TAHOE-TRUCKEE SANITATION AGENCY

REGULAR BOARD MEETING

FEBRUARY 21, 2024

TAHOE-TRUCKEE SANITATION AGENCY
A Public Agency
13720 Butterfield Drive
TRUCKEE, CALIFORNIA 96161
(530) 587-2525 • FAX (530) 587-5840
www.ttsa.ca.gov

BOARD OF DIRECTORS
REGULAR MEETING NOTICE AND AGENDA

Date: February 21, 2024
Time: 9:00 AM
Place: Board Room, Tahoe-Truckee Sanitation Agency, 13720 Butterfield Drive, Truckee, California

All or portions of this meeting will be conducted by teleconferencing in accordance with Government Code section 54953(b). The following is the teleconferencing location: 647 Broadway, Dunedin, FL. 34698. This location is accessible to the public, and members of the public may listen to the meeting and address the Board of Directors from the teleconference location.

Public comments will be accepted by the Board and should be submitted to Roshelle Chavez, Board Clerk, at rchavez@ttsa.ca.gov, by mail at 13720 Butterfield Drive, Truckee, CA 96161 (the final mail collection before the meeting will be the Tuesday before the meeting at 3:00 p.m.), on any item on the agenda.

Members of the public will have the opportunity to directly address the Agency Board of Directors concerning any item listed on the Agenda below before or during consideration of that item. To better accommodate members of the public and staff, some Agenda items may be considered in an order different than listed below.

I. Call to Order, Roll Call, and Pledge of Allegiance

II. Public Comment Discussion items only, no action to be taken. Any person may address the Board at this time upon any subject that is within the jurisdiction of Tahoe-Truckee Sanitation Agency and that does not appear on the agenda. Any matter that requires action may be referred to staff for a report and action at a subsequent Board meeting. Please note there is a five (5) minute limit per person. In addition to or in lieu of public comment, any person may submit a written statement concerning Agency business to be included in the record of proceedings and filed with the meeting minutes. Any such statement must be provided to the recording secretary at the meeting

III. Professional Achievements, Awards, Anniversaries, and Acknowledgements of staff for professional achievements and other awards

IV. Consent Agenda Consent Agenda items are routine items that may be approved without discussion. If an item requires discussion, it may be removed from the Consent Agenda prior to action

1. Approval of the minutes of the Regular Board meeting on January 17, 2024
2. Ratify payment of General Fund Warrants
3. Ratify approval of Financial Statements

V. Regular Agenda

1. Presentation and Discussion of Proposed Nutrient Removal Alternatives Study
2. Approval of Consultant Services to Develop Network Upgrade Preliminary Design Report for the SCADA/IT Master Plan
3. Approval to Award Procurement of SCADA/IT Server Upgrade & Replacement
4. Presentation of the SCADA/IT Master Plan Standards – Phase 1
5. Placer County LAFCO Notice of Upcoming Vacancies and Call for Nominations

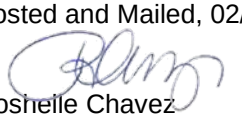
VI. Management Team Reports

1. Department Reports
2. General Manager Report

VII. Board of Director Comment Opportunity for directors to ask questions for clarification, make brief announcements and reports, provide information to staff, request staff to report back on a matter, or direct staff to place a matter on a subsequent agenda

VIII. Adjournment

Posted and Mailed, 02/14/2024.



Roshelle Chavez
Executive Assistant/Board Clerk

In compliance with the Americans with Disabilities Act, if you are a disabled person and you need a disability-related modification or accommodation to participate in this meeting, then please contact Roshelle Chavez at 530-587-2525, 530-587-5840 (fax), or email rchavez@ttsa.ca.gov. Requests must be made as early as possible, and at least one-full business day before the start of the meeting.

Documents and material relating to an open session agenda item that are provided to the T-TSA Board of Directors less than 72 hours prior to a regular meeting will be available for public inspection and copying at the Agency's office located at 13720 Butterfield Drive, Truckee, CA.

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Richard Pallante, General Manager
Item: I
Subject: Call to Order, Roll Call, and Pledge of Allegiance

Background

Call to Order, Roll Call, and Pledge of Allegiance.

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Richard Pallante, General Manager
Item: II
Subject: Public Comment

Background

Discussion items only, no action to be taken. Any person may address the Board at this time upon any subject that is within the jurisdiction of Tahoe Truckee Sanitation Agency and that does not appear on the agenda. Any matter that requires action may be referred to staff for a report and action at a subsequent Board meeting. There is a five (5) minute limit per person.

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Vicky Lufrano, Human Resources Administrator
Item: III
Subject: Professional Achievements, Awards and Anniversaries

Background
Acknowledgement of staff for professional achievements, awards and anniversaries received the previous calendar month or quarter.

Achievements and Promotions

- Kevin Demm – New Employee – Purchasing Agent II

Acknowledgements

On February 13, 2024, while returning to the plant from a work-related errand, Mark Messerschmidt noticed an unusual black smoke billowing out of the boiler smokestack. After investigating further, Mark reported the anomaly to his supervisor. It was subsequently discovered that a part had failed on the air control damper and that the diesel fuel was not burning efficiently. While we will never know what events were prevented, it is worth acknowledging Mark for his awareness and quick action. Had Mark not noticed and reported the situation it is possible that the built-up fuel could have resulted in an explosion severely damaging equipment and possibly injuring staff.

Fiscal Impact
None.

Attachments
None.

Recommendation
No action required.

Review Tracking

Submitted By: _____
Vicky Lufrano
Human Resources Administrator

Approved By: _____
Richard Pallante
General Manager

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Roshelle Chavez, Executive Assistant/Board Clerk
Item: IV-1
Subject: Approval of the minutes of the Regular Board meeting on January 17, 2024

Background
Draft minutes from previous meeting(s) held are presented to the Board of Directors for review and approval.

Fiscal Impact
None.

Attachments
Minutes of the Special Board meeting on January 17, 2024.

Recommendation
Management and staff recommend approval of the minutes of the Special Board meeting on January 17, 2024.

Review Tracking

Submitted By: Roshelle Chavez
Roshelle Chavez
Executive Assistant/Board Clerk

Approved By:
Richard Pallante
General Manager

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BOARD OF DIRECTORS
REGULAR MEETING MINUTES

January 17, 2024

I. Call to Order

President Tresan called the special meeting of the Tahoe-Truckee Sanitation Agency Board of Directors to order at 9:00 A.M. Roll call and Pledge of Allegiance followed.

Directors Present:
Blake Tresan, TSD
Scott Wilson, NTPUD (via teleconference)
Dan Wilkins, TCPUD
Dale Cox, OVPSD (via teleconference)
David Smelser, ASCWD

Staff Present:
Richard Pallante, General Manager
Roshelle Chavez, Executive Assistant/Board Clerk
Vicky Lufrano, Human Resources Administrator
Michael Peak, Operations Manager
Paul Shouse, Maintenance Manager
Jason Hays, Technical Services Manager
Andrew Ramos, Agency Counsel (via teleconference)
Greg O'Hair, Chief Plant Operator
Luke Swann, IT Supervisor
Michelle Mackey-Adams, Accounting Supervisor
Celeste Graves, Administration Department
Scott Fleming, Engineering Department
Ryan Schultz, Maintenance Department
Tanner McGinnis, Maintenance Department
Jaime Garcia, Maintenance Department
Soraya Bedout-Morz, Maintenance Department

II. Public Comment

There was no public comment. No action was taken by the Board.

III. Professional Achievements, Awards, and Anniversaries

Ms. Lufrano acknowledged Agency staff who received promotions in the month of December; Brad Beattie, who achieved his Operator III Certification. Luke Swann was promoted to IT Supervisor, and Jason Hays who was promoted to Technical Services Department Manager. Ms. Lufrano also congratulated Jaime Garcia, who was celebrating his five (5) year employment anniversary.

Additionally, there were several staff members who received fourth quarter safety awards; Zeb Snyder, Dean Haines, Brad Beattie, and Scott Wilcox. The Board acknowledged and congratulated staff for their achievements.

IV. Consent Agenda

1. Approval of the minutes of the Special Board meeting on December 5, 2023

2. Ratification of approval of General Fund Warrants

3. Ratification of approval of Financial Statements

MOTION by Director Smelser **SECOND** by Director Wilkins to approve the Consent Agenda; unanimously approved.

The Board approved the motion by the following vote:

AYES:	Directors Cox, Wilson, Smelser, Wilkins and President Tresan.
NOES:	None.
ABSENT:	None.
ABSTAIN:	None.

Motion approved.

V. Regular Agenda

1. Discussion and Update on the Classification and Compensation Study

Ms. Lufrano provided an update on the Classification and Compensation Study to the Board of Directors. Staff selected a peer observation group to review study information with management and Gallagher (formerly Koff & Associates) and in turn report back to their select staff groups. Gallagher will be joining the February Board of Directors meeting via Zoom to review two topics for discussion; (1) Selecting which employee basis to use as a reference point for salary compensation, Classic or PEPRA, and (2) Finalizing a list of comparable agencies.

The employee observation group submitted a list of comparable agencies to Gallagher for the compensation portion of the study. Those agencies are; Delta Diablo, Monterey One Water, Union Sanitary District, Central Contra Costa Sanitary District, Dublin San Ramon Sanitary District, Fairfield Suisun Sewer District, Oro Loma Sanitary District, Napa Sanitation District, Silicon Valley Clean Water, West County Wastewater District, Carmel Area Wastewater District, Mammoth Community Wastewater District, El Dorado Wastewater District, North Tahoe PUD, Tahoe City PUD, and Truckee Sanitary District.

Gallagher will make suggestions on the list of comparable agencies. Additionally, Director Wilkins requested to have a copy of the list used in the previous Comp/Class study as a point of reference. Ultimately, the Board will review the list to make a final selection so that Gallagher can proceed with the study following the February Board meeting. The completion of the study remains to be July 2024, therefore they are working on a tight deadline.

A majority of staff left the meeting following this item.

2. Presentation on Suitability of Standard EDU Assumptions

Mr. Hays provided a PowerPoint presentation to staff and the Board of Directors regarding Suitability of Standard EDU Assumptions. Historically, T-TSA has used a value of 200 gallons per day to estimate the hydraulic impact of each equivalent dwelling unit (EDU) to the facility. Empirical data has indicated that the facility rarely reaches this level of hydraulic loading from committed EDUs.

Staff was tasked with assessing the hydraulic and nutrient load impact of each EDU on the facility to determine the suitability of using the 200 gal/day value for purposes of billing, planning, and emergency preparedness. Data dating from the mid-1980s was assessed to correlate flows and individual nutrient constituents and compare them to plant design criteria.

After reviewing plant data, it was clear that wastewater flow to the plant has remained steady with seasonal flow spikes typically appearing late winter and early spring, which is likely related to I&I events. Nitrogen and BOD loading to the plant, likewise, has steadily increased with seasonal peaks aligning in the summer months to represent higher occupancy.

The plant design calls for a max BOD loading of 17,300lbs/day and Nitrogen max of 3,440lbs/day (or 0.072 lbs/EDU). When you compare the Nitrogen lbs/day for each EDU the data has remained relatively steady. The Agency (plant) permit is at a max of 9.6MGD; 22,400 lbs/day BOD; 200 gpd = 48,000 EDU. The plant will reach Max design BOD leading capacity at 48,000 EDUs regardless of changes in gallons per EDU. In the wastewater treatment industry although Nitrogen loading is a more mathematically accurate measurement, it is not widely used as the 200 gpd/EDU measurement standard is.

3. Presentation and Discussion of Agency Sewer Connection Fee Study by HDR Engineering, Inc

Mr. Shawn Koorn of HDR Engineering, Inc. provided an update of the Agency Connection Fee Study with a PowerPoint presentation. Since the previous meeting with the entire Board of Directors at the October 18, 2023 Board meeting Mr. Koorn has been meeting with Agency staff and the Finance Committee to further refine data within the study. There was discussion and questions for clarification. The Board had additional questions regarding actual values of existing and future capacity that was clarified by the previous EDU assumption presentation. These assumptions will be added to the Sewer Connection Fee Study for additional transparency for all constituents.

Mr. Koorn will provide the updated and final Sewer Connection Fee Study to staff and the Board prior to the February Finance Committee meeting and Board of Directors meeting for review. At the February Board of Directors meeting the Board will review and consider approving the Sewer Connection Fee Study and management will provide a recommendation to the Board of Directors for implementation.

The Board took a five minute recess and returned at 10:48 A.M.

4. Presentation and Discussion on Request to Update Waste Discharge Requirements (WDR)

Mr. O'Hair provided staff and the Board of Directors with a PowerPoint presentation regarding the current status on the update to the Agency Waste Discharge Requirements (WDR) permit. Staff and management submitted the request for revision cover letter for legal review prior to submitting to Lahontan Regional Water Quality Control Board.

Requests for the revision included:

1. WDR, Section C-4: Ground water pH as measured at well 31, consider eliminating or revising pH limits for well 31 due to fluctuations in ground water chemistry and biology.
2. WDR, Section C-1 and C-2: Receiving Water Limitations, consider removal of receiving water limits as this can be directly influenced by other upstream sources outside of T-TSA's control.
3. MRP, Treatment Plant Monitoring: Effluent Monitoring, consider using Fecal Coliform instead of Total Coliform for effluent monitoring (as well as discharge requirements).

Additional revisions include:

- Add definition to Arithmetic Mean of Monthly Means and provide a defined time frame.
- Provide more direction of on flow measurements for each district.

- For example: How to calculate “Daily Peak flow rate” for calculations.
- Change semi-annual TRI Q meter calibration to an annual calibration.
- Change the specific day of the week (Sun and Wed) of reporting requirement for Influent COD, BOD, TSS, TN and TP to 2/week or weekly.
- Change reporting frequency of Temperature and Nitrate on Truckee River and Martis Creek from 2/month to Monthly.
- Removal of Periphyton and Benthic Invertebrates testing. If not removed, provide method of procedure to be used in place.
- Removal of the annual Trend Analysis Report requirement.
- General updates to wording, plant processes, lab procedures, typos, etc.

Staff was advised to expect a response as early as six months but it could take longer and new plant applicants receive responses sooner than updated plant applicants. As soon as the new permit was approved and received it would be relayed to the Board.

VI. Management Team Reports

1. Department Reports

Mr. O’Hair provided an update on the Operations department.

Mr. Shouse provided an update on the Maintenance department.

Mr. Hays provided an update on the Technical Services department.

Mr. Pallante provided an update on the Administration department.

No action was taken by the Board.

2. General Manager Report

Mr. Pallante provided an update on the status of various ongoing projects, none of which required additional action by the Board.

VII. Board of Directors Comment

Director Cox inquired about what year it was that the $5,000 Sewer Connection Fee rate was instated. Mr. Pallante said he would inquire with staff and forward that information to the Board.

President Tresan thanked the Administration staff for their work with the recent and sudden exit of their department manager.

VIII. Adjournment

There being no further business, the meeting was adjourned at 11:41 A.M.

By:

_____
Richard Pallante, General Manager

Date:
Approved: _____

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Michelle Mackey, Accounting Supervisor
Item: IV-2
Subject: Ratification of General Fund Warrants

Background

The report of General Fund Warrants is attached as prepared by Agency accounting software. It should be noted, payroll summaries are excluded from the General Fund Warrants and are incorporated into the Financial Statements.

Fiscal Impact

Decrease in Agency funds per the warrant amounts.

Attachments

Report of General Fund Warrants.

Recommendation

Management and staff recommend the Board of Directors approve the Ratification of the payment of the General Fund Warrants.

Review Tracking

Submitted By: Michelle Mackey
Michelle Mackey
Accounting Supervisor

Approved By:
Richard Pallante
General Manager

Payee	Check Number	Check Issue Date	Description	Amount
AIRGAS USA LLC				
	90699	01/25/2024	CYLINDER RENTALS	92.65
	90699	01/25/2024	CYLINDER RENTALS	89.83
Total AIRGAS USA LLC:				182.48
ALESHIRE & WYNDER LLP				
	90700	01/25/2024	DECEMBER 2023 FEES	11,754.50
Total ALESHIRE & WYNDER LLP:				11,754.50
ALPHA ANALYTICAL INC				
	90644	01/11/2024	SOIL TESTING	310.00
	90644	01/11/2024	SOIL TESTING	475.00
	90644	01/11/2024	LAB TESTING	160.00
	90644	01/11/2024	LAB TESTING	390.00
	90644	01/11/2024	LAB TESTING	65.00
	90644	01/11/2024	LAB TESTING	65.00
	90644	01/11/2024	LAB TESTING	65.00
	90644	01/11/2024	LAB TESTING	585.00
Total ALPHA ANALYTICAL INC:				2,115.00
ANNIE'S CLEANING SERVICE				
	90645	01/11/2024	DECEMBER 2023 JANITORIAL SERVICE	4,766.67
Total ANNIE'S CLEANING SERVICE:				4,766.67
AT&T 530 582-0827 966 5				
	90646	01/11/2024	TELEPHONE BILL 90%	1,327.76
	90646	01/11/2024	TELEPHONE BILL 10%	147.52
Total AT&T 530 582-0827 966 5:				1,475.28
AT&T 831-000-9983 804				
	90701	01/25/2024	TELEPHONE BILL 10%	137.04
	90701	01/25/2024	TELEPHONE BILL 90%	1,233.36
Total AT&T 831-000-9983 804:				1,370.40
AWAXX SYSTEMS INC.				
	90702	01/25/2024	CARD READER	242.48
Total AWAXX SYSTEMS INC.:				242.48
BARTKIEWICZ, KRONICK & SHANAHAN				
	90703	01/25/2024	NOVEMBER LEGAL FEES	3,852.50
	90703	01/25/2024	DECEMBER LEGAL FEES	3,049.75
Total BARTKIEWICZ, KRONICK & SHANAHAN:				6,902.25
BLUE WHITE				
	90704	01/25/2024	FLOWMETER	2,618.92
	90704	01/25/2024	QUICK DISCONNECT	1,253.56
Total BLUE WHITE:				3,872.48

Payee	Check Number	Check Issue Date	Description	Amount
CAROLLO				
	90647	01/11/2024	SEPTEMBER GENERAL SERVICES	1,323.00
	90647	01/11/2024	OCTOBER CONTRACT SERVICES	7,957.75
	90647	01/11/2024	NOVEMBER GENERAL SERVICES	7,426.50
	90705	01/25/2024	LAND USE RISK ANALYSIS STUDY	10,111.50
Total CAROLLO:				26,818.75
CASELLE				
	90706	01/25/2024	SUPPORT & MAINTENANCE FEB 2024	3,631.00
Total CASELLE:				3,631.00
CASHMAN EQUIPMENT CO.				
	90648	01/11/2024	PLATE, CLAMP, ELBOW	161.86
	90648	01/11/2024	COUPLINGS	47.47
	90648	01/11/2024	HOSE, COUPLINGS	135.83
	90648	01/11/2024	SODIUM HYPOCHLORITE TANK RENTAL	3,758.57
	90707	01/25/2024	HOSES AND COUPLINGS	135.83
	90707	01/25/2024	RING, SEAL, BRACKETS	704.77
	90707	01/25/2024	SODIUM HYPOCHORITE TANK RENTAL	3,758.57
Total CASHMAN EQUIPMENT CO.:				8,702.90
CDW-G				
	90649	01/11/2024	TONERS	230.05
	90649	01/11/2024	TONERS	111.96
	90649	01/11/2024	TONERS	111.96
	90649	01/11/2024	TONERS	111.96
	90649	01/11/2024	TONERS	189.69
	90649	01/11/2024	TONERS	103.21
	90649	01/11/2024	FORTINET CARE SWITCH	1,250.65
	90649	01/11/2024	FORTINET FORTICARE	340.08
	90708	01/25/2024	AXIOM 10GBASE-SR SFP+ TRANSCEIVER	612.22
	90708	01/25/2024	AXIOM-SFP+TRANSRECEIVER MODULE	236.45
	90708	01/25/2024	AXIOM LC-LC-MULTIMODE DUPLEX	58.28
	90708	01/25/2024	AXIOM LC-LC MULTIMIDE DUPLEX	34.54
Total CDW-G:				3,391.05
CHARD SNYDER & ASSOCIATES				
	1222401	01/22/2024	HRA2	35.00
	1222401	01/22/2024	HRA	60.00
	1222401	01/22/2024	HRA	21.78
	1222401	01/22/2024	HRA	350.00
	1222401	01/22/2024	HRA	35.00
	1222401	01/22/2024	HRA2	15.00
	1222401	01/22/2024	HRA	15.00-
	1222401	01/22/2024	HRA	20.00
	1222401	01/22/2024	HRA	35.00
	1222401	01/22/2024	HRA	5.00
	1222401	01/22/2024	HRA	5.00
	1222401	01/22/2024	HRA2	30.00
	1222401	01/22/2024	HRA	145.00
	1222401	01/22/2024	HRA	52.37
	1222401	01/22/2024	HRA	121.00
	1222401	01/22/2024	HRA	35.00

Payee	Check Number	Check Issue Date	Description	Amount
	1222401	01/22/2024	HRA	35.63
	1222401	01/22/2024	HRA3 VISION	482.49
	1222401	01/22/2024	HRA	20.00
	1222401	01/22/2024	HRA2	15.00
	1222401	01/22/2024	HRA	5.36
	1222401	01/22/2024	HRA	12.50
	1222401	01/22/2024	HRA2	521.85
Total CHARD SNYDER & ASSOCIATES:				2,042.98
CLARK PEST CONTROL				
	90650	01/11/2024	PEST AWAY SERVICE	320.00
	90709	01/25/2024	PEST AWAY SERVICE 1/22/24	320.00
Total CLARK PEST CONTROL:				640.00
CORELOGIC INFORMATION SOLUTIONS, IN				
	90710	01/25/2024	MONTHLY BILLING FOR DEC2023	521.67
Total CORELOGIC INFORMATION SOLUTIONS, IN:				521.67
CSRMA % ALLIANT INSURANCE SERVICES				
	90651	01/11/2024	PLP RETRO ADJUSTMENT	4,363.00
	90651	01/11/2024	PLP POOLED DEPOSIT FEES	7,860.00
	90651	01/11/2024	PLP JPA CHARGE	6,489.00
	90651	01/11/2024	PLP EXCESS INSURANCE PREMIUM	15,954.00
	90651	01/11/2024	PLP DEPOSIT	33,770.00
Total CSRMA % ALLIANT INSURANCE SERVICES:				68,436.00
CWEA-SIERRA SECTION				
	90711	01/25/2024	CWEA MEMBERSHIP	221.00
Total CWEA-SIERRA SECTION:				221.00
DXP ENTERPRISES INC				
	90712	01/25/2024	PUMP, PROGRESSIVE CAVITY	89,975.19
Total DXP ENTERPRISES INC:				89,975.19
E&M ELECTRIC				
	90652	01/11/2024	REMOTE IO COMPONENTS	1,498.42
	90652	01/11/2024	REMOTE ID COMPONENT	386.91
	90652	01/11/2024	REMOTE IO COMPONENTS	1,427.13
	90652	01/11/2024	REMOTE IO COMPONENTS	1,003.39
Total E&M ELECTRIC:				4,315.85
FASTENAL				
	90653	01/11/2024	HARDWARE FOR FINAL EFFLUENT FLOW METER	818.73
	90653	01/11/2024	NUTS AND BOLTS - STOCK	1,687.27
	90713	01/25/2024	NUTS AND BOLTS	119.37
Total FASTENAL:				2,625.37
FERGUSON ENTERPRISES LLC #3325				
	90654	01/11/2024	3/4-10X 3" HEX BOLT A307 A ZINC	103.76

Payee	Check Number	Check Issue Date	Description	Amount
	90654	01/11/2024	3/4-10 FIN HEX NUT STL ZN *Z	18.02
	90654	01/11/2024	5/8-11X 3" HEX BOLT A307 A ZINC	54.13
	90654	01/11/2024	5/8-11 FINISH HEX NUT STEEL ZINC	13.53
	90654	01/11/2024	4 NA 1/16 150# FF GSKT	57.11
	90654	01/11/2024	4 NA 1/8 150# FF GSKT	114.52
Total FERGUSON ENTERPRISES LLC #3325:				361.07
FISHER SCIENTIFIC COMPANY				
	90655	01/11/2024	FILTER CAPS	642.78
	90655	01/11/2024	VIALS	178.52
	90714	01/25/2024	COLOR COMPARISSION TUBES	292.79
	90714	01/25/2024	SHELL VIALS	199.70
	90714	01/25/2024	NITROGEN STD 1000PPM	165.62
	90714	01/25/2024	PSEUDOMONAS AERUGINOSA	297.02
	90714	01/25/2024	ESCHERICHIA COLI	188.36
	90714	01/25/2024	KLEBSIELLA PNEUMONIAE	212.17
	90714	01/25/2024	ENTEROBACTER AEROGENES	300.41
	90714	01/25/2024	NUTRIENT AGAR	234.90
Total FISHER SCIENTIFIC COMPANY:				2,712.27
GLOBAL INDUSTRIAL				
	90715	01/25/2024	EYESALINE	844.18
Total GLOBAL INDUSTRIAL:				844.18
GRAINGER INC., W.W.				
	90656	01/11/2024	SCHEDULE 80 GUIDE	21.05
	90656	01/11/2024	PIPE FITTING REAMER	98.63
	90656	01/11/2024	REPLACEMENT BEARING BRACKET	104.22
	90656	01/11/2024	DISINFECTING WIPES	83.94
	90656	01/11/2024	ALL PURPOSE CLEANER	121.71
	90656	01/11/2024	DIPSOSABLE DISPENSER NAPKINS	147.15
	90656	01/11/2024	PAPER TOWELS	247.88
	90716	01/25/2024	WELDING CALBLE CONNECTOR	94.73
	90716	01/25/2024	WELDING CABLE	670.85
	90716	01/25/2024	PAPER TOWELS	165.25
	90716	01/25/2024	DISPOSABLE CUPS	338.22
	90716	01/25/2024	HAND SANITIZER	172.90
	90716	01/25/2024	DISINFECTIONG WIPES	83.94
	90716	01/25/2024	V-BELT	77.16
	90716	01/25/2024	HEAT DETECTOR	111.16
	90716	01/25/2024	TOILET PAPER DISPENSER, STANDARD CORE	90.91
Total GRAINGER INC., W.W.:				2,629.70
HACH CHEMICAL COMPANY				
	90717	01/25/2024	SAMPLE CELL	404.80
Total HACH CHEMICAL COMPANY:				404.80
HARRINGTON INDUSTRIAL PLASTICS				
	90657	01/11/2024	CLEARBRAID/PVC	1,006.76
	90718	01/25/2024	1/2" IDX .813" OD HOSE CLR PVC	1,884.05

Payee	Check Number	Check Issue Date	Description	Amount
Total HARRINGTON INDUSTRIAL PLASTICS:				2,890.81
HDR ENGINEERING INC				
	90658	01/11/2024	SEWER CONNECTION FEE STUDY	1,581.06
Total HDR ENGINEERING INC:				1,581.06
HELSIN CONSTRUCTION				
	90659	01/11/2024	CONNECTION FEE REFUND	1,500.00
Total HELSIN CONSTRUCTION:				1,500.00
HOME DEPOT CREDIT SERVICES				
	90660	01/11/2024	FLOOR ADHESIVE, 1 GAL.	199.10
	90660	01/11/2024	ROBERTS 7350, 4 GAL	171.06
	90660	01/11/2024	14" QEP PRO FLOOR SCRAPER	34.17
	90660	01/11/2024	14" WIDE REPLACEMENT SCRAPER BLADE	14.36
	90660	01/11/2024	MILWAUKEE NUT DRIVER SET, 4 PIECE	51.86
	90660	01/11/2024	FLOOR ADHESIVE, 1 GAL.	398.17
	90660	01/11/2024	12" VINYL TILE CUTTER	66.54
	90660	01/11/2024	1/16" SQURARE TROWEL	22.80
Total HOME DEPOT CREDIT SERVICES:				958.06
HUNT & SONS INC.				
	90661	01/11/2024	FUEL WITH WINTERIZATION	8,461.82
	90719	01/25/2024	ON ROAD GASOLINE	1,258.17
	90719	01/25/2024	HWY DIESEL	1,213.06
Total HUNT & SONS INC.:				10,933.05
IDEXX LABORATORIES INC.				
	90720	01/25/2024	SIMPLATE FOR HPC	169.96
	90720	01/25/2024	SHRINK BANDED VESSELS	563.85
	90720	01/25/2024	COMPARATOR	22.73
Total IDEXX LABORATORIES INC.:				756.54
INNOVATIVE HYDRAULICS				
	90662	01/11/2024	VISUAL HYDRAULICS RENEWAL	300.00
Total INNOVATIVE HYDRAULICS:				300.00
J.W. WELDING SUPPLY				
	90663	01/11/2024	CYLINDER RENTAL	57.75
	90663	01/11/2024	CYLINDER RENTAL	116.79
	90663	01/11/2024	CYLINDER RENTAL	29.85
Total J.W. WELDING SUPPLY:				204.39
JACOBS ENGINEERING GROUP INC				
	90721	01/25/2024	#38 DEVELOP T-TSA SCADA STANDARDS	8,384.51
	90721	01/25/2024	#38 DEVELOP T-TSA SCADA STANDARDS	6,000.09
Total JACOBS ENGINEERING GROUP INC:				14,384.60

Payee	Check Number	Check Issue Date	Description	Amount
JASON OR CRISTINA WOOLEY				
	90664	01/11/2024	CONNECTION FEE REFUND	1,500.00
Total JASON OR CRISTINA WOOLEY:				1,500.00
JENSEN PRECAST - CORPORATE				
	90754	01/31/2024	BARRIER K-RAIL	11,102.13
Total JENSEN PRECAST - CORPORATE:				11,102.13
LHOIST NORTH AMERICA				
	90665	01/11/2024	25020 TONS HYDATED LIME DEC 12/19	9,815.35
	90722	01/25/2024	24.61 TONS HYDRATED LIME DEL 12/27	9,642.94
Total LHOIST NORTH AMERICA:				19,458.29
LIBERTY PROCESS EQUIPMENT INC				
	90723	01/25/2024	DRIVE SHAFT	1,508.00
	90723	01/25/2024	GREASE SEAL	56.00
	90723	01/25/2024	DRIVE PIN	102.00
	90723	01/25/2024	PIN RETAINER	202.00
	90723	01/25/2024	STATOR GASKET = GFA1G1200	42.00
	90723	01/25/2024	SNAP RING	34.00
	90723	01/25/2024	RETAINING RING = EC060	32.00
	90723	01/25/2024	ROTOR	3,098.97
	90755	01/31/2024	ROTOR	2,896.00
	90755	01/31/2024	GEAR JOINT SEAL KIT	172.00
	90755	01/31/2024	GREASE SEAL (RADIAL)	76.00
	90755	01/31/2024	DRIVE SHAFT	1,681.00
	90755	01/31/2024	BR PLUG	9.00
	90755	01/31/2024	BEARING LOCK NUT	97.00
	90755	01/31/2024	GEAR JOINT SHELL	571.00
	90755	01/31/2024	CDQ HEAD RING	96.00
	90755	01/31/2024	PACKAGING FEE	573.18
	90755	01/31/2024	GREASE SEAL (THRUST)	76.00
	90755	01/31/2024	RETAINING RING	40.00
	90755	01/31/2024	O-RING	12.00
	90755	01/31/2024	SHAFT ADAPTER	1,581.00
	90755	01/31/2024	GEAR JOINT SHELL	3,114.00
	90755	01/31/2024	GEAR JOINT RETAINER	447.00
Total LIBERTY PROCESS EQUIPMENT INC:				16,516.15
LIBERTY UTILITIES				
	90724	01/25/2024	ELECTRIC	33.27
	90724	01/25/2024	ELECTRIC	34.79
	90724	01/25/2024	ELECTRIC	33.05
	90724	01/25/2024	ELECTRIC	36.39
Total LIBERTY UTILITIES:				137.50
LINDE GAS AND EQUIP INC				
	90725	01/25/2024	CYLINDER RENTAL	117.74
Total LINDE GAS AND EQUIP INC:				117.74

Payee	Check Number	Check Issue Date	Description	Amount	
MCMASTER-CARR					
	90666	01/11/2024	PACKING SEAL	325.75	
	90666	01/11/2024	ALUMINUM SLIP ON FITTING	42.03	
	90666	01/11/2024	ALUMINUM SLIP ON FITTING	285.93	
	90666	01/11/2024	PVC PIPE FITTING	118.21	
	90666	01/11/2024	TUBE	1,358.98	
	90726	01/25/2024	STRUT CHANNEL	833.69	
	90726	01/25/2024	STRUT CHANNEL	1,012.90	
Total MCMASTER-CARR:				3,977.49	
MOTION INDUSTRIES					
	90667	01/11/2024	SHEAVES	1,585.56	
	90727	01/25/2024	BALL BEARING CARTRIDGE	153.39	
Total MOTION INDUSTRIES:				1,738.95	
MOUNTAIN HARDWARE					
	90728	01/25/2024	CHAIN, MANPLOW, SNOW SHOVEL	168.84	
	90728	01/25/2024	WRENCH KIT	541.24	
	90728	01/25/2024	PROPANE GAS	69.75	
Total MOUNTAIN HARDWARE:				779.83	
NAPA- SIERRA					
	90668	01/11/2024	SURFACE PREP PAD	94.87	
	90729	01/25/2024	10W305Q	58.84	
	90729	01/25/2024	SOLDERING IRON	174.27	
	90729	01/25/2024	ROSIN CORE SOLDER	19.58	
	90729	01/25/2024	ROSIN CORE SOLDER	12.74	
	90729	01/25/2024	AIR HOSE	78.36	
	90729	01/25/2024	ICE BLADE	30.30	
	90729	01/25/2024	OIL FILTER WRENCH	32.47	
	90729	01/25/2024	OIL FILTER	16.24	
	90729	01/25/2024	MAC WITE	6.98	
	90729	01/25/2024	GRAPHITE LUBE	10.60	
Total NAPA- SIERRA:				535.25	
NEWEGG INC					
	90669	01/11/2024	NETWORK ETHERNET	21.22	
	90669	01/11/2024	POWER OVER ETHERNET SURGE	194.83	
Total NEWEGG INC:				216.05	
O'REILLY AUTO PARTS					
	90670	01/11/2024	18 STL WELD, 18 FULL FACE	864.51	
	90670	01/11/2024	18 STL WELD, 18 FULL FACE	864.51-	V
Total O'REILLY AUTO PARTS:				.00	
PACIFIC OFFICE AUTOMATION					
	90730	01/25/2024	12/28/23-01/28/24 MONTHLY BILL	61.43	
	90730	01/25/2024	1/3/24-2/3/24 MONTHLY BILL	181.31	
Total PACIFIC OFFICE AUTOMATION:				242.74	

Payee	Check Number	Check Issue Date	Description	Amount
PAYMENTUS CORP				
	90671	01/11/2024	TRANSACTION FEES FOR NOV 2023	17.50
	90731	01/25/2024	TRANSACTION FEES FOR DEC23	15.00
Total PAYMENTUS CORP:				32.50
PDM STEEL SVC CNTRS INC-SPARKS NV				
	90672	01/11/2024	C CHANNEL	457.48
	90672	01/11/2024	FUEL SURCHARGE	30.00
Total PDM STEEL SVC CNTRS INC-SPARKS NV:				487.48
PENCCO INC				
	90732	01/25/2024	22.33 TONS FERRIC CHLORIDE DEL 1/11	16,692.40
Total PENCCO INC:				16,692.40
PERS-RETIREMENT				
	1052401	01/05/2024	LOUREYREPLACEMENT BENEFIT FUND	313.08
Total PERS-RETIREMENT:				313.08
PINNACLE TOWERS INC.				
	90673	01/11/2024	MONTHLY RADIO TOWER RENTAL	852.75
	90733	01/25/2024	OCT23 MONTHLY TOWER RENTAL	852.75
	90733	01/25/2024	NOV23 MONTHLY TOWER RENTAL	852.75
Total PINNACLE TOWERS INC.:				2,558.25
PLATT ELECTRIC COMPANY				
	90674	01/11/2024	RIGID 3 PIECE COUPLING	151.84
	90734	01/25/2024	RECEPTILCE	261.65
	90734	01/25/2024	TIMER SWITCH	155.31
Total PLATT ELECTRIC COMPANY:				568.80
QUADIENT				
	90675	01/11/2024	QUARTERLY METER BILL	173.66
Total QUADIENT:				173.66
RED WING BUSINESS ADVANTAGE ACCOUNT				
	90676	01/11/2024	EMPLOYEE SUMMER BOOTS	399.49
	90735	01/25/2024	EMPLOYEE SUMMER BOOTS	170.23
	90735	01/25/2024	EMPLOYEE SUMMER BOOTS	230.05
Total RED WING BUSINESS ADVANTAGE ACCOUNT:				799.77
RJMS CORPORATION DBA TOYOTA MATERIAL				
	90677	01/11/2024	DRIVE MOTOR	1,315.94
	90677	01/11/2024	FIELD LABOR	1,586.00
Total RJMS CORPORATION DBA TOYOTA MATERIAL:				2,901.94
ROCKWELL SOLUTIONS				
	90678	01/11/2024	STUFFING BOX	1,680.25

Payee	Check Number	Check Issue Date	Description	Amount
Total ROCKWELL SOLUTIONS:				1,680.25
ROY SMITH COMPANY				
	90736	01/25/2024	4822 GAL LIQUID OXYGEN DEL 1/11/24	9,161.80
Total ROY SMITH COMPANY:				9,161.80
RUPPERT INC				
	90679	01/11/2024	PPE#2 SODIUM HYPOCHLORITE FOUNDATION PROJECT	119,074.00
	90679	01/11/2024	PPE#2 RETENTION SODIUM HYPOCHLORITE FOUNDATION PROJECT	5,953.70-
Total RUPPERT INC:				113,120.30
SAFETY UNLIMITED, INC.				
	90680	01/11/2024	40 HOURS HAZWOPER	210.00
Total SAFETY UNLIMITED, INC.:				210.00
SAFETY-KLEEN CORP.				
	90681	01/11/2024	RENTAL SERVICE PARTS WASHER	587.15
Total SAFETY-KLEEN CORP.:				587.15
SHRED-IT USA				
	90682	01/11/2024	11/29/23 & 12/13/23 SERVICE	174.63
Total SHRED-IT USA:				174.63
SIEMENS INDUSTRY				
	90683	01/11/2024	TRANSDUCER	1,051.11
	90683	01/11/2024	HYDRORANGER	2,143.35
Total SIEMENS INDUSTRY:				3,194.46
SIERRA ELECTRONICS				
	90737	01/25/2024	RADIO REPEATER MONTHLY FEE	160.00
Total SIERRA ELECTRONICS:				160.00
SOLENIS				
	90738	01/25/2024	K133 L	4,685.17
	90738	01/25/2024	K290FLX	27,640.01
Total SOLENIS:				32,325.18
SOUTHWEST GAS CORP.				
	90684	01/11/2024	12/2/23-1/3/24 MAIN	700.73
	90684	01/11/2024	12/2/23-1/3/24 MAIN	6,306.55
	90684	01/11/2024	12/2/23-1/3/24 PLANT	1,232.56
	90684	01/11/2024	12/2/23-1/3/24 PLANT	11,093.01
Total SOUTHWEST GAS CORP.:				19,332.85
SOUTHWEST VALVE LLC				
	90739	01/25/2024	VALVE PLUG	3,991.22

Payee	Check Number	Check Issue Date	Description	Amount
Total SOUTHWEST VALVE LLC:				3,991.22
STATE WATER RESOURCES CONTROL BOARD				
	90685	01/11/2024	LOW IMPACT CHARGES	399.00
Total STATE WATER RESOURCES CONTROL BOARD:				399.00
TAHOE FOREST HOSP. DIST./TAHOE WORX				
	90740	01/25/2024	NEW EMPLOYEE SCREENING	69.50
Total TAHOE FOREST HOSP. DIST./TAHOE WORX:				69.50
TAHOE TRUCKEE DISPOSAL				
	90741	01/25/2024	SLUDGE DEC 2023	4,590.37
	90741	01/25/2024	CENTRIFUGE	17,497.29
Total TAHOE TRUCKEE DISPOSAL:				22,087.66
TEICHERT MATERIALS				
	90686	01/11/2024	DRAIN ROCK	3,850.39
	90686	01/11/2024	AGGREGATE FOR GRADING	3,275.57
Total TEICHERT MATERIALS:				7,125.96
TELEDYNE INSTRUMENTS INC				
	90687	01/11/2024	LOTIX SALT CATALYST	569.57
	90687	01/11/2024	LOTIX PERMEATION DRYER	656.11
	90687	01/11/2024	QUARTZ WOOL	121.67
	90687	01/11/2024	COPPER 20 MESH, 1.5 OZ	162.38
	90687	01/11/2024	LOTIX CONDENSATE LOOP	194.75
	90687	01/11/2024	LOTIX NDIR SAMPLE FILTER	232.56
Total TELEDYNE INSTRUMENTS INC:				1,937.04
TERRYBERRY COMPANY				
	90688	01/11/2024	EMPLOYEE LONGEVITY AWARD	522.36
Total TERRYBERRY COMPANY:				522.36
THATCHER COMPANY OF CA INC				
	90689	01/11/2024	7168 GAL METHANOL DEL 12/7/23	14,676.69
	90689	01/11/2024	7025 GAL METHANOL DEL 12/21/23	14,689.70
	90689	01/11/2024	4560 GAL SODIUM HYPOCHLORITE DEL 11/27/23	12,220.80
	90689	01/11/2024	4522 GAL SODIUM HYPOCHLORITE DEL 1/6/24	12,116.45
	90689	01/11/2024	4498.094 GAL SODIUM HYPOCHLORITE DEL 1/1/24	12,054.89
	90742	01/25/2024	6774.584 GAL METHANOL DEL 1/2/24	14,164.63
	90742	01/25/2024	4515.045 GAL SODIUM HYPOCHLORITE DEL 1/12/24	12,100.32
Total THATCHER COMPANY OF CA INC:				92,023.48
TONY LIPKA CONSULTANT & TRAINER				
	90690	01/11/2024	ELECTRICAL SAFETY PROGRAM REVISION	1,200.00
Total TONY LIPKA CONSULTANT & TRAINER:				1,200.00

Payee	Check Number	Check Issue Date	Description	Amount
TRUCKEE DONNER PUD				
	90691	01/11/2024	11/15/23-12/12/23 ELECTRIC	58.16
	90691	01/11/2024	11/15/23-12/12/23 ELECTRIC	70.05
	90691	01/11/2024	11/15/23-12/12/23 ELECTRIC	33.06
	90691	01/11/2024	11/15/23-12/12/23 ELECTRIC 10%	8,489.44
	90691	01/11/2024	11/15/23-12/12/23 ELECTRIC 90%	76,405.03
	90691	01/11/2024	11/15/23-12/12/23 WATER 10%	14.94
	90691	01/11/2024	11/15/23-12/12/23 WATER 90%	134.55
Total TRUCKEE DONNER PUD:				85,205.23
T-TIME ENTERPRISES				
	90743	01/25/2024	3420 SOFT SHELL JACKET WITH LOGO, LG, BLACK	90.78
Total T-TIME ENTERPRISES:				90.78
ULINE				
	90692	01/11/2024	15X19 UNIVERSAL SORBENT PADS	98.54
	90692	01/11/2024	SAFETY GLASSES WIPES 120/BOX	44.30
	90692	01/11/2024	FEATHER DUSTER	103.13
	90692	01/11/2024	MOP HEAD	75.64
	90692	01/11/2024	Dust Mop, Deluxe Kit, 36", mfr# H-867BLU	254.61
	90692	01/11/2024	Dust Mop, Deluxe Kit, 24", mfr# H-866 (20-000196)	167.79
	90692	01/11/2024	Foam Bumper Guard - Type B, Edge Guard	125.79
	90692	01/11/2024	Slim Storage Cabinet - 24 x 18 x 66", Unassembled, Black	400.87
	90692	01/11/2024	Duster, Feather, 20", mfr# H-2680 (23-000223)	92.01
	90692	01/11/2024	Mop, Wet, Heavy Duty, 32oz, mfr# S-14793BLU (23-000224)	87.68
	90692	01/11/2024	3M DBI-SALA Trauma Safety Straps	305.28
Total ULINE:				1,755.64
UNIFIRST CORPORATION				
	90693	01/11/2024	UNIFORMS	180.48
	90693	01/11/2024	UNIFORMS	24.60
	90693	01/11/2024	UNIFORMS	117.77
	90693	01/11/2024	MATS	174.48
	90693	01/11/2024	UNIFORMS	53.24
	90693	01/11/2024	UNIFORMS	39.83
	90693	01/11/2024	TOWELS	13.06
	90693	01/11/2024	UNIFORMS	198.66
	90693	01/11/2024	UNIFORMS	24.60
	90693	01/11/2024	UNIFORMS	118.16
	90693	01/11/2024	UNIFORMS	53.24
	90693	01/11/2024	UNIFORMS	39.83
	90693	01/11/2024	UNIFORMS	179.30
	90693	01/11/2024	UNIFORMS	24.60
	90693	01/11/2024	UNIFORMS	116.61
	90693	01/11/2024	MATS	174.48
	90693	01/11/2024	UNIFORMS	53.24
	90693	01/11/2024	UNIFORMS	39.83
	90693	01/11/2024	MATS	13.06
	90744	01/25/2024	UNIFORMS	24.60
	90744	01/25/2024	UNIFORMS	118.16
	90744	01/25/2024	MATS	171.77
	90744	01/25/2024	UNIFORMS	53.24
	90744	01/25/2024	UNIFORMS	39.83
	90744	01/25/2024	TOWELS	13.06

Payee	Check Number	Check Issue Date	Description	Amount
	90744	01/25/2024	UNIFORMS	239.38
	90744	01/25/2024	UNIFORMS	24.60
	90744	01/25/2024	UNIFORMS	117.58
	90744	01/25/2024	MATS	108.48
	90744	01/25/2024	UNIFORMS	53.24
	90744	01/25/2024	UNIFORMS	39.83
	90744	01/25/2024	TOWELS	13.06
	90744	01/25/2024	UNIFORMS	181.18
	90744	01/25/2024	UNIFORMS	24.60
	90744	01/25/2024	UNIFORMS	153.27
	90744	01/25/2024	UNIFORMS	53.24
	90744	01/25/2024	UNIFORMS	39.83
	90744	01/25/2024	UNIFORMS	179.30
Total UNIFIRST CORPORATION:				3,287.32
UNITED PARCEL SERVICE, UPS				
	90694	01/11/2024	SHIPPING CHARGES	66.71
	90694	01/11/2024	SHIPPING CHARGES	44.08
	90694	01/11/2024	SHIPPING CHARGES	94.63
	90694	01/11/2024	SHIPPING CHARGES	40.69
	90745	01/25/2024	SHIPPING FOR LAB SAMPLES	90.16
Total UNITED PARCEL SERVICE, UPS:				336.27
UNITED RENTALS				
	90695	01/11/2024	BARRIER WALL FOR SODIUM HYPOCHLORITE TANKS	190.00
	90746	01/25/2024	BARRIER WALL FOR SODIUM HYPO	190.00
Total UNITED RENTALS:				380.00
USA BLUE BOOK				
	90747	01/25/2024	2" SHANK	35.07
	90747	01/25/2024	2" SHANK	77.19
	90747	01/25/2024	ALL WEATHER SUCTION HOSE	182.57
Total USA BLUE BOOK:				294.83
VARIED PRODUCTS				
	90748	01/25/2024	ORANGE GLOVES LG	775.36
	90748	01/25/2024	ORANGE GLOVES XL	775.36
	90748	01/25/2024	SORBENT WIPES	104.37
Total VARIED PRODUCTS:				1,655.09
VWR SCIENTIFIC INC				
	90696	01/11/2024	BDH AMMONIUM MOLYBDAT ACS 500G	272.99
	90696	01/11/2024	POTASSIUM SULFATE CRYS RGT ACS	224.63
	90696	01/11/2024	MINERALS QC STD. 500ML	650.27
	90696	01/11/2024	NITROGEN NO3 1000MG/L 500ML	111.32
	90696	01/11/2024	VIAL AMBER 40ML	577.59
	90696	01/11/2024	VWR CONDUCTIVITY STANDRD 100ML	86.09
	90696	01/11/2024	VWR FILTER PAPER 4.7CM PK100	1,352.50
	90696	01/11/2024	BRILLIANT GREEN BILE 2% 500G	343.88
	90696	01/11/2024	MEDIUM TSA 15X100MM PLTD PK10	52.76
	90749	01/25/2024	VWR CHLORIDE (CL)- 1000 UG/ML 500ML	185.67
	90749	01/25/2024	EC MEDIUM 500G	355.67

Payee	Check Number	Check Issue Date	Description	Amount
	90749	01/25/2024	VIAL AMBER 40ML	305.88
	90749	01/25/2024	LAURYL TRYPTOSE BROTH	533.09
	90749	01/25/2024	NITROGEN STD	93.76
	90749	01/25/2024	VWR VIAL 5ML W/FILTER PK 250	829.67
	90749	01/25/2024	LAURYL TRYPTOSE BROTH 500G	810.58
	90749	01/25/2024	VWR BOX GLASS DISP FLOOR PK6	177.66
	90749	01/25/2024	CLEAR TUBES	319.80
Total VWR SCIENTIFIC INC:				7,283.81
WATER ENVIRONMENT FEDERATION				
	90750	01/25/2024	PROFESSIONAL MEMBERSHIP	361.00
Total WATER ENVIRONMENT FEDERATION:				361.00
WEDCO INC				
	90697	01/11/2024	MALL.3PC.COND.COUPLING	48.17
Total WEDCO INC:				48.17
WESTERN NEVADA SUPPLY				
	90751	01/25/2024	GASKETS	864.51
Total WESTERN NEVADA SUPPLY:				864.51
White Water Solutions				
	90752	01/25/2024	VALVE SAFETY RELIEF	85.52
	90752	01/25/2024	NOZZLE, #4.0 VARIABLE	31.50
	90752	01/25/2024	DIESEL	17.21
	90752	01/25/2024	SERVICE SUPPLIES	20.00
	90752	01/25/2024	SERVICE	217.50
Total White Water Solutions:				371.73
ZORO				
	90698	01/11/2024	SLIDING BEVEL	16.08
	90698	01/11/2024	DIGITAL LEVEL	68.19
	90698	01/11/2024	BLOWER MOTOR	141.81
	90698	01/11/2024	GLOVES	506.57
	90753	01/25/2024	1-1/4" ROUND BRUSH TOOL	21.63
	90753	01/25/2024	CARHARTT BEANIE, ORANGE	151.47
	90753	01/25/2024	TUBE AND VALVE BRUSH	11.90
	90753	01/25/2024	TUBE AND VALVE BRUSH	12.65
	90753	01/25/2024	HAMMER DRILL BIT	29.42
	90753	01/25/2024	RATCHETING TUBE CUTTER	34.54
	90753	01/25/2024	LED PAR 38 E26 BW 90W	30.93
Total ZORO:				1,025.19
Grand Totals:				777,576.24

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Michelle Mackey, Accounting Supervisor
Item: IV-3
Subject: Ratification of Financial Statements

Background
Attached are the Financial Statements for the previous calendar month(s); each of which include (1) fund summaries and (2) end of month cash balances.

Summaries of the expenditure and revenue activity are provided for Fund 10: General Fund; Fund 02: Wastewater Capital Reserve Fund; and Fund 06: Replacement, Rehabilitation and Upgrade Fund.

The end of month Combined Cash Investment table provides the end of month balances for all Agency cash accounts, which reconciles with Agency end of month fund balances.

Fiscal Impact
None.

Attachments
Report of Financial Statements.

Recommendation
Management and staff recommend the Board of Directors approve the Ratification of Financial Statements.

Review Tracking

Submitted By: Michelle Mackey
Michelle Mackey
Accounting Supervisor

Approved By:
Richard Pallante
General Manager

Tahoe-Truckee Sanitation Agency
Fund 10: General Fund
Fiscal Year 2023 - 2024
Period Ending December 31, 2023
(Revised January 2024)

	Budget $	Month $	Month %	YTD $	YTD %	Notes
REVENUE						
Income from Service Charge	17,026,000.00	1,407,673.55	8.3	8,329,380.25	48.9	1,2,3
Tax Revenue - Ad Valorem	5,078,000.00	0.00	0.0	179,071.66	3.5	2
Fund Interest	254,000.00	24,002.03	9.4	233,870.78	92.1	4
Other Revenue	73,000.00	1,843.40	2.5	10,345.67	14.2	5
Temporary Discharge	25,000.00	50.00	0.2	12,577.83	50.3	
TOTAL REVENUE	**22,456,000.00**	**1,433,568.98**	**6.4**	**8,765,246.19**	**39.0**	
EXPENDITURE						
Salaries & Wages	6,567,000.00	693,347.90	10.6	3,202,201.24	48.8	
Employee Benefits	3,602,500.00	421,065.04	11.7	1,945,432.74	54.0	
OPEB Retiree Health Reimbursement	0.00	0.00	0.0	(450,000.00)	0.0	6
Director Fees	9,500.00	0.00	0.0	3,800.00	40.0	
Vehicle	83,000.00	1,823.71	2.2	38,380.47	46.2	
CSRMA Insurance	415,000.00	35,622.05	8.6	394,434.45	95.0	7
Professional Memberships	53,500.00	1,060.00	2.0	35,390.00	66.1	
Agency Permits & Licenses	225,000.00	205,003.00	91.1	211,576.07	94.0	8
Office Expense	336,500.00	25,914.54	7.7	93,321.91	27.7	
Contractual Services	2,740,500.00	134,363.61	4.9	944,407.66	34.5	
Professional Services	689,000.00	41,676.52	6.0	198,679.30	28.8	
Conferences & Training	214,000.00	3,567.52	1.7	25,999.56	12.1	
Utilities	1,413,000.00	17,982.22	1.3	477,743.69	33.8	
Supplies, Repairs & Maintenance	1,234,500.00	76,413.04	6.2	483,917.31	39.2	
TOTAL EXPENDITURE	**17,583,000.00**	**1,657,839.15**	**9.4**	**7,605,284.40**	**43.3**	
NET INCOME (LOSS)	**4,873,000.00**	**(224,270.17)**		**1,159,961.79**		
Unfunded Accrued Liability	1,144,000.00	0.00		1,106,589.00	96.7	

50% of the fiscal year has elapsed.
This is an unaudited status report.

Notes:
1 - TTSA collects the majority of its Sewer Service Charges on the county property tax bills of Placer County, El Dorado County and Nevada County. Placer County and Nevada County Sewer Service Charges are on the Teeter Schedule.
2 - Sewer Service Charges and Property Tax Revenue are net amounts of each County's billing fees. Teeter Schedule 55% - 1/2024, 40% 5/2024 and 5% 7/2024.
3 - The majority of Sewer Service Charges are collected on the County tax roll and recorded on a monthly basis according to the accrual-based accounting method. Sewer Service Charges not on the County tax roll are recorded when received.
4 - Interest income for various investments to include LAIF, CalCLASS, US Securities, FDIC Certificates of Deposit, Money Market Account and Bank Accounts.
5 - Other Revenue includes rebates, billings and surplus items sold.
6 - OPEB Reimbursement received from CalPERS for FY22 retiree health insurance premiums.
7 - Property and Pooled liability insurance.
8 - SWRCB Waste Discharge annual permits in the amount of $199,478

Tahoe-Truckee Sanitation Agency
Fund 10: General Fund
Fiscal Year 2023 - 2024
Period Ending January 31, 2024

	Budget $	Month $	Month %	YTD $	YTD %	Notes
REVENUE						
Income from Service Charge	17,026,000.00	3,139,546.15	18.4	11,468,926.40	67.4	1,2,3
Tax Revenue - Ad Valorem	5,078,000.00	2,805,879.34	55.3	2,984,951.00	58.8	2
Fund Interest	254,000.00	112,973.23	44.5	346,844.01	136.6	4
Other Revenue	73,000.00	225.00	0.3	10,570.67	14.5	5
Temporary Discharge	25,000.00	0.00	0.0	12,577.83	50.3	
TOTAL REVENUE	**22,456,000.00**	**6,058,623.72**	**27.0**	**14,823,869.91**	**66.0**	
EXPENDITURE						
Salaries & Wages	6,567,000.00	451,464.50	6.9	3,653,665.74	55.6	
Employee Benefits	3,602,500.00	289,012.28	8.0	2,234,445.02	62.0	
OPEB Retiree Health Reimbursement	0.00	0.00	0.0	(450,000.00)	0.0	6
Director Fees	9,500.00	700.00	7.4	4,500.00	47.4	
Vehicle	83,000.00	6,878.98	8.3	45,259.45	54.5	
CSRMA Insurance	415,000.00	68,436.00	16.5	462,870.45	111.5	7
Professional Memberships	53,500.00	762.00	1.4	36,152.00	67.6	
Agency Permits & Licenses	225,000.00	399.00	0.2	211,975.07	94.2	8
Office Expense	336,500.00	16,401.16	4.9	109,723.07	32.6	
Contractual Services	2,740,500.00	361,463.46	13.2	1,305,871.12	47.7	
Professional Services	689,000.00	50,687.56	7.4	249,366.86	36.2	
Conferences & Training	214,000.00	870.61	0.4	26,870.17	12.6	
Utilities	1,413,000.00	116,696.27	8.3	594,439.96	42.1	
Supplies, Repairs & Maintenance	1,234,500.00	86,185.95	7.0	570,103.26	46.2	
TOTAL EXPENDITURE	**17,583,000.00**	**1,449,957.77**	**8.2**	**9,055,242.17**	**51.5**	
NET INCOME (LOSS)	**4,873,000.00**	**4,608,665.95**		**5,768,627.74**		
Unfunded Accrued Liability	1,144,000.00	0.00		1,106,589.00	96.7	

59% of the fiscal year has elapsed.
This is an unaudited status report.

Notes:
1 - TTSA collects the majority of its Sewer Service Charges on the county property tax bills of Placer County, El Dorado County and Nevada County. Placer County and Nevada County Sewer Service Charges are on the Teeter Schedule.
2 - Sewer Service Charges and Property Tax Revenue are net amounts of each County's billing fees. Teeter Schedule 55% - 1/2024, 40% 5/2024 and 5% 7/2024.
3 - The majority of Sewer Service Charges are collected on the County tax roll and recorded on a monthly basis according to the accrual-based accounting method. Sewer Service Charges not on the County tax roll are recorded when received.
4 - Interest income for various investments to include LAIF, CalCLASS, US Securities, FDIC Certificates of Deposit, Money Market Account and Bank Accounts.
5 - Other Revenue includes rebates, billings and surplus items sold.
6 - OPEB Reimbursement received from CalPERS for FY22 retiree health insurance premiums.
7 - Property and Pooled liability insurance.
8 - SWRCB Waste Discharge annual permits in the amount of $199,478

Tahoe-Truckee Sanitation Agency
Fund 02: Wastewater Capital Reserve
Fiscal Year 2023 - 2024
Period Ending January 31, 2024

	Budget $	Month $	Month %	YTD $	YTD %	Notes
REVENUE						
Income from Connection Fees	1,071,000.00	10,242.75	1.0	794,944.63	74.2	
Fund Interest	440,000.00	76,384.71	17.4	518,248.94	117.8	7
TOTAL REVENUE	**1,511,000.00**	**86,627.46**	**5.7**	**1,313,193.57**	**86.9**	
EXPENDITURE						
FY24 Disinfection Process Modernization	500,000.00	136,987.59	27.4	289,919.76	58.0	1
FY24 Improve Physical Security	167,000.00	0.00	0.0	5,280.40	3.2	1
FY24 Digestion Improvements Project	81,000.00	0.00	0.0	0.00	0.0	2
FY24 Lime Systems Improvements	56,500.00	0.00	0.0	0.00	0.0	2
FY24 River Crossing, Gravity Main	31,500.00	0.00	0.0	0.00	0.0	2
FY24 Plant Wide Electrical Improvements	12,500.00	0.00	0.0	0.00	0.0	3
FY24 TWAS Pump Replacement Project	7,000.00	0.00	0.0	0.00	0.0	2
FY23 Maintenance Carts	0.00	0.00	0.0	29,289.76	0.0	1
FY23 Flowmeter Improvements	0.00	0.00	0.0	10,349.78	0.0	1
FY23 Scada/IT Develop Standards	237,000.00	14,384.60	6.1	120,039.56	50.6	1
SUBTOTAL EXPENDITURES	**1,092,500.00**	**151,372.19**	**13.9**	**454,879.26**	**41.6**	
Allocation of 73.2% of Bond Payment	2,206,000.00	0.00	0.0	200,105.70	9.1	8
TOTAL EXPENDITURE	**3,298,500.00**	**151,372.19**	**4.6**	**654,984.96**	**19.9**	
NET INCOME (LOSS)	**(1,787,500.00)**	**(64,744.73)**		**658,208.61**		

59% of the fiscal year has elapsed.
This is an unaudited status report.

Notes:
(1) Project started
(2) Project started; no expenses invoiced
(3) Project not started
(4) Project completed
(5) Project postponed to after FY24
(6) Project cancelled
(7) Interest income from various investments to include LAIF, CalCLASS, US Securities, FDIC Certificates of Deposit, Money Market Account and Bank Accounts.
(8) Bond Payments are paid twice per year, December interest only and June principal and interest

Tahoe-Truckee Sanitation Agency
Fund 06: Replacement, Rehabilitation and Upgrade
Fiscal Year 2023 - 2024
Period Ending January 31, 2024

	Budget $	Month $	Month %	YTD $	YTD %	Notes
REVENUE						
Fund Interest	100,000.00	8,223.42	8.2	65,276.64	65.3	7
TOTAL REVENUE	**100,000.00**	**8,223.42**	**8.2**	**65,276.64**	**65.3**	
EXPENDITURE						
FY24 Building Roof Replacements	1,268,000.00	10,174.92	0.8	876,008.20	69.1	1
FY24 Front Entry Landscape Improvements	1,260,000.00	0.00	0	2,475.00	0.2	1
FY24 Lime Systems Improvements	414,000.00	0.00	0	0.00	0	2
FY24 LEL Equipment Replacement	364,000.00	0.00	0	0.00	0	3
FY24 Cashman CAT 938M Wheel Loader	297,000.00	0.00	0	0.00	0	2
FY24 Upgrade Networks	188,000.00	0.00	0	0.00	0	2
FY24 Harmonic Filter Replacement	148,000.00	0.00	0	0.00	0	2
FY24 Plant Wide NFPA 820 Compliance	126,000.00	0.00	0	0.00	0	3
FY24 Visable Reinforcement Study	105,000.00	0.00	0	0.00	0	3
FY24 Light Vehicle Replacement	104,000.00	0.00	0	0.00	0	2
FY24 Filter Press Feed Pump	103,000.00	89,975.19	87.4	89,975.19	87.4	1
FY24 Plant Wide Electrical	92,000.00	0.00	0	0.00	0	3
FY24 2-Water Valve Replacement	86,000.00	0.00	0	0.00	0	2
FY24 Odorous Air VFD	80,000.00	0.00	0	0.00	0	2
FY24 Cashman CAT Skid Steer	78,000.00	0.00	0	0.00	0	2
FY24 BIPS Strainer Basket Refurbishment	75,000.00	0.00	0	0.00	0	2
FY24 Condition Assessment	74,000.00	0.00	0	0.00	0	2
FY24 Maintenance Carts	63,000.00	0.00	0	0.00	0	2
FY24 Replacement Primary Sludge Pumps	63,000.00	0.00	0	48,372.83	76.8	1
FY24 TWAS Pump Replacement Project	50,000.00	0.00	0	17,906.77	35.8	1
FY24 Misc Plant Rehab Project	50,000.00	0.00	0	0.00	0	3
FY24 Breaker Replacement	49,000.00	0.00	0	0.00	0	3
FY24 WAS Thickening	46,000.00	0.00	0	0.00	0	3
FY24 Cake Discharge VFD	41,000.00	0.00	0	0.00	0	2
FY24 Operation Forklift	40,000.00	0.00	0	0.00	0	2
FY24 2-Water System	40,000.00	0.00	0	0.00	0	3
FY24 Replacement Valves	35,000.00	0.00	0	0.00	0	3
FY24 VFD Replacements	34,000.00	0.00	0	20,833.96	61.3	1
FY24 BNR Blower Replacement	29,000.00	0.00	0	0.00	0	2
FY24 Filter Press Hydraulic	26,000.00	0.00	0	0.00	0	2
FY24 Phosphorus Stripper Flow	17,000.00	0.00	0	0.00	0	3
FY23 Digestion Improvements Project	501,000.00	0.00	0	13,500.00	2.7	1
FY23 Scada/IT Replace Servers	285,000.00	0.00	0	0.00	0	2
FY23 River Crossing, Gravity Main	255,000.00	0.00	0	0.00	0	2
FY23 Lab Equipment Replacements	73,000.00	0.00	0	0.00	0	3
FY23 Chlorine Scrubber IMP	0.00	7,897.14	0	27,936.74	0	1
FY23 Odorous Air VFD	0.00	0.00	0	599.21	0	1
FY23 Cake Discharge VFD	0.00	0.00	0	17,935.71	0	1
FY23 Plant Coating Improvement	0.00	0.00	0	48,838.50	0	1
SUBTOTAL EXPENDITURES	**6,559,000.00**	**108,047.25**	**1.6**	**1,164,382.11**	**17.8**	
Allocation of 26.8% of Bond Payment	808,000.00	0.00	0.0	73,262.73	9.1	8
TOTAL EXPENDITURES	**7,367,000.00**	**108,047.25**	**1.5**	**1,237,644.84**	**16.8**	
NET INCOME (LOSS)	**(7,267,000.00)**	**(99,823.83)**		**(1,172,368.20)**		

59% of the fiscal year has elapsed.
This is an unaudited status report.

Notes:
(1) Project started
(2) Project started; no expenses invoiced
(3) Project not started
(4) Project completed
(5) Project postponed to after FY23
(6) Project cancelled
(7) Interest income from LAIF and CalCLASS
(8) Bond Payments are paid twice per year, December interest only and June principal and interest

Tahoe-Truckee Sanitation Agency
Combined Cash Statement
January 31, 2024

COMBINED CASH ACCOUNTS	
CASH - US BANK CHECKING	526,885.57
CASH - USB SERVICE CHARGE	588,036.36
CASH - US BANK TAX REV	4,501.81
CASH - US BANK WWCRF	9,753.29
CASH - WELLS FARGO PAYROLL	447,087.06
CASH - PETTY CASH	600.00
CASH - L.A.I.F.	3,970.46
MONEY MARKET INV - PERSHING	240,205.66
MONEY MARKET INV - ZIONS	11,167.80
CALIFORNIA CLASS	29,935,835.54
FDIC INSURED CERTIFICATES OF DEPOSIT - RESTRICTED FUNDS @ COST	4,900,032.76
US TREASURY SECURITIES - UNRESTRICTED FUNDS @ COST	5,124,521.62
CASH CLEARING - UTILITIES	0.00
TOTAL COMBINED CASH	41,792,597.93
CASH ALLOCATED TO OTHER FUNDS	(41,792,597.93)
TOTAL UNALLOCATED CASH	0.00

FUND	CASH ALLOCATION RECONCILATION	January 31, 2024	December 31, 2023	Amount of Change	% of Change	January 31, 2023	Amount of Change	% of Change
02	ALLOCATION TO WASTWATER CAPITAL RESERVE FUND	19,173,602.83	19,250,090.31	(76,487.48)	(0.40)	23,321,843.61	(4,148,240.78)	(17.79)
06	ALLOCATION TO R.R. & UPGRADE FUND	2,367,487.32	2,467,311.15	(99,823.83)	(4.05)	8,590,759.84	(6,223,272.52)	(72.44)
07	ALLOCATION TO EMERGENCY & CONTINGENCY FUND	4,172,373.37	4,158,513.26	13,860.11	0.33	4,034,707.55	137,665.82	3.41
10	ALLOCATION TO GENERAL FUND	16,079,134.41	6,463,534.66	9,615,599.75	148.77	4,966,751.03	11,112,383.38	223.74
	TOTAL ALLOCATION TO OTHER FUNDS	41,792,597.93	32,339,449.38	9,453,148.55	29.23	40,914,062.03	878,535.90	2.15
	ALLOCATIONS FROM COMBINED CASH	(41,792,597.93)	(32,339,449.38)			(40,914,062.03)		
	ZERO PROOF IF ALLOCATIONS BALANCE	0.00	0.00			0.00		

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Jason Hays, Technical Services Manager
Item: V-1
Subject: Presentation and Discussion of Proposed Nutrient Removal Alternatives Study

---

Background

In 2022 the TTSA Board of Directors approved the Master Sewer Plan. This plan identified infrastructure needs at the facility and defined rough timeframes and scopes for projects designed to address those needs. The Agency CIP list was built on these identified needs along with other internally identified projects.

As projects are being more clearly defined in preparation for implementation, staff are noticing a common post COVID-19 trend. Costs for projects are increasing and availability of resources is increasingly becoming an issue. Staff took assumptions from the 2022 Master Plan and made best estimates on what these projects might entail in detail when viewed through the lens of new realities after the global pandemic. Not surprisingly, costs are expected to be substantially more than was originally assumed.

Facing these potential realities, staff are asking the question of whether it makes sense to continue to repair aging facilities or to investigate new technologies that have been developed and proven in the last few decades. To identify these potential alternatives and to determine their viability compared to current systems and repair costs, staff would like to employ a consultant to exhaustively study the issue.

This presentation and discussion are intended to give board members an opportunity to understand the proposed study and what Agency staff hope to gain from it. This is also a time to ask questions about the study and why members of the staff believe this is such an important endeavor.

Fiscal Impact
None.

Attachments
Nutrient Removal Alternative Process Evaluation Project, Proposal from Carollo

Recommendation
None, informational only.

Review Tracking:

Submitted By: Jason Hays
Jason Hays
Technical Services Manager

Approved By:
Richard Pallante
General Manager

Nutrient Removal Alternative Process Evaluation Project Proposal

Presented by: Jason Hays, Technical Services Manager

Background

- TTSA Master Plan, approved by the Board in Early 2022
- Several infrastructure needs identified and prioritized
- An estimated $144 Million of projects established over next 25 years
- Current CIP is composed of projects from the master plan and previously identified needs

Background

WHILE PROJECT PLANNING, STAFF HAVE SEEN SUBSTANTIAL, UNEXPECTED INCREASES IN COSTS AND SUPPLY CHAIN ISSUES

LIME CONVEYANCE SYSTEM IMPROVEMENTS PROJECT PLANNING IDENTIFIED LINKAGE TO APPROXIMATELY $8.5 MILLION OF FUTURE PROJECTS

STAFF ASKED THE QUESTION OF WHETHER CHEMICAL NUTRIENT REMOVAL REPRESENTED THE FUTURE OF THE TREATMENT PLANT

Existing Master Plan

- High level view of long-term needs at the facility
- Limited scope with goal of creating a path forward
- Cost estimates based on best available knowledge at the time
- Internal staff cost estimates show costs could now be as high as $270 million

Staff Considerations

DO TECHNOLOGIES DEVELOPED SINCE THE PLANT WAS BUILT REPRESENT A BETTER SOLUTION?

DO FACILITIES REQUIRE MORE THAN SUPERFICIAL REPAIR WORK?

COULD NEWER FACILITIES OFFER LIFE CYCLE COST BENEFITS IN THE FORM OF REDUCED MAINTENANCE COSTS?

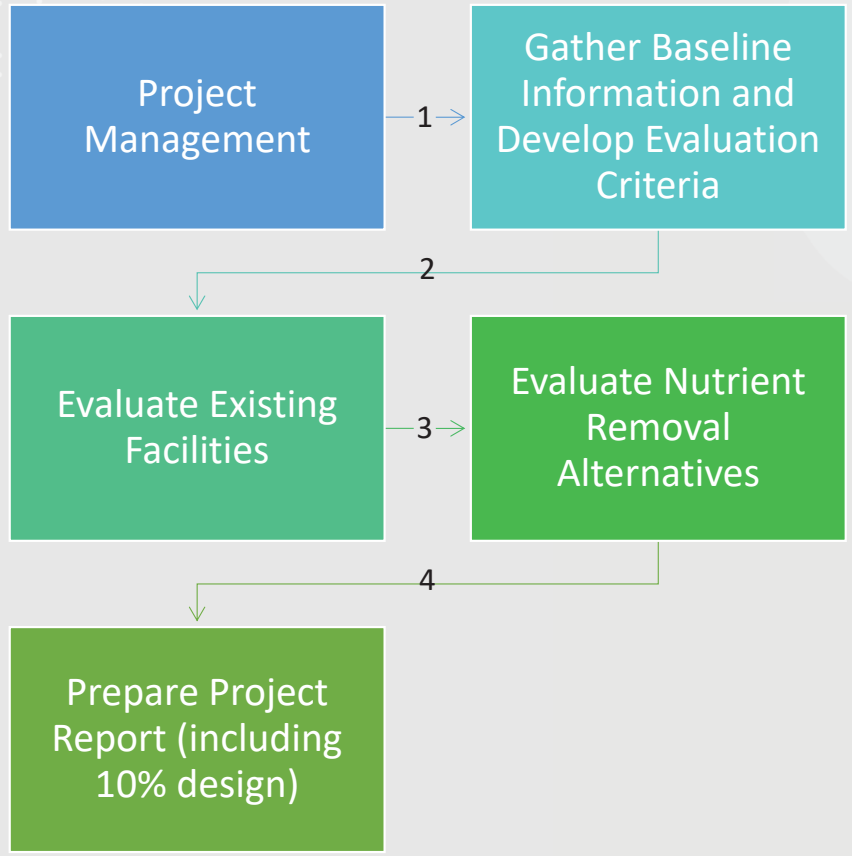
WOULD A MORE HOLISTIC APPROACH SIMPLIFY FACILITY DESIGN PROCEDURES?

DO WE WANT TO LEAD THE INDUSTRY OR FOLLOW IT?

Intent of Study

1. Compare available nutrient removal technologies to identify best potential solution for TTSA
2. Investigate financial feasibility of alternatives and compare to maintaining status quo
3. Select the option that best fits the agency and the community
4. Develop a 10% design for implementation of selected option

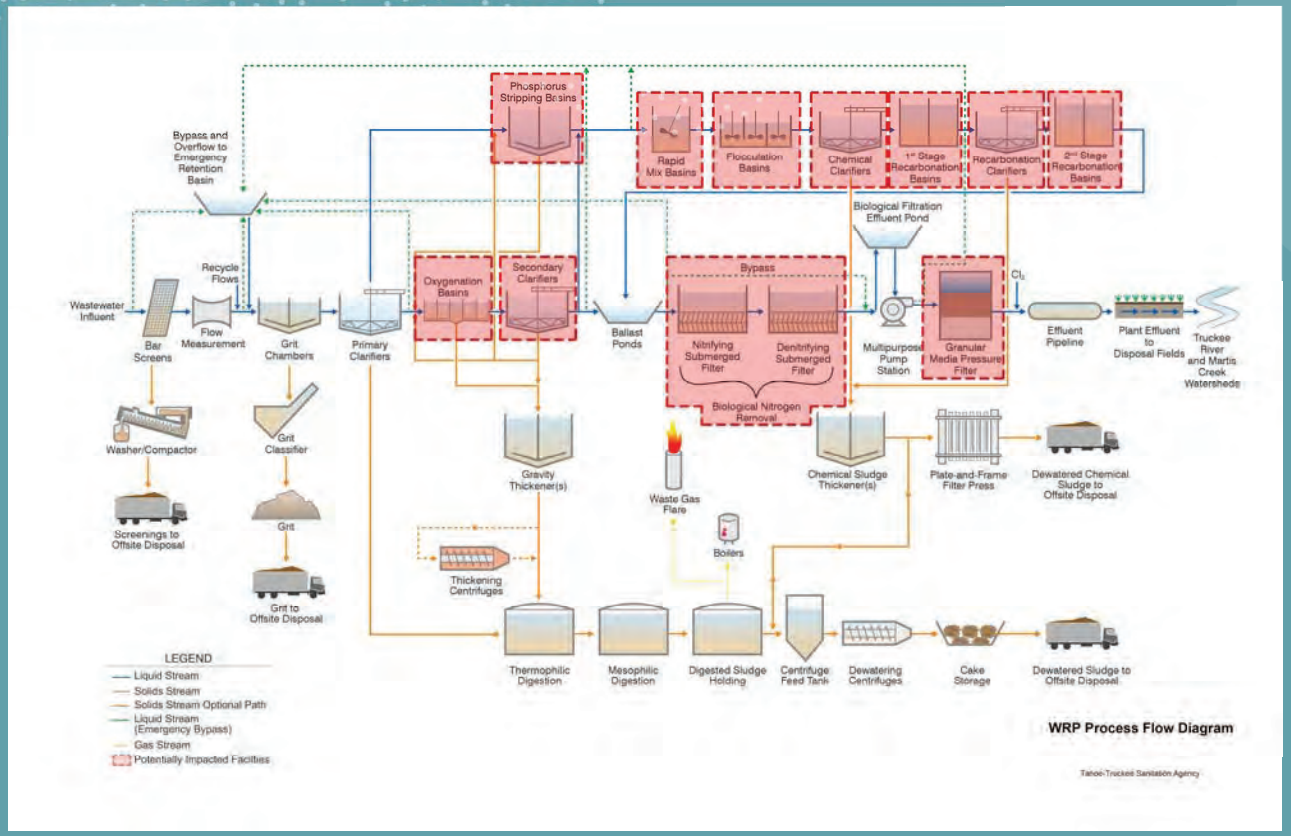
Project Scope



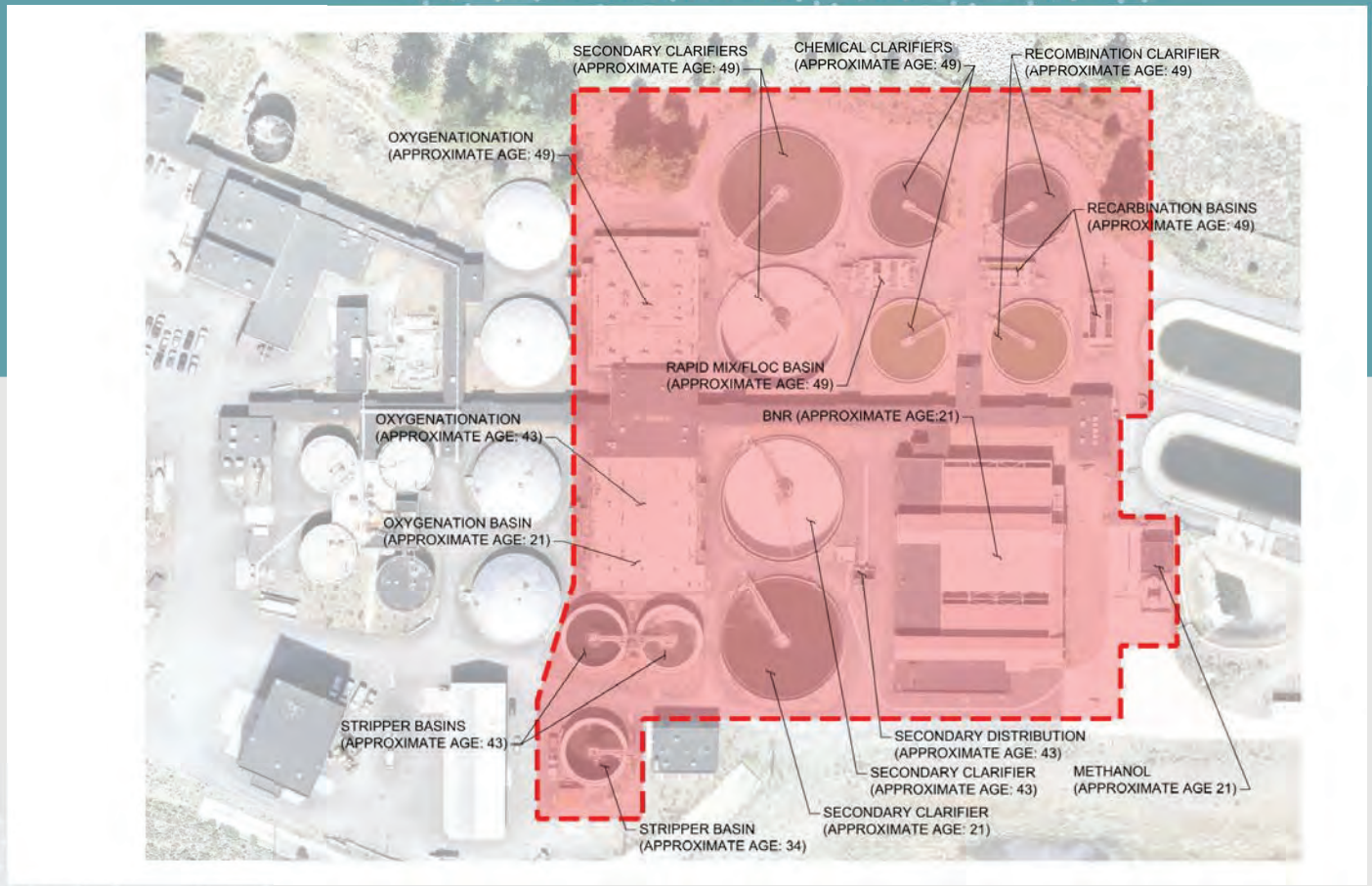
Potential Alternatives

- Membrane Bioreactor (MBR)
  - Compact, proven effectiveness and widely adopted. Potential setup for UV disinfection
- Bardenpho Process
  - Highly effective at removing BOD, nitrogen and phosphorus in one primarily biological step
- “Universe of Alternatives”
- Reevaluation and assessment of current plan for facilities
  - Fine tuning of near-term projects and more depth

Potentially Impacted Facilities



Potentially Impacted Facilities



TTSA Control over Direction

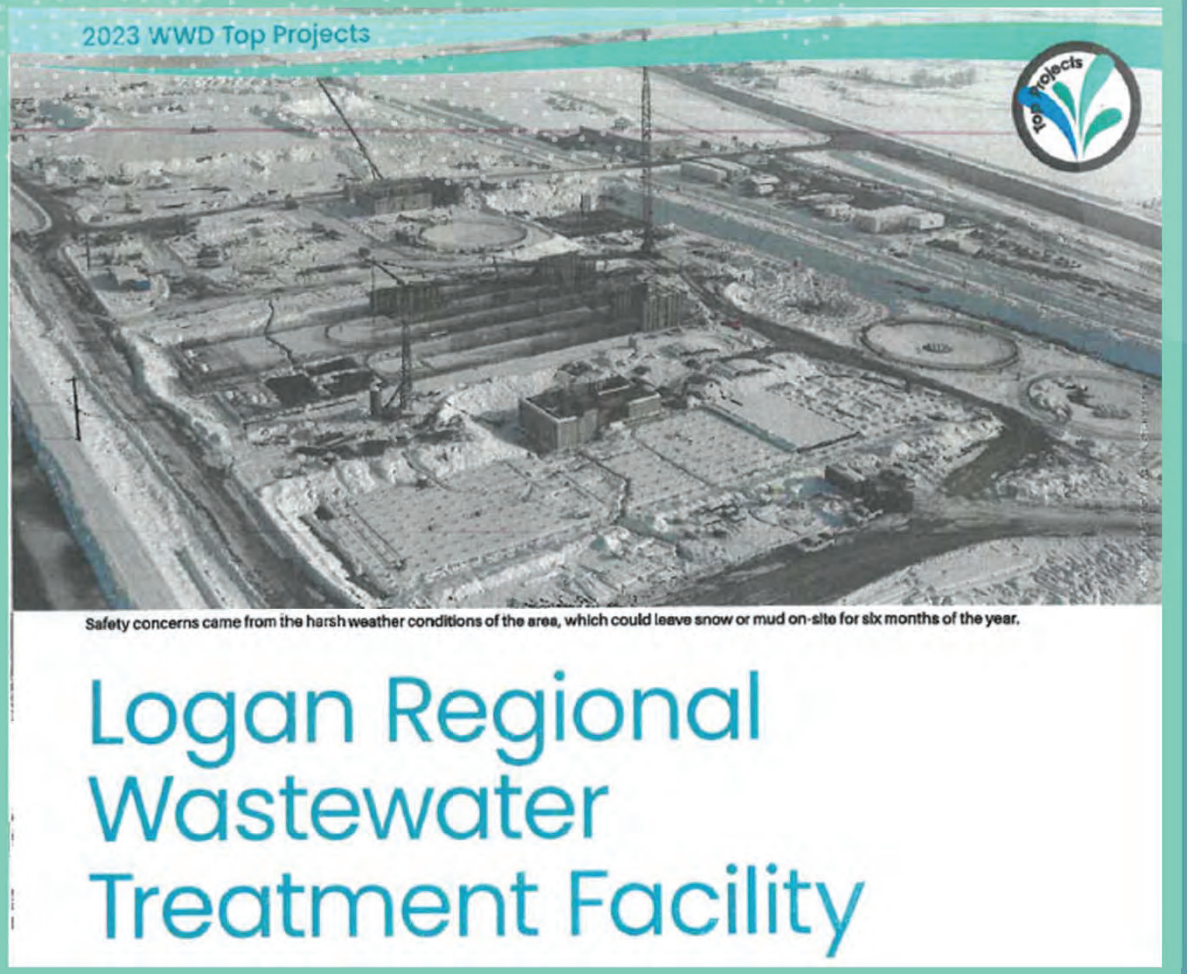
1	T1	PROJECT MANAGEMENT
	1.1	Project Management Plan
	1.2	Kickoff Meeting
	1.3	Biweekly Progress Meetings (20 total)
	1.4	Board Meeting
	1.5	Invoicing
	1.6	Monitor Budget, Schedule and Decision Log
	1.7	Quality Assurance/Quality Control
2	T2	GATHER BASELINE INFORMATION AND DEVELOP EVAL. PARAMETERS
	2.1	Gather and Review Existing Information
	2.2	Evaluation Criteria and Metrics
	2.3	Description of Existing Facilities
3	T3	EVALUATE EXISTING FACILITIES
	3.1	Flows and Loads Projection Updates
	3.2	Process Performance and Capacity Analysis
	3.3	Condition Assessment and CIP for R&R
	3.4	Identify Current and Potential Future WDRs
	3.5	Workshop No. 1 - Review Findings from Tasks 2 and 3
4	T4	EVALUATE NUTRIENT REMOVAL PROCESS ALTERNATIVES
	4.1	Develop Alternatives
	4.2	Compare Alternatives
	4.3	Workshop No. 2 - CAMP®
	4.4	Develop Selected Alternative
	4.5	Constructability Assessment
	4.6	Power Load Evaluation
	4.7	Site Visits to Other WRF's
5	T5	PREPARE PROJECT REPORT
	5.1	Draft Report and Executive Summary
	5.2	Workshop No. 3 - Review Draft Report
	5.3	Final Report and Executive Summary

- From November/December2023 Wastewater Digest

  18 MGD facility built in Logan, Utah

  Bardenpho process designed to remove nitrogen and phosphorus without the use of chemicals

  Project completed in 2023 at a cost of $139 million



Potential Benefits

- New infrastructure with more well-defined integrity and life expectancy
- Reduced O&M and chemical costs
- Better positioned to deal with any tightening of WDR/NPDES restrictions
- Leverage technology to address obstacles
- Ensure we are in the best position to treat wastewater for the next 5 decades
- Demonstrate a commitment to our local natural resources by leading the industry
- Civic pride in a truly state-of-the-art facility

Questions?

Prepared for
TAHOE-TRUCKEE SANITATION AGENCY

PROFESSIONAL CONSULTING SERVICES

Nutrient Removal Alternative Process Evaluation Project

PROPOSAL / December 2023

carollo®

90 YEARS

50 West Liberty Street, Suite 300
Reno, Nevada 89501
P 775-324-4427
carollo.com

December 29, 2023

Richard Pallante, General Manager
Tahoe-Truckee Sanitation Agency
13720 Butterfield Drive
Truckee, CA 96161

Subject: T-TSA Nutrient Removal Alternative Process Evaluation Project - Proposal

Dear Mr. Pallante,

As requested, enclosed please find our proposal for the Nutrient Removal Alternative Process Evaluation Project. We appreciate the opportunity to continue to assist T-TSA in developing a vision that will serve as a pathway for long-term operational reliability and resiliency of the Water Reclamation Plant. For this endeavor, we have assembled at team that includes your local Truckee project management team as well as nationally recognized experts in nutrient removal process implementation. Over the past 5 years, Ricky and Tim have assisted T-TSA in addressing challenges at the aging WRP facilities through efforts associated with the Master Sewer Plan, Organizational Assessment, Boiler Redundancy Project and other ongoing engineering assistance. We understand the operational complexities at the WRP, the environmental challenges associated with construction implementation, and the dynamics of the community it serves.

Our process experts that will assist with guiding us through the analysis of the potential process alternatives include Ron Appleton, John Fraser, and Bryan Coday. Ron led process modeling analysis efforts for your Sewer Master Plan and is very familiar with your facilities, the process model, and nutrient removal processes in general. He has spent considerable effort understanding your facilities, process data, and operational parameters to develop a whole-plant Biowin model that will be used to evaluate process alternatives. John and Bryan have decades of experience implementing nutrient removal projects in Colorado and throughout the country, with expertise in plants with low nitrogen and phosphorus discharge limits, specifically in cold weather climates. Our team's expertise will provide T-TSA with confidence in the analysis and recommendations to provide you with a clear path forward.

Thank you for your consideration and we are happy to discuss any questions you have regarding this proposal and can adjust the scope as necessary to fit your needs.

Sincerely,
CAROLLO ENGINEERS, INC.

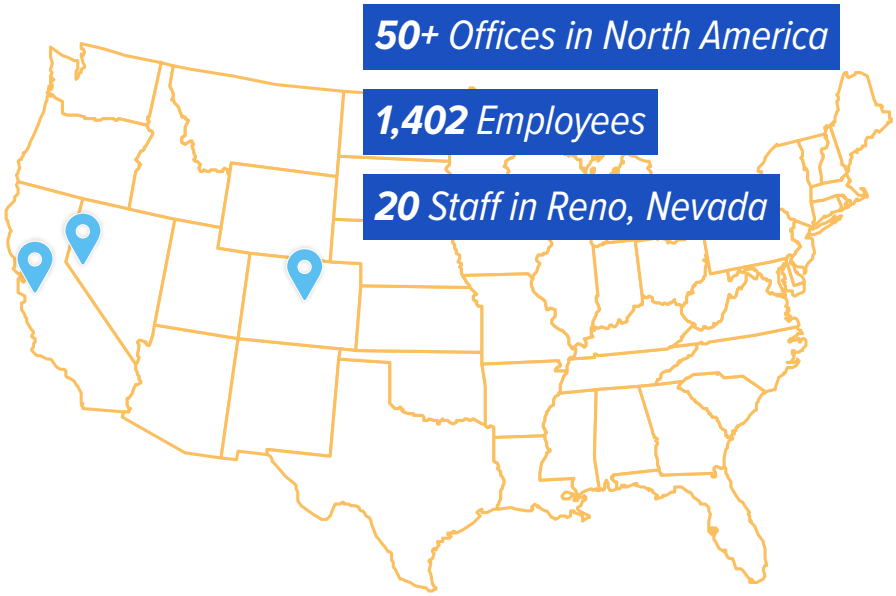
Richard L. Gutierrez
Project Manager/Vice President

Company Information and Background

Firm Experience

Carollo specializes in the planning, design, and construction management of water and wastewater facilities. We are 100-percent focused on water and wastewater, resulting in a level of understanding of key issues that few can match.

Carollo has a strong reputation in the industry for our creative thinking, innovative designs, and excellent client service. We currently maintain 50+ offices in North America and our staff numbers more than 1,400 employees and includes over 600 registered engineers and specialists. Your project will be managed from our local Reno office. This office has 20 professional, technical, and administrative staff members to successfully complete your project in a timely manner.



Carollo has continued to serve the Agency cover the years and is very familiar with your existing facilities and the need for strategic planning and cost-effective solutions on your projects. The Agency is a valued client of Carollo Engineers, and we are committed to meeting your needs and expectations.

Carollo will manage this project from our Reno (NV) location with support from our offices in Walnut Creek (CA) and Denver (CO).

Scope of Work

Nutrient Removal Alternative Process Evaluations for Water Reclamation Plant Scope of Work

Background

The Tahoe-Truckee Sanitation Agency (T-TSA, Agency) provides wastewater collection and treatment for the North Lake Tahoe and Truckee region. T-TSA's service area and five member districts include:

1. North Tahoe Public Utility District (NTPUD)
2. Tahoe City Public Utility District (TCPUD)
3. Alpine Springs County Water District (ASCWD)
4. Olympic Valley Public Service District (OVPSD)
5. Truckee Sanitary District (TSD), which includes contributions from Northstar Community Services District (NCSD)

T-TSA owns and operates the Water Reclamation Plant (WRP) located along the Truckee River in the eastern portion of the Town of Truckee near the confluence of the Truckee River and Martis Creek. The WRP includes conventional treatment, chemical treatment for phosphorus removal (Phostrip), biological nitrogen removal (BNR), tertiary filtration utilizing pressure filters, chlorine disinfection, mesophilic and thermophilic digestion, solids handling and land disposal with soil aquifer treatment. The treated water flows to Martis Creek and the Truckee River watersheds through soil aquifer percolation.

T-TSA staff are looking to evaluate process alternatives for nutrient removal at the WRP to meet current and potential future waste discharge requirements. Although the WRP is achieving excellent treatment results, staff have expressed several concerns about continued operation and maintenance of some of the advanced treatment facilities. Although portions of the WRP have been modified several times over its 50+ year life in response to increasingly stringent discharge requirements and increased flows, much of the original treatment infrastructure still serves as the foundation of the WRP and is nearing the end of its useful life. Additionally, because the original WRP has been added on to over the years, the advanced treatment trains are complex and at times challenging to operate over the wide range of seasonal variations for achieving stringent nutrient (nitrogen and phosphorous) limits. A key issue is the need to use lime for phosphorus removal. Lime is expensive, messy and a constant maintenance issue.

The current processes are also energy and chemical intensive. More efficient treatment processes that use less energy and chemicals and are more economical over the longer term will be evaluated.

This Alternative Process Evaluation will rely on information and modeling tools developed from the 2022 Sewer Master Plan, prepared by Carollo, and it will be an adjunct to the Master Plan. The evaluation will consist of the following scope of services.

Scope of Services

Task 1 - Project Management

Project Management Plan

Prepare a project management plan. The plan will define the personnel, project schedule, scope of services, Quality Assurance/Quality Control (QA/QC) plan, field work safety plan, communication protocol, and other procedures used in performing the Work.

Meetings and Workshops

This task includes the preparation of agendas, handouts, presentation material, and minutes for the following meetings:

1. **Kick-off Meeting:** Organize, prepare, and attend the project kickoff meeting. One of the goals of the kick-off meeting will be to establish goals, visions, and objectives for the Process Evaluation. The kick-off meeting will be attended by the project manager and the project leads, as well as other critical staff such as the modeling and condition assessment leads.
2. **Biweekly Progress Meetings:** Organize, prepare, and attend biweekly progress meetings. These meetings will review progress and any deviations from the schedule and budget. The project manager will maintain decision and action logs as well as a critical issue log that will be updated for these monthly meetings. The level of effort for this task is based on an 10-month project duration.
3. **Agency Board Meetings:** Organize, prepare presentation material, and attend one board meeting to support Agency staff in presenting the recommendations and findings from the Nutrient Removal Alternative Process Evaluation.

Invoicing and Progress Reports

At the end of each month submit an invoice for the Work performed during the preceding month. The invoice shall include a brief description of the Work performed, the dates of Work, number of hours worked and by whom, payment due, and an itemization of any reimbursable expenditures.

Monitor Budget, Schedule, and Decision Log

Monitor and track the overall project scope, budget, schedule, and update on a monthly basis. Maintain a log throughout the project to record the decisions made by the project team. The log shall contain decisions made during technical workshops and project meetings as well as during telephone conversations or email. The log shall list the date the decision was made, the type of meeting in which it was made (regular design meeting, telephone conversation, etc.), the individual involved in making the decision, and the nature of the decision.

Quality Assurance/Quality Control

Review and provide general QA/QC of all work products developed by Carollo. All documents delivered to T-TSA are considered deliverables, including but not limited to the Nutrient Removal Alternative Process Evaluation Report and Executive Summary, technical memorandum, agendas, meeting materials and summaries, invoices, progress reports, and other communications.

Task 2 – Gather Baseline Information and Develop Evaluation Parameters

The purpose of this task is to gather the information needed and establish key assumptions and criteria used for development of the Alternative Process Evaluation. This includes establishing the Agency's vision, goals, and objectives for the Process Evaluation as well as identifying evaluation and reliability criteria and metrics. The major sub tasks and activities are listed below.

Gather and Review Existing Information

Gather and review existing information available from T-TSA, its member Districts and other sources. Information that will be required includes the 2022 Master Plan, historical drawings and specifications, previous studies of existing facilities, and recent plant data including flows, loads, and process data. After reviewing the data, it is possible that additional sampling efforts or data collection may be required. It is assumed that this effort will be conducted by T-TSA staff if necessary.

Evaluation Criteria and Metrics

As part of the kick-off meeting, identify economic and noneconomic criteria and measurable outcomes (metrics) to compare process alternatives, and to assess attainability with the stated goals and objectives. These criteria and metrics shall allow for a relative comparison of the ranking of conceptual alternatives, as well as the ability to measure progress towards the project goals. The Process Evaluation objectives, and associated evaluation criteria will be further developed to identify performance parameters and units of measure (metrics). Likely evaluation criteria will include capital cost, operational costs, energy use, chemical use, ease of operation, reliability, and resiliency.

Description of Existing Facilities

The description of existing facilities will be taken from the 2022 Master Plan.

Task 3 – Evaluate Existing Facilities

Flow and Loading Projections Updates

Flows and loadings will be taken from the 2022 Master Plan and supplemented with recent data from the past 5 years. Flow and load projections made as part of the Master Plan will be revisited and updated based on recent information from member Districts.

Process Performance and Capacity Analysis

The performance and capacity analysis performed for the Master Plan will be summarized for reference and updated as necessary based on the revised flow and load projections.

Condition Assessment of WRP and CIP for Renewal and Replacement

The condition assessment recommendations for renewal and replacement improvements developed for the Master Plan will be summarized for reference and costs updated.

Update Current and Potential Future Waste Discharge Requirements

The regulatory analysis from the Master Plan will be summarized and updated with new potential WDRs or NPDES considerations. Any updates from T-TSA staff will be incorporated. It is noted that T-TSA may be required to sample effluent for compliance at the filter effluent pipe prior to the disposal field discharge and monitoring point at Well 31. Therefore, limitations such as Nitrogen may be exceeded based on the current WDR's and existing treatment approach. This shall be considered as part of the alternatives analysis.

Workshop No. 1 – Review Findings and Recommendations from Tasks 2 and 3

Workshop No. 1 will be held on the same day as a biweekly progress meeting.

Task 4 - Evaluate Nutrient Removal Process Alternatives

Develop Alternatives

A “universe” of reasonable alternatives will be identified and screened at a high level and shall either be eliminated or moved into the next phase of analysis. Of these alternatives, up to four nutrient removal process alternatives will be evaluated in further detail. These alternatives will be confirmed after the initial screening process is complete. It is assumed the alternative process configurations may consist of the following, however it is understood that this could change after the screening process:

- **Alternative 1** – Continue current Phostrip/ Biostyr process configuration with rehabilitation and optimization including WASSTRIP process for reducing chemical use and nitrified effluent recycle to the plant headworks to reduce methanol addition.
- **Alternative 2** – Five-stage Bardenpho biological process, with sidestream phosphorus recovery process, followed by tertiary filtration.
- **Alternative 3** – Membrane Bio Reactor (MBR) with biological nutrient removal tanks designed for nitrogen and phosphorus removal.
- **Alternative 4** – An emerging technology identified from the "universe" of alternatives screening process.

The alternatives will be modeled using Carollo’s Biowin process model developed for the Master Plan as a starting point and validated with Water Year 2023 data. The original model will be modified to represent each process alternative listed above. Results of the modeling effort will be used to size the facilities and prepare facility layouts that will be the basis for planning level cost estimates. The models will also be used to estimate operating costs such as energy and chemical consumption. Impacts on the existing solids processing train and electrical power loads will be assessed for each alternative.

The WRP Alternative Process Evaluation will also consider potential regulatory scenarios that may occur beyond the 25-year planning horizon so that space is reserved, and considerations made, for future needs to minimize the risk of stranding assets.

The use of flow equalization (FEQ) will also be evaluated for Alternatives 2 – 5. FEQ may be cost effective in that the nutrient removal facilities could be designed for essentially constant flows, without the need to oversize to accommodate daily and seasonal peak flows and loadings. A cost comparison of capital and O&M costs will be performed to compare the cost with and without FEQ. The volume/size of the FEQ basins will be taken from the 2022 Master Plan. Siting conditions and restrictions will be considered to select a preliminary site for the FEQ basin.

Compare Alternatives

The process alternatives will be compared according to the established evaluation criteria. The basis for comparison will include capital costs, O&M costs, use of resources, operability, reliability, use of space, and total life cycle costs, as well as other criteria identified in Task 2. Capital costs will be based on estimates derived from similar facilities. These estimates will be planning level estimates (AACE Class 5) for comparison and budgeting purposes.

Workshop No.2 – Alternatives CAMP®

The CAMP® approach was developed by Carollo to facilitate execution of fast-track projects; however, it has become a popular mechanism for targeted client input and focused collaboration. CAMP® (Concentrated, Accelerated, Motivated, Problem Solving) is a technique to optimize stakeholder participation, make decisions, solidify process criteria, and critically evaluate the design. Through a facilitated approach, the combined experiences of key personnel from the client, the designer, and other specialists are leveraged over a short, concentrated effort to accelerate project development. When decades of experience are brought together in an organized fashion, the quality and speed of decision making are dramatically enhanced, with reduced overall impact on our client's time.

CAMP® is expected to be conducted on-site in Truckee to allow a focused team with minimal interruptions. It will consist of a two-day effort, approximately 6 hours each day. Participants from Carollo and the Agency will be selected several weeks in advance to block out the required time. Tasks for CAMP® include:

- Prepare CAMP® working materials - design information and alternatives evaluations along with a detailed agenda two weeks prior to CAMP®.
- Prepare and present objectives and tasks.
- Provide support services on stand-by to make changes to the alternatives during CAMP®.
- CAMP® notes will be prepared to summarize the discussions and outcomes of the alternatives review process. Notes will include action items, decision expectations, and outcomes/ work products.
- A CAMP® facilitator will be used to keep the process on track. The facilitator will have experience facilitating CAMP® on other projects coupled with our team's technical knowledge of future facility needs and strong relationships with T-TSA staff will keep the CAMP® on track and arriving at a consensus for the selected project alternative.

Develop Selected Alternative

The selected alternative will be developed further to a 10% conceptual design level sufficient to define the project characteristics to become the basis for CEQA permitting and final design implementation. The following will be defined in the project report:

- Site plans for the process components, including the FEQ basin if applicable.
- Process flow diagrams for the new processes and their connection with the existing plant facilities.
- Preliminary hydraulic profile.
- 3-D model of all proposed facilities utilizing Sketchup. Model shall be exported to 2-D plan and section sheets for the proposed facilities.
- Conceptual design of yard piping for all major process piping including tie-ins to existing facilities and new facilities. Any pumping facilities required shall be identified.
- Preliminary design criteria.
- Process descriptions.
- General process control descriptions.
- Capital and O&M costs.
- Chemical requirements, if applicable.
- Power loads and information on power supply as well as electrical facility siting.

Constructability Assessment

Additionally, a construction feasibility assessment will be performed including a preliminary sequence of work that demonstrates the selected alternative is feasible to implement while T-TSA maintains existing treatment objectives. This document will detail the construction sequencing of critical process, power, and communication tie-ins. A preliminary construction schedule will be provided that includes all major elements for construction to understand sequencing and project implementation timing.

Power Load Evaluation

This evaluation will include a detailed discussion on the WRP's current electrical supply system and the limited capacity for additional loads. An load analysis on Building 27 will bee included to identify power supply needs for the proposed facility and how they will be met. Standby power reliability shall also be considered as part of this analysis.

Site Visits to other Water Reclamation Facilities

Carollo will coordinate site visits to three other facilities to allow T-TSA staff to view other facilities that have implemented similar processes for nutrient removal, discuss the process with operations and maintenance staff, and better understand the implications of implementing the technologies. Plants of similar size, with similar nutrient limits, and environmental conditions will be targeted for these site visits. It is assumed that they will be in the Mountain West region of the United States.

Task 5 – Prepare Project Report

Draft Report and Executive Summary

The project report will be prepared in draft form for review by T-TSA. The report will consist of the following chapters and an executive summary suitable for review by the Board of Directors.

- **Chapter 1** – Existing Facility Overview
- **Chapter 2** – Alternatives Evaluation Criteria and Metrics
- **Chapter 3** – Evaluation of Existing Nutrient Removal Process
- **Chapter 4** – Alternatives Analysis
- **Chapter 5** – Selected Alternative Recommendations for Implementation

- **Appendix A** – 10% Level Design Drawings for Recommended Alternative
- **Appendix B** – Cost Estimates
- **Appendix C** – Power Load Study
- **Appendix D** – Supplemental Reference Materials

The draft report will be delivered in electronic (PDF) format. Each draft report chapter will be submitted separately for T-TSA review and comment, summarizing the findings and efforts associated with each task.

Workshop No. 3 – Review Draft Report

Workshop No. 3 will be held to receive comments from Staff and discuss final findings and recommendations. Comments from Staff will be incorporated into the final draft of the report.

Final Report and Executive Summary

The final report and executive summary will be delivered in electronic (pdf) format and hard copy (5 copies).

Deliverables

Project deliverables will include:

1. Project Management Plan
2. Monthly Progress Reports
3. Agenda, presentation material, and minutes for:
   a. Sixteen biweekly progress meetings
   b. One board meeting
   c. Two workshops
   d. CAMP® Workshop
4. Draft and final project report (5 copies of final)
5. Draft (pdf only) and final (5 copies and pdf) of separate Executive Summary

Services/Information to be Provided by Agency

Services and information to be provided by the Agency are provided below.

1. Attend project meetings and review meeting notes.
2. Provide updates on potential future WDR permit as applicable to analyzing the project alternatives.
3. Participate in the CAMP® workshop, expected to require two consecutive 6-hour days.
4. Review project deliverables, including the draft project report. 2 weeks of review time for each deliverable has been assumed in the project schedule. Additional review time will impact the project schedule.

Project Schedule

The project schedule is presented in Exhibit A.

Project Fee

The project fee is presented in Exhibit B.

Assumptions

The following assumptions have been made in development of the attached fee.

- All workshops and the project kick-off meeting will be held in person at T-TSA and include key project staff.
- Biweekly progress meetings will be held virtually using MS Teams platform.
- Project duration is anticipated to be 10 months per the attached schedule.
- Up to 5 liquid-stream alternatives will be evaluated including rehabilitation and optimization of the existing nutrient removal process.
- Development of the recommended alternative will be completed to an estimated 10% level of design completion. This will include a site plan, 3D renderings of proposed facilities showing structural and mechanical facilities using Sketchup exported to 2D sheets, electrical improvements including electrical site plan and one-line diagrams, control block diagram and process control narratives.
- Any required sampling and laboratory analysis will be conducted by T-TSA staff.
- Piloting of the recommended alternative if required will be scoped separately.
- Cost estimate will be AACE Class 5 planning level estimates.
- No geotechnical investigations are included in the scope. Assumptions will be made for foundation designs based on available historical geotechnical information from the site.
- No new survey will be performed. Consultant will rely on available survey and topographical information for the site.
- No permitting is included in the effort. It is assumed that if the recommended alternative is selected for implementation, the necessary permitting efforts will be included as part of the final design scope.

Proposed Organizational Chart and Team Members

The Carollo team offers a local project management team based in Truckee, CA with national nutrient removal expertise that brings real-world experience in implementation of these process alternatives. Our experience implementing solutions for nutrient removal for clients in Avon, Telluride, and Crested Butte Colorado as well as MBR solutions for Modesto California, Meridian and Boise Idaho will provide you with confidence that we understand nutrient removal, and particularly for mountain resort communities.

The success of a project stems directly from the dedication and capabilities of the individuals assigned. The Carollo team has the capacity to proactively partner with Agency staff throughout the entire project, from the earliest conceptual phases through design and construction. This same team has worked extensively together and will function as a cohesive unit to deliver proven and reliable solutions that will exceed your expectations.

Quality Manager
Michael Britten, PE

Project Manager
Richard Gutierrez, PE

Principal-In-Charge
Tim Loper, PE

Technical Advisor
John Fraser, PE

Project Engineer
Jenny Warren, PE

Support Team

Process Modeling
Ron Appleton, PE

Solids Process Assessment
Christine Polo, PE

Regulation Review
Elisa Garvey, PhD, PE

Structural Lead
Mike Dadik, PE

Electrical / I&C Lead
Erik Bahneman, PE

Cost Estimating
Jason Rozgony, PE

Alternatives Development
Chad Knight, PE

Alternatives Evaluation
Bryan Coday, PE

Tim Loper, PE

PRINCIPAL IN CHARGE, TRUCKEE

Tim is Carollo's Chief of Infrastructure Planning. For over 20 years, he has helped clients develop master planning and modeling projects for technically sound, defensible planning documents and an implementable CIP. He understands the dynamics of wastewater facility planning, which he will bring to the team and T-TSA.

RESPONSIBILITIES: Tim will provide executive direction for the project, and provide the commitment of sufficient Carollo resources to meet the project's needs.

Ricky Gutierrez, PE

PROJECT MANAGER, TRUCKEE

Ricky has 22 years of experience in planning, design, and construction of wastewater treatment facilities. He is an expert in secondary and tertiary treatment process evaluation and implementation. Ricky is particularly adept at gaining consensus through leading workshops and design reviews to work through a variety of project challenges.

RESPONSIBILITIES: Ricky will manage the project scope, schedule, and budget, maintain the decision and actions logs, secure project resources, coordinate with team and agency staff, evaluate process alternatives and oversee quality production.

Mike Britten, PE

QUALITY MANAGER, RENO

Mike has over 40 years of experience with master planning, design, and construction management of wastewater facilities. Mike has worked on several nutrient removal facilities throughout his career and is very familiar with denitrification processes, process pump station retrofits, and complex construction sequencing. He has conducted numerous constructability and biddability reviews for secondary treatment and denitrification projects, including those for the cities of Turlock, Modesto, San Jose, South San Francisco, San Leandro, and Central Contra Costa Sanitary District.

RESPONSIBILITIES: Mike's will lead quality management efforts and review all project deliverables.

Jenny Warren, PE

PROJECT ENGINEER, RENO

Jenny brings 20 years of engineering experience in wastewater collection and pumping, construction administration, wastewater treatment facilities, and infrastructure upgrades/rehabilitation. She is well versed in process modeling and evaluations.

RESPONSIBILITIES: Jenny will be responsible for coordinating project team efforts, overseeing the development of deliverables, and providing for cohesive well coordinated work products.

John Fraser, PE

TECHNICAL ADVISOR, DENVER

John has 40 years of experience in planning, designing, and managing wastewater facilities. He has participated in over $630 million in construction projects and serves as Carollo's National Wastewater Practice Director.

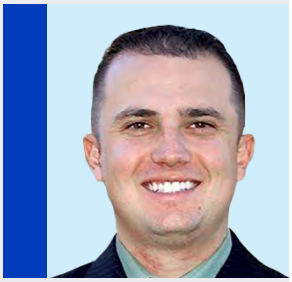
RESPONSIBILITIES: John will provide technical guidance on process components. He will serve as a sounding board for specific design details leveraging his hands-on experience, technical knowledge, and lessons learned.

Ron Appleton, PE

PROCESS MODELING, WALNUT CREEK

Ron brings over 40 years of civil engineering experience with a focus on wastewater treatment plant process and operations optimization. He specializes in process modeling, process evaluation and design, hydraulic analysis and design, and process mechanical design. Ron is a proven expert in “whole plant” simulation using BioWin software to integrate liquid and solids treatment train operations and performance. Ron will be responsible for solids and liquid stream process analysis.

RESPONSIBILITIES: Ron will model the process alternatives using the Biowin model he created for T-TSA as part of the previous Sewer Master Plan effort.



Bryan Coday, PE

ALTERNATIVES EVALUATION, DENVER

Bryan has experience in process engineering, condition assessments, hydraulic modeling, and whole-plant modeling. He developed an advanced and dynamic Biowin model to assess nutrient removal improvements for multiple utilities and has design experience with phosphorus removal and recovery systems from concentrate.

RESPONSIBILITIES: Bryan's experience in implementing nutrient removal process solutions for clients in Colorado including Telluride, Avon, Fort Collins, and others will assist the team in evaluating the process alternatives based on real world experience.

Chad Knight, PE

ALTERNATIVE DEVELOPMENT

Chad has 8 years of experience in civil and environmental engineering projects in northern California and Nevada, including planning, design, and construction services for water and wastewater infrastructure.

RESPONSIBILITIES: Chad will assist with the development and layout of the alternatives, including siting considerations, and modeling of the facilities using Sketchup.

Cristine Polo, PE

SOLIDS PROCESS ASSESSMENT, WALNUT CREEK

Christine is a senior technologist with 12 years of experience performing evaluations to help wastewater utilities select the best processes and technologies for biosolids management and biogas utilization. She has experience with process modeling, conceptual sizing, lifecycle cost analysis, and sustainability assessments.

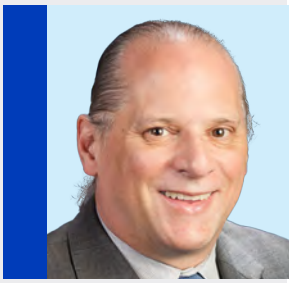
RESPONSIBILITIES: Christine will assess the impacts of the nutrient removal process alternatives on the WRF's solids handling processes.

Elisa Garvey, PE

REGULATION REVIEW, TRUCKEE

Elisa is Carollo's National Water Supply Planning Lead. Her time in water resources planning has required simultaneous attention to detailed planning analyses and long-term goals and strategies. Elisa's 30 years of experience includes master planning with an emphasis on reuse, water resources management, water quality assessments, and regulatory and permitting support.

RESPONSIBILITIES: Elisa will coordinate existing and future permitting activities with the Tahoe-Truckee Sanitation Agency and regulatory agencies and develop likely future regulatory scenarios for analysis.



Mike Dadik, PE

STRUCTURAL ASSESSMENT, WALNUT CREEK

Mike has 30 years of structural engineering experience focused on water and wastewater construction. He has led structural design on numerous projects involving rehabilitation and replacement of water tanks. He also has extensive experience in coating and corrosion controls as he serves as Carollo's coating specialist and is responsible for managing and up-keeping our firm's coatings and finishes specifications.

RESPONSIBILITIES: Mike will assist the team in confirming the preliminary structural assumptions for the alternatives evaluations and recommended alternative design development.

Erik Bahneman, PE

ELECTRICAL I&C ASSESSMENT, WALNUT CREEK

Erik has 18 years of experience in design and construction support of electrical and control systems for water and wastewater facilities. He has developed and overseen dozens of electrical system studies and routinely provides electrical condition assessments and electrical master planning. Erik is qualified in both low- and medium-voltage design and has specific expertise in the design of switchgear, motor controls, instrumentation, and SCADA systems.

RESPONSIBILITIES: Erik will assist the team in confirming the preliminary electrical assumptions and load requirements for the alternatives evaluations and recommended alternative design development.

Jason Rozgony, PE

COST ESTIMATING, DENVER

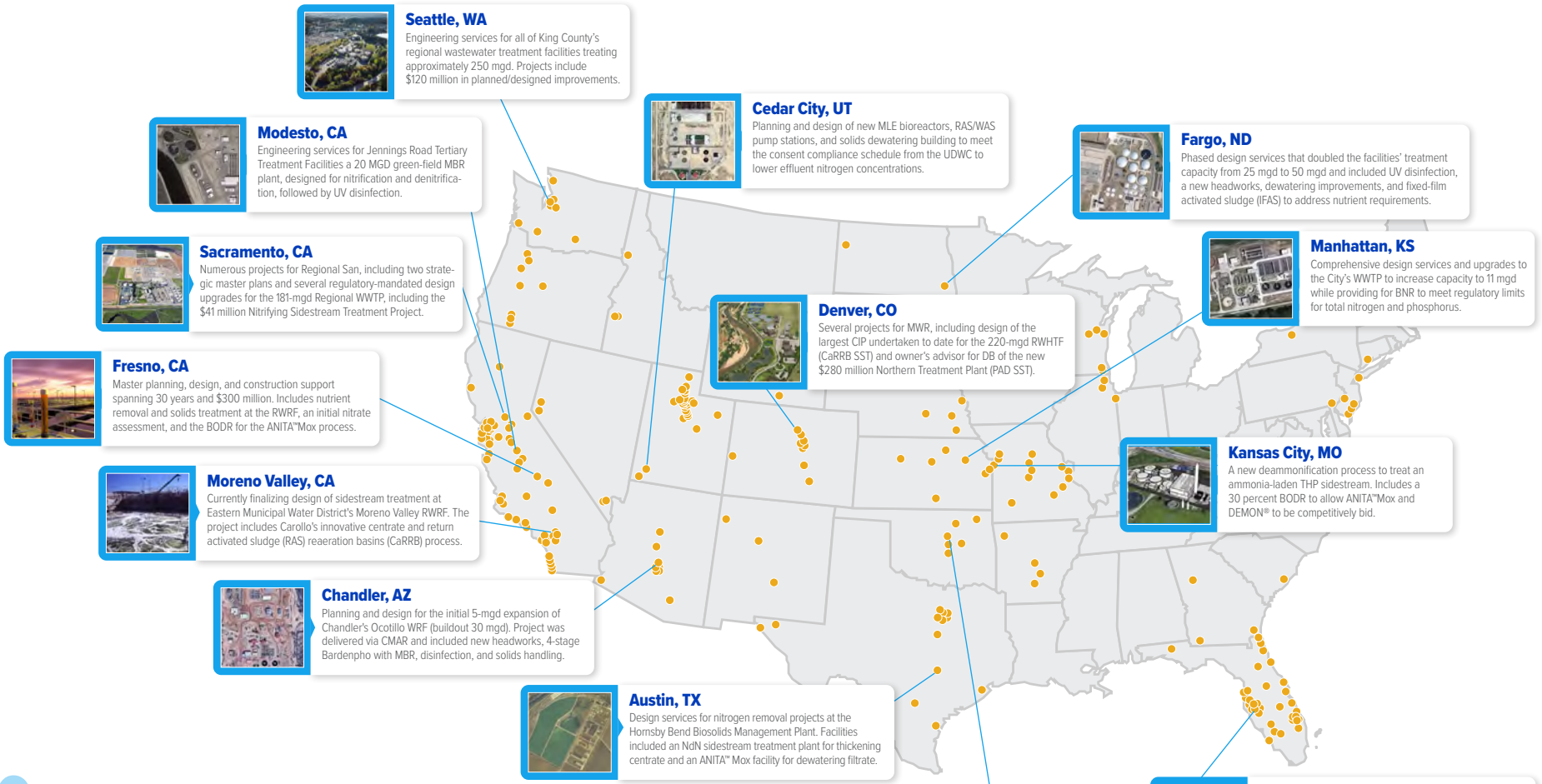
Jason has 26 years of experience developing construction cost estimates for the water and wastewater industry, using various types of project delivery methods. He manages Carollo's companywide cost estimating standards and has prepared discipline-level estimates and complete estimates for more than 150 design and fixed-price construction projects requiring collaboration with design engineers, vendors, and subcontractors from preliminary through final design.

RESPONSIBILITIES: Jason's knowledge will provide the agency with confidence in the engineering estimates provided.

Project Experience

National WRF Nutrient Removal/Recovery and Sidestream Expertise

The lessons learned from these projects will provide valuable insights to make the best possible recommendation for your project.



Seattle, WA
Engineering services for all of King County's regional wastewater treatment facilities treating approximately 250 mgd. Projects include $120 million in planned/designed improvements.

Modesto, CA
Engineering services for Jennings Road Tertiary Treatment Facilities a 20 MGD green-field MBR plant, designed for nitrification and denitrification, followed by UV disinfection.

Sacramento, CA
Numerous projects for Regional San, including two strategic master plans and several regulatory-mandated design upgrades for the 181-mgd Regional WWTP, including the $41 million Nitrifying Sidestream Treatment Project.

Fresno, CA
Master planning, design, and construction support spanning 30 years and $300 million. Includes nutrient removal and solids treatment at the RWRF, an initial nitrate assessment, and the BODR for the ANITA™Mox process.

Moreno Valley, CA
Currently finalizing design of sidestream treatment at Eastern Municipal Water District's Moreno Valley RWRF. The project includes Carollo's innovative centrate and return activated sludge (RAS) reaeration basins (CaRRB) process.

Chandler, AZ
Planning and design for the initial 5-mgd expansion of Chandler's Ocotillo WRF (buildout 30 mgd). Project was delivered via CMAR and included new headworks, 4-stage Bardenpho with MBR, disinfection, and solids handling.

Austin, TX
Design services for nitrogen removal projects at the Hornsby Bend Biosolids Management Plant. Facilities included an NdN sidestream treatment plant for thickening centrate and an ANITA™ Mox facility for dewatering filtrate.

Cedar City, UT
Planning and design of new MLE bioreactors, RAS/WAS pump stations, and solids dewatering building to meet the consent compliance schedule from the UDWC to lower effluent nitrogen concentrations.

Denver, CO
Several projects for MWR, including design of the largest CIP undertaken to date for the 220-mgd RWHTF (CaRRB SST) and owner's advisor for DB of the new $280 million Northern Treatment Plant (PAD SST).

Edmond, OK
Design services for expanding the Coffee Creek WRRF from 9 mgd to 36 mgd. Design included significant nutrient removal to address near- and long-term nitrate and phosphorus effluent limits.

Fargo, ND
Phased design services that doubled the facilities' treatment capacity from 25 mgd to 50 mgd and included UV disinfection, a new headworks, dewatering improvements, and fixed-film activated sludge (IFAS) to address nutrient requirements.

Manhattan, KS
Comprehensive design services and upgrades to the City's WWTP to increase capacity to 11 mgd while providing for BNR to meet regulatory limits for total nitrogen and phosphorus.

Kansas City, MO
A new deammonification process to treat an ammonia-laden THP sidestream. Includes a 30 percent BODR to allow ANITA™Mox and DEMON® to be competitively bid.

Daytona Beach, FL
Phased design projects for the City's two water reclamation facilities. Carollo provided optimization opportunities to reduce electrical and chemical costs while improving the nutrient removal process.

"Carollo's ability to listen and collaborate with the owner on innovative design solutions is unmatched by anyone in the industry. Their attention to detail and thorough design development translates into a quality work product in the field, one that the entire project team can be proud of."

— Sherman Papke, Senior Director of Technical Services
Metro Water Recovery, Denver, CO

Project Schedule

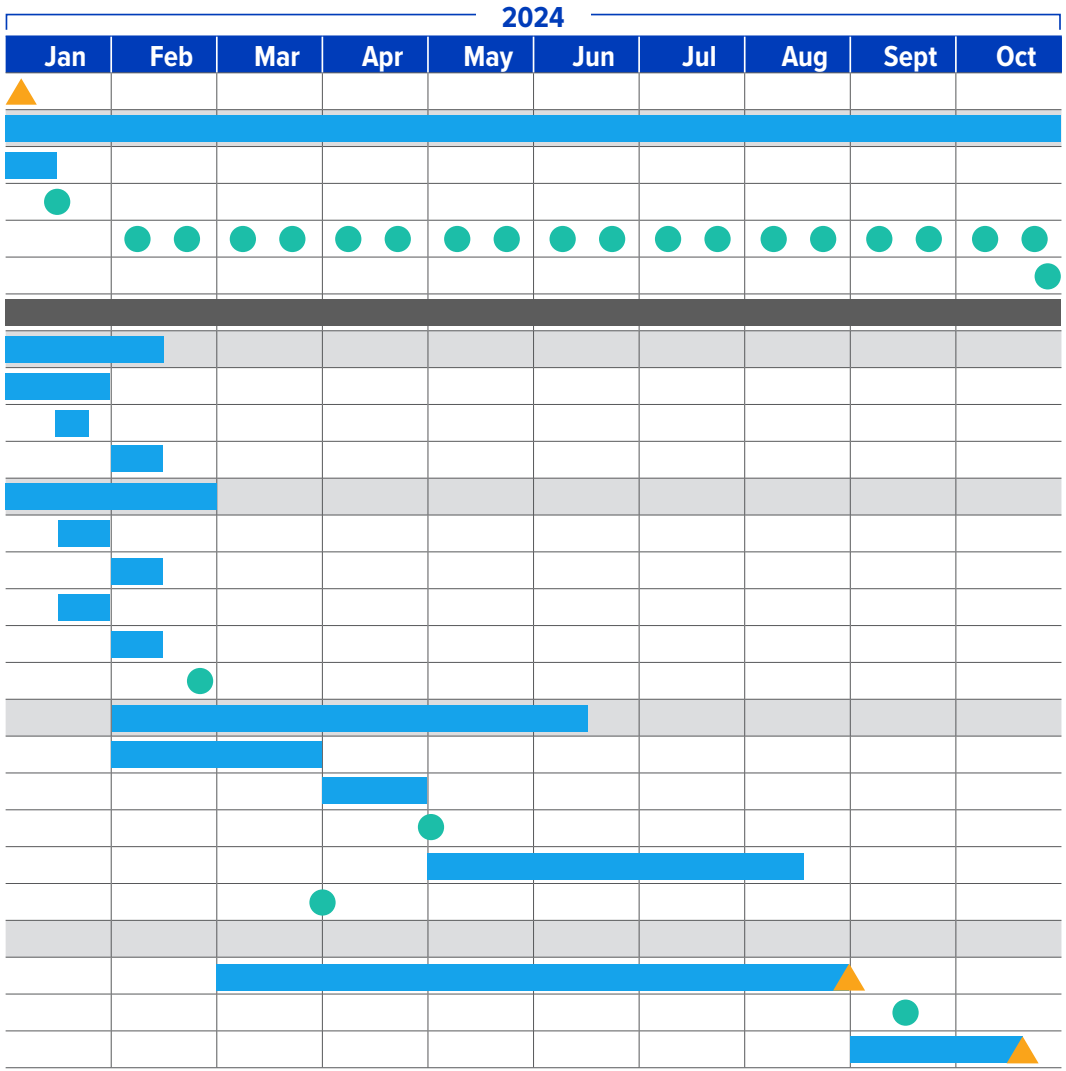


EXHIBIT B

ESTIMATED LEVEL OF EFFORT AND FEE

NUTRIENT REMOVAL ALTERNATIVE PROCESS EVALUATION PROJECT

Tahoe Truckee Sanitary Agency

Task	Job Code	Task Description	CAROLLO LABOR																OTHER DIRECT COSTS		TOTAL OTHER DIRECT COSTS	TOTAL
			Principle-in-Charge Tim Loper	Project Manager Richard Gutierrez	Project Engineer Jenny Warren	Project Professional Chad Knight	Electrical & Instrumentation Lead Engineers Erik Bahneman Darnell Robinson	Technical Advisor John Fraser Andrew Gilmore Scott Parker	Process Lead Engineers Ron Appleton Bryan Coday Ryan Orgill (flow projections)	Quality Manager Michael Britten	Regulatory Review Elissa Garvey	Process Engineer - Solids Christine Polo	Structural Lead Engineer Mike Dodik	Cost Estimator/Constructability Jason Razgony/ Mauricio Gomez	CAD/Graphics	Word Processing/Clerical	TOTAL LABOR HOURS	SUBTOTAL LABOR COST	PECE	REPRODUCTION TRAVEL		
		Billing Rate (2024 Rates)	**$350**	**$324**	**$308**	**$262**	**$324**	**$350**	**$324**	**$350**	**$324**	**$308**	**$324**	**$308**	**$156**	**$133**			**$15**			
1	**T1**	**PROJECT MANAGEMENT**	**10**	**54**	**44**	**2**	**0**	**4**	**8**	**20**	**2**	**0**	**0**	**0**	**8**	**18**	**170**	**$53,504**	**$2,685**	**$1,100**	**$3,785**	**$57,289**
	1.1	Project Management Plan	1	6	0	0	0	0	0	0	0	0	0	0	0	2	9	$2,560	$135	$0	$135	$2,695
	1.2	Kickoff Meeting	2	4	8	2	0	4	8	0	2	0	0	0	4	2	36	$10,514	$540	$1,000	$1,540	$12,054
	1.3	Biweekly Progress Meetings (20 total)	8	20	20	0	0	0	0	0	0	0	0	0	0	10	58	$16,770	$870	$0	$870	$17,640
	1.4	Board Meeting	4	4	8	0	0	0	0	0	0	0	0	0	4	0	20	$5,784	$300	$50	$350	$6,134
	1.5	Invoicing	2	8	0	0	0	0	0	0	0	0	0	0	0	4	14	$3,824	$210	$0	$210	$4,034
	1.6	Monitor Budget, Schedule and Decision Log	2	8	8	0	0	0	0	0	0	0	0	0	0	0	18	$5,756	$270	$0	$270	$6,026
	1.7	Quality Assurance/Quality Control	0	4	0	0	0	0	0	20	0	0	0	0	0	0	24	$8,296	$360	$50	$410	$8,706
2	**T2**	**GATHER BASELINE INFORMATION AND DEVELOP EVAL. PARAMETERS**	**5**	**10**	**16**	**0**	**0**	**12**	**16**	**0**	**4**	**0**	**0**	**0**	**4**	**6**	**73**	**$22,020**	**$1,095**	**$0**	**$1,095**	**$23,115**
	2.1	Gather and Review Existing Information	0	4	8	0	0	4	16	0	0	0	0	0	0	0	32	$10,344	$480	$0	$480	$10,824
	2.2	Evaluation Criteria and Metrics	4	4	4	0	0	8	0	0	4	0	0	0	0	2	26	$8,290	$390	$0	$390	$8,680
	2.3	Description of Existing Facilities	1	2	4	0	0	0	0	0	0	0	0	0	4	4	15	$3,386	$225	$0	$225	$3,611
3	**T3**	**EVALUATE EXISTING FACILITIES**	**6**	**8**	**22**	**0**	**0**	**0**	**56**	**0**	**8**	**0**	**0**	**4**	**4**	**0**	**108**	**$34,060**	**$1,620**	**$1,000**	**$2,620**	**$36,680**
	3.1	Flows and Loads Projection Updates	1	1	4	0	0	0	48	0	0	0	0	0	0	0	54	$17,458	$810	$0	$810	$18,268
	3.2	Process Performance and Capacity Analysis	1	1	4	0	0	0	4	0	0	0	0	0	0	0	10	$3,202	$150	$0	$150	$3,352
	3.3	Condition Assessment and CIP for R&R	1	1	4	0	0	0	0	0	0	0	0	4	0	0	10	$3,138	$150	$0	$150	$3,288
	3.4	Identify Current and Potential Future WDRs	1	1	2	0	0	0	0	0	6	0	0	0	0	0	10	$3,234	$150	$0	$150	$3,384
	3.5	Workshop No. 1 - Review Findings from Tasks 2 and 3	2	4	8	0	0	0	4	0	2	0	0	0	4	0	24	$7,028	$360	$1,000	$1,360	$8,388
4	**T4**	**EVALUATE NUTRIENT REMOVAL PROCESS ALTERNATIVES**	**40**	**100**	**216**	**280**	**256**	**70**	**164**	**64**	**8**	**28**	**84**	**120**	**240**	**40**	**1,710**	**$487,420**	**$25,650**	**$6,003**	**$31,653**	**$519,073**
	4.1	Develop Alternatives	4	8	40	0	8	4	100	0	0	16	8	0	16	8	212	$63,784	$3,180	$0	$3,180	$66,964
	4.2	Compare Alternatives	2	16	20	24	4	30	16	0	8	4	0	40	0	4	168	$51,988	$2,520	$0	$2,520	$54,508
	4.3	Workshop No. 2 - CAMP®	16	16	24	16	16	16	16	16	0	4	4	4	8	4	160	$49,476	$2,400	$4,000	$6,400	$55,876
	4.4	Develop Selected Alternative	4	24	80	200	100	12	16	24	0	4	48	8	200	8	728	$187,912	$10,920	$0	$10,920	$198,832
	4.5	Constructability Assessment	2	16	24	40	8	8	8	8	0	0	24	60	8	8	214	$63,108	$3,210	$1	$3,211	$66,319
	4.6	Power Load Evaluation	0	8	16	0	120	0	0	16	0	0	0	8	8	8	184	$56,776	$2,760	$2	$2,762	$59,538
	4.7	Site Visits to Other WRF's	12	12	12	0	0	0	8	0	0	0	0	0	0	0	44	$14,376	$660	$2,000	$2,660	$17,036
5	**T5**	**PREPARE PROJECT REPORT**	**10**	**24**	**52**	**20**	**8**	**10**	**22**	**0**	**0**	**0**	**0**	**2**	**20**	**22**	**190**	**$52,414**	**$2,850**	**$2,000**	**$4,850**	**$57,264**
	5.1	Draft Report and Executive Summary	4	8	32	16	4	4	16	0	0	0	0	0	16	12	112	$30,012	$1,680	$0	$1,680	$31,692
	5.2	Workshop No. 3 - Review Draft Report	2	4	4	4	4	4	4	0	0	0	0	0	0	2	28	$8,534	$420	$1,500	$1,920	$10,454
	5.3	Final Report and Executive Summary	4	12	16	0	0	2	2	0	0	0	0	2	4	8	50	$13,868	$750	$500	$1,250	$15,118
		TOTAL ALL TASKS	**80**	**196**	**350**	**302**	**264**	**96**	**266**	**84**	**22**	**28**	**84**	**126**	**276**	**86**	**2,260**	**649,418**	**$33,900**	**$10,103**	**$44,003**	**$693,421**

Education

MS Environmental Engineering, University of California, Berkeley, 2005

BS Civil Engineering, California State University, Fresno, 2003

Licenses

Civil Engineer, California, Nevada

Professional Affiliations

Nevada Water Environment Association

American Water Works Association

Timothy J. Loper, PE

Timothy Loper has 20 years of experience in wastewater collection system modeling, water distribution system modeling, water system feasibility studies, wastewater treatment facilities planning, and infrastructure master planning. He is Carollo's Infra-structure Master Planning Services Lead and has served as project manager and/or project engineer for more than 90 water, wastewater, stormwater, and/or recycled water master plans and modeling projects, with a focus on helping agencies develop capital improvement programs that help prioritize rehabilitation and replacement projects, as well as integrate capital with inspection and funding prioritization.

Master/Facility Planning

→ Principal-in-charge for the ongoing Truckee Sanitary District, California, 2017 Hydraulic Modeling Assistance. The District hired Carollo to provide assistance with development and calibration of three of the four existing wastewater collection system models. The models are being calibrated to peak dry and peak wet weather flow conditions using flow monitoring data from the 2016 and 2017 storm season.

→ Project manager for the Washoe County