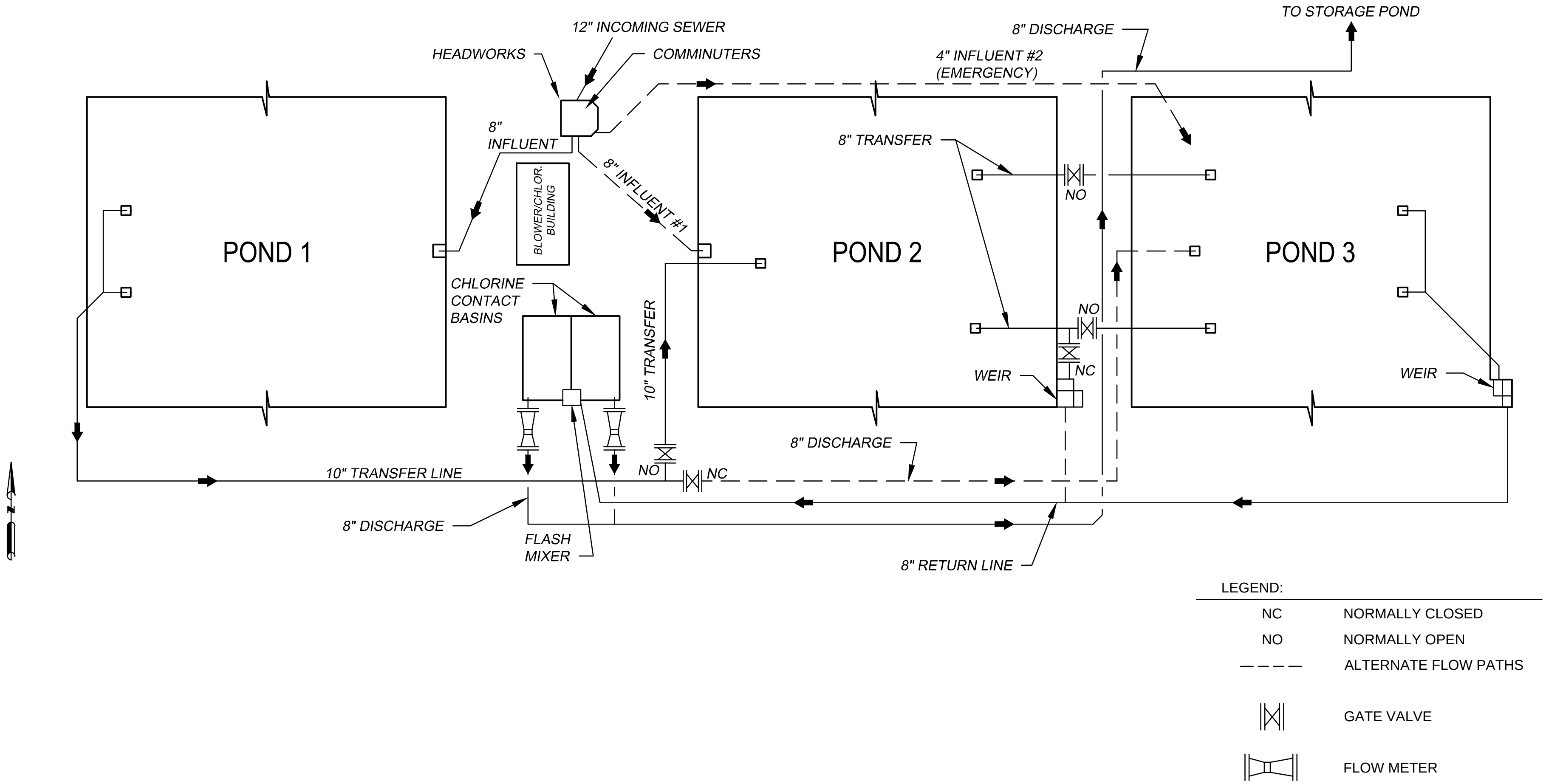

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NIPOMO COMMUNITY SERVICES DISTRICT
BLACKLAKE SEWER MASTER PLAN

EXISTING PROCESS FLOW DIAGRAM

FIGURE

5-1

5.3 Condition Assessment, Hydraulic Review and Treatment Evaluation

The following section summarizes the findings from the field condition assessment and hydraulic/treatment evaluation of the existing WRF.

MKN, with a representative from Thoma Electric, completed a field condition assessment of the entire WRF. MKN visited the facility with District operations staff and identified design, installation, and operational issues related to mechanical and electrical systems at the facility.

5.3.1 Manual Screens

The headworks structure was designed with two manual bar screens, a coarse screen (with 1.5-inch openings) ahead of comminuters and a finer screen (with 0.75-inch openings) in the bypass channel. The screens corroded and have not been replaced. While the existing plant is in operation, we recommend the District replace these screens to protect the downstream equipment and assist with trash removal from the influent.

5.3.2 Comminutors

As described previously, the comminutors were replaced in 2011 and are rated for 300 and 800 gpm. Both have sufficient capacity to handle the full anticipated future PHF. However, materials often pass through the headworks that wrap around the aerators and cause binding, "ragging", reducing dissolved oxygen and mixing in the aerated ponds and costing operational staff time to repair.

5.3.3 Chlorine Contact Basin

MKN reviewed the hydraulic capacity of the existing chlorine contact basins and confirmed the design criteria. The condition assessment revealed significant corrosion in support beams, equipment and conduit, and cracking of the concrete walls. New equipment and support beams are recommended, as well as repair and recoating of the concrete walls. Additional recommendations are provided for improving disinfection efficiency and monitoring.

5.3.4 Aerated Ponds

MKN performed a hydraulic review to assess estimated future flow through the facility. Available as-builts for the treatment plant were utilized to assess the hydraulic profile through the plant at permitted MMF (200,000 gpd). An outlet weir in Pond 3 dictates the water levels in Ponds 2 and 3, as there is minimal headloss in the two 8-inch transfer pipes between these ponds. The water surface elevation in Pond 1 is based on the downstream water levels and headloss experienced in the transfer piping between Ponds 1 and 2. A hydraulic analysis was performed for the flow paths between the headworks, the ponds, the chlorine contact chamber, and the storage pond. Hydraulically, the current pond system has sufficient capacity to meet future flow demands.

The ability for the existing aerated pond system to treat influent wastewater was evaluated using a first-order rate kinetics model to estimate biodegradation of BOD_5 within the system. Historical flow rates and temperatures were applied and the 90^{th} percentile BOD_5 was assumed to be similar to that found for the neighboring Nipomo CSD Southland Wastewater Facility, 300 mg/L[4]. The analysis assumed an operational configuration of three ponds in series. Results of the modeling estimate that the existing system is capable of treating existing and future flow and loading conditions, provided adequate aeration is supplied, effluent is drawn at the appropriate heights above the sludge

[4] The 90^{th} percentile BOD_5 is the concentration beneath which ninety percent of the sample concentrations fall, and only ten percent of the sample concentrations exceed. This 90^{th} percentile concentration is representative of two years of influent sampling data at the Southland WWTF between September 2007 and August 2009. (Southland WWTF Master Plan Amendment #1, AECOM, January 2010).

blanket and below the surface, and algae and microbial plant growth is controlled. Table 5-3 summarizes the modeling results.

Table 5-3: Treatment Modeling Results For Existing System			
Flow and Temperature Condition	**Influent Flow Rate (gpd)**	**Retention Time (days)**	**Estimated effluent BOD_5 concentration**
Low Temp & Low Flow, existing	43,000	102	< 1 mg/L
High Temp & MMF, existing	72,000	61	< 1 mg/L
Low Temp & MMF, future	78,000	56	3 mg/L
Low Temp & permitted MMF	200,000	22	22 mg/L

Monitoring results from 2011 and 2012 indicate the effluent BOD_5 concentrations range from 3 to 40 mg/L with an average of approximately 11 mg/L (Table 5-2). Variations between modeled and actual results may be due to algae growth, difference between modeled pond flows and actual currents and short-circuiting through the ponds, and other factors.

5.4 Sludge Removal

Managing biosolids is a significant cost with regulatory variables that inevitably drive up program costs. Biosolids settle out in the aerated ponds with minor anaerobic digestion occurring and reducing sludge amounts in the bottom of the ponds. Historically, when sludge depths accumulated, sludge was removed from the system by isolating one pond from the incoming wastewater flow, draining the pond, and mechanically removing the sludge from the ponds (using contract services) for hauling and disposal. Biosolids have previously been hauled to Southland WWTF for drying at the sludge drying beds, and ultimately transported to a landfill.

The Southland WWTF has been upgraded to include a screening process and extended aeration, which produces a higher quality of sludge that is being used for composting at the Engel and Gray (E&G) facility. This facility will not accept unscreened biosolids. Therefore, comingling of the sludge from Blacklake (unscreened) with sludge from Southland cannot continue in the same manner. There is not sufficient drying bed space to dry the sludge from the Blacklake facility. In addition, the Southland WWTF is neither permitted nor funded to receive unscreened biosolids from the Blacklake facility.

Since hauling to the Southland facility (with final composting at E&G) is no longer a viable sludge management option for the Blacklake facility, NCSD will be required to dredge, dewater, and haul biosolids to the Santa Maria Regional Landfill, or other nearby landfill facility. To develop budgetary costs for sludge disposal, MKN estimated the sludge volumes in in the ponds assuming an average of three feet accumulation (Table 5-4), contacted contract dredging and dewatering contractors, and acquired tipping fees for final disposal at the Santa Maria Regional Landfill.

Table 5-4: Estimated Pond Effective and Sludge Volumes				
	Pond 1 Estimated Volume (Gallons)	**Pond 2 Estimated Volume (Gallons)**	**Pond 3 Estimated Volume (Gallons)**	**Total Pond System Estimated Volume (Gallons)**
Effective Volume	1,373,730	1,488,728	1,512,325	4,374,783
Wet Sludge Volume	146,179	319,667	151,770	617,616
Notes: Based on June 2016 sludge measurements. Average sludge depths for Pond 1, Pond 2 and Pond 3 are 1.55 feet, 3 feet and 1.4 feet, respectively.				

Table 5-5 provides a budgetary cost for sludge disposal for the volume shown in Table 5-4. The cost assumes sludge is dredged from the ponds at an average two percent total solids, sludge is screened and dewatered onsite to 20% total solids with a portable unit (such as a trailer-mounted centrifuge or belt press), and hauled to Santa Maria Landfill for disposal. Since this budget includes hauling, it will vary with the cost of fuel. The polymer costs can also vary significantly between various projects and over time. If the District plans to pursue contract dewatering, additional investigation will be required prior to performing the work. To refine the estimated costs, as provided in Table 5-5, it is recommended that the District complete sludge testing to better estimate polymer usage (dewatering) and perform additional sludge judging to refine sludge volumes (if needed) prior to completing a sludge removal project. It should be noted that sludge removal may be needed every five to eight years.

Table 5-5: Budgetary Cost for Contract Sludge Removal and Disposal	
Description	**Recommended Budgetary Cost**
Dredging, dewatering, and hauling to Santa Maria Landfill	$260,000
Disposal at Santa Maria Landfill ($71/ton)	$28,000
Subtotal Cost Opinion	**$288,000**
Administration (8%)	$23,000
Contingency (30%)	$86,000
Total Cost Opinion	**$397,000**
Note: Costs are rounded to the nearest $1,000.	

For future biosolids disposal, additional onsite management alternatives have been reviewed for the Blacklake facility and are included in Section 8 of this Master Plan.

5.5 WRF Rehabilitation

The following system WRF rehabilitation projects and budget recommendations are based on the condition assessment of the existing facility. Several facilities are in need of repair or replacement

5.5.1 Headworks Rehabilitation

The contract documents for the Blacklake WRF Headworks Rehabilitation Project recently went out to bid. The cost opinion below is based on the apparent low bid for the project. Self-cleaning screens and influent flow metering are recommended as improvements, but are not included with this project. Alternatives for these improvements are evaluated in Section 5.7.

Table 5-6: WRF Headworks Rehabilitation Cost Opinion	
Description	**Estimated Cost**
Mobilization/Demobilization	$9,000
Temporary Sewage Bypassing	$20,113
Headworks Spalled Concrete Repair	$11,895
Concrete Crack Repair at Handrails	$5,175
Headworks Concrete Protective Coating	$46,978
Slide Gates	$47,040
Headworks Improvements	$36,870
Influent Manhole Rehabilitation	$8,794
Total Construction Cost Opinion	**$186,000**
Note: Based on actual bid results for apparent low bidder. Total construction cost opinion was rounded up to the nearest $1,000.	

5.5.2 Treatment Ponds

The following cost opinion includes minimum improvements to address safety concerns and maintenance and repair issues related to civil and mechanical systems at the treatment ponds.

Table 5-7: Treatment Pond Rehabilitation Cost Opinion	
Description	**Recommended Budget**
Replace HDPE liner at Pond 1 (60 mil, textured)[1]	$170,000
Repair CMU walls around Ponds 2 and 3[2]	$15,000
Install safety railing along the east perimeter of Pond #1 and west perimeter of Pond #2	$10,000
Subtotal Construction Cost Opinion	**$195,000**
Engineering & Administration (30%)	$59,000
Contingency (30%)	$59,000
Total Construction Cost Opinion	**$313,000**
Notes: Costs are rounded to the nearest $1,000. [1] Liner costs estimated at $5 per SF based on escalation of 2007 liner replacement construction costs. [2] CMU wall repair costs assumes repair required for 25% of Ponds 2 & 3 perimeters.	

5.5.3 Chlorine Contact Chamber

The following cost opinion includes items required for rehabilitation of the existing chlorine contact chambers. Since effluent flow metering is a regulatory requirement, and the existing metering system does not allow collection of flow data by the minute or hour and requires manually recording flows from two meters, replacing these meters with one effluent meter is recommended. A new effluent meter is included in the cost opinions provided below. An online chlorine analyzer is also included since it would allow the District to better monitor the addition of sodium hypochlorite and manage chemical cost.

Table 5-8: Chlorine Contact Chamber Rehabilitation Cost Opinion	
Description	**Estimated Cost**
Replace steel support beams	$3,000
Repair concrete basin walls	$6,000
Recoat basin interior	$100,000
Replace air sparger with stainless steel mechanical mixer	$5,000
Install online chlorine analyzer	$10,000
Effluent flow meter	$50,000
Automatic composite sampler with weather enclosure	$20,000
Subtotal Construction Cost Opinion	**$194,000**
Engineering & Administration (30%)	$58,000
Contingency (30%)	$58,000
Total Construction Cost Opinion	**$310,000**
Note: Costs are rounded to the nearest $1,000.	

5.6 WRF Site and Electrical Improvements

The following table summarizes cost opinions for improvements related to the control building and general plant site.

Table 5-9: WRF Site Improvements Cost Opinion	
Description	**Estimated Cost**
Allowance for controls building repair (interior and exterior paint, repair holes and roof edges, repair SCADA room ventilation fan)	$50,000
Allowance for controls building security alarm	$ 4,000
Replace temporary retaining wall with permanent reinforced concrete wall	$20,000
Redirect site drains from offsite to treatment ponds	$50,000
Subtotal Construction Cost Opinion	**$124,000**
Engineering & Administration (30%)	$37,000
Contingency (30%)	$37,000
Total Construction Cost Opinion	**$198,000**
Note: Costs are rounded to the nearest $1,000.	

The following table summarizes cost opinions electrical improvements recommended at the WRF.

Table 5-10: WRF Electrical Improvements Cost Opinion	
Description	**Estimated Cost**
Additional automation & SCADA interfacing	$15,000
Permanent Generator	$200,000
Pond 3 effluent weir/valve improvements	$18,000
Improve site lighting (LED fixtures, expand throughout site)	$15,000
Clean, repair, and/or replace corroded equipment	$18,000
Grounding for phone service and SCADA	$1,500
Protect SCADA antenna	$1,500
Subtotal Construction Cost Opinion	**$269,000**
Engineering & Administration (30%)	$81,000
Contingency (30%)	$81,000
Total Construction Cost Opinion	**$431,000**
Note: Costs are rounded to the nearest $1,000.	

5.7 WRF Headworks Improvements

5.7.1 Influent Flow Meter

An influent flow meter installed upstream of the headworks structure is recommended to monitor and record incoming sewage flow. A prefabricated FRP metering manhole provides for ease of installation. For adequate resolution at lower flow rates, an integral trapezoidal flume is recommended. Additional options recommended for the metering manhole include a spring-assisted access hatch, integral ladder, a water level transducer, and brackets and ports for sampling tubing. The opinion of cost for an influent flow meter, including required piping modifications, is summarized in Table 6-10. A detailed siting review is recommended during design phase, including design-level headloss calculations and consideration of manufacturer recommendations for upstream/downstream piping.

Table 5-11: Influent Flow Metering Manhole Cost Opinion	
Description	**Estimated Installed Cost**
Prefab Flow Metering Manhole with level transducer	$50,000
Piping modifications and fittings	$20,000
Electrical and Instrumentation	$20,000
Subtotal Construction Cost Opinion	**$90,000**
Engineering & Administration (30%)	$27,000
Contingency (30%)	$27,000
Total Construction Cost Opinion	**$144,000**
Note: Costs are rounded to the nearest $1,000.	

5.7.2 Self-Cleaning Screening System

The following two screening technologies were reviewed to improve the headworks screen process:

- ❑ Shaftless spiral screw screen
- ❑ Mechanical moving rake screen

The existing headworks system will require additional funding to maintain the system and may require full replacement within the next 10 to 15 years due to the aging facility. The existing headworks consists mainly of comminuters, which grind large solids and pass them to the pond system, increasing total volume of solids that need to be removed from the pond system, a costly and time-consuming effort. Both technologies reviewed herein are self-cleaning mechanical screens, which would replace the comminuters, to remove and wash large solids from the influent stream (instead of passing them through to the ponds), which would protect downstream equipment, improve reliability of treatment, and ultimately reduce long term O&M costs.

Shaftless spiral screw screens utilize a spiral screw to transport screenings from the screen surface submerged in the channel up to a dewatering/compression section above the deck. The screw is fitted with a brush to continuously clean the screen surface.

WesTech CleanFlo® shaftless spiral screw screen

An alternative to the spiral screw screen is a moving rake screen. Moving rake screens typically employ a framed chain with bushings or sprockets and a head drive to run multiple rakes across a bar screen set in a channel. The rakes carry screenings to the top of bar screen where they are discharged to either a bin or a washer compactor.

There are several moving rake screens on the market. The Duperon FlexRake® offers the advantage of their patented FlexLink® technology – a "self-framing" bar-and-pin chain with no lower sprocket, allowing clearance from the bar as needed for large debris. Attached rakes are designed with through-bar scrapers which reach three sides of the bars on the bar screen.

For either technology, the screening system would include one screen with 0.25 inch openings sized to handle the future PHF, a screenings washer compactor or wash press and a bypass channel with a manual bar screen. Both screen types can operate with timers in an on-off mode or based on water level.

Duperon Low-Flow FlexRake® and washer compactor

MKN reviewed the potential to retrofit the existing headworks structure for installation of a screen. This would require modifications to create a screening channel and deck for mounting the screen. The existing structure contains two general areas that could potentially be modified for a screen – the bypass channel and the area where the existing comminuters are installed. The bypass channel may be viable for a screen with a compact footprint. However it is short, approximately 7-feet long, and 18-inches wide. The preliminary sizing indicates a 24-inch wide channel is desired. Based on the 1984 as-builts, it appears that the length in the comminutor area is limited to approximately 4.5 feet, which is inadequate based on the preliminary technology review. In addition, the top 1- 2 feet of the walls of the structure (as discussed previously) are failing, particularly in the areas around the safety railing. While it may be possible to design a retrofit for the headworks, for budgeting purposes a new channel structure is included in the estimated cost summarized in Table 5-12.

The shaftless screw screen is longer than the moving rake screen, approximately 15 feet, 2 inches compared to 6 feet, 4 inches. Because of this, it would be impractical to retrofit the existing headworks structure with a shaftless screw screen. The longer lay length would require additional concrete for a new headworks structure when compared to the channel requirements for a rake screen. With similar equipment costs, operations and maintenance, a moving rake screen is recommended. Table 6-11 summarizes the opinion of probable cost assuming a Duperon LowFlow FlexRake® screen is installed, although there are other products with similar features available at similar costs.

Table 5-12: Self-Cleaning Screening System Cost Opinion

Description	Estimated Installed Cost
Concrete channel structure	$60,000
Adjacent slab for screenings bin	$4,000
Manual screen	$5,000
Duperon LowFlow FlexRake® Screen	$90,000
Duperon Washer Compactor	$74,000
Site work	$50,000
Piping and appurtenances	$20,000
Electrical and Instrumentation	$46,000
Demolish existing headworks structure	$30,000
Subtotal Construction Cost Opinion	**$379,000**
Engineering & Administration (30%)	$114,000
Contingency (30%)	$114,000
Total Construction Cost Opinion	**$607,000**
Note: Costs are rounded to the nearest $1,000.	

The hydraulic profile indicates a difference of 2 feet from the invert elevation of the 12" influent sewer pipe to the water level in Pond 1. Slowing the velocities through the screen, in order to prevent damage, requires installing weirs on the downstream end of the channel. Both the screen itself and the weirs will increase headloss through the plant's hydraulic profile upstream of Pond 1. Therefore, some modifications may be required to allow for the screening system to be added and maintain gravity flow through the system. For instance, lowering the operating level of the ponds may allow for additional headloss at the headworks.

5.8 WRF Aeration Improvements

The condition assessment revealed two main potential improvement areas for the aeration system – reduce algae growth, and reduce energy consumption. The plant meets BOD treatment requirements, but often has high pH and solids, likely due to microbial plant and algae growth in the ponds. Reliability of the surface splasher aerators is a concern due to ragging, a problem that could be addressed with improved headworks. Aeration could be improved by employing one of several options (brush aerators, automation, etc.).

5.8.1 Automated Aeration

Based on the current power cost and discussion with operators the actual annual power cost for the existing aeration system was approximately $30,000 on average over the past 5 years. This indicates the aerators are running at approximately 40% utilization over a typical year.

Monitoring data shows an average dissolved oxygen (DO) of 9.3 mg/L for the past two years (Table 5-2). There is potential to reduce the aerator run time and maintain adequate treatment. A DO probe can be added to each pond and connected to controls for the existing aerators to maintain the DO between desired set points for each pond between 2 and 6 mg/L. An estimate to install a controls system is approximately $120,000 based on a review of similar installations. This would include furnishing and installing three programmable, automatic-washing DO probes on (three) mounting arms with (three) pre-assembled and vented enclosures each containing a controller, an air-blast compressor, a power disconnect breaker, relays, and power connections. The estimate also includes new conduit and conductors, mooring posts for the mounting arms, concrete pads for the control panels and new aerator disconnects with contactors for the controls.

5.8.2 Brush Aeration

Brush aerators are floating mechanical surface aerators that use a horizontal cylinder with steel or plastic blades and an in-line horizontal drive. The blades become submerged in the water as the cylinder is rapidly rotated by an electrical motor drive, spraying the water across the pond to provide circulation and entrain air in the wastewater. The rapidly rotating blades "sheer" the water, creating fine bubbles for oxygen transfer.

House Brush Aerator with Levee-stake Anchoring

MKN reviewed brush aerators for potential installation at the Blacklake WRF. When compared to splasher surface aerators (the current aeration equipment), brush aerators report a greater average Standard Aeration Efficiency (SAE) and mixing efficiency, and can be designed to provide a mixed, oxygenated surface layer while allowing the deeper portions to remain settled and oxygen limited. The larger SAE, measured in pounds of oxygen per hour per horsepower, translates to lower electricity requirements.

Brush aerators can be anchored using cables or levee arms, and can be equipped with splash shields and rotor covers to reduce aerosol sprays. The drive train is completely sealed in an enclosure for corrosion resistance.

The recommended installation consists of a total of four 5-hp brush aerators: two in Pond 1, and one 5-hp aerator in each Pond 2 and Pond 3, for approximately 55% less aeration horsepower than the current operations. Arrangement of the aerators depends on several site-specific conditions. Generally, it is recommended that the aerators for Pond 1 be installed on each of the longer berms (northern and southern), about 75 feet from the ends. This configuration allows the aerator to discharge across the width of the pond and create a serpentine pathway between pond inlet and outlet. Regarding Ponds 2 and 3, it is recommended that the aerators be installed at the approximate midpoint of the western berm of each pond. This arrangement allows the aerators to discharge across the length of each pond, promoting uniform distribution.

Table 5-13: Brush Aeration Cost Opinion	
Description	**Estimated Cost**
Brush Aerators (four 5 hp)	$99,000
Appurtenances	$20,000
Electrical and Instrumentation	$25,000
Subtotal Construction Cost Opinion	**$144,000**
Engineering & Administration (30%)	$43,000
Contingency (30%)	$43,000
Total Construction Cost Opinion	**$230,000**
Note: Costs are rounded to the nearest $1,000.	

The installation would reduce the number of aerators to maintain by about 30%. Typical maintenance consists of biannual service for each aerator. Assuming the brush aerators, screen, and screenings washer/compactor are installed and allowing another 5 horsepower for miscellaneous plant equipment, the future annual electrical cost is estimated as follows:

$$Est. annual\ power\ req'mt = (20 + 1 + 5)HP * 1.341\frac{KW}{HP} * 24\frac{hrs}{day} * 365\frac{days}{yr} = 305{,}426\ KWhrs/yr$$

At $0.13 per kilowatt-hour, the estimated annual power cost for the entire plant would be approximately $36,650 assuming all equipment items operate 24 hours per day.

In order to compare it with the power requirement for the existing aerators with new screening and washer/compactor equipment, the calculation below assumes the plant operates 24 hours per day.

$$Est. annual\ power\ req'mt = (45 + 1 + 5)HP * 1.341\frac{KW}{HP} * 24\frac{hrs}{day} * 365\frac{days}{yr} = 599{,}000\ KWhrs/yr$$

At $0.13 per kilowatt-hour, the estimated power cost for the existing aeration system with new screening equipment and 24-hr/day operation would be $78,000 per year.

5.8.3 Diffused Aeration

Another option for aeration in the ponds is to replace the surface splasher aerators with a diffused aeration system. MKN investigated the MARS diffused aeration system by Triplepoint, an American Company with over 100 US installations. The MARS lagoon aeration diffuser utilizes a patented technology (Double Bouble™) which combines fine bubble membranes with a coarse bubble static tube aerator.

The fine bubble membrane diffusers provide for oxygenation of the water column, while the coarse bubble aerator provides mixing. The Triplepoint MARS system is portable, not attached to piping or frames in the pond. Each MARS diffuser has its own weighted legs and is fed air by flexible weighted tubing. The flexible tubing is connected to air headers on the shore, and air piping to one or more blowers. A tethered float, connected to each submerged diffuser, allows the diffuser assemblies to be located from the surface. The diffusers can be installed without dewatering existing treatment ponds, and lifted for maintenance from a boat on the surface.

The primary advantages to a submerged diffused aeration technology over surface aerators is the potential to lower energy costs, and reduced visual and auditory impacts. TriplePoint estimates that less than 10 horsepower is required for a MARS system at the Blacklake WRF.

The primary disadvantage is the aeration diffusers are more difficult to access, requiring that staff enter the pond in a boat and lift the diffusers to the surface for access.

Table 5-14 summarizes the opinion of cost to install the system at Blacklake. It is assumed that the existing blower building can be utilized to house two new 10 horsepower blowers, one duty and one standby. An allowance of $20,000 was included for minor building repair and removal and disposal of existing unused equipment.

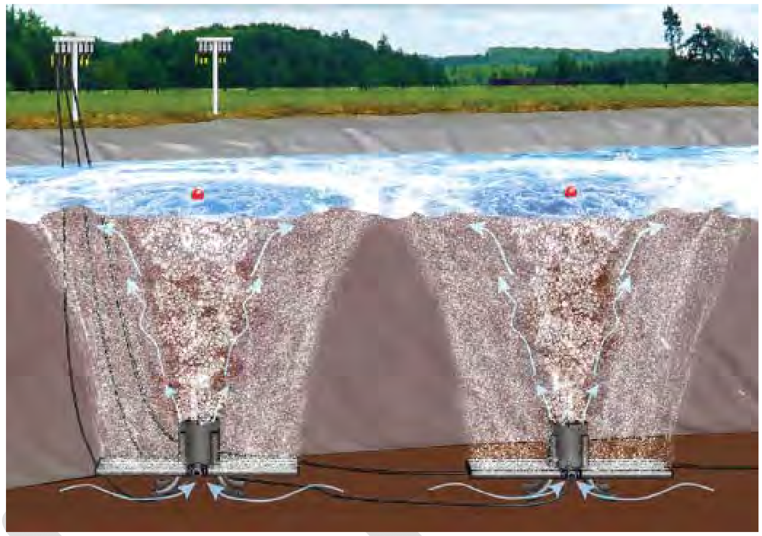


Table 5-14: TriplePoint MARS Diffused Aeration System Cost Opinion	
Description	**Estimated Cost**
Triplepoint MARS (6) aerator assemblies, (2) 10-hp blowers, and air tubing	$129,000
Air piping and appurtenances	$26,000
Electrical and Instrumentation	$39,000
Allowance for use of existing blower building	$20,000
Subtotal Construction Cost Opinion	**$214,000**
Engineering & Administration (30%)	$64,000
Contingency (30%)	$64,000
Total Construction Cost Opinion	**$342,000**
Note: Costs are rounded to the nearest $1,000.	

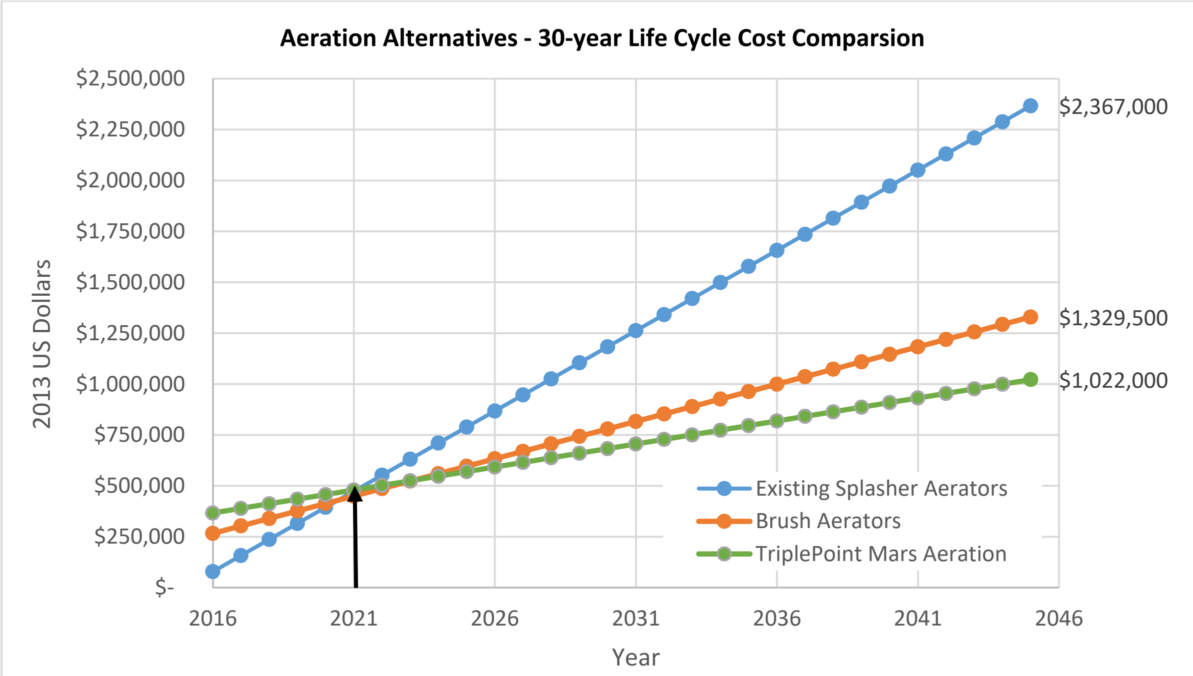
Assuming both the TriplePoint system and a headworks screen and screenings washer-compactor are installed and allowing 5 horsepower for miscellaneous plant power requirements, the annual electrical cost is estimated as follows:

$$Est.\,annual\ power\ requirement = (10 + 1 + 5)HP * 1.341\frac{KW}{HP} * 24\frac{hrs}{day} * 365\frac{days}{yr} = 187{,}955\ KWhrs/yr$$

At $0.12 per kilowatt-hour, the estimated annual power cost is approximately $22,600.

The life-cycle capital power costs for a TriplePoint Mars aeration system were compared to that of the existing splasher aeration system and a brush aeration system. Power consumption to the year 2046 (30 years) were determined assuming the systems were constructed to meet the projected buildout demand. The cumulative present-worth costs (assuming discount rate approximately equal to cost escalation rate) for the TriplePoint system would be approximately $1,022,000, while the brush aeration system would cost approximately $1,329,500, and the existing aeration system would cost approximately $2,367,000. Figure 5-2 summarizes the comparative, cumulative life cycle costs (capital and power), assuming the system is built this year. Costs for headworks, disposal systems and sludge management were not included, since it is assumed these facilities would be the same cost for each alternative. The analysis shows the estimated payback for the capital improvement would occur within five years (shown here at 2021).

Figure 5-2: Comparative 30-year Life Cycle Costs for Splasher, Brush, and Diffused Aeration Systems



As illustrated in Figure 5-2 the TriplePoint Mars Aeration system has the highest initial capital cost, but the lowest annual operational costs (following year 2021) compared to the other aeration alternatives.

SECTION 6 WATER AND BIOSOLIDS QUALITY GOALS

Both effluent water quality goals and biosolids treatment goals are determined by regulatory requirements according to the end use or final disposal method. Regulatory requirements may change with an update to the WDR order or desired changes to the end use of the effluent.

6.1 Comparison of Regulatory Requirements to Similar Facilities

The regulatory requirements for the Blacklake WRF were compared to regulatory requirements for similar water reclamation and wastewater treatment facilities in the area. WDR Orders for three other similar facilities were reviewed, including:

- San Luis Obispo County Service Area 18 (CSA #18) Country Club Estates – WDR dated 10/24/2003
- Rural Water Co. Cypress Ridge (RWCCR) – WDR dated 11/29/1997
- Woodland's Mutual Water Co. (WMWC) – WDR dated 11/29/2000

The WDRs specify limitations for effluent and receiving water quality, and monitoring requirements for effluent, influent, groundwater, water supply and bio-solids.

6.1.1 Effluent Limits:

The effluent limits for Blacklake WRF are similar to those of the CSA #18 treatment plant, while the effluent limits for RWCCR's and WMWC's facilities are similar. Generally, the most stringent effluent limitations of the four are contained in the WDR's for RWCCR and WMWC. The BOD_5 and suspended solid concentration limits for Blacklake WRF and CSA #18's facility are higher than the limitations for the RWCCR and WMWC facilities. Settleable solid limits are identical for all four WWTP's. Unlike the WDR's for RWCCR and WMWC, there is no effluent limitation for turbidity in the WDRs for Blacklake WRF and CSA #18 facility. Regarding limits on salts (TDS, sodium, and chloride), the CSA #18 WDR contains maximum daily limits, Blacklake WRF WDR has monthly mean limits, but RWCCR and WMWC WDRs do not include salts limits. The effluent limits contained in the four WDRs are summarized in Table 6-1.

Table 6-1: Comparison of Effluent Limits

	NCSD Blacklake (WDR 03/11/1994)	San Luis Obispo CSA 18 - Country Club Estates (WDR 10/24/2003)	Rural Water Co Cypress Ridge (WDR 12/5/1997)	Woodland's Mutual Water Co. (WDR 11/29/2000)
Permitted Maximum Monthly Average Daily Flow Rate (gpd)	*200,000*[d]	*120,000*	*140,000*	*700,000*
Treatment Processes	*Comminution, aerated lagoons, disinfection*	*Aerated lagoons, disinfection*	*Sequencing batch reactors, chemical addition, filtration, disinfection*	*Facultative pond(1), clarification, multimedia filtration, disinfection*
Receiving Waters	*Irrigation Reclamation areas & Groundwater*	*Irrigation Reclamation areas & Groundwater*	*Irrigation Reclamation areas & Groundwater*	*Irrigation Reclamation areas & Groundwater*
Monthly Mean BOD_5 (mg/L)	40	40	**10**	**10**
Daily Maximum BOD_5 (mg/L)	100	100	**30**	**30**
Monthly Mean Suspended Solids (mg/L)	30	40	**10**	**10**

Table 6-1: Comparison of Effluent Limits				
	NCSD Blacklake (WDR 03/11/1994)	San Luis Obispo CSA 18 - Country Club Estates (WDR 10/24/2003)	Rural Water Co Cypress Ridge (WDR 12/5/1997)	Woodland's Mutual Water Co. (WDR 11/29/2000)
Daily Maximum Suspended Solids (mg/L)	100	100	**30**	**30**
Monthly Mean Settleable Solids (mg/L)	**0.1**	**0.1**	**0.1**	**0.1**
Daily Maximum Settleable Solids (mg/L)	**0.3**	**0.3**	**0.3**	**0.3**
Monthly Mean Total Dissolved Solids (mg/L)	WS + 250[f]	--	--	--
Daily Maximum Total Dissolved Solids (mg/L)	--	WS + 424[f]	1000	**710**
pH (range)	6.5 - 8.4	6.5 - 8.5	6.5 - 8.4	6.5 - 8.4
Minimum Dissolved Oxygen (mg/L)	1.0	1.0	**2.0**	NA
Monthly Mean Sodium (mg/L)	WS + 70[f]	--	--	--
Daily Maximum Sodium (mg/L)	--	**WS + 184[f]**	--	--
Monthly Mean Chloride (mg/L)	WS + 65[f]	--	--	--
Daily Maximum Chloride (mg/L)	--	**WS + 100[f]**	--	--
Monthly Mean Turbidity (NTU)	--	--	**2**	**2[b]**
Daily Maximum Turbidity (NTU)	--	--	**5[a]**	**5[b]**
Maximum Average Weekly Coliform (MPN/100 ml)	23[R]	23[R]	**2.2[R]**	**2.2[R]**
Maximum Monthly Coliform (MPN/100 ml)	--	--	--	**23[R]**
Maximum Coliform (MPN/100 ml)	240[R]	240[R]	**230[R]**	240[R]
Minimum Free Chlorine (mg/L)	**1[R]**	**1[R]**	0.5[R]	0.5[R]
Maximum Free Chlorine (mg/L)	--	--	--	**5[R]**

Notes: Most stringent limits indicated in bold text

(1) The WDR for Woodlands incorrectly refers to the facultative pond treatment process as activated sludge.

[a] Turbidity must not exceed 5 NTU more than 5% of the time and must not exceed 10 NTU.

[b] Shall not exceed a daily average of 2 NTU or 5 NTU for more than 5% of the time over a 24 hour period.

[c] Compliance shall be based on a three-year running monthly mean.

[d] After completion of Phase 2.

[e] Applicable for effluent discharged to reclamation areas

[f] WS = Water Supply

[R] Limit applies to reclaimed water.

6.1.2 Receiving Water Limits:

Of the four WDRs reviewed, Blacklake and CSA#18 WDRs have receiving water limits. Both are required to monitor for nitrate as nitrogen. The receiving water limit for Blacklake WRF is 10 mg/L nitrate (as N), while the CSA #18 receiving water limit is 8 mg/L. RWCCR and WMWC do not have receiving waters monitoring requirements.

The WDRs also contain requirements for monitoring of effluent, influent (only for WMWC), water supply, groundwater, and biosolids (only for WMWC).

6.2 Effluent Water Quality Goals

Currently, the Blacklake Golf Course utilizes the treated effluent for irrigation purposes and the Specific Plan states that the facility will continue to do so, as well as make any changes or upgrades to the facility that are required to meet water quality requirements. The most feasible effluent disposal/reuse options are provided below:

- Continue existing practice: The Blacklake WRF effluent is discharged to a holding pond for irrigation of the roughs at Blacklake Golf Course. The effluent quality goals for this option are already addressed by the current Reclamation Requirements. If this option is pursued, no significant change would be required in the existing treatment process.
- Irrigation of golf course greens, or elsewhere (unrestricted urban reuse): In order to comply with California requirements, disinfected tertiary wastewater must be produced utilizing coagulation and filtration and with a total coliform count (most probable number or MPN) less than 2.2 per 100 mL.

The State of California's State Water Resources Control Board issued General Orders for Water Reclamation Requirements for Recycled Water Reuse (Order WQ 2016-0068-DDW, adopted June 7, 2016). The purpose of the General Order is to streamline the regulatory process for recycled water users under the following conditions:

- Specified recycled water uses are limited to non-potable uses (landscape irrigation, golf course irrigation, dust control, street sweeping, etc.) and do not include recharge of groundwater.
- Specified uses of recycled water including parks, greenbelts, playgrounds, school yards, athletic fields, golf courses, cemeteries, residential common area landscaping, commercial landscaping excluding eating areas, and freeway/highway/street landscaping.
- Producers, distributors, and users of recycled water must comply with Title 22 requirements and all applicable requirements of the State Recycled Water Policy. Producers and distributors are required to ensure compliance of recycled water users.
- Salt sources shall be managed through pretreatment and source control in the water supply, treatment of salts at the treatment plan, or through development of a salt/nutrient management plan for a groundwater basin or subbasin.

The General Order provides requirements for operation, monitoring, and signage indicating recycled water is in use. The Order indicates that the intent is that regulatory coverage under an existing General Order or conditional waiver for non-potable uses of recycled water will be terminated by the applicable Regional Water Board within three years after adoption of the General Order. Enrollees covered by a Regional Water Board general order or conditional waiver may continue discharging under that authority until the applicable Regional Water Board issues a Notice of Applicability to an Administrator per the terms of the new General Order.

This General Order is intended to be the primary method for permitting recycled water distribution and use. Treatment facilities intending to produce recycled water for reuse must be permitted under a separate Regional Water Board permit. Wastewater treatment plants under 100,000 gpd can be covered under the statewide general Waste Discharge Requirements for Small Domestic Wastewater Treatment Facilities permit (Order WQ 2014-0153-DWQ, dated September 23, 2014). The Regional Water Board Executive Officer may determine whether the discharge would be better regulated under this General Order or by a waiver of WDRs, individual WDRs, a different general order, and enforcement order, or a National Pollutant Discharge Elimination System (NPDES) permit. Producers of recycled water must comply with Title 22 water recycling criteria and the permit approval conditions.

While the permitting process may be more predictable, given the General Orders, the process improvements would be significant if additional irrigation of the golf course (unrestricted urban reuse) is pursued. The current level of treatment (40 mg/L BOD5 and 30 mg/L TSS) is not adequate for downstream filtration. Tertiary filtration systems are typically designed for upstream concentrations of 20-30 mg/L BOD5 and TSS. While the effluent monitoring records show 2-yr average of 10 mg/L for each, pond systems typically produce significant algae concentrations during parts of the year and will not consistently meet filter influent requirements. Equipment manufacturers will typically not provide process warranties for filtration systems downstream of pond systems. Although disinfection is currently performed, significantly larger contact basins would be required to provide 90 minutes of contact time per the Title 22 requirements.

At this time, it is expected that continuation of the existing practice, blending recycled water with groundwater for restricted irrigation of the golf course roughs, will not require significant changes to the treatment process.

6.3 Biosolids Quality Goals

Biosolids from the Blacklake WRF must be extracted from the bottom of the ponds, either while the ponds or in service or are taken out of service. In the past, sludge removal has been performed in conjunction with pond liner replacement.

Currently sludge from the WRF can be:

- ❑ Extracted and disposed as untreated, wet sludge (requiring hauling and disposal at a landfill, such as the Santa Maria Landfill in Santa Barbara County); and
- ❑ Treated to Class A or Class B levels and over 50% solids content for landfill disposal; or land-applied.

Composting at a regional facility could be possible with the upgrade of headworks screening to remove trash and inorganics. The Code of Federal Regulations, Title 40, Part 503 (40 CFR 503) defines time and temperature requirements for Class A and Class B biosolids as defined below:

1. Class A: Aerated static pile or in-vessel: 55 degrees Celsius (deg C) for at least 3 days. Windrow: 55 deg C for at least 15 days with 5 turns
2. Class B: 40 deg C or higher for 5 days during which temperatures exceed 55 deg C for at least 4 hours

In addition, the designation of “exceptional quality” or EQ can be applied to biosolids that meet both the Class A requirements and the maximum pollutant levels of part 503 including various metals. According to federal and state regulations, these biosolids can be sold in bags or bulk and used without additional regulatory restrictions. Class B composted biosolids can be used on agricultural land (within the limits established by the San Luis Obispo County Biosolids Ordinance) where there is no public contact provided additional site restrictions are met.

San Luis Obispo County has a Biosolids Ordinance that limits land application of treated biosolids to 1,500 cubic yards per year until March 2017. The extension was intended to allow time for additional studies to determine impact on food crops, issues related to emerging contaminants, and address other concerns with more widespread use of biosolids. Composted biosolids have been exempt from the County’s application limits. An example of a successful composting program is the City of Morro Bay which produces EQ biosolids mixed with green waste for use in landscaping.

SECTION 7 FUTURE PROCESS ALTERNATIVES

Several potential processes alternatives were explored for the existing WRF aerated pond system. Section 5 shows the existing treatment process is adequate to treat existing and projected future flows and loadings. Therefore, the process improvements discussed herein are not expected to be required. Potential drivers for replacing the existing system include improving effluent quality and reliability and reducing energy requirements. A higher level of effluent quality may be required by the Regional Board (though it is not anticipated at this time), or may be desired in the future to provide additional water for irrigation. Cost evaluation tables in this section are listed below:

List of Tables with Cost Implications			
Table	**Description**	**Cost**	**Page**
7-3	Anoxic-Aerobic Biological Treatment System w/Biolac Cost	$2,518,000	7-4
7-4	Disc Filtration Opinion of Probable Construction Cost	$1,097,000	7-6
7-5	Membrane Filtration Opinion of Probable Construction Cost	$2,203,000	7-7
7-7	Opinion of Construction Cost for Blacklake Lift Station	$7,433,000	7-10
7-8	Opinion of Construction Cost for Collection System Impacts for Blacklake Regionalization	$168,000	7-11
7-9	Opinion of Construction Cost for Southland WWTF Tie-In	$752,000	7-11
7-10	Estimated Annual Operating and Maintenance Costs for Regionalization	$150,000	7-12
7-11	Estimated 20-year Life Cycle Costs for Regionalization	$11,353,000	7-13
7-12	Estimated 20-year Life Cycle Costs for Treatment at Blacklake WRF	$13,817,000	7-13
7-13	Estimated Capital, Operating and 20-year Life Cycle Costs for Recycled Water	$9,335,000	7-14

7.1 Biological Treatment Process

7.1.1 Extended Aeration System with Nitrogen Removal

When compared to an aerated pond system, extended aeration systems improve effluent quality and have the advantage of allowing for future tertiary treatment. The disadvantage is a greater capital investment and more complicated operation with additional mechanical equipment and electrical controls and instrumentation.

The Parkson Biolac® Biological Nutrient Removal System employs an extended solids retention time (SRT) and moving aeration chains with attached submerged diffusers to reduce BOD, ammonia and TSS. The floating aeration chains are moved across the basin when air supplied by blowers propels through the submerged diffusers, which are connected to the aeration chains and suspended off the basin floor. Airflow to each chain is independently controlled by air piping and butterfly valves at air headers on the shore. The system allows for a turndown of 50-70% during periods of low loading without sacrificing mixing due to the movement of the aeration chains. The extended SRT increases system stability by allowing for fluctuating loads.

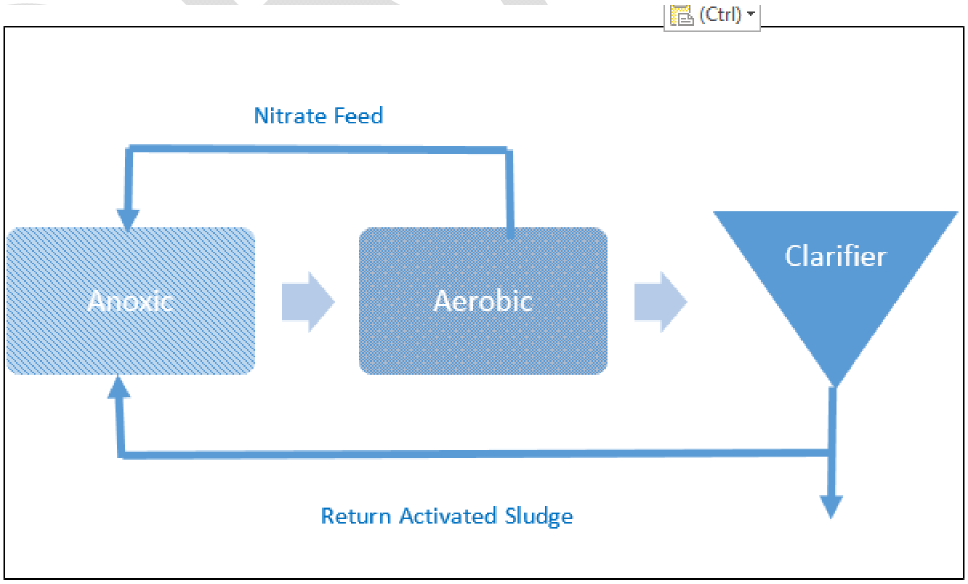
Parkson Biolac® Installation in a Dewatered Basin

The Biolac® system utilizes a clarifier downstream of the aeration basin. Parkson offers equipment for an integral clarifier basin designed with a hopper zone. These clarifiers are rectangular and designed to fit at the end of the aeration basin. The clarifier utilizes a flocculating rake assembly and an airlift pump for sludge removal. Return sludge will flow by gravity to the influent upstream of the Biolac® basin. A fixed overflow weir controls the liquid level in the clarifier and the Biolac® basin. A separate conventional, circular clarifier could also be used. However, similar effluent quality is expected for both technologies and at this size the circular clarifier system is estimated to be significantly more expensive.

Parkson offers the Wave Oxidation System, which is the Biolac® system designed with additional controls to create separate anoxic and aerobic zones across the basin to allow for single-tank, simultaneous nitrification and denitrification to provide biological nitrogen removal. This system is currently installed at the District's Southland WWTF. MKN investigated the potential to utilize this same system at the Blacklake WRF. However, the WWTF loading is not large enough to support a similar system to perform biological nitrogen removal in the same basin (single-tank). At these flows and loadings, a small Biolac® basin with three aeration chains is required for the Nutrient Removal System. After investigation, Parkson determined that there is not sufficient room to create separate anoxic zones in the single tank.

Alternatively, biological nitrogen removal can be achieved by creating a separate anoxic tank upstream of the Biolac® aeration basin. Activated sludge from the clarifier would be run to the pre-anoxic zone instead of the aeration basin, and aerated mixed liquor would be pumped from the Biolac aeration basin back to the anoxic zone to feed nitrate to the influent. The pre-anoxic chamber should be equipped with a mechanical mixer to maintain solids suspension, but minimize potential aeration to establish anoxic conditions. Mixing can typically be achieved with 0.3 to 0.5 horsepower per 1000 cubic feet.

Pre-anoxic Biological Nitrogen Removal Schematic



The required anoxic volume was estimated using specific denitrification rate (SDNR), the nitrate reduction rate in the anoxic tank normalized to the mixed liquor suspended solids (MLSS) concentration. The following equations[5] were used for the estimate:

$$NOr = (Vnox) * (SDNR) * (MLVSS)$$

$$SDNR = 0.4 * \left(\frac{F}{M}\right) + 0.029$$

Using these equations and assumptions as included in Appendix D, the estimated required pre-anoxic volume is approximately 60,000 gallons. It should be noted that SDNR is site and design specific, and these empirical relationships are meant to provide rough estimates only. These are utilized herein for preliminary sizing and development of planning-level cost opinions. The anticipated treated effluent quality for the system is summarized in Table 7-1.

Table 7-1: Effluent Quality for Anoxic-Aerobic Treatment System with Biolac®

Parameter	Concentration (mg/L)
BOD_5	10
TSS	15
NH_3-N	1
NO_3-N*	10
*Not guaranteed by aeration equipment manufacturer.	

The preliminary design criteria for the anoxic-aerobic biological treatment system as described is summarized in Table 7-2.

Table 7-2: Preliminary Design Criteria for Anoxic-Aerobic Treatment System with Biolac®

Pre-anoxic basin	
Approximate dimensions at grade (ft)	41 x 53
Approximate bottom dimensions (ft)	13 x 25
Side slope (H:V)	1.5:1
Side water depth (ft)	8
Basin volume (MG)	0.063
Mixing horsepower	3
Biolac® Extended Aeration Basin	
Approximate dimensions at grade (ft)	60 x 71
Approximate bottom dimensions (ft)	42 x 35
Side slope (H:V)	1.5:1
Side water depth (ft)	9
Basin volume (MG)	0.16
Clarifier hydraulic loading rate (gpd/SF)	282
Integral clarifier size (ft)	25 x 11
Estimated SOR (lbs/hr)	35
Estimated SCFM	226
Estimated brake horsepower (aeration)	7.4
Number of diffusers, assemblies, headers	45, 15, 3
PD Blowers (number) horsepower	(3) 7.5

[5] Wastewater Engineering Treatment & Reuse, 4th Edition. McGraw-Hill. Tchobanoglous, et al, 2003. Equations 8-41 and 8-42.

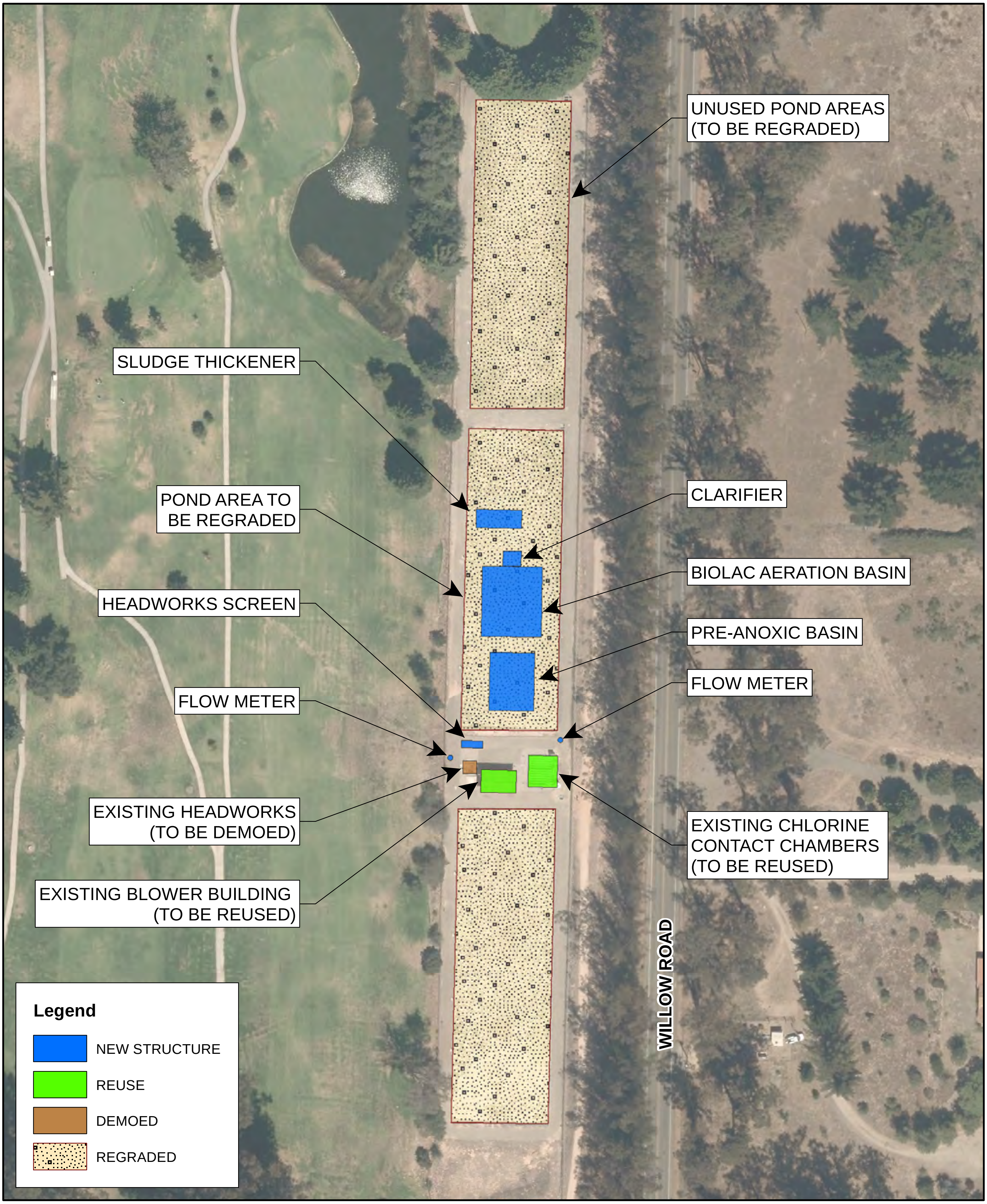
Other reliable extended aeration systems are available, such as conventional activated sludge and oxidation ditches. However, these systems require new concrete or steel structures, whereas the Biolac® system and pre-anoxic zone can be retrofitted into a portion of one of the existing ponds. The preliminary design indicates a total volume of 0.23 MG for the anoxic, aerobic, and clarifier, less than 20% of one of the existing ponds. The activated sludge system and oxidation ditch offer a smaller footprint. However, with a larger volume and longer SRT time, the Biolac® system can handle a wider range of loading fluctuations when compared to the activated sludge or oxidation ditch systems. For the level of treatment, Biolac® appears the most maintainable when compared with activated sludge and oxidation ditch systems – simple parts that are relatively inexpensive to replace. With a Biolac® system installed at the Southland WWTF, the process has the added advantage of familiarity for the District. The diffuser sheets will need to be replaced approximately every 5 to 7 years and the air tubing will need replacing about every 7 to 10 years.

A planning-level opinion of probable construction cost is provided in Table 7-3. It is assumed that the Biolac® aeration basin, integral clarifier and preanoxic basin would be retrofitting within the footprint of existing Pond 2. The cost for earthwork and grading to fill Pond 2 is included in the cost opinion. A gunite liner is assumed for the sides and bottom of the basins. Earthen basins with a plastic liner can also be utilized. However, a 1.5-to-1 side slope is desired. With the native dune sand soils, a concrete or gunite liner is recommended for slope stability. The feasibility and potential cost savings for utilizing earthen slopes with a plastic liner can be investigated during preliminary design.

Table 7-3: Anoxic-Aerobic Biological Treatment System (with Biolac®) Opinion of Probable Cost

Description	Estimated Installed Cost
Earthwork	$298,000
Gunite liner for aeration basin (87 CY)	$29,000
Gunite liner for anoxic basin (79 CY)	$24,000
Parkson Biolac® System with blowers, aeration chains, diffusers, and integral clarifier equipment	$367,000
Blower Building (700 SF)	$210,000
Concrete clarifier tank and appurtenances	$197,000
Mechanical mixer, preanoxic zone (3 hp)	$20,000
Nitrate feed pumping system	$35,000
Piping and appurtenances	$186,000
Electrical and Instrumentation	$208,000
Subtotal Construction Cost Opinion	**$1,574,000**
Engineering and Administration (30%)	$472,000
Contingency (30%)	$472,000
Total Construction Cost Opinion	**$2,518,000**
Note: Costs are rounded to the nearest $1,000	

Figure 7-1 shows the approximate footprint of an extended aeration system wastewater plant utilizing the preanoxic basin, Biolac® aeration basin and integral clarifier, headworks screen and onsite sludge thickening (discussed further in Section 8).



NIPOMO COMMUNITY SERVICES DISTRICT
BLACKLAKE SEWER MASTER PLAN

FIGURE 7-1: CONCEPTUAL LAYOUT
FUTURE EXTENDED AERATION SYSTEM

1 inch :125 feet

7.2 Tertiary Treatment

Tertiary treatment may be required at some point in the future. The level of treatment will be dictated by water quality goals, regulations and the end use. Unrestricted reuse opportunities as described in California Code of Regulations (CCR) Title 22 require tertiary treatment (coagulation, filtration, and disinfection). The current end use and water reclamation requirements do not require tertiary treatment. However, higher water quality regulations and monitoring may be required at some point in the future. Alternatives for filtration were investigated, assuming an extended aeration process is implemented. It is assumed that a coagulant feed and mixing facility (at an estimated $150,000) will be required for each alternative to meet Title 22 requirements. The units were sized and priced to meet future flow rates, and it was assumed that redundancy requirements would be met with an alternate effluent flow path to a storage pond.

7.2.1 Disc Filtration

Rotating disc filter design varies between manufacturers. A type of surface filtration, disc filters remove particulate material suspended in wastewater by mechanical sieving by passing the wastewater through a thin surface, the filter material. The filter material is typically woven or pile cloth, metal, or synthetic material. Openings typically range from 10 to 30 microns or larger. Disc filters consist of a series of two-sided parallel discs used to support the filter material. The discs are vertically mounted on a central tube. Wastewater enters through a central channel and flows outward through the filter material as the discs rotate through the channel. Water and particulates smaller than the filter material openings pass through, while particles larger are retained. Filtered effluent is collected in the effluent channel. High pressure spray continuously wash the filter material from the outside, and different designs have continuous or intermittent backwash cycles and others can operate in either mode. Assuming a TSS concentration to the disc filter of 30 mg/L or less, it's expected that the effluent will have TSS concentrations less than 5 mg/L and turbidity less than 2 NTU, meeting Title 22 requirements. The estimated installed cost for a disc filter unit capable of treating future PHF (0.23 mgd) is approximately $1,096,000, as summarized in Table 7-4.

Table 7-4: Disc Filtration Opinion of Probable Construction Cost

Description	Estimated Installed Cost
Disc Filter in steel tank, skid system with backwash pump and controls (1 unit)	$313,000
Coagulant feed & mixing facility	$150,000
Site work and equipment slab	$35,000
Piping and appurtenances	$63,000
Maintenance platform and appurtenances	$30,000
Electrical and Instrumentation	$94,000
Subtotal Construction Cost Opinion	**$685,000**
Engineering and Administration (30%)	$206,000
Contingency (30%)	$206,000
Total Construction Cost Opinion	**$1,097,000**
Note: Costs are rounded to the nearest $1,000.	

7.2.2 Membrane Filtration

Membrane filtration provides separation of dissolved constituents from a liquid, ranging from 0.001 micron (nanofiltration) to 1.0 micron (microfiltration). The membrane serves as a selective barrier allowing certain size particles to pass, while retaining larger particles. Membrane filters vary by nominal separation size, membrane material, and separation mechanism. All use the hydrostatic pressure difference as the driving force, though microfiltration can use a vacuum in an open vessel to achieve separation. Membrane filters (microfiltration, ultrafiltration, and nanofiltration) come in several different configurations, from tubular modules where the membrane is cast in a support tube to plate and frame modules using a series of flat membrane sheets with support plates. A pump is used to pressurize the feed solution and circulate it through the module, while a valve maintains the pressure of the waste stream, and the permeate is withdrawn. As constituents from the feed solution accumulate on the membrane, the flow through the membrane and the percent rejection decreases. Once performance decreases significantly, the modules are taken out of service and backwashed or cleaned with chemical solutions.

MKN reviewed membrane filter technologies for potential future application at the Blacklake WRF. Microfiltration and ultrafiltration were considered, assuming the filters would be utilized to reduce turbidity and suspended solids for Title 22 tertiary recycled water purposes. Assuming a TSS concentration to the membrane filter of 30 mg/L or less, it's expected that the effluent will have TSS concentrations less than 5 mg/L and turbidity less than 2 NTU, meeting Title 22 requirements. Nanofiltration is primarily used to reduce dissolved solids, hardness, metals, and other smaller constituents, and requires a higher level of pretreatment.

The opinion of cost summarized in Table 7-5 utilizes a quote from Wigen Water Technologies and assumes one membrane ultrafiltration system on a skid with a feed pump and a 200 micron stainless steel self-cleaning screen. An electromagnetic flow meter on the feed piping will monitor and control flow rate to the assembly. A turbidity meter is included to analyze the filtrate flow. An air compressor is mounted on the skid for air scouting and instrument air. Chemical dosing pump, meters and controls are included for cleaning and backwash cycles (sodium hypochlorite, sodium bisulfate, and citric acid). The cost for supply and install of piping and appurtenances was estimated at approximately 25% of the equipment cost, and electrical and instrumentation costs were assumed to be approximately 30% of the equipment. A building to house the membrane filter and related equipment is estimated to be 1,000 square feet.

Table 7-5: Membrane Filtration Opinion of Probable Construction Cost

Description	Estimated Installed Cost
Wigen Membrane ultrafiltration system, with screen and backwash, scouring, and chemical pumps, and controls (1 unit)	$537,000
Chemical storage tanks & piping	$80,000
Coagulant feed & mixing facility	$150,000
Building (1000 SF)	$250,000
Site work	$35,000
Piping and appurtenances	$134,000
Maintenance platform and appurtenances	$30,000
Electrical and Instrumentation	$161,000
Subtotal Construction Cost Opinion	**$1,377,000**
Engineering and Administration (30%)	$413,000
Contingency (30%)	$413,000
Total Construction Cost Opinion	**$2,203,000**
Note: Costs are rounded to the nearest $1,000.	

7.3 Advanced Treatment

Removing salts from treatment plant effluent is most commonly performed by applying reverse osmosis technology to treat all or part of the waste stream. The reverse osmosis (RO) systems considered for this project are canister-type membrane units horizontally mounted on skid units with a feed pump and manifold piping.

A very high quality feed is required for efficient operation of reverse osmosis. The existing wastewater treatment pond process is not capable of providing adequate pretreatment for the RO system. RO membranes can be fouled by both settleable solids and colloidal materials. Direct filtration is required to remove suspended solids and colloidals upstream of the RO system. Typically microfiltration (less than one micron) or ultrafiltration is preferred –membrane bioreactor

(MBR) technology is often used for pretreatment for salts removal since it provides a high-quality effluent. Disinfection may be required to reduce bacterial growth on both the MBR and RO membranes and pH adjustments are sometimes necessary to prevent formation of calcium carbonate scaling on the membrane surface. Regular chemical cleaning (once a month) is needed to restore membrane flux. RO systems must be provided with a chemical cleaning system including chemical feed and mixing equipment and a feed pump.

This option would include the following components to replace the existing treatment pond system, which would be decommissioned:

- Screening (1-2 mm interval)
- Flow equalization basin
- Bioreactor tank with aerobic, anoxic, and post-anoxic zones
- Mixed liquor recirculation equipment
- Membrane bioreactor basin and submerged membrane units
- Citric acid and sodium hypochlorite feed for membrane bioreactor units
- Blowers and diffusers
- Yard piping and valves
- RO skid unit with integral feed pump
- Brine disposal for the RO unit (this is often the most prohibitive issue for new RO systems since discharge of high-salinity effluent often requires injection wells to high-salinity subsurface zones, as for Laguna Sanitation District, or even ocean discharge)
- Clean-in-place system for RO system
- Air scour system for RO skids
- Electrical, instrumentation, and controls systems

A new MBR and RO plant, designed for future Blacklake demands is estimated to be in the range of $5,000,000 to $7,500,000 for treatment equipment only, not including brine disposal.

7.4 Regionalization of Blacklake and Southland Treatment Facilities

MKN analyzed the cost of decommissioning the WRF and directing Blacklake WRF flows to the Southland WWTF. The 20-year lifecycle costs for continued treatment at the WRF was compared to the 20-year lifecycle costs for regionalizing sewer treatment at the Southland WWTF.

The Southland WWTF Phase 1 improvements are designed for a MMF of 0.9 mgd. As of September 2016 the plant is experiencing a MMF of approximately 0.56 mgd. Flows from Blacklake would increase existing flow rates to approximately 0.62 mgd, which is within the rated capacity of the WWTF. Considering the wastewater contribution from Blacklake would increase future flows to the Southland WWTF by approximately four percent, we've assumed for the purposes of this report that the planned infrastructure will be sufficient. However, if this option is further pursued, the hydraulic and treatment capacities for the Southland WWTF infrastructure should be reviewed in detail.

7.4.1 Preliminary Blacklake WRF Lift Station Sizing

The regionalization alternative will require a lift station near the existing Blacklake WRF and a dedicated force main to connection to the Town collection system. A wetwell with submersible, solids-handling pumps is recommended. The preliminary sizing of the lift station pumps and wetwell are based on the future projected flows presented in Section 3. The lift station will need sufficient capacity to pump the future PHF of 0.23 MGD or 160 gpm. A duplex lift station, where one pump is capable of pumping 160 gpm would provide redundancy at the future peak hour flow.

It is important that wetwells are sized with the correct volume and controls for optimized pump station operation. Wetwells should be large enough to prevent rapid pump cycling, and small enough to reduce residence time and minimize odors and settling/accumulation of solids. The following equation is used to determine the recommended storage volume for a wetwell using constant speed pumps[6]:

$$V = \frac{Tq}{4}$$

Where T is the allowable minimum cycle time between starts, q is the rated capacity of a single pump, and V is the active volume of the wetwell. The active volume is defined as the amount of storage available between pump cycles. To protect the pumps from overheating, the recommended minimum cycle time is 10 minutes per pump. Under this condition, assuming each pump is rated at 160 gpm, the minimum wetwell active volume for the lift station is 400 gallons, or 53 cubic feet. Assuming a 5-foot diameter wetwell, the active depth is approximately 3 feet. The active depth is defined as the distance between the set point elevation at which the lead pump is called on and the set point at which the pumps are called off. Allowing space for additional set points such as a high water alarm and a call for the lag pump beneath the influent sewer invert is important for operational flexibility. Additionally, pump manufacturers require minimum submergence for the pumps, typically between 4 and 12 inches. The influent sewer invert at the Blacklake WRF is 3.5 feet below grade. Assuming a similar invert for the lift station and estimating the required submergence for the pumps and elevations for the control set points, a total wet depth of 11 feet would be required for a 5-foot diameter wetwell.

The total dynamic head (TDH) required for the pumps was estimated assuming one lift station for the entire length from Blacklake WRF to Camino Caballo at Crosby Way (approximately 17,000 linear feet)[7]. The static head difference is estimated at 50 feet. Assuming a 6-inch force main and including approximately 2 feet for minor losses, the required TDH is estimated to be approximately 100 feet. This assessment assumes a submersible, solids handling pump with a design point of 160 gpm at 100 feet. A dry pit/wet pit pump station configuration could also be considered if the District is interested in pursuing a connection to the Southland WWTF.

Table 7-6 summarizes the preliminary design parameters for the lift station.

Table 7-6: Preliminary Lift Station and Force Main Design for Tie-in to Southland WWTF	
Number of pumps	2
Flow, each pump, gpm	160
Total Dynamic Head, ft	100
Force main diameter, in	6
Force main length, ft	17,000
Friction coefficient, C	130
Pump elevation, ft	299.84
Force main invert at outlet, ft	350.5
Wetwell diameter, ft	5
Active depth, ft	3
Total wetwell depth, ft	11

The existing peak hour inflow at the manhole located at Division Street and Frontage Road is 1800 gpm (1000 gpm pumped and 800 gpm gravity). With the addition of Blacklake WRF existing flows would increase to 1960 (1160 pumped

[6] Sanks, Robert L. *Pumping Station Design*, 2nd Edition. Butterworth-Heinemann: (1998), 370.

[7] Force main alignment is assumed to commence east on Willow Road to Pomeroy Road, southeast on Pomeroy Road to Camimo Caballo, and northeast along Camino Caballo to Cross Way.

and 800 gpm gravity) during peak hour flow conditions. The above modeling results are based on existing wastewater flows (using the 2014 model) and do not include flows from future development or septic conversions. If this option is pursued, additional hydraulic analyses should be performed to determine if the pipelines under the planned capital improvements will have sufficient capacity or if a larger diameter pipeline would be recommended to accommodate the flows from Blacklake WRF and other future flows. Blacklake would increase future peak hour flow by approximately 8% at Frontage and Division Street and 4% at the Southland WWTF. The cost opinion to send wastewater from the Blacklake WRF to the Southland WWTF is included as Table 7-7.

Table 7-7: Opinion of Construction Cost for Blacklake Lift Station

Description	Quantity	Unit	Unit Price	Estimated Cost
Earthwork and subgrade prep	1	LS	$65,000	$65,000
60-inch diameter wetwell with hatch	1	EA	$90,000	$90,000
Submersible pumps with appurtenances	2	EA	$35,000	$70,000
6-inch diameter PVC force main	17,000	LF	$200	$3,400,000
Valves and appurtenances	1	LS	$50,000	$50,000
Electrical and Instrumentation	1	LS	$100,000	$100,000
Onsite generator allowance	1	LS	$65,000	$65,000
Sitework allowance (fence, driveway, etc.)	1	LS	$50,000	$50,000
Odor control allowance	1	LS	$5,000	$5,000
Demolition/decommission of existing WRF[1]	1	LS	$750,000	$750,000
Subtotal Construction Cost				**$4,645,000**
Engineering & Administration (30%)				$1,394,000
Contingency (30%)				$1,394,000
Total Construction Cost Opinion				**$7,433,000**

Notes:
[1] If the District includes recycled water delivery back to Blacklake, portions of the existing WRF could be repurposed for recycled water.
[2] Construction Cost Opinion does not include property acquisition, permitting, or other cost categories.

7.4.2 Review of Potential Town Collection System Impacts

Improvements to the Town Collection System are planned and will be performed by the District with or without regionalization with Blacklake. The existing collection system and planned improvements that may be impacted by regionalization were reviewed.

It is assumed the new force main for the Blacklake Lift Station would connect to the Town Sewer system near Camino Caballo and Crosby Way. The estimated distance from the Blacklake WRF to the Camino Caballo connection is 17,000 linear feet. Based on the District's 2007 Water and Sewer Master Plan it was recommended that 4,000 linear feet of new 8-inch sewer pipe be constructed from Camino Caballo near Crosby Way to Frontage Road at Juniper Street to serve future wastewater flows from residential septic conversations in the Town System. In addition, it was also recommended that the existing 10-inch (from Juniper Street to Grande Street) and 12-inch (from Grande Street to Division Street) along Frontage Road be upgraded to 12-inch and 15-inch respectively to increase the overall capacity of the District's trunk sewer pipeline in Frontage Road. The District updated the existing Town system hydraulic model in 2014 and is currently completing a flow monitoring study to verify flows and peaking factors. Based on a preliminary evaluation (using the 2014 model) of the proposed Blacklake lift station flows (160 gpm), assuming the planned upgrades for the Town System are completed (including new Camino Caballo sewer pipes and the Frontage Road sewer improvements) the future Town System may have sufficient capacity. The following depth/Diameter (d/D) conditions were observed during existing peak hour flow conditions:

- 8-inch pipeline d/D – 0.59 to 0.73

- ☐ 12-inch pipeline d/D – 0.50 to 0.80
- ☐ 15-inch pipeline d/D – 0.66 to 0.73
- ☐ 21-inch pipeline d/D – 0.40 to 0.60

However, if regionalization is considered, a more detailed evaluation of the collection system impacts under existing and future anticipated Town System flow rates, with the potential introduction of flow from the Blacklake Lift Station, should be performed when the District updates the Sewer Master Plan for the Town system. Some of the planned pipelines may need to be larger to allow sufficient capacity for flows from the Blacklake lift station. The anticipated costs for the planned Town System collection system improvements existing downstream of the proposed connection point are included in Table 7-8. Since this assessment assumes sufficient capacity in the planned Town System improvements for the addition of flows from Blacklake lift station, if regionalization does not occur, the Town System would be responsible for the total estimated costs for the planned improvements.

Table 7-8: Opinion of Construction Cost for Collection System Impacts for Blacklake Regionalization

	Total Estimated Cost
Gravity Line (8-Inch Camino Caballo to Frontage)	$536,000
Frontage Trunk Line (8-Inch Camino Caballo to Juniper)	$259,000
Frontage Trunk Line (15-inch Grande to Division)	$355,000
Frontage Trunk Line (12-Inch Juniper to Grande)	$950,000
Total Construction Cost Opinion	**$2,100,000**

Notes: Only those planned Capital Improvement Projects (CIPs) that are downstream of the proposed connection point are tabulated here. Costs from the 2007 Master Plan CIPS were escalated to 2016 dollars using Caltrans Price index of 128.71 and rounded to the nearest $1,000.

Table 7-9 summarized the estimated cost share for the Town collection system impacts under the regionalization scenario. Cost shares were estimated based on proportion of flow.

Table 7-9: Estimated Cost Share for Town System Collection System Impacts from Blacklake Regionalization

	Blacklake Cost Share	**Town System Cost Share**
Gravity Line (8-Inch Camino Caballo to Frontage)	$42,880	$493,120
Frontage Trunk Line (8-Inch Camino Caballo to Juniper)	$20,720	$238,280
Frontage Trunk Line (15-inch Grande to Division)	$28,400	$326,600
Frontage Trunk Line (12-Inch Juniper to Grande)	$76,000	$874,000
Total Construction Cost Opinion	**$168,000**	**$1,932,000**

Notes:
Based on the overall existing peak hour flow observed at Division Street and Frontage Road the cost share for the pipeline improvements along Frontage Road is assumed to be 92% to the Town system and 8% to Blacklake WRF. Costs from the 2007 Master Plan CIPS were escalated to 2016 dollars using Caltrans Price index of 128.71 and rounded to the nearest $1,000.

7.4.3 Southland WWTF Tie-In

The District completed a major capital improvements project at the Southland WWTF in 2014, Phase 1 of a planned two-phased improvement and expansion. The Phase 1 Improvements allow for a higher level of treatment, but did not expand the capacity of the plant. The planned Phase 2 Improvements are anticipated to increase capacity from 0.9 MGD to 1.8 MGD to meet future anticipated conditions. If regionalization occurs, it is anticipated that the Blacklake community would buy in to the existing Southland WWTF based on a proportion of flow. Because the Blacklake lift station flows would represent approximately four percent of the combined systems future flow to Southland WWTF, it is estimated that the Southland WWTF would have sufficient capacity to accommodate Blacklake. However, this should be confirmed with a detailed analysis if this option is pursued, summarizes the total costs of the Phase 1 Improvements and the estimated budget for the planned Phase 2 Improvements.

Table 7-10: Estimated Cost for Southland WWTF Phase 1 and Phase 2 Improvements	
	Total Estimated Cost
Southland Phase 1 Improvements[1]	$13,800,000
Southland Phase 2 Improvements[2]	$5,000,000
Total Construction Cost Opinion	**$18,800,000**
Notes: [1] Based on the final cost for the Phase 1 Improvements, completed in 2014. [2] Budgetary number from Nipomo Community Services District Southland WWTF Master Plan Amendment #1 dated August 2010 and prepared by AECOM.	

The estimated cost share for these improvements if regionalization were pursued are summarized in . The estimated cost share is based on the proportion of flows. If regionalization does not occur, the Town System would be responsible for the entire cost.

Table 7-11: Estimated Cost Shares for Southland WWTF Phase 1 and Phase 2 Improvements for Regionalization		
	Blacklake Cost Share	**Town System Cost Share**
Southland Phase 1 Improvements	$552,000	$13,248,000
Southland Phase 2 Improvements	$200,000	$4,800,000
Total Construction Cost Opinion	**$752,000**	**$18,048,000**
Notes: Based on total costs shown in Table 7-10. Cost shares based on estimated proportion of flow to the WWTF.		

Regionalization offers the benefit to the District of one wastewater treatment plant to operate and maintain. With the improvements at the Southland WWTF, a higher level of treatment is available. If regionalization is pursued, the costs for the Southland WWTF capital improvements, operations and maintenance of the facility and any future improvements would be distributed between the two sewer fund areas (Blacklake and Town). Table 7-12 summarizes the estimated annual operation and maintenance costs for the Southland WWTF.

Table 7-12: Estimated Annual Operating and Maintenance Costs for Southland WWTF	
	Total Estimated Annual Cost
Southland WWTF – Operating[1]	$437,000
Southland WWTF – Labor[1]	$400,000
Southland WWTF – Replacement[1]	$296,000
Southland WWTF – Administration[1]	$150,000
Total Estimated Annual O&M Cost	**$1,283,000**
Notes: Total estimated annual costs are rounded to the nearest $10,000. [1] Southland WWTF total costs are estimated by assuming 75% of the Town Sewer Fund budget for FY16-17.	

The estimated cost shares for operating and maintenance were developed assuming regionalization occurs. The following assumptions were used for estimating annual O&M cost shares as summarized in Table 7-13:

- The assumed cost share for the Southland WWTF Improvements and Southland WWTF O&M were based on contributing flows (4% to Blacklake).
- Capital and O&M costs for the Blacklake lift station and force main to connect to the Town System were allocated wholly to Blacklake.

Table 7-13: Estimated Cost Shares for Annual Operating & Maintenace Costs for Regionalization		
	Blacklake Cost Share	Town System Cost Share
Southland WWTF – Operating[1]	$17,480	$419,520
Southland WWTF – Labor[1]	$16,000	$384,000
Southland WWTF – Replacement[1]	$11,840	$284,160
Southland WWTF – Administration[1]	$6,000	$144,000
Blacklake Lift Station - Power and replacement	$39,000	$ -
Blacklake Lift Station – Labor[2]	$58,000	$ -
Total Estimated Annual O&M costs	**$150,000**	**$1,230,000**
Notes: Total estimated annual costs are rounded to the nearest $10,000. [1] Southland WWTF costs are based on estimated O&M Costs shown in Table 7-12. [2] Assumes average maintenance/operations of 2 hours per day, 5 days per week at fully-burdened labor rate of $110/hr.		

Life cycle costs are useful for considering the combined costs of capital and operations and maintenance over time. Table 7-14 summarizes the 20-year life cycle costs for the regionalization option as described herein. Though many of the facilities are anticipated to last more than 20 years, a term of 20 to 30 years is often used for assessment. Annual O&M costs assume the costs for inflation and depreciation balance, and are simply multiplied by 20 for this life cycle evaluation.

Table 7-14: Estimated Total 20-year Life Cycle Costs for Regionalization	
	Total Estimated Cost
Capital Costs	
Blacklake Lift Station	$7,433,000
Town System Capital Improvements	$2,100,000
Southland Phase 1 & 2 Improvements	$18,800,000
Estimated 20-year O&M Costs	$27,600,000
Total Estimated 20-year Life Cycle Costs	**$55,933,000**
Notes: See preceding tables for cost assumptions.	

Table 7-15 summarizes the estimated cost shares for the 20-year life cycle costs for regionalization.

Table 7-15: Estimated Cost Shares for 20-year Life Cycle Costs for Regionalization		
	Blacklake Cost Share	Town System Cost Share
Capital Costs		
Blacklake Lift Station	$7,433,000	$ -
Town System Capital Improvements	$168,000	$1,932,000
Southland Phase 1 & 2 Improvements	$752,000	$18,048,000
Estimated 20-year O&M Costs	$3,000,000	$24,600,000
Total Estimated 20-year Life Cycle Costs	**$11,353,000**	**$44,580,000**
Notes: See preceding tables for cost assumptions.		

To evaluate the cost of regionalization to maintaining treatment at the WRF the following estimated 20-year life cycle costs were developed. The total estimated capital costs of $2,937,000 are far less than the estimated capital costs of the regionalization option. However, the estimated annual costs to operate and maintain the WRF greatly exceeds these same costs for the regionalization option. As with the regionalization operation and maintenance costs, the first year's costs did not include inflationary factors, but was simply multiplied by 20 years to result in $10,880,000. Adding the $10,880,000 to the capital needs of $2,937,000 results in the $13,817,000 estimate for the 20-year lifecycle costs in Table 7-16.

Table 7-16: Estimated 20-year Life Cycle Costs for Treatment at Blacklake WRF	
Capital Costs	
Blacklake WRF - Existing Deficiency Capital Improvements[1]	$1,841,000
Blacklake WRF – Future System Efficiency Capital Improvements[1]	$1,096,000
Total Estimated Capital Costs	**$2,937,000**
Annual Operating and Maintenance Costs	
Blacklake WRF – Labor, admin, operating, replacement[2]	$464,000
Blacklake WRF Sludge removal[3]	$80,000
Estimated Annual Operating and Maintenance Costs	**$544,000**
Total Estimated 20-year Life Cycle Costs	**$13,817,000**

Notes:
[1] Assumes capital improvements are implemented based on Table 10-2.
[2] Blacklake WRF costs are estimated by assuming 75% of the Blacklake Sewer Fund budget for FY16-17, with Labor increased by 50% assuming an added 0.5 FTE per staffing evaluation (Section 9.1).
[3] Sludge removal costs estimated by assuming $397,000 for contract dredging, dewatering, hauling and final disposal as Santa Maria Landfill once every 5 years.

The 20-year lifecycle cost comparison indicates regionalizing the sewer treatment systems would be less expensive over time than continuing to improve, operate and maintain the WRF ($11.3 million, compared to $13.8 million). As stated, inflationary factors were excluded from the operations and maintenance costs. With the major difference in the costs of these two options in operations and maintenance, $150,000 versus $544,000, with inflation factors considered and added into the equation it is anticipated that the estimated 20-year life cycle costs will increase for both options. However, it is logical to conclude that the option of retaining the WRF will be subject to greater cost impacts as a result of inflation widening the 20-year lifecycle cost difference between the two options.

7.4.4 Recycled Water Alternative

Currently the Blacklake Golf Course receives 50 AFY of secondary disinfected-23 recycled water from the WRF for limited golf course irrigation. If the District proceeds with regionalization without the recycled water project, the golf course would be required to change their irrigation operations, increase water conservation and/or pursue an alternative supplemental water source.

Treated effluent from the Southland WWTF is percolated onsite for final treatment through the soil column. Theoretically, the beneficial reuse of the water for irrigation at Blacklake golf course could continue with some additional improvements at the Southland WWTF and construction of a recycled water lift station and dedicated force main. At a minimum, disinfection would be required. However, if a recycled water pipeline is constructed nearly seven miles back to Blacklake Golf Course, additional treatment would be recommended to produce tertiary disinfected recycled water[8] to allow for additional recycled water opportunities.

[8] Tertiary disinfected recycled water is defined by California Code of Regulations, Title 22, and is required for urban irrigation (parks, schools, playgrounds, and commercial landscape), and some agricultural irrigation.

In January 2009, AECOM prepared a report titled Preliminary Screening Evaluation of Southland WWTF Disposal Alternatives, which included two alternatives for additional treatment and pumping recycled water from Southland WWTF to the Blacklake golf course and other potential major recycled water users in Nipomo and are described below:

- Alternative 5A consisted of expanding the percolation basins at Southland, adding tertiary filtration, chlorination and a storage tank, and installing a pump station and 36,500 linear foot 16-inch diameter recycled water force main to send recycled water from Southland WWTF to the Blacklake golf course. The report provided a total estimated capital cost for Alternative 5A of $21,624,000 (including 25% for engineering and administration and a 25% contingency).
- Alternative 5B described a scenario utilizing the percolation basins and the soil column for final treatment at Southland, then extracting the treated water with a series of new wells and pumping it to the Blacklake Golf Course for reuse. This alternative assumed the extracted water will meet Title 22 requirements for unrestricted irrigation, though some pH adjustment may be necessary and chlorination will likely be required for disinfection. The estimated capital cost for Alternative 5B was reported as $14,267,000 (including 25% for engineering and administration and a 25% contingency). This includes expansion of the percolation basins at Southland, installation of extraction wells, and 36,500 linear feet of a 16-inch diameter recycled water force main to deliver irrigation water to the Blacklake golf course. It is assumed that additional water users along the pipeline route, such as Nipomo Community Park, may take part in a recycled water project.

If a recycled water system is constructed, it would be most efficient to design it to deliver the entire wastewater flow amount. These alternatives and cost opinions assumed the entire future flow from Southland will be treated and utilized for recycled water, an AAF of 1.67 MGD. Adding wastewater from the Blacklake WRF would increase this by approximately four percent, to 1.73 MGD. The recycled water project capital and O&M costs were allocated based on recycled water usage (approximately 54% for Blacklake) and are summarized in Table 7-17. Identification of recycled water users and estimation of costs shares was outside this scope of work, but would need to be performed if the recycled water project is pursued.

Table 7-17: Estimated Total Capital, Operating and 20-year Life Cycle Costs for Recycled Water Alternative

	Total Project/Annual Cost
Estimated Recycled Water Project Capital Cost (assuming Alternative 5B)	$14,267,000
Estimated Annual Recycled Water Project O&M Costs	$151,000
Total Estimated 20-year Life Cycle Costs for Recycled Water	**$17,287,000**

Notes:
[1] Assumes Alternative 5B (AECOM, 2010)

The costs associated with developing and delivering recycled water are independent of the regionalization cost outlined in the section above to the extent this source is excluded from the project. The Master Plan evaluates both options, regionalizing the two systems and continued operations at the WRF, but assumes recycled water use is discontinued under the regionalization option. If the District is required to provide recycled water to Blacklake in any amount, the cost assumptions for regionalizing the two facilities will be significantly higher.

SECTION 8 BIOSOLIDS MANAGEMENT FOR FUTURE PROCESS

MKN reviewed potential biosolids management strategies assuming an extended aeration system is implemented in the future. Providing a higher level of treatment will produce more sludge than the existing aerated pond system. These strategies include sludge thickening and onsite drying, and thickening and dewatering onsite. Cost evaluation tables in this section are listed below:

8.1 Sludge Thickening

The sludge management strategies each include a sludge thickening component to thicken waste activated sludge. Thickening can remove over 80% of the water and greatly reduced the weight and volume of sludge for disposal. Two reliable and commonly available sludge thickening technologies were identified for Blacklake WRF: Gravity Belt Thickener (GBT) and Rotary Drum Thickener (RDT).

The GBT was developed from belt filter press technology, and is a modification of the upper gravity zone in a filter press dewatering system with an emphasis on thickening. This is the system that is being installed at the Southland WWTF. A fabric belt moves over rollers driven by a variable speed drive. Polymer is added to the sludge upstream of the belt. The sludge is fed to the belt on one end and as it moves across the length, the concentrated sludge is furrowed by a series of plow blades, allowing water to drain through the belt. The sludge is deposited to a hopper on the opposite end of the belt where it can drop to a sludge pump or conveyor. After discharging the sludge, the belt runs through a wash cycle. Wash water and centrate from both technologies would be returned to the headworks for treatment.

An RDT uses a rotating media-covered cylindrical drum screen and internal screw to thicken sludge. Polymer is mixed with the sludge before it is fed to the rotating drum screen, which is driven by a variable- or constant-speed drive. The internal screw promotes movement along the length of the screen. The screen is cleaned with a built-in spray backwashing system, typically operated by timers.

The GBT and RDT will both thicken waste activated sludge (WAS) from 0.5 to 1.0 percent solids to 4 to 7 percent solids and have a solids capture rate of 90 to 98 percent. Specific performance is highly dependent on the sludge characteristics and polymer operations. Estimated capital cost is slightly higher for the RDT. The relative capital cost comparison is summarized in Table 8-1. Equipment costs assume a skid-mounted unit, complete with controls, sludge pump, and polymer system.

Table 8-1: Relative Cost Comparison for Sludge Thickeners		
Description	**Gravity Belt Thickener Estimated Installed Cost**	**Rotary Drum Thickener Estimated Installed Cost**
Thickener skid system with polymer, controls, & pump	$398,000	$430,000
Piping and appurtenances	$50,000	$45,000
Site work, equipment slab and shade structure	$50,000	$45,000
Electrical and Instrumentation	$75,000	$75,000
Subtotal Construction Cost Opinion	**$573,000**	**$ 595,000**
Engineering and Administration (30%)	$172,000	$179,000
Contingency (30%)	$172,000	$179,000
Total Construction Cost Opinion	**$917,000**	**$953,000**
Note: Costs are rounded to the nearest $1,000.		

Both technologies have a small footprint and relatively low power requirements. Operations and maintenance is comparable, with the exception that the polymer usage is estimated to be slightly greater for the RDT. At this time, MKN recommends a GBT for a future thickening system because of the lower capital and operating costs.

The smallest commonly available GBT is a 0.5-meter belt, typically designed for a capacity of 75- to 100-gallons per minute. At 75 gpm, estimated weekly run time is just 5 hours. However, turndown is available. Assuming a 50% turndown, a weekly run time of approximately 10 hours is estimated for future demands.

The estimated electrical requirement for the GBT, sludge feed pump, and related equipment is 13 horsepower. Assuming a run time of 10 hours per week, the annual electrical usage is estimated to be approximately 9,070 KWhrs.

The thickened sludge would need to be collected and either hauled to a landfill for disposal, or dewatered further to reduce water weight and volume before disposal. Disposing of thickened sludge, at just 4 to 7 percent solids, is not recommended, as disposal fees are significant. Dewatering options were reviewed and are summarized below.

8.2 Thickening and Drying Onsite

This scenario assumes a thickening system as described in Section 8.1 will thicken waste activated sludge to approximately 5%, and the thickened sludge will be pumped to an onsite solar drying chamber.

Parkson provides a solar drying technology, the Thermo-System which is an active solar sludge dryer that utilizes a glass or polycarbonate cover with electrical and mechanical equipment and controls to assist in drying and working the sludge for more efficient and controlled sludge drying. The solar dryer reduces the sludge volume through heat and aeration such that it is possible to produce Class A biosolids. The Thermo-System utilizes sun power for 95% if its energy usage, and requires less energy than conventional gas or oil-fired dryers, using only 30 – 40 kWh per ton of water evaporated. With fully automated controls, operations and maintenance are minimal.

The ThermoSystem consists of custom designed chambers with a galvanized steel frame and transparent tempered glass and twin wall polycarbonate sheets. Each drying chamber is provided with a sliding door for equipment access. The drying chambers are equipped with a gable integrated air flap, driven by electric motors for fresh air, and exhaust fans are installed at the opposite end to blow saturated air out of the chamber. The ceiling of each chamber contains slowly rotating aeration fans designed to ensure turbulent air flow above the sludge.

Adequate mixing and aerating of the sludge is essential for successful drying and to reduce potential for odors. Each chamber is equipped with an Electric Mole to automatically mix and aerate the sludge, dramatically improving drying. The Electric Mole is a computer controlled 4-wheel device, constructed of stainless steel and fiberglass to prevent corrosion, which utilizes six ultrasonic onboard sensors for orienting.

The system is controlled by a central control panel with a PLC, HMI, MCC, and various climatic sensors including interior and exterior ambient temperature, interior and exterior relative humidity, solar radiation, and wind speed.

Table 8-2 summarizes the preliminary design of a Parkson ThermoSystem® for the Blacklake WRF assuming a Biolac® Extended aeration process in the future.

The approximate footprint of a Biolac® extended aeration process, headworks screen, and sludge thickener at the WRF is shown in Figure 8-2. The area currently used for Ponds 1 and 3 would no longer be required. The ponds could be filled and a portion of the area for a solar dryer, which would require approximately 15 - 20% of pond area.

Table 8-2: Preliminary Design Criteria for ThermoSystem®	
Assumptions	
Solids production (lbs sludge per lbs BOD)	0.7
Biological Process	Biolac®
BOD_5 influent concentration (mg/L)	285
BOD_5 effluent concentration (mg/L)	20
Thickened sludge percent solids	5
Final dry sludge percent solids	85
Preliminary Design	
Number of Chambers	1
Chamber dimensions (ft)	42 x 108
Minimum height (ft)	12.5
Roof material	Tempered glass
Side Walls material	Twin wall polycarbonate
# Exhaust fans per chamber	3
# Ceiling fans per chamber	6
# Electrical Moles	1
Start Wet Sludge (tons/year)	588
Final Wet Sludge (tons/year)	35
Estimated annual energy usage (kWh/yr)	16,590

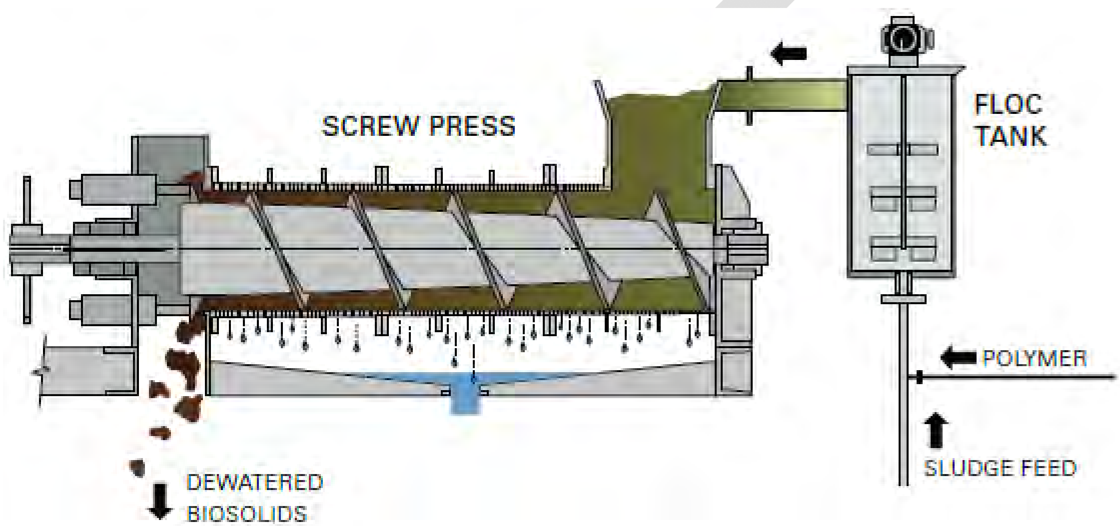
The opinion of cost for thickening and solar drying, assuming a gravity belt thickener is provided in Table 8-3.

Table 8-3: Thickener and Solar Dryer Opinion of Probable Construction Cost	
Description	**Estimated Installed Cost**
Gravity Belt Thickener with polymer, feed pump and controls	$398,000
GBT site work, slab, and shade structure	$35,000
Parkson ThermoSystem solar dryer	$1,138,000
Concrete (42' x 108' chamber)	$84,000
Thickened sludge pump	$20,000
Piping and appurtenances	$95,000
Site work	$60,000
Electrical and Instrumentation	$212,000
Subtotal Construction Cost Opinion	**$2,042,000**
Engineering and Administration (30%)	$613,000
Contingency (30%)	$613,000
Total Construction Cost Opinion	**$3,268,000**
Note: Costs are rounded to the nearest $1,000.	

8.3 Thickening and Dewatering Onsite

Biosolids hauling and disposal costs are continually increasing. Dewatering biosolids reduces costs for hauling and disposal fees. MKN reviewed the screw press technology for onsite dewatering at the Blacklake WRF. The main advantages to the screw press technology when compared to a belt filter press or centrifuge are generally automated operations, translating to low operator attendance requirements, low operating and energy costs, and relatively low odor potential since the system is almost fully enclosed. The main disadvantages are fewer municipal installations and lower solids capture rate, although capture rate is typically greater than 90% (meaning 10% of solids are returned to the plant headworks from the screw press drainage system). This scenario assumes influent waste sludge is thickened to 5% solids as described in Section 8.1.

The exhibit below shows the general process flow for a screw press. To achieve 18% solids or more from waste activated sludge, it is assumed a thickener will be required upstream of the screw press. A sludge feed pump would move the thickened sludge to a flocculation tank where it is mixed with polymer. Flocculated sludge is then pumped into a cylindrical screen where an internal auger slowly rotates. The auger shaft diameter increases towards the end of the screen and the space between its flights decreases. The volume between the basket screen, shaft and flights continuously decreases, increasing the pressure as the sludge moves through. Water is pressed from the sludge through the screen and the auger pushes the increasingly thicker sludge towards the annular clearance.



General Screw Press Process Flow

A planning level cost opinion (Table 8-4) was developed assuming the screw press will be housed in a metal-sided building with a gravity belt thickener and sufficient space for a dump truck to maneuver in and out. The press will be elevated on a platform in order to drop the dewatered sludge into a dump truck or bin and a maintenance platform with ladder will be provided to allow operator access. Piping and appurtenances were estimated at 15% of the installed equipment cost, and electrical and instrumentation costs were estimated at 25% of the equipment cost.

Table 8-4: Screw Press Opinion of Probable Construction Cost

Description	Estimated Installed Cost
Gravity belt thickener, feed pump, polymer system, and controls	$398,000
Screw press with polymer system and sludge pump	$428,000
Maintenance platform and appurtenances	$50,000
Piping and appurtenances	$114,000
Site work and equipment slab	$30,000
Dewatering building (2,500 SF)	$300,000
Electrical and Instrumentation	$182,000
Subtotal Construction Cost Opinion	**$1,502,000**
Engineering and Administration (30%)	$451,000
Contingency (30%)	$451,000
Total Construction Cost Opinion	**$2,404,000**
Note: Costs are rounded to the nearest $1,000.	

Should the District pursue onsite sludge dewatering, there may be advantages to specifying that the thickening and dewatering equipment be provided by the same manufacturer, to simplify future equipment maintenance and performance coordination. It may also reduce the overall cost.

SECTION 9 STAFFING EVALUATION AND RECOMMENDED RESERVES

9.1 Staffing Evaluation

Cost evaluation tables in this section are listed below:

List of Tables with Cost Implications			
Table	**Description**	**Cost**	**Page**
9-5	Blacklake WRF Major Equipment Replacement Assessment	$150,000	9-4

The goal of the staffing evaluation was to examine the adequacy of current staffing levels to efficiently operate and maintain the Blacklake collection system and WRF. NCSD provides engineering and operational staffing for both the Blacklake and Southland wastewater collection and treatment systems as described below:

- Director of Engineering and Operations
- Assistant Engineer
- Wastewater Supervisor
- Utility Operators (5)

To evaluate the adequacy of the existing collection system and WRF staffing, MKN reviewed staffing levels of local similar sized wastewater agencies and evaluated staffing using "The Northeast Guide for Estimating Staffing at Publicly and Privately Owned Wastewater Treatment Plants" prepared by the New England Interstate Water Pollution Control Commission.

For reviewing staffing levels of other local wastewater agencies the following questions were addressed during the comparison. This list comes from "The Cost of Clean Water: A Sewer User Rate Survey and Guidance Manual" (Connecticut DEP, 1999).

- Are the treatment processes similar?
- Are both plants of the same level of complexity?
- Are the treatment systems roughly the same age?
- Have the facilities been properly maintained in the past?
- What is the level of automation?
- Is sludge managed on-site or sent off-site for disposal?
- Do the collection systems have roughly the same mileage (within 20-30 percent)?
- Who does the O&M of the collection systems?
- Do the collection systems have roughly the same number of lift stations?
- Are all functions being carried out by plant staff or shared with other departments?
- Do the facilities handle similar waste, i.e., what is the percentage of industrial flow, food preparation or processing waste, etc.?
- Is the facility operating in compliance with operating permit?

Other agencies evaluated for this staffing evaluation included the Woodlands Mutual Water Company, Heritage Ranch Community Services District, and San Miguel Community Services District. A summary of agency service connections, collection system size, treatment plant capacity, and number of current wastewater staffing are included in Table 9-1.

Table 9-1: Agency Staff Comparison

Parameter	Blacklake Nipomo CSD[1]	Woodlands Mutual Water Company[2]	Heritage Ranch CSD[3]	San Miguel CSD[4]
Approximate System Connections	618	850	1,711	425
Miles of Collection System (Gravity and Pressure)	9	11	9	9
Lift Stations	3	1	10	1
Average Daily Flow (MGD)	0.06	0.20	0.12	0.11
Design Flow (MGD)	0.20	0.40	0.40	0.20
Wastewater General Manager	0.15	1	1	1
Operation Supervisor	0.15	1	1	-
Operation and Maintenance Staff	0.6	3	4	2
Total Operations Staff	0.9	4	5	2
Total Operators for Wastewater	**0.9**	**2**	**2**	**1**

1. Information provided by NCSD based on FTEs. Blacklake wastewater collection and WRF utilize 0.9 FTEs for operation.
2. Information provided by Wallace Group. Operators are used for both the water and wastewater systems. Wastewater staffing was assumed to be 50%.
3. Information provided by Heritage Ranch CSD. Operators are used for both the water and wastewater systems. Wastewater staffing was assumed to be 40%.
4. Information provided by Wallace Group. Operators are used for both the water and wastewater systems. Wastewater staffing was assumed to be 50%.

The strategy for evaluating staffing is to compare the total number of operations staff for each agency divided by each system size parameter, including system connections, average daily flow, number of lift stations, and miles of collection mains, giving a set of "operation staffing factors". Each of these four factors is equally weighted. An average of these factors was then multiplied by the same criteria for the District, then averaged. The calculation of the staffing factors is shown in Table 9-2**.**

Table 9-2: Operation Staffing Factors

Operation Staffing Factor	Woodlands Mutual Water Company	Heritage Ranch CSD	San Miguel CSD	Average Staffing Factor
Operators Per System Connection	0.0024	0.0012	0.0024	0.0020
Operators Per MGD of Average Daily Flow	10.00	16.67	9.09	11.9192
Operators per Lift Station	2.00	0.20	1.00	1.0667
Operators per Mile of Collection System	0.18	0.22	0.11	0.1717

The calculated recommended staffing levels for the Blacklake wastewater collection system and WRF is shown in Table 9-3.

Table 9-3: Calculated Blacklake Staffing Requirements

Parameter	Average Operation Staffing Factor	System Parameter	Recommended Staff Based on Operation Staffing Factor
System Connections	0.0016	618	1.21
Average Daily Flow (MGD)	7.76	0.06	0.72
Lift Stations	0.74	3.00	3.20
Miles of Collection System	0.09	9.00	1.55
		Average	**1.7**

Based on this comparative analysis of other local wastewater agency staffing, the recommended staffing for the Blacklake wastewater collection and WRF facilities is 1.6 staff members, or 1 full time, and one part time operator to be adequately staffed. The District currently has 0.9 full-time equivalents (FTEs) for the Blacklake wastewater system.

In addition to reviewing staffing at other local wastewater agencies, MKN utilized the Northeast Guide for Estimating Staffing at publicly and Privately Owned Wastewater Treatment Plants for the Blacklake collection system and WRF. The guide is a macro-enabled spreadsheet from the New England Interstate Water Pollution Control Commission (NEIWPCC), which is an update of the USEPA staffing guide published in 1973. Results of the staffing tool are included in Table 9-4 and the full worksheets are included in Appendix E.

Table 9-4: The Northeast Guide For Estimating Staffing At Publicly And Privately Owned WWPs	
Plant Name: Blacklake Water Reclamation Facility	
Design Flow: 0.25-0.5 mgd	**Actual Flow: 0.06 ADF**
FINAL ESTIMATES	
Chart #	**Annual Hours**
Chart 1 – Basic and Advanced Operations and Processes	650.00
Chart 2 – Maintenance	429.00
Chart 3 – Laboratory Operations	1182.00
Chart 4 – Biosolids/Sludge Handling	0.00
Chart 5 – Yardwork	0.00
Estimated Operation and Maintenance Hours	2261.00
Estimated Operation and Maintenance Staff	1.51
TOTAL STAFFING ESTIMATE	**1.51**
Chart 6 - Automation/SCADA	
Supervisory Control and Data Acquisition (SCADA)	
Chart 7 - Considerations for Additional Plant Staffing	
Plant staff responsible for collection system operation and maintenance, pump station inspections, and/or combined sewer overflows	

Based on the comparison to similar facilities and the Northeast Guide for estimating staffing, one additional part-time operator (0.6 – 0.7 FTE) is recommended for the Blacklake collection system and WRF facilities.

9.2 Repair and Replacement Reserves

There are a number of approaches to develop a repair and replacement program for a facility. A typical methodology is to inventory the existing equipment, develop unit costs for replacement and estimate the annual accumulation amount required to fund the future replacement projects. A rate impact study or other funding method to accumulate the funds for future replacements can then be determined.

MKN reviewed the major pieces of equipment and appurtenances at the existing facility that would require regular replacement over a 20 year timeframe. An installed replacement cost and typical design life was estimated. We recommend adding a 25% reserve to cover potential expenses in the case that a piece of equipment needs to be replaced sooner than anticipated. Table 9-5 presents the facility replacement assessment. The recommended annual replacement reserve fund for the existing facility's major equipment is $150,000.

Table 9-5: Blacklake WRF Major Equipment Replacement Assessment			
Equipment/ Materials	**Estimated Installed Cost**	**Typical Design Life (Yrs)**	**Recommended Repair Fund (125% Annualized Cost)**
Aerator 1 (10 hp)	$ 40,000	5	$ 10,000
Aerator 2 (10 hp)	$ 40,000	5	$ 10,000
Aerator 3 (10 hp)	$ 40,000	5	$ 10,000
Aerator 4 (5 hp)	$ 20,000	5	$ 5,000
Aerator 5 (5 hp)	$ 20,000	5	$ 5,000
Aerator 6 (5 hp)	$ 20,000	5	$ 5,000
Pond 1 HDPE Liner	$ 272,000	20	$ 17,000
Pond 2 HDPE Liner	$ 272,000	20	$ 17,000
Pond 3 HDPE Liner	$ 272,000	20	$ 17,000
Headworks Channel Coating	$ 66,000	10	$ 8,250
Grinder 1	$ 40,000	20	$ 2,500
Grinder 2	$ 40,000	20	$ 2,500
Chlorine Contact Chamber Coating	$ 100,000	10	$ 12,500
Chemical Feed Systems	$ 50,000	10	$ 6,250
Influent Sampler	$ 8,000	5	$ 2,000
Effluent Sampler	$ 8,000	5	$ 2,000
Valves and Gates	$ 60,000	15	$ 5,000
Plant Electrical Panels	$ 100,000	20	$ 6,250
Recommended major equipment replacement Fund/Yr (Rounded to $10,000)			**$ 150,000**

With respect to pond liner replacement the District may consider budgeting for an average 15 year liner replacement cycle coupled with a sludge removal project every 5 years.

SECTION 10 CAPITAL IMPROVEMENTS PLAN

Capital improvements are recommended based on the condition assessment and the analyses for existing and future anticipated conditions. These capital improvement projects are divided between the existing collection system (lift stations, force mains and gravity collection system) and the WRF and are summarized below.

List of Tables with Cost Implications			
Table	Description	Cost	Page
10-1	Recommended Capital Improvements Projects for Blacklake Collection Syst.	$1,744,000	10-3
10-2	Recommended Capital Improvement Projects for WRF	$2,928,000	10-4

10.1 Summary of Repairs and Improvements

The following is a summary of the repairs and/or improvements to address existing deficiencies and/or provide system efficiencies for the Blacklake collection system and WRF. In addition, each project has been assigned a priority ranking as to when the improvement should be completed. The following describes the priority ranking for capital projects:

10.1.1 Wastewater Collection System

The following improvements are recommended based on existing system deficiencies associated with the Blacklake collection system facilities:

- Golf Course Trunk Main Replacement – Install 980 linear feet of 12-inch sewer pipe
- Tourney Hill Sewer Main Replacement – Install 690 linear feet of 8-inch sewer pipe
- Oakmont Sewer Main Replacement – Install 566 linear feet of 8-inch sewer pipe
- Augusta Sewer Main Replacement – Install 185 linear feet of 8-inch sewer pipe
- Repair Offset Joints (2 locations)

10.1.2 Lift Stations

The following improvements are recommended based on existing system deficiencies associated with the Blacklake lift station facilities:

- Woodgreen Lift Station – Replace lift station
- The Oaks Lift Station – Add ventilation, coat piping, replace panels, instruments & cables
- Misty Glen Lift Station – Replace panels, instruments & cables

10.1.3 WRF Facility

The following improvements are recommended based on existing system deficiencies associated with the Blacklake WRF facility:

- Headworks Rehabilitation – Repair and recoat concrete channels, install safety rails, chains and gates, replace stop plates with slide gates, recoat piping, perform miscellaneous improvements, and rehabilitate influent manhole (concrete repair, coating, and replace rim and lid).
- Treatment Pond Rehabilitation – Replace HDPE liner on Pond 1, rebuild failing CMU wall, and install safety railing.
- Sludge Removal for existing flows and loadings.

- Chlorine Contact Chamber Rehabilitation – Repair and recoat concrete channels, replace steel support beams, and install effluent flow meter, mechanical mixer, composite sampler, and online chlorine analyzer.
- WRF Site Improvements – Miscellaneous control building repairs, install building security alarms, replace temporary retaining wall with permanent wall, drainage improvements.
- WRF Electrical Improvements – Add automation and SCADA interfacing, install permanent generator, effluent lift station improvements, and various electrical site improvements.

The following improvements are recommended to reduce operational costs at the Blacklake WRF facility:

- Headworks Improvements – Add an influent flow metering manhole and mechanical self-cleaning screening system.
- Aeration System Improvements – Replace surface splasher aerators with brush aerators or diffused aeration system for reduced electrical costs. Refer to Figure 5-2 in Section 5 for the 30-year life cycle cost comparison between the aeration systems. Diffused aeration has a higher initial capital cost than brush aerators, but lower annual power costs. The operational differences could be considered significant. Alternative aeration systems should be evaluated in detail to develop recommendations during preliminary design.

Opinions of probable construction cost for the recommended Blacklake collection system, lift stations, and WRF improvements are included in Tables 10-1 and 10-2. In addition, each project has been assigned a priority ranking in the order of when the improvement should be completed. The following describes the priority ranking for capital projects:

- Priority 1 – Recommended to be completed 1 to 3 years from completion of the Master Plan to replace pieces of equipment that are at the end of their design life, address capacity and /or performance deficiencies, and/or address safety concerns.
- Priority 2 – Recommended to be completed 3 to 5 years from completion of the Master Plan to address operational and maintenance issues.
- Priority 3 – May be completed in 5 years or more from completion of the Master Plan to address system improvements that increase efficiencies and reduce operational costs.

Table 10-1: Recommended Capital Improvements Projects for Blacklake Wastewater Collection System

Project	Project Name	Existing Facility	Deficiency	Capital Improvement Project (CIP)	Priority/Schedule	Construction Cost ($)	Engineering and Administration Cost ($)	Construction Contingency ($)	Opinion of Cost ($)
CS-CIP-1	Woodgreen Lift Station Improvements	Woodgreen Lift Station	Insufficient access, equipment is aging, corroded, coating is failing, pump is near end of design life	Replace lift station	1 (1-3 yrs)	$410,000	$77,000	$123,000	$610,000
CS-CIP-2	The Oaks Lift Station Improvements	The Oaks Lift Station	No ventilation, no light at controls enclosure, piping is corroded and needs recoating	Add ventilation, coat piping, replace panels, instruments & cables	2 (3-5 yrs)	$51,000	$15,000	$15,000	$81,000
CS-CIP-3	Misty Glen Lift Station Improvements	Misty Glen Lift Station	No light at controls enclosure, hatch lids are not traffic-rated	Replace panels, instruments & cables, etc	2 (3-5 yrs)	$47,000	$14,000	$14,000	$75,000
								Lift Station Existing Deficiency Capital Improvements Subtotal	**$766,000**
CS-CIP-4	Golf Course Trunk Main Replacement	8-inch pipe & 3 manholes	Camera underwater, unable to proceed, unable to see	Replace with 12-in SDR-35 PVC and 3 manholes, 980 LF, 10-20 ft deep (including pipe segments 842, 843, 844)	1 (1-3 yrs)	$294,000	$88,000	$88,000	$470,000
CS-CIP-5	Tourney Hill Sewer Main Replacement	6-inch PVC	Sags, camera underwater	Replace with 8-in SDR-35 PVC, 690 LF (including pipe segments 633, 634, 635, 685)	1 (1-3 yrs)	$168,000	$50,000	$50,000	$268,000
CS-CIP-6	Oakmont Sewer Main Replacement	8-inch pipe	Roots, sags	Remove plants and replace with 8-in SDR-35 PVC, 566 LF (including pipe segments 545 & 550)	2 (3-5 yrs)	$97,000	$29,000	$29,000	$155,000
CS-CIP-7	Augusta Sewer Main Replacement	8-inch pipe	Sags	Replace with 8-in SDR-35 PVC, 185 LF (including pipe segment 729)	2 (3-5 yrs)	$33,000	$10,000	$10,000	$53,000
CS-CIP-8	Repair Offset Joints	6-inch and 8-inch pipes	Offset joints, 2 locations	Repair offset joints, 2 locations (including pipe segments 656 & 834)	2 (3-5 yrs)	$16,000	$5,000	$5,000	$26,000
								Gravity Collection System Existing Deficiency Capital Improvements Subtotal	**$972,000**
								Blacklake Collection System – Capital Improvements Total	**$1,738,000**

Notes: Costs rounded to the nearest $1,000.
Engineering and Administration costs estimated at 30%. Construction contingency estimated at 30%

Table 10-2: Recommended Capital Improvements Projects for Blacklake WRF									
Project	Project Name	Existing Facility	Deficiency	Capital Improvement Project (CIP)	Priority/Schedule	Construction Cost ($)	Engineering and Administration Cost ($)	Construction Contingency ($)	Opinion of Cost ($)
WRF-CIP-1	WRF Headworks Rehabilitation	WRF Headworks	Deterioration, safety concern	Rehab influent manhole, headworks structure, misc. improvements	1 (1-3 yrs)	$186,000	-	-	$186,000
WRF-CIP-2	WRF Treatment Pond Rehabilitation	WRF Treatment Ponds	Deterioration, safety concern	New liner, CMU wall repair, safety railing	1 (1-3 yrs)	$195,000	$59,000	$59,000	$313,000
WRF-CIP-3	WRF Sludge Removal	WRF Treatment Ponds	Reduced treatment due to sludge buildup	Contract dredging, dewatering, and hauling to Santa Maria Landfill	2 (3-5 yrs)	$288,000	$23,000	$86,000	$397,000
WRF-CIP-4	WRF Chlorine Contact Chamber Rehabilitation	WRF Chlorine Contact Chamber	Deterioration, inefficiencies	Rehab structure, add automation	2 (3-5 yrs)	$194,000	$58,000	$58,000	$310,000
WRF-CIP-5	WRF Site Improvements	WRF	Old and temporary elements	Repair building & retaining wall, improve drainage	2 (3-5 yrs)	$124,000	$37,000	$37,000	$198,000
WRF-CIP-6	WRF Electrical Improvements	WRF electrical	Inefficiencies, corrosion, vulnerabilities	Repairs, improvements, automation, standby power	2 (3-5 yrs)	$269,000	$81,000	$81,000	$431,000
Existing Deficiency Capital Improvements Subtotal									**$1,835,000**
WRF-CIP-7	WRF Headworks Improvements	WRF Headworks	No screening system and aging equipment	Install mechanical self-cleaning screen, flow meter and appurtenances	3 (>5 yrs)	$469,000	$141,000	$141,000	$751,000
WRF-CIP-8	WRF Aeration Improvements	Surface aerators	Higher power requirements	Install brush aerators or diffused air system	3 (>5 yrs)	$214,000	$64,000	$64,000	$342,000
Future System Efficiency Capital Improvements Subtotal									**$1,093,000**
Blacklake WRF – Capital Improvements Total									**$2,928,000**

Notes: Costs rounded to the nearest $1,000.
Engineering and Administration costs estimated at 30% of construction cost, with the exception of the WRF sludge removal, where it is estimated at 8%. Construction contingency estimated at 30%

SECTION 11 REVIEW OF GRANTS AND LOANS

MKN has evaluated several grant and loan programs to determine if funding would be available for future upgrades at the Blacklake WRF. The District is not considered an economically disadvantaged community, has low unemployment, is not considered a “rural” entity, and the project is not part of the Bay Delta Restoration or aimed to alleviate flood risks or a contaminated water supply. Therefore, they are not eligible for many grant programs.

The following federal & state grant and loan programs appear to be the most viable for the District, particularly if recycling-related upgrades at the WRF are pursued. In general, expanding the water recycling program would have more grant and loan opportunities than the other capital improvements identified for the WRF.

11.1 Federal Grant Programs

11.1.1 US Bureau of Reclamation Title 16 Grant Program

If the District pursues an expansion of their recycled water program, the Title 16 Grant Program should be considered. There are three prerequisites for the Title 16 construction grant program: 1) the Project must be authorized by Congress for up to a specific dollar amount, 2) a feasibility study that meets specific requirements must be completed and approved by the Bureau, and 3) Congress must appropriate funds for the construction Project. This is a minimum three-year process.

Currently, many agencies are already in line for construction funding, and Congress has not authorized any new funding for construction projects since the Recovery Act of 2009. If the District were to be successful in steps 1, 2 and 3, in the future, then this grant program could potentially fund up to 25% of a recycled water project’s cost, up to $20 million. The Title 16 federal grants require a minimum 75% match.

The Bureau must approve the feasibility study before a construction grant can be received. Having an approved feasibility study can also facilitate the appropriation by Congress.

Most years, the Bureau of Reclamation offers the WaterSMART: Title 16 Feasibility Study competitive grant program, which may contribute up to 50% of the cost of a feasibility study. These grants are capped at $150,000 and require a 50% local match. This grant is highly competitive.

11.1.2 Other WaterSMART Grants

The Bureau of Reclamation offers other types of WaterSMART grants most years. The majority of these grants are less than $300,000 and they support whatever objective the Bureau is focusing on that year in the 17 western states. For example, in 2013 the focus was energy efficiency and sustainability in wastewater treatment. The Bureau awards a handful of larger WaterSMART grants each year – up to $1,500,000 – however, Blacklake WRF is not likely to be competitive for these based on the size of the population, demographics and location.

As project plans solidify, the District could potentially apply for a WaterSMART grant of up to $300,000 for features of a project that align with the Bureau’s objectives and schedule for that particular year.

There are no other significant federal grants for construction available to the District.

11.2 State Grant Programs

Most of California’s major grant programs for water infrastructure (including recycled water) originate from the sale of statewide water bonds, which have been approved by voters. Examples of these include the parks and water bonds, Propositions 40, 50, & 84. Funding from Propositions 40, 50, and 84 has been completely exhausted. Proposition 1 was approved in November 2014. The measure enacts the Water Quality, Supply, and Infrastructure Improvement Act of

2014. The $7.545 billion bond includes funding for several grant programs that could provide some funds toward Project construction:

- $810 million for expenditures on, and competitive grants and loans to integrated regional water management plan projects,
- $725 million for water recycling and advanced water treatment technology projects, and
- $2.7 billion for water storage projects - including underground storage, dams, reservoirs.

The funding is administered through the Department of Water Resources' (DWR) Integrated Regional Water Management Grant Program and various program under the State Water Resources Control Board, including Clean Water State Revolving Fund (SRF), Water Recycling Funding Program, and Drinking Water SRF. Project funding began in late 2015. As of May 2016, 7.5% of the SWRCB's appropriation had been awarded.

Other state grants might support innovative stormwater features or public access or recreation features that might be included in a facility master plan. But these grants would likely be in the hundreds of thousands of dollars, and really depend on the design, timing and benefits of what is proposed.

11.3 Loans

The Clean Water State Revolving Fund (CWSRF) loan program originates from federal funds that come to the State Water Board from the USEPA. The state administers the loan program and also contributes funds. Wastewater treatment projects are financed through CWSRF at the regular rate, which is determined at the time of the loan. The rate is typically ½ of the General Obligation bond rate. Throughout 2015, the interest rate has been approximately 1.5 to 2%. The program will loan up to $50 million per project. Communities that meet the "economically disadvantaged" criteria may be eligible for a portion of the loan principal to be "forgiven". The Blacklake Community does not meet these criteria.

Because of California's drought, recycled water projects are currently eligible for a reduced interest rate on CWSRF loans. The interest rate is approximately 1% annually. It is possible to use the CWSRF loans for both planning and construction. The application process is extensive, and completed environmental documents are required for construction loans, but applications are accepted year- round. CWSRF may also be used for loan guarantees.

The California Infrastructure and Economic Development Bank (IBank) has broad authority to issue tax-exempt and taxable revenue bonds, provide financing to public agencies, provide credit enhancements, acquire or lease facilities, and leverage State and Federal funds. The IBank's current relevant program for water and wastewater project is the Infrastructure State Revolving Fund (ISRF) Program. Infrastructure loans are available in amounts ranging from $50,000 to $25,000,000, with loan terms of up to 30 years. Interest rates are set on a monthly basis and currently range from 2-5%. Financing applications are continuously accepted.

11.4 Recommendations

- If the District intends to expand the recycled water program, initiate the process for Title 16 funding by meeting with your local Representative. Meet with Bureau of Reclamation officials to discuss the project relative to their objectives. Complete a Title 16 Feasibility Study. Even if the Title 16 funds are not initially available, this program may be useful for future phases of the Project.
- Engage in the San Luis Obispo regional water management group that serves as the vehicle for Integrated Regional Water Management grants.
- Be aware of greenhouse gas emissions and energy impacts associated with different alternatives, as this is something that is evaluated and scored in almost all state funding.
- If the District would rather use a CWSRF loan than issue municipal bonds, initiate the loan application at least 9 months before funding is needed.

SECTION 12 CONCLUSIONS

12.1 Capital Improvement Summary

The capacity and condition evaluations presented in Sections 4 and 5 determined that the existing collection system and WRF have sufficient capacity for existing demands. Maintaining treatment process systems and repairing deficiencies of these systems in a timely manner as well as committing to relatively minor improvements, assure systems will operate as designed in a reliable manner. Table 12-1 provides a summary of the recommended capital improvements with opinion of costs for the Blacklake sewer collection system and WRF, as presented in Section 10. A total of approximately $4.7 million in capital improvements are recommended to meet the community's wastewater demands.

Table 12-1: Recommended Capital Improvements Summary

	Opinion of Cost
Blacklake Collection System Capital Improvements	$1,738,000
Blacklake WRF - Existing Deficiency Capital Improvements	$1,835,000
Blacklake WRF - Future System Efficiency Capital Improvements	$1,093,000
Total Blacklake Wastewater Capital Improvements	**$4,666,000**

12.2 Regionalization of Blacklake and Southland Treatment Facilities

The 20-year lifecycle costs for continued treatment at the WRF includes the costs to complete the recommendations in Table 12-1. These costs are compared to the conceptual option to regionalize treatment at the District's Southland WWTF. The life cycle cost analysis indicates it will be less expensive to regionalize the WRF flows into the Southland WWTF costing $11.3 million when compared to $13.8 million for ongoing treatment at the existing WRF.

If a recycled water system is constructed, it would be more efficient to design the system to deliver the entire wastewater flow amount. However, the costs of implementing a recycled water system is significant and it is anticipated that the community would not pay for a recycled water system unless there is a demonstrated value to the users.

The costs associated with developing and delivering recycled water are independent of the regionalization cost outlined in Section 7.4. This Master Plan evaluates both options, regionalizing the two systems and continued operations at the WRF, but assumes recycled water use is discontinued under the regionalization option. If the District is required to provide recycled water to Blacklake in any amount, the cost assumptions for regionalizing the two facilities will be significantly higher.

12.3 Sludge Management and Disposal

Sludge management is an ongoing challenge at Blacklake WRF. The options for sludge management, assuming the District maintains its current treatment process, were reviewed and summarized in Section 5.4 of this Master Plan. Prior to the Southland WWTF upgrade and new discharge permit, the District has taken a pond offline to remove sludge, then hauled the wet sludge to Southland WWTF for drying at their sludge drying beds. This method is no longer an option as the Disposal Contractor will not accept a commingled Southland and Blacklake sludge for composting. In addition, there is not sufficient drying bed space to dry the sludge from the Blacklake facility at the Southland WWTF. Finally, the Southland WWTF is neither permitted nor funded to receive unscreened biosolids from the Blacklake facility. The Master Plan includes costs for contract dredging, dewatering, and hauling to the Santa Maria Landfill and is recommended to be completed on a 5 year cycle.

APPENDIX A

WATER RECLAMATION REQUIREMENTS FOR NCSD BLACKLAKE RECLAMATION FACILITY

ID#3 401028001

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

81 Higuera Street Suite #200
San Luis Obispo, California 93401

ORDER NO. 94-14

WATER RECLAMATION REQUIREMENTS
FOR
NIPOMO COMMUNITY SERVICES DISTRICT,
BLACK LAKE RECLAMATION FACILITY,
SAN LUIS OBISPO
(Producer of Reclaimed Water)

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

1. Nipomo Community Services District (Discharger) owns and operates a domestic wastewater treatment facility which serves Black Lake residential development and golf course facilities. The wastewater facility was formerly owned and operated by San Luis Obispo County Service Area No. 1 regulated by Order No. 84-14 adopted by the Board on February 24, 1984.

2. The Discharger filed a Report of Waste Discharge on October 4, 1993, in accordance with Sections 13260 and 13522.5 of the California Water Code. The report was filed requesting revision of Water Reclamation Requirements to reflect change in ownership of the Black Lake Reclamation Facility located on the Nipomo Mesa, three miles west of the community of Nipomo, Section 10 and 11, T11N, R35W, SB B&G, as shown on Attachment A of this Order.

3. Ultimately an average daily flow of 200,000 gallons-per-day (757 m^3/day) will be treated at this facility. The treatment facility consists of comminution, aerated lagoons and disinfection designed in two identical 100,000 gpd units. Currently one 100,000 gpd treatment unit has been constructed. Treated wastewater is discharged to a storage lake for pumping to the golf course irrigation system. Emergency storage is provided in the aerated lagoons and storage lake to allow effluent containment during periods of process breakdowns or wet weather.

4. The reclamation area is located on 36 acres of gently rolling topography consisting of sandy soils to a depth of approximately 150 feet. Ground water occurs at approximately 125 feet below ground surface and flows in a westerly to southerly direction depending on local conditions. A report prepared by the applicant, titled "Ground Water Availability for the Proposed Black Lake Golf Course Development Project", dated June 1982, lists average ground water quality under the project site as follows:

Total Dissolved Solids	373 mg/l
Sodium	48 mg/l
Chloride	57 mg/l
Nitrate (as N)	2.7 mg/l
pH	7.4 mg/l

5. The Black Lake Golf Course will use reclaimed water supplied by the Discharger. This primary user of reclaimed water is regulated by separate water reclamation requirements.

6. The Water Quality Control Plan, Central Coast 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.

7. Title 22, Chapter 3 of the California Code of Regulations specifies State Department of Health Services' criteria for use of reclaimed water. The Board has consulted with the State and County Health Departments regarding these reclamation requirements.

8. Present and anticipated beneficial uses of ground water in the vicinity of the discharge include: Domestic, Municipal, Agricultural and Industrial Supply.

9. Water Reclamation Requirements for this discharge are exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et. seq.) in accordance with Section 13389 of the California Water Code.

10. 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 assume this and mitigate any potential adverse changes in water quality due to discharge

11. On December 3, 1993, the Board notified the Discharger and interested agencies and person of its intent to issue water reclamation requirements for the discharge and has provided them with a copy of the proposed Order and an opportunity to submit written views and comments.

12. After considering all comments pertaining to this discharge during a public hearing on March 11, 1994, this Order was found consistent with the above findings.

IT IS HEREBY ORDERED, pursuant to authority in Section 13263 of the California Water Code, Nipomo Community Services District, its agents, successors, and assigns, may discharge reclaimed water from the Black Lake Reclamation Facility to Black Lake Golf Course, 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.)

Throughout these requirements footnotes are listed to indicate the source of requirements specified. Requirement footnotes are as follows:

A = California Code of Regulations, Title 22
B = Basin Plan
C = Administrative Procedures Manual
D = Draft Guidelines for Use of Reclaimed Water

Requirements not referenced are based on Staff's professional judgement.

A. PROHIBITIONS

1. Discharge to areas other than the storage lake or golf course reclamation areas shown in Attachment A, is prohibited.[D]

2. Discharge of any wastes including overflow, bypass, overspray and runoff from transport, treatment, or disposal systems to adjacent drainageways or adjacent properties is prohibited.[D]

3. Bypass of the treatment facility and discharge of untreated or partially treated wastes directly to the storage lake or golf course irrigation ares in prohibited.[A]

B. RECLAMATION SPECIFICATIONS

1. Until completion of Phase II of the treatment facility, daily flow averaged over each month shall not exceed 100,000 gallons (379m^3). Upon completion of Phase II of the treatment facility, daily flow shall not exceed 200,000 gallons (757m^3).

2. Reclaimed water discharged to the storage lake or golf course shall at all times be adequately clarified, oxidized, disinfected[A] and not exceed the following limitations:

Parameter	Units	Mean	Maximum
BOD_5	mg/l	40	100
Total Suspended Solids	mg/l	30	100
Total Dissolved Solids	mg/l	WS* + 250**	
Sodium	mg/l	WS + 70**	
Chloride	mg/l	WS + 65**	
Settleable Solids	mg/l	0.1	0.3
pH[B]	units	Within the range 6.5 to 8.4	
Dissolved Oxygen	mg/l	Minimum 1.0	

*WS = Water Supply

**Incremental limits do not account for use of water conserving fixtures which will tend to increase salts concentrations by reducing diluting flows. If after implementing best salts management practices, the Discharger is unable to comply with the incremental limits specified in B.2., these limits may be revised to reflect increased salts concentrations resulting from water conservation practices. Revised limits may be approved by the Executive Officer after adequate justification has been presented by the Discharger.

3. Freeboard shall exceed 18 inches in the aerated lagoons during normal operating conditions.

4. The median number of coliform organisms in reclaimed water shall not exceed 23 MPN per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms shall not exceed 240 MPN per 100 ml in any single sample.[A]

5. Free chlorine residual in reclaimed water shall equal or exceed 1 mg/l, as measured immediately after the chlorine contact zone.

6. Delivery of reclaimed water shall cease and all wastewater shall be contained within the aeration lagoons if:

   a. Disinfection of wastewater ceases at any time; or,

   b. Reclamation specifications are violated or threaten to be violated.

7. Personnel involved in producing, transporting, or using reclaimed water shall be informed of possible health hazards that may result from contact and use of reclaimed water.[D]

8. Wastewater treatment and storage facilities shall be managed to exclude the public and posted to warn the public of the presence of wastewater.[D]

C. GROUND WATER LIMITATIONS

1. The treatment or discharge shall not cause nitrate concentrations in the ground water downgradient of the reclamation area to exceed 10.0 mg/l (as N).

2. The discharge shall not cause a significant increase of mineral constituent concentrations in underlying ground waters, 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.[B]

D. PROVISIONS

1. The requirements prescribed by this Order supersede requirements prescribed by Order No. 84-14 adopted by the Board on February 24, 1984. Order No. 84-14 "Water Reclamation Requirements for Black Lake Golf Course, San Luis Obispo County Service Area No. 1, Producer of Reclaimed Water, San Luis Obispo County" is hereby rescinded.

2. Discharger shall comply with "Monitoring and Reporting Program No. 94-14", as specified by the Executive Officer.

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

4. Production of reclaimed water shall be as described in the "Engineering Report to RWQCB, WWTP for Black Lake Project", dated June 28, 1983. Revision to the engineering report shall be subject to review and approval of the Executive Officer after consultation with State and County Health Departments.[A]

5. Discharger shall implement salts best management practices. If the Discharger is unable to comply with salts limits specified in this Order, a plan for salts management and reduction must be submitted within 30 days of such noncompliance. The plan must include a schedule for implementation (not to exceed six months) of activities or installation of equipment needed to assure compliance and submittal of periodic progress reports.

6. By June 11, 1994, the Discharger shall adopt an ordinance restricting the continued use of self-regenerating water softeners within the Black Lake Reclamation Facility service area.

7. Pursuant to Title 23, Division 3, Chapter 9, of the California Code of Regulations, the Discharger must submit a written report to the Executive Officer not later than September 11, 1998, addressing:

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

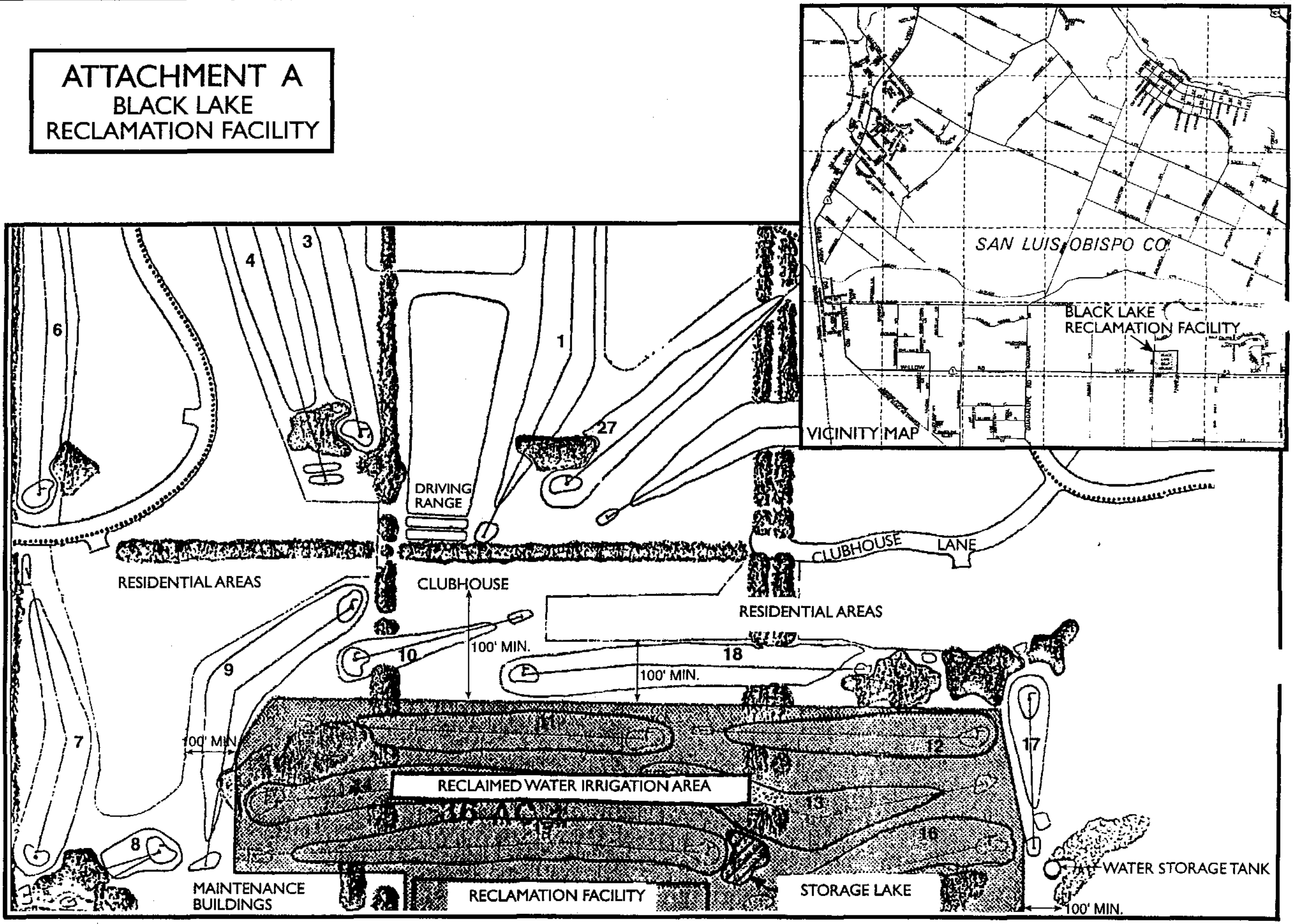
   b. Whether, in their opinion, there is any portion of the Order that is incorrect, obsolete, or otherwise in need of revision.

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 March 11, 1994.

EXECUTIVE OFFICER

SJM/A/sm1:blacklak.wdr

ATTACHMENT A
BLACK LAKE RECLAMATION FACILITY



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM NO. 94-14
FOR
NIPOMO COMMUNITY SERVICE DISTRICT,
BLACK LAKE RECLAMATION FACILITY,
SAN LUIS OBISPO COUNTY

WATER SUPPLY MONITORING

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

Constituent	Units	Type of Sample	Minimum Sampling & Analyzing Frequency
Total Dissolved Solids	mg/l	Grab	Quarterly* (Jan/Apr/Jul/Oct)
Sodium	mg/l	Grab	" " " "
Chloride	mg/l	Grab	" " " "

RECLAIMED WATER MONITORING

Representative samples of reclaimed water delivered to the golf course shall be collected and analyzed as follows:

Constituent[C]	Units	Type of Sample	Minimum Sampling & Analyzing Frequency
Daily Flow	Gallons	Metered	Daily[C]
Mean Daily Flow	Gallons	Calculated	Monthly
Total Coliform Organisms	MPN	Grab	Daily[A]
Settleable Solids	ml/l	Grab	Daily[A]
pH	-	Grab	Weekly
BOD[5]	ml/l	24-hour Composite	Weekly
Total Suspended Solids	mg/l	24-hour Composite	Weekly
Dissolved Oxygen**	mg/l	Grab	Weekly
Chlorine Residual	mg/l	Grab	Weekly
Total Dissolved Solids	mg/l	Grab	Quarterly* (Jan/Apr/Jul/Oct)
Sodium	mg/l	Grab	" " " "*
Chloride	mg/l	Grab	" " " "*
Total Nitrogen (as N) (Kjedahl+Nitrate+Nitrite-Nitrogen)	mg/l	Grab	Semi-Annually (April & October)

*Semi-annual monitoring (April & October) may resume after consistent compliance (three consecutive quarters) with salts limitations demonstrated and with approval of the Executive Officer.

**Sample to be collected from at least 12" below pond surface.

OPERATING RECORDS AND REPORTS

1. Operating records shall be maintained at the reclamation facility. These records shall include: all analyses specified in the reclamation requirements; records of operational problems, plant and equipment breakdowns, and diversions to emergency storage basin; and all corrective or preventive action taken.

2. Process or equipment failures triggering an alarm shall be recorded and maintained as a separate record file. The recorded information shall include the time and cause of failure and corrective action taken.

3. A monthly summary of operating records as specified under Item No. 1 (above) shall be filed with the monthly monitoring report.

4. Any discharge of untreated or partially treated wastewater to the use area, and the cessation of same, shall be reported immediately by telephone to the Regional Board, the State Department of Health Services and the County Health Officer.

5. An annual solids inventory of the treatment ponds shall be prepared and submitted with the annual report (Standard Provisions and Reporting Requirements, Item C.16.). The solids inventory shall include a contingency plan to reduce excess solids if necessary.

REPORTING

In reporting the monitoring data, the discharger shall arrange the data in tabular form so the date, constituents and concentrations are readily discernable. The data shall be summarized to demonstrate compliance with Water Reclamation Requirements.[B] All monitoring data shall be made available to reclaimed water users upon request.

Monitoring Reports shall be submitted by the 30th of the month following sampling.

ORDERED BY [signature]
EXECUTIVE OFFICER

March 11, 1994
Date

SJM/A/sm1:blacklak.mrp

APPENDIX B

NCSD BLACKLAKE WASTEWATER TREATMENT FACILITY - FLOW AND PRECIPITATION SUMMARY

NCSD BLACKLAKE WASTEWATER TREATMENT FACILITY - FLOW AND PRECIPITATION SUMMARY

	2009			2010			2011			2012		
	Total Effluent Flow	Avg Effluent Flow	Rainfall	Total Effluent Flow	Average Effluent Flow	Rainfall	Total Effluent Flow	Average Effluent Flow	Rainfall	Total Effluent Flow	Average Effluent Flow	Rainfall
	MGM	MGD	INCH	MGM	MGD	INCH	MGM	MGD	INCH	MGM	MGD	INCH
Jan	2.41	0.150	0.29	2.67	0.086	6.44	2.40	0.077	1.10	2.22	0.072	3.16
Feb	2.14	0.079	4.36	2.32	0.083	3.70	2.31	0.145	3.68	1.89	0.064	0.53
Mar	2.06	0.066	0.79	2.46	0.079	1.10	3.09	0.100	5.97	1.89	0.061	4.04
Apr	1.95	0.109	0.43	1.99	0.066	3.52	1.92	0.064	0.11	1.67	0.056	2.73
May	1.40	0.045	0.20	1.77	0.057	0.23	1.61	0.052	0.69	1.34	0.043	0.00
Jun	1.90	0.063	0.17	1.86	0.062	0.00	1.82	0.061	0.91	1.42	0.046	0.00
Jul	1.74	0.056	0.00	1.95	0.063	0.02	1.60	0.052	0.00	1.48	0.048	0.00
Aug	1.82	0.059	0.01	2.00	0.065	0.00	1.92	0.062	0.00	1.56	0.050	0.00
Sep	1.80	0.060	0.00	2.01	0.067	0.00	1.25	0.042	0.04	1.31	0.044	0.00
Oct	1.83	0.059	2.18	1.93	0.062	3.16	1.60	0.051	0.91	1.65	0.053	0.10
Nov	2.00	0.067	0.01	2.30	0.077	2.52	1.86	0.062	2.18	1.85	0.062	1.29
Dec	2.24	0.072	3.78	3.31	0.107	13.36	1.74	0.056	0.17	1.88	0.061	3.90
Total	23.27		12.21	26.57		34.04	23.11		15.74	20.17		15.75

No Data = 0.00

	2009	2010	2011	2012
ADF (MGD)	0.064	0.073	0.063	0.055
PHF (MGD)	0.255	0.291	0.253	0.221
PDF (MGD)	0.223	0.286	0.222	0.230
Adj. PDF	0.184	0.245	0.200	0.181
PDDF (MGD)	0.139	0.171	0.141	0.183
Adj. PDDF (MGD)	0.137	0.165	0.141	0.181
PDWF (MGD)	0.223	0.286	0.222	0.230
Adj. PDWF (MGD)	0.184	0.245	0.200	0.152
ADMMF (MGD)	0.063	0.067	0.062	0.052
AWMMF (MGD)	0.150	0.110	0.145	0.074
Adj. AWMMF (MGD)	0.150	0.084	0.137	0.068

Notes:

ADF = Average Annual Flow = Total flow conveyed in one year divided by 365 days a year.

PDF = Peak Day Flow = Highest single day for the year (not an average).

PDDF = Peak Day Dry Weather Flow = Single highest day during a dry month.

PDWF = Peak Day Wet Weather Flow = Single highest day during a wet month.

ADMMF = Average Day Maximum Month Dry Weather Flow
= Max flow rate during the peak month of summer.

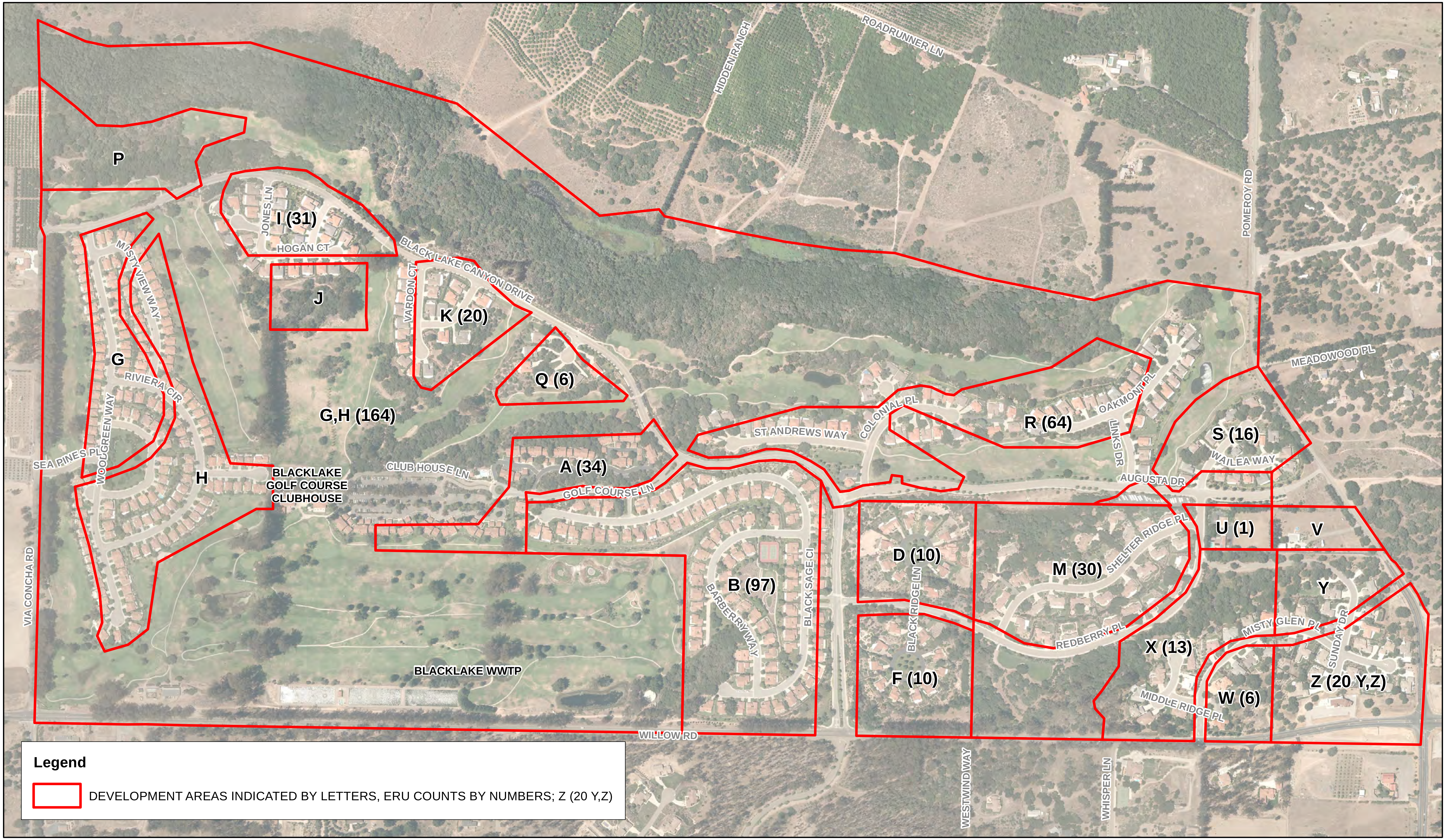
AWMMF = Average Day Maximum Month Wet Weather Flow
= Max flow rate during peak month of winter

Adj. PDWF, PDDF, and PDF = Peak days selected from middle of operating cycles.
No peak days at the beginning or end of weekly operating cycle were allowed.

Adj. AWMMF = AWMMF reduced by the average daily rainfall over the approx.
94000 SF WWTF during that month

APPENDIX C

DEVELOPMENT AREAS FROM BLACKLAKE SPECIFIC PLAN



MICHAEL K NUNLEY & ASSOCIATES
WATER • WASTEWATER • WATER REUSE

BLACKLAKE COLLECTION SYSTEM
AND WWTP MASTER PLAN

DEVELOPMENT AREAS FROM BLACKLAKE SPECIFIC PLAN

N
1 inch :500 feet

NIPOMO COMMUNITY SERVICES DISTRICT

APPENDIX D

ESTIMATE OF REQUIRED PRE-ANOXIC VOLUME FOR BIOLOGICAL NITROGEN REMOVAL

Estimate the required pre-anoxic volume for biological nitrogen removal
Assume extended aeration process, such as Parkson Biolac.
Equations per Wastewater Engineering Treatment and Reuse, 4th Edition
Note, SDNR is very site and design specific. Empirical relationships are only a rough estimate!

EQUATIONS

$NO_r = V_{nox}$ x SDNR x MLVSS

where,

NO_r	Nitrate removed, g/d
V_{nox}	Anoxic tank volume, m^3
SDNR	Specific denitrification rate, g NO_3-N/g MLVSS-day
MLVSS	Mixed liquor volatile suspended solids concentration, mg/L

SDNR = 0.03 x (F/M) + 0.029

where,

F/M is g BOD applied / g MLVSS-day

ASSUMPTIONS

Per Parkson Biolac preliminary design and quote (5-30-13),

F/M =	0.055		
MLSS =	3,000	mg/L	relatively high
MLSS =	1,500	mg/L	check lower MLSS, since depends on operation
MLVSS/MLSS =	0.85		
NO_3-N to be removed =	30	mg/L	
Flowrate, Q =	0.078	MGD	MMF, future

CALCULATIONS

SDNR = 0.03065

$V_{nox} = NO_r/(SDNR x MLVSS)$ rearrangement of equation

NO_r = 8,857 g/day

Using high MLSS			Using Mid MLSS		
V_{nox} =	113.32	m^3	V_{nox} =	226.64	m^3
	29,936	gallons		59,873	gallons
	4,002	CF		8,003	CF

Estimated required pre-anoxic volume = 60,000 gallons

APPENDIX E

NORTHEAST GUIDE FOR ESTIMATING STAFFING AND PUBLIC AND PRIVATE WWTPS

NEIWPCC
New England Interstate Water Pollution Control Commission

THE NORTHEAST GUIDE FOR ESTIMATING STAFFING AT PUBLICLY AND PRIVATELY OWNED WASTEWATER TREATMENT PLANTS

Choose Staffing Shifts: One Shift

Enter Plant Design Flow: 0.25-0.5 mgd

Total Staffing Hours: 2261.00

Data Notes	# of Units	Process/Activity/Flow	Hours	Calculated	Subtotal
		Begin Chart 1 – Basic and Advanced Operations and Processes			
Data Notes	**# of Units**	**Process**	**Hours**	**Calculated**	**Subtotal**
	1	Preliminary Treatment	0.50	130.00	
# of units		Primary Clarification	0.50	0.00	
		Activated Sludge	2.00	0.00	
		Activated Sludge w/BNR	3.00	0.00	
		Rotating Biological Contactor	1.00	0.00	
# of tanks		Sequencing Batch Reactor	1.00	0.00	
		Extended Aeration (w/o primary)	2.50	0.00	
		Extended Aeration w/BNR	3.50	0.00	
		Pure Oxygen Facility	*X*		
		Pure Oxygen Facility w/BNR	*X*		
		Trickling Filter	1.00	0.00	
		Oxidation Ditch (w/o primary)	2.50	0.00	
		Oxidation Ditch w/BNR	3.50	0.00	
	1	Aeration Lagoon	1.50	390.00	
		Stabilization Pond	1.00	0.00	
		Innovative Alternative Technologies	2.00	0.00	
		Nitrification	0.25	0.00	
		Denitrification	0.25	0.00	
		Phosphorus Removal (Biological)	0.25	0.00	
		Phosphorus Removal (Chemical/Physical)	0.25	0.00	
		Membrane Processes	0.25	0.00	
		Cloth Filtration	0.25	0.00	
		Granular Media Filters (Carbon, sand, anthracite, garnet)	0.50	0.00	
		Water Reuse	0.25	0.00	
		Plant Reuse Water	0.10	0.00	
	1	Chlorination	0.50	130.00	
		Dechlorination	0.50	0.00	
		Ultraviolet Disinfection	0.50	0.00	
# of units		Wet Odor Control	0.50	0.00	
# of units		Dry Odor Control	0.25	0.00	
		Septage Handling	0.50	0.00	
		End of Chart 1 – Basic and Advanced Operations and Processes SUBTOTAL:			**650.00**

** Secondary Clarification has been built into basic operations processes.*
** Activated Sludge process includes RAS and WAS pumping.*

Begin Chart 2 – Maintenance

Unit Descriptons	# of Units	Activity/Flow	Hours	Calculated	Subtotal
# of screens	1	Manually Cleaned Screens	0.25	65.00	
# of screens		Mechanically Cleaned Screens	0.25	0.00	
# of screens		Mechanically Cleaned Screens with grinders/washer/ compactors	0.25	0.00	
# of units	2	Comminutor/Macerator	0.25	130.00	
# of chambers		Aerated Grit Chambers	0.10	0.00	
# of units		Vortex Grit Removal	0.10	0.00	
# of units		Gravity Grit Removal	0.10	0.00	
# of tanks		Additional Process Tanks	0.10	0.00	
# of chemicals added for processes	1	Chemical Addition (varying dependent upon degree of treatment)	0.10	26.00	
# of clarifiers		Circular Clarifiers	0.25	0.00	
# of clarifiers		Chain and Flight Clarifiers	0.25	0.00	
# of clarifiers		*Traveling Bridge Clarifiers*	*X*		
# of clarifiers		Squircle Clarifiers	0.25	0.00	
X		Pumps	100.00	0.00	
# of trains		Rotating Biological Contactor	0.15	0.00	
# of TFs		Trickling Filters	0.15	0.00	
# of tanks		Sequencing Batch Reactor	0.15	0.00	
# of mixers	6	Mechanical Mixers	0.10	156.00	
# of blowers		Aeration Blowers	0.20	0.00	
# of cartridges		Membrane Bioreactor	0.10	0.00	
# of systems		Subsurface Disposal System	0.10	0.00	
X		Groundwater Discharge	0.10	0.00	
# of digesters		Aerobic Digestion	0.10	0.00	
# of digesters		*Anaerobic Digestion*	*X*		
# of basins		Gravity Thickening	0.10	0.00	
# of belts		Gravity Belt Thickening	0.15	0.00	
# of presses		Belt Filter Press	0.15	0.00	
# of units		Mechanical Dewatering (Plate Frame and Centrifuges)	0.15	0.00	
# of units		*Dissolved Air Floatation*	*X*		
X		Chlorination (gas)	0.10	0.00	
X	1	Chlorination (liq.)	0.20	52.00	
X		Dechlorination (gas)	0.10	0.00	
X		Dechlorination (liq.)	0.20	0.00	
# of racks		Ultraviolet	0.10	0.00	
# of units		Biofilter	0.50	0.00	
# of units		Activated Carbon	0.50	0.00	
# of units		*Wet Scrubbers*	*X*		
# of screens		Microscreens	0.10	0.00	
# of units		*Pure Oxygen*	*X*		
# of units		Final Sand Filters	0.20	0.00	
# of different types of probes		Probes/Instrumentation/Calibration	0.10	0.00	
		End of Chart 2 – Maintenance SUBTOTAL:			**429.00**

Begin Chart 3 – Laboratory Operations

Frequency of test	# of times test is run for selected time frame	Tests	Hours	Calculated	Subtotal
		Acidity	0.75	0.00	
		Alkalinity, total	0.75	0.00	
		Biochemical Oxygen Demand (BOD)	2.50	0.00	
		Chemical Oxygen Demand (COD)	2.50	0.00	
		Chloride	0.50	0.00	
52	1	Chlorine, Total Residual	0.25	13.00	
		Coliform, Total, Fecal, E.Coli	1.00	0.00	
52	1	Dissolved Oxygen (DO)	0.25	13.00	
52	1	Hydrogen Ion (pH)	0.25	13.00	
		Metals	3.00	0.00	
		Toxicity	2.00	0.00	
		Ammonia	2.00	0.00	
		Total Nitrogen	2.00	0.00	
		Oil and Grease	3.00	0.00	
		Total and Dissolved Phosphorus	2.00	0.00	
52	1	Solids, Total, Dissolved, and Suspended	3.00	156.00	
		Specific Conductance	0.25	0.00	
		Sulfate	1.00	0.00	
		Surfactants	1.00	0.00	
		Temperature	0.25	0.00	
		Total Organic Carbon (TOC)	0.25	0.00	
		Turbidity	0.25	0.00	
		Bacteriological Enterococci	1.00	0.00	
		Lab QA/QC Program	1.00	0.00	
52	6	Process Control Testing	3.00	936.00	
52	3	Sampling for Contracted Lab Services	0.25	39.00	
4	6	Sampling for Monitoring Groundwater wells	0.50	12.00	
		End of Chart 3 – Laboratory Operations SUBTOTAL:			**1182.00**

**Sampling time is built into testing time estimates.*

Begin Chart 4 – Biosolids/Sludge Handling

Unit Descriptons	# of Units	Process	Hours	Calculated	Subtotal
		Belt Filter Press	1.00	0.00	
		Plate & Frame Press	1.00	0.00	
		Gravity Thickening	0.25	0.00	
		Gravity Belt Thickening	0.25	0.00	
		Rotary Press	0.25	0.00	
		Dissolved Air Floatation	*X*		
		Alkaline Stabilization	0.25	0.00	
		Aerobic Digestion	0.50	0.00	
		Anaerobic Digestion	0.25	0.00	

		Centrifuges	1.00	0.00	
		Composting	1.00	0.00	
		Incineration	*X*		
		Air Drying – Sand Beds	0.50	0.00	
	0	Land Application	0.25	0.00	
	0	Transported Off-Site for Disposal	0.25	0.00	
		Static Dewatering	1.00	0.00	

End of Chart 4 – Biosolids/Sludge Handling SUBTOTAL: **0.00**

Begin Chart 5 – Yardwork

Unit Descriptons	# of Units	Process	Hours	Calculated	Subtotal
		Janitorial/Custodial Staff	100	0.00	
		Snow removal	60	0.00	
		Mowing	100	0.00	
# of vechicles		Vehicle Maintenance	25	0.00	
		Facility Painting	60	0.00	
		Rust removal	60	0.00	

End of Chart 5 – Yardwork SUBTOTAL: **0.00**

Begin Chart 6 – Automation/SCADA

Automation/SCADA	Yes/No
Automated attendant or Interactive voice recognition (IVR) equipment	No
Automated Meter Reading (AMR), Touchpad meters or other automated metering technology	No
Automatic Call Director (ACD)	No
Billing system	No
Computerized Facilities Management (FM) System	No
Computerized preventative maintenance	No
Computerized recordkeeping	No
E-mail	No
Geographical Information System (GIS)	No
Integrated purchasing and inventory	No
Internet website	No
Laboratory Information Management System (LIMS)	No
Local Area Network (LAN)	No
Supervisory Control and Data Acquisition (SCADA)	Yes
Telemetry	No
Utility customer information system (CIS) package	No

End of Chart 6 – Automation/SCADA

Begin Chart 7 – Considerations for Additional Plant Staffing

Activities	Yes/No

Management responsibilities (i.e., human resources, budgeting, outreach, training, town/city meetings, scheduling, etc.) and responsibility for clerical duties (i.e., billing, reports, correspondence, phones, time sheets, mailings, etc.)	**No**
Plant staff responsible for collection system operation and maintenance, pump station inspections, and/or combined sewer overflows	**Yes**
Plant operators responsible for snow plowing, road/sidewalk repair, or other municipal project	**No**
Plant staff involved in generating additional energy	**No**
Plant receives an extra high septage and/or grease load (higher than designed organic and grease loadings) or plant takes in sludge from other treatment plants	**No**
Plant is producing a Class A Biosolid product	**No**
Plant operators responsible for operating generators and emergency power	**No**
Plant responsible for industrial pre-treatment program	**No**
Plant staff responsible for plant upgrades and large projects done both on-site and off-site (i.e., collection systems, manholes, etc.)	**No**
Plant operators responsible for machining parts on-site	**No**
Age of plant and equipment (over 15 years of age)	**No**
End of Chart 7 – Considerations for Additional Plant Staffing	