WASHOE COUNTY

SOUTH TRUCKEE MEADOWS WATER RECLAMATION FACILITY FACILITY PLAN UPDATE

TECHNICAL MEMORANDUM NO. 1

EXECUTIVE SUMMARY

FINAL

January 2016

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WASHOE COUNTY

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EXECUTIVE SUMMARY

1.0 BACKGROUND

Washoe County's (County's) Facility Plan Update for the South Truckee Meadows Water Reclamation Facility (STMWRF) includes an update of the 2008 Facility Plan Update. The last facility Master Plan, titled *Draft Facility Plan Update South Truckee Meadows Water Reclamation Facility 6-mgd Expansion Project* (CH2M, April 2008), began in a period of significant economic and population growth, and was published at a time shortly thereafter where changes had taken place in economic growth, regulatory climate, wastewater quality, and treatment technologies.

STMWRF was originally constructed in 1991 as a 1.5 million gallon per day (mgd) secondary treatment facility. In 2003, the plant capacity was expanded to 4.1 mgd through the addition of a new oxidation ditch, four secondary clarifiers, tertiary filters, chemical building, and associated appurtenant structures. STMWRF is owned by Washoe County (County) and managed by the Washoe County Community Services Department (WCCSD). WCCSD Water Resources staff is responsible for preparing and maintaining a comprehensive Capital Improvement Program and has been proactive in identifying the need for direct evaluation and assessment of elements within the STMWRF and the Steamboat Creek Lift Station (SCLS). Carollo Engineers, Inc. (Carollo) was retained to provide engineering services that would identify potential improvements for the facility through year 2035.

The County has commissioned this STMWRF Facility Master Plan Update to evaluate the current design criteria, establish new criteria as appropriate, and make recommendations for the Capital Improvements Program (CIP). A series of technical memoranda (TM) have been prepared to analyze and document the findings and recommendations throughout this facility planning effort. The TM content is summarized in the following sections.

2.0 TM NO. 2: PLANNING FRAMEWORK

2.1 Wastewater Flow Projections

In order to adequately plan for future wastewater services, projections were completed based on historical wastewater flows, available flow monitoring data, anticipated population, and anticipated development within the service area.

Peaking factors are used to adjust average annual flows to peak hourly flows to correctly determine required infrastructure capacity. For collection systems, peaking factors help to conservatively size future pipes and lift stations to handle peak flows. Peaking factors help sized reclamation facilities to accommodate flows as well as loading rates that fluctuate from day to day. These peaking factors were calculated using 2014 STMWRF daily influent

flow data and the continuous eight months of data available from South Meadows permanent flowmeter.

The flow projection for each planning year was calculated by multiplying the projected population times the ERU flow of 237 gallons per day divided by the number of people per dwelling unit (2.56). The buildout flow projection was calculated using the total buildout acreage times the respective unit flow for each land use type, except for the vacant acreage which was assumed to be developed as single family residential land use.

Table 1.1 shows the projected average and peak flows for the STMWRF based on the near term growth projection flow curve. Figure 1.1 shows the historic and projected annual average daily wastewater flows in the STMWRF service area.

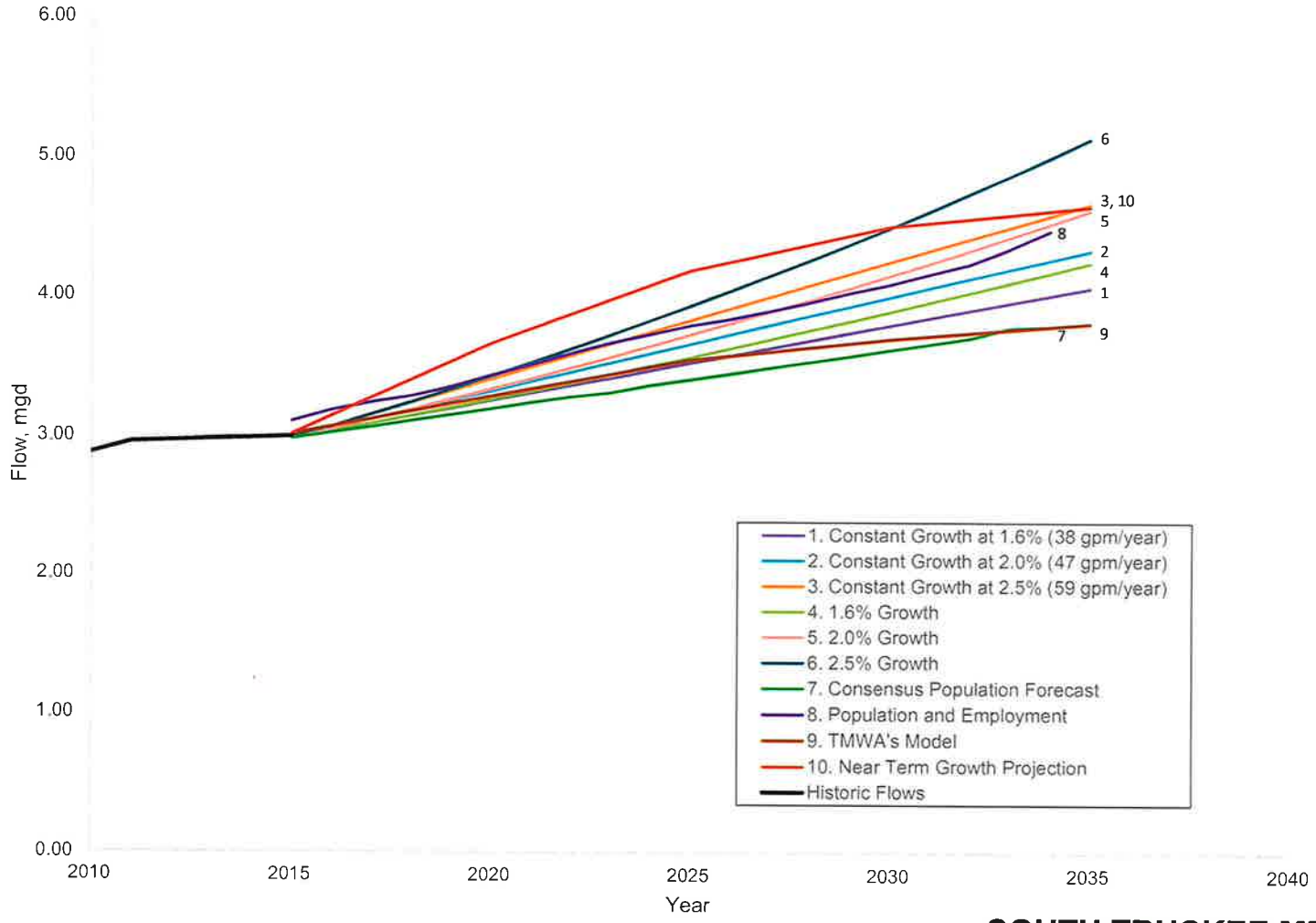
Table 1.1 Projected Wastewater Minimum, Average, and Maximum Flows STMWRF Facility Plan Update Washoe County

Year	Ave Flow, mgd	Max Month Flow, mgd	WW Peak Hour Flow, mgd	Total ERUs
2015	3.0	3.4	7.4	14,290
2020	3.6	4.0	8.9	17,150
2025	4.1	4.6	10.1	19,380
2030	4.4	4.9	10.8	20,730
2035	4.5	5.0	11.1	21,360
Buildout	11.6	13.0	28.7	42,963

2.2 Wastewater Characteristics

Influent wastewater quality parameters from August 2010 to July 2011 were collected and reviewed as part of the evaluation for STMWRF. Plant influent samples were taken at the plant headworks, before any of the internal process recycle flows are mixed with the raw wastewater. Concentrations of the following parameters were provided:

- Total Suspended Solids (TSS)
- Five-day Carbonaceous Biochemical Oxygen Demand (cBOD)
- Ammonia
- Total Kjeldahl Nitrogen
- Total Phosphorus



SOUTH TRUCKEE MEADOWS WATER RECLAMATION FACILITY FLOW PROJECTION

FIGURE 1.1

WASHOE COUNTY
STMWRF FACILITY PLAN UPDATE

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The influent wastewater characteristics were evaluated to determine the average wastewater constituent concentrations and peaking factors. For each constituent, the daily flow was multiplied by the corresponding concentration to obtain the daily load, which was then used for the load trending and peaking factor analysis. These parameters drive the capacity of the secondary treatment system and are critical elements of the plant evaluation completed as part of the facility plan update. Table 1.2 presents the adopted wastewater characteristics for this Facility Plan Update.

Table 1.2 Summary of Adopted Wastewater Characteristic Parameters STMWRF Facility Plan Update Washoe County

Parameter	2008 FP Planning Values	2015 FMP Planning Values
cBOD		
Concentration (mg/L)	327	327
Load Peaking Factor	1.45	1.45
TSS		
Concentration (mg/L)	256	276
Load Peaking Factor	1.54	1.54
Ammonia[(1)(2)]		
Concentration (mg/L)	-	33
Load Peaking Factor	-	-
Total Kjeldahl Nitrogen[(1)(2)]		
Concentration (mg/L)	-	56
Load Peaking Factor	-	-
Total Phosphorus as P[(1)(2)]		
Concentration (mg/L)	-	6.4
Load Peaking Factor	-	-

Notes:
(1) Average values do not include loads from centrate or any other recycle streams. Very limited data is available for analysis.
(2) Recommended values are for planning purposes only.

3.0 TM NO. 3: WASTEWATER COLLECTION SYSTEM EVALUATION

Model simulations of existing and future scenarios were used in this study to evaluate planned infrastructure or identify new infrastructure that should be added based on projected growth. The result of this analysis is a set of recommendations in a capital improvement plan that identifies the cost of specific improvements through planning year 2035.

The major wastewater collection system issues that the County will need to address in the near future is collection pipe capacity and collection pipes to new service areas. Currently the STMWRF collection system serves the western portion of the service area via gravity, and the eastern portion via the Steamboat lift station. In the near future, the County plans to serve the southern portion of the planning area by gravity with the Pleasant Valley Interceptor.

There are 142.5 miles of sewer pipe owned by Washoe County in the STM Basin. There are also sewer pipes that drain into the STM Basin that are owned by the City of Reno. Flow from City of Reno areas was used in the hydraulic model and to produce flow projections. The collection system has seven wastewater lift stations of various capacities. The County's hydraulic sewer model is a skeletonized representation of the collection system that only models the Steamboat Creek Lift Station.

A summary of the findings from the hydraulic modeling of the County's wastewater collection system are as follows:

1. The collection system and Steamboat Creek Lift Station has sufficient capacity in 2015.
2. By 2035, 3,520 feet of sewer main near Whitecliff Drive and Parma Way will need to be replaced with a 15-inch pipe. Prior to replacing this pipe flow monitoring should be undertaken to ensure that actual flows are consistent with modeled flows.
3. The Steamboat Creek Lift Station has sufficient capacity through 2035.
4. The Pleasant Valley interceptor can be constructed using smaller pipe diameters than the original design. Construction of new homes in the Reach 4 service area beginning in 2018 will require that the interceptor be in place by 2018.
5. The estimated project cost for the recommendations developed in this TM total approximately $11.9 million.

4.0 TM NO. 4: CONDITION ASSESSMENT

The primary goal for the evaluation and assessment is to visually evaluate the electrical, mechanical, and structural condition of the existing facilities and identify potential improvements. Carollo developed checklists to assist prior to the field review. The

checklists were used to document the condition of the facility and photos were taken to document the existing and deficient conditions provided throughout the evaluation. County Operations and Engineering staff, as well as the Contract Operator, SPB Utility Services, participated in the field review and assisted in the evaluation and provided valuable historical information to the field review team.

The field review was conducted on April 22, 2015. Weather and lighting conditions were favorable for the field review. Carollo evaluated the apparent condition of equipment using direct observation methods. As much as practicable, the team assessed the equipment by order of the treatment process. In May 2014, Carollo prepared an evaluation of the Chemical Storage Building facilities recommending rehabilitation and replacement of existing equipment and storage facilities. Therefore, condition assessment of the Chemical Storage Building was not part of this condition assessment effort.

The overall condition of the facility was observed to be significantly superior to many like facilities the Carollo team has evaluated. Much credit for the condition of the facility can be given to the proactive operators and operations and engineering staff that oversees the facility. Table 1.3 presents the recommended projects identified through the condition assessment effort. The estimated project cost for the recommendations presented in this TM total approximately $3.2 million.

Table 1.3 Summary of Rehabilitation Projects Needed within the Planning Period
STMWRF Facility Plan Update
Washoe County

Facility/Process	Equipment[1]	Condition[2]	Recommendation[2]
Steamboat Creek Lift Station	I	I&C equipment obsolete.	Phased replacement and upgrade.
Influent Pump Station	M	Splashing occurs at the top of screw pumps.	Design and add splash protection.
Influent Pump Station	E	Emergency stop button damaged on the west screw pump panel.	Replace
Manual Bar Screen	S	Coating failure in inlet and outlet channel.	Dewater, inspect, repair concrete damage, recoat.
Oxidation Ditch	S	Coating failure.	Dewater, inspect, repair concrete damage, recoat.

Table 1.3 Summary of Rehabilitation Projects Needed within the Planning Period STMWRF Facility Plan Update Washoe County			
Facility/Process	**Equipment[1]**	**Condition[2]**	**Recommendation[2]**
Oxidation Ditch	S	Cracking of concrete structure.	Repair cracks.
Oxidation Ditch	I	Probes and meters will reach end of life within 5-10 years.	Phased replacement.
Secondary Clarifier	S	Coating failure on units 2 and 3.	Dewater, inspect, repair concrete damage, recoat.
Secondary Clarifier	M	Algae buildup on launder weirs.	Evaluate brushes or covers for implementation.
Tertiary Filters	S	Cracking of concrete structure.	Repair cracks.
Tertiary Filters	I	Inlet channel level float inoperable.	Replace or repair.
Chlorine Contact Basin	S	Cracking of concrete structure.	Dewater, inspect, repair concrete damage.
Export Pump Station	M	Pump and piping drains supported by rope; Air release valves have garden hose vice hard piping to floor drains.	Design and replace piping.
Effluent Pump Station	S	Roof leak.	Conduct roof inspection and repair.
Effluent Pump Station	S	Joist above Pump 1 is twisted at electrical conduit attachment.	Reinforce joist and repair deformation.
Effluent Pump Station Electrical Room	M	AC unit freezes evaporative coil in air handler.	Replace AC unit.

Table 1.3 Summary of Rehabilitation Projects Needed within the Planning Period STMWRF Facility Plan Update Washoe County			
Facility/Process	**Equipment[1]**	**Condition[2]**	**Recommendation[2]**
Sand Drying and Sludge Dewatering Beds	--	Degraded.	Minimum refurbishment.

Notes:
(1) Type of Equipment: E = Electrical, I = Instrumentation, M = Mechanical, S = Structural.
(2) See TM No. 4 for additional detail on condition observations and recommendations for mitigation.

5.0 TM NO. 5: PLANT PERFORMANCE AND PROCESS MODEL

This TM summarizes the performance evaluation and process modeling analysis conducted for STMWRF. A capacity evaluation of the existing facility was performed using a combination of process modeling and engineering design criteria for specific unit processes. A biological process model was used to simulate process operation based on inputs for flow, loading, and other operating conditions at STMWRF. Outputs from the model included expected process effluent characteristics, process safety factors and allow able loading to prevent process failure.

5.1 Treatment Process Evaluation

A BioWin process model was configured for the existing oxidation ditch, secondary clarifiers, and tertiary filters at the STMWRF and was calibrated using routine operations and performance data and analyses of supplemental wastewater samples collected between July 23 and August 4, 2015. Very good agreement between all relevant calibration parameters and actual plant data was achieved after calibration was completed (deviation less than 10 percent).

5.1.1 Secondary Treatment Process Evaluation

The treatment capacity and performance of the existing secondary process was evaluated under the current design ADMMF (4.1 mgd) and projected 2035 ADMMF conditions (6.0 mgd) to meet the TN and ammonia treatment goal of less than 7 mg/L TN and less than 2 mg/L, respectively. The STMWRF process model was expanded to include the two aerobic digesters, recuperative rotary drum thickener, and screw press currently under construction to capture suspended solids and nutrient recycles. Simulation results confirm the current rated capacity of 4.1 mgd for the existing secondary treatment facility.

The secondary treatment expansion requirements were evaluation for the case that the facility receives in the future the 2035 projected flows (6.0 mgd ADMMF). Results indicate that the facility needs two additional equal sized oxidation ditches for a total of four ditches

in service. In order to realize the maximum capacity of the existing secondary clarifiers, a biological selector is recommended upstream of the oxidation ditches to improve reliable sludge settleability (i.e., reduce the SVI).

5.2 Summary of Capacity Rating of All Existing Facilities

Table 1.4 presents the peak capacity (all units in service) and firm capacity (standby units out of service) for process treatment and hydraulic conveyance for each of the major treatment processes based on the reliability and design criteria developed in TM No. 2.

Table 1.4 Capacity Rating of Existing Facilities
STMWRF Facility Plan Update
Washoe County

Treatment Process or Equipment	Peak Capacity (mgd)	Firm Capacity (mgd)	Comment / Reliability Criteria[1]
Influent Pumping	10.8	5.4	1 UIS + 1 Standby
Screening[2]	24.0	12.0	1 UIS + 1 Standby + 1 bypass channel with manual screen
Scum Pump Stations	1.03	0.78	3 UIS + 1 Standby
Secondary Treatment	NA	4.1 (ADMMF)	No Standby
RAS Pumping	11.52	9.21	4 UIS + 1 Standby
WAS Pumping	1.08	0.54	1 UIS + 1 Standby
Tertiary Filters[3]	10.4	6.7	No Standby
Chlorine Contact Basins[4]	14.7	11.0	3 UIS + 1 Standby
Effluent Pump Station	13.25	9.65	4 UIS + 1 Standby

Notes:
(1) UIS = Unit In-Service; Standby Unit assumed to be largest unit.
(2) Based on 12 mgd peak hour capacity of each screen and ADMMF capacity of 4.1 mgd.
(3) Based on loading rates of 5.0 gpm/sf for peak and 2.9 gpm/sf for ADMMF (2008 Facility Plan).
(4) Capacity is based on assumption of 30 minute chlorine contact time, and adequate chlorine dose to achieve required contact time.

5.3 Optimization Opportunities

Optimization opportunities for current process operation were identified with the goal of enhancing STMWRF effluent quality and for identifying opportunities for labor, power, and chemical cost savings.

Table 1.5 summarizes the optimization opportunities recommended for implementation at STMWRF. Opportunities selected for field implementation are summarized in TM No. 5.

Table 1.5 Identified Optimization Opportunities at STMWRF STMWRF Facility Plan Update Washoe County		
Treatment Process or Equipment	**Opportunity**	**Recommendation**
General	Influent Data Collection	Data collection plan that includes long-term sampling and historical trending of these influent constituents: COD, cBOD, TSS, VSS, pH, alkalinity, ammonia, TKN, total phosphorus, and orthophosphorus.
Oxidation Ditches and Aeration System	DO Profile Sampling	Additional DO profile sampling will verify that the existing aeration control scheme is adequate for peak flow and load, low flow and load, and all diurnal conditions. Cost savings may be realized through more robust instrumentation and control.
Oxidation Ditches and Aeration System	Alternative Ammonia Probes	Assess whether newer equipment may be more reliable and less maintenance intensive in the oxidation ditch environment compared to the current product used. Ammonia probe controlled aeration should further optimize aeration and subsequently reduce aeration cost.
Oxidation Ditches and Aeration System	Assess Fine Bubble Diffuser System	Confirm adequate capacity to supply the necessary oxygen transfer efficiency under projected 2035 ADMMF and loads.
Oxidation Ditches and Aeration System	Daily MLSS and MLVSS Analysis	Conduct several times per week and/or consider a TSS probe installation in the oxidation ditches to improve on solids inventory and tSRT management. Stabilizing solids wasting is critical to maintain low and consistent effluent ammonia.
Secondary Clarifiers	Reduce Algae Growth	Replace or rehab existing chlorine rings in clarifiers to reduce the algae formation in secondary clarifiers effluent launders.
Tertiary Filters	TSS Monitoring	Begin continuous monitoring of secondary effluent turbidity upstream of the filters and filter effluent to understand the performance of the filters particularly during times when the secondary clarifiers are stressed due to high flow rates, high MLSS concentrations, and/or poor sludge settleability

Table 1.5 Identified Optimization Opportunities at STMWRF STMWRF Facility Plan Update Washoe County		
Treatment Process or Equipment	**Opportunity**	**Recommendation**
Tertiary Filters	Coagulation of Filter Influent	Coagulation of filter influent should increase the performance of the filters. For effective and cost-efficient coagulation, pH adjustment for the filter influent will be required.
Tertiary Filters	Filter Media Assessment	Assess the media by analyzing its effective grain size for better particle capture, perform thorough filter media cleaning for possible mud accumulation in the filters, and implement a periodic chlorine shock to reduce biological growth.
Tertiary Filters	Chemical Phosphorus Removal	Should additional phosphorus removal be desired or required, a pilot study could be initiated to assess the filter capacity under addition of metal coagulants upstream of the filters for chemical phosphorus removal.
Tertiary Filters	EcoWash® Installation	Based on pilot and full-scale testing that has been conducted at other locations, it is likely that installing the EcoWash® system at STMWRF would likely reduce the backwash water generated by up to 50 percent (up to 0.24 mgd). Pilot testing is recommended to verify the actual reduction in backwash water generated.
Tertiary Filters	Pre-Conditioning/Algae Removal	Implementation of a DAF process as pre-treatment to filter influent could decrease solids loads and increase performance of the filters.
Chlorine Contact Basins	pH Investigation	Further investigation of the causes for elevated pH in tertiary effluent and its impact on disinfection performance
Chlorine Contact Basins	Additional Instrumentation and Control	Provide online chlorine analyzer (or online surrogate analyzer) immediate down stream of chlorine injection point. Using proposed analyzer to control the chlorine dosage through basins may reduce the chlorine dosages and provide better control on residuals.

6.0 TM NO. 6: FACILITY PLAN

The purpose of this TM is to identify and evaluate alternative processes, which could be implemented at STMWRF. Alternative secondary treatment processes will be identified and discussed in regards to their required components, advantages and disadvantages, and potential capital and/or operation costs. Alternative filter methods and configurations will also be presented.

6.1 Hydraulic Evaluation

The hydraulic model for STMWRF was reviewed and updated to reflect current process and flow conditions. The purpose of the hydraulic evaluation was to identify potential pinch points or hydraulic limitations in the liquids treatment process train. The hydraulic modeling results indicate that all sections of the plant can satisfactorily convey the design ADMMF and PHF flow conditions. No hydraulic bottlenecks were identified during hydraulic model runs at these conditions.

Future flow conditions were also modeled with the addition of secondary and tertiary treatment processes as recommended. Similarly, no hydraulic bottlenecks were identified during hydraulic model runs at these conditions.

6.2 Proposed Expansion Plan

The major facility improvements needed to handle a 6.0 mgd ADMMF and 13.3 mgd peak hour flows include a new perforated plate screen, anaerobic selector zone upstream of the oxidation ditches, two additional oxidation ditches, a new DAF system to remove algae prior to tertiary filters, and four new tertiary filters. The new process units are planned to be similar to the existing facilities in terms of footprint and capacity. Table 1.6 summarizes the existing, planned, and future facilities required for the projected flows in 2035. Figure 1.2 shows the general site layout for the new facilities. The estimated project cost for the recommendations presented in this TM total approximately $41.9 million.

STMWRF - EXPANSION PLAN AND LAYOUT

FIGURE 1.2

WASHOE COUNTY
STMWRF FACILITY PLAN UPDATE

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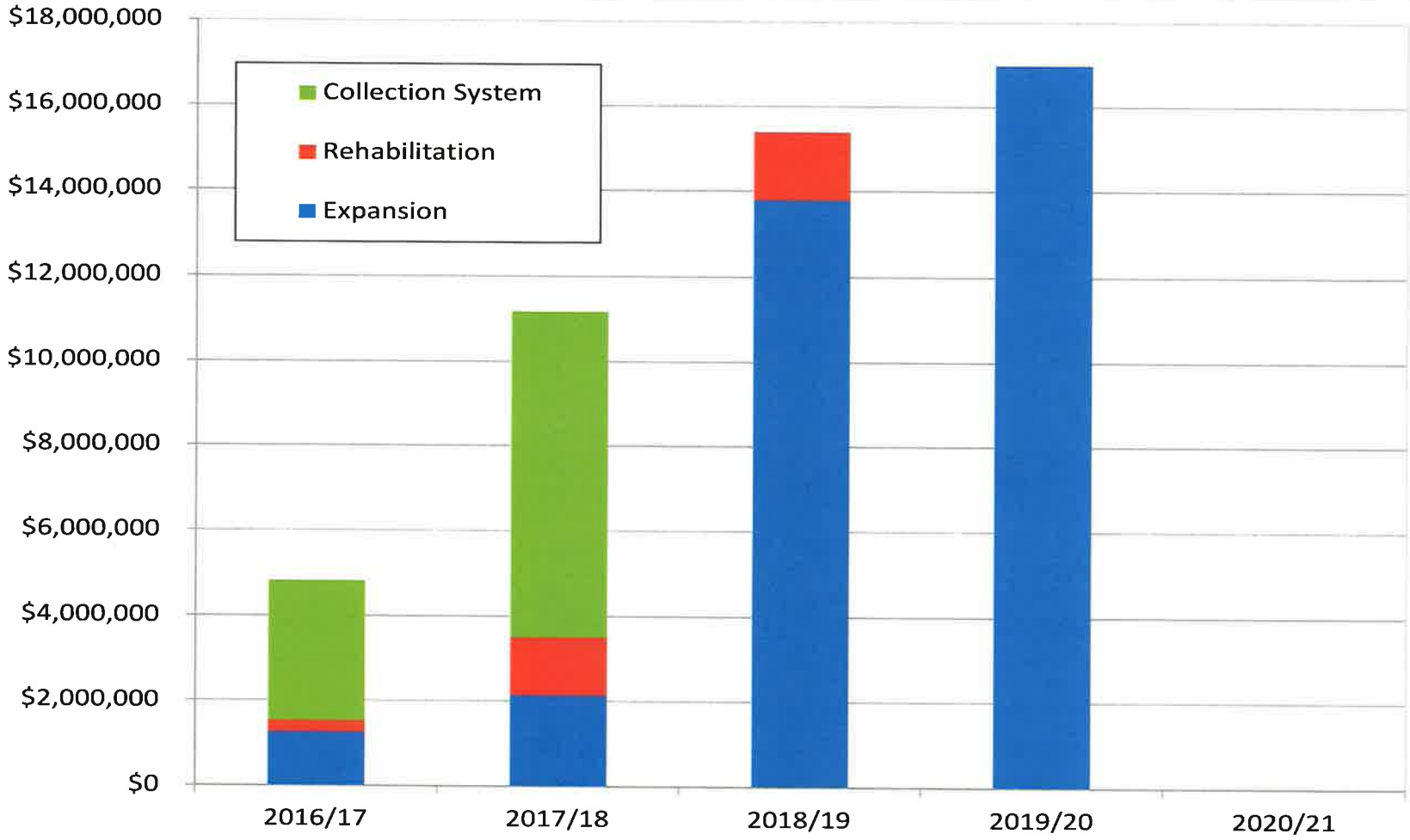
Table 1.6 Summary of Facilities Needed within the Planning Period STMWRF Facility Plan Update Washoe County			
Facility/Process	**No. Existing[1]**	**No. Future Required[2]**	**Total Required[3]**
Headworks Screw Pumps	2	1	3
Anaerobic Basin	-	1	1
Oxidation Ditches	2	2	4
Secondary Clarifiers	4	0	4
DAF System	-	1	1
Tertiary Filters	8	4	12
Chlorine Contact Basins	4	0	4
Effluent Pumps[4]	5	1	6
Export Pumps	5	1	6

Notes:
(1) Existing facilities are operational, under design, or under construction as of January 2015.
(2) Future facilities are required to treat average day maximum month flows of 6 mgd.
(3) Total number of each type of facility for treating 6 mgd ADMMF and 13.3 mgd peak.
(4) Expansion of existing with larger pumps.

7.0 TM NO. 7: OVERALL CIP AND IMPLEMENTATION PLAN

Table 1.7 through 1.9 summarizes the recommended project budgets and fiscal years for the collection system, rehabilitation and renewal, and process expansion projects described in this Facility Plan Update. Figures 1.3 and 1.4 present the 5- and 20-year capital expenditures for STMWRF. Figure 1.5 depicts the cumulative capital expenditures over the 20-year planning period.



5-YEAR PROJECTED CAPITAL EXPENDITURE FOR STMWRF

FIGURE 1.3

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STMWRF FACILITY PLAN UPDATE

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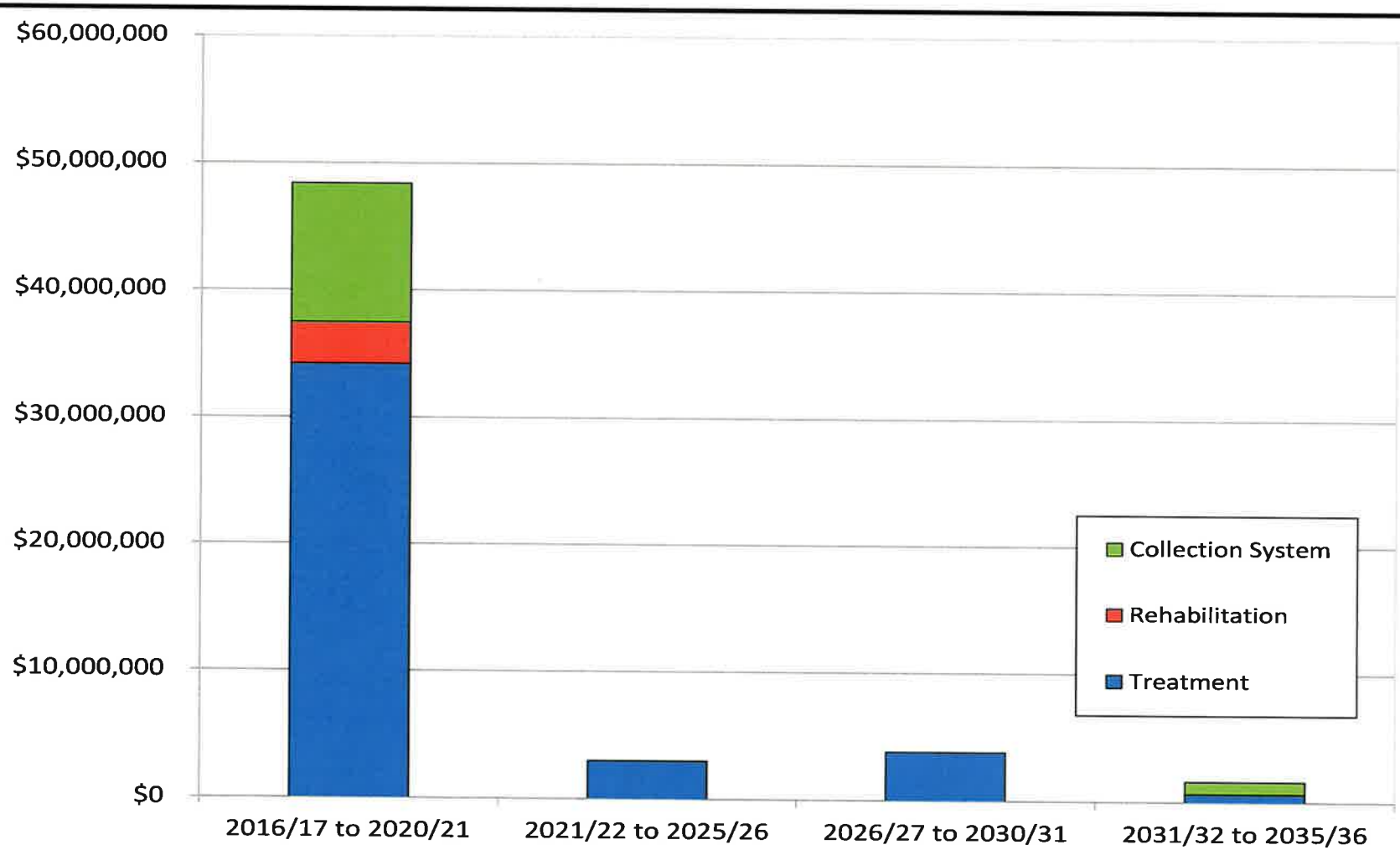

20-YEAR PROJECTED CAPITAL EXPENDITURE FOR STMWRF

FIGURE 1.4

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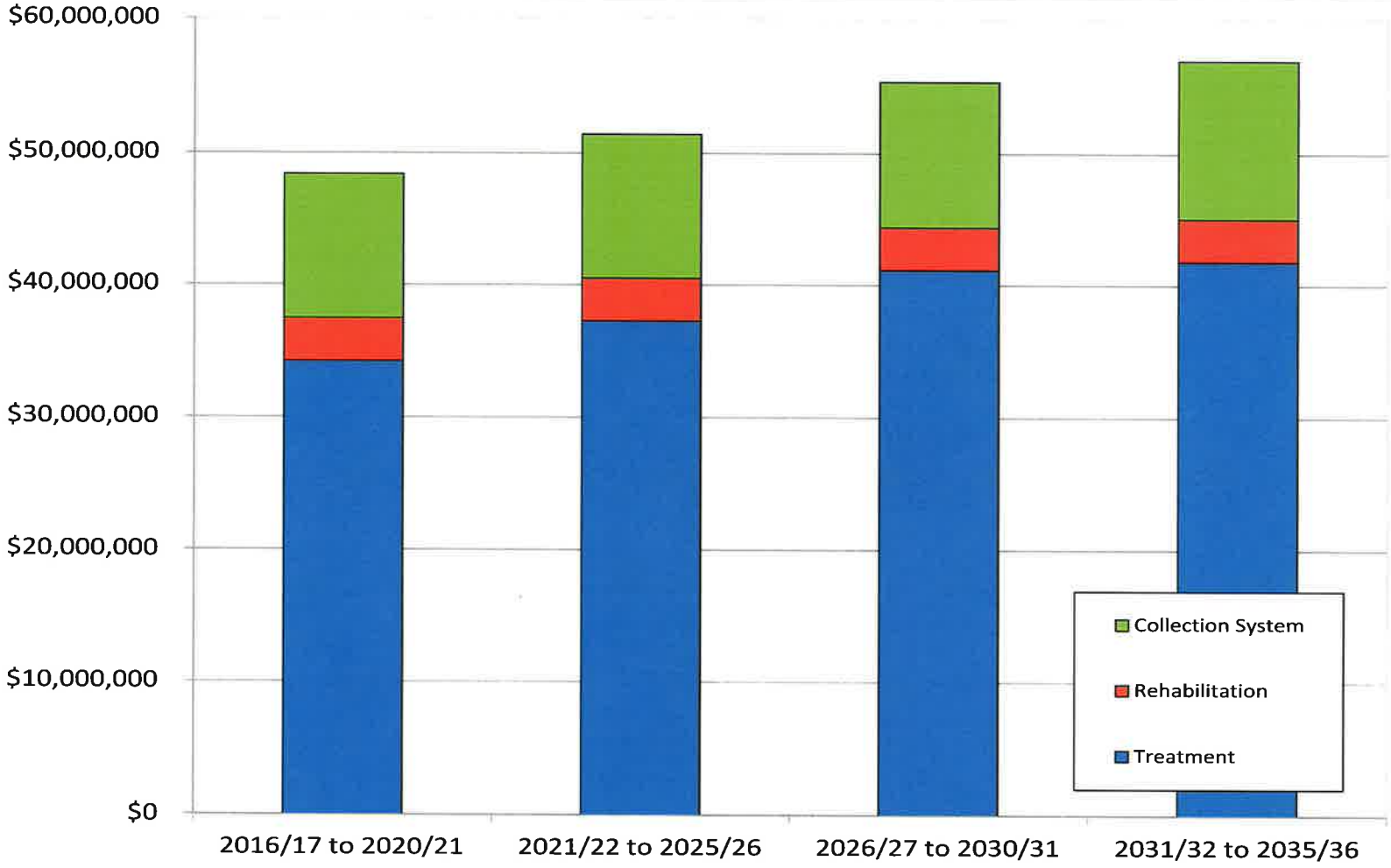

20-YEAR CUMULATIVE COSTS FOR STMWRF

FIGURE 1.5

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Table 1.7 Cost Estimates for Wastewater Collection System Projects STMWRF Facility Plan Update Washoe County		
Facility	**Year Needed**	**Cost[1] ($, millions)**
Pleasant Valley Interceptor Reach 3A[2]	2018	1.3
Pleasant Valley Interceptor Reach 3B[2]	2018	4.3
Pleasant Valley Interceptor Reach 4[2]	2018	5.3
3,520 feet of 15-in Sewer Main Near Whitecliff Drive and Parma Way	2035	1.0
Total Project Cost		**11.9**

Note:
(1) Cost based on December 2015 dollars, includes engineering design, inspection, and project management.
(2) See TM 3 for additional detail.

Table 1.8 Cost Estimates for STMWRF Rehabilitation and Renewal Projects STMWRF Facility Plan Update Washoe County		
Project Identification	**Year Needed**	**Cost[1] ($, M)**
Structural Rehabilitation and Renewal Projects	2019	2.7
Other Rehabilitation and Renewal Projects	2017	0.5
Total Project Cost		**3.2**

Note:
(1) Cost based on December 2015 dollars.

Table 1.9 Cost Estimates for STMWRF Expansion Projects STMWRF Facility Plan Update Washoe County		
Facility	**Year Needed**	**Cost[1] ($, millions)**
Influent Raw Wastewater Conveyance – Screw Pumps	2020	2.4
Preliminary Treatment Facilities – Screen No. 3	2032	1.5
Secondary Treatment Facilities – Anaerobic Zone and Two Oxidation Ditches	2020	22.4
Tertiary Filtration Pre-conditioning – DAF	2018	9.4
Tertiary Filtration Facilities – Four Tertiary Filters	2027	6.2
Total Project Cost		**41.9**

Note:
(1) Cost based on December 2015 dollars.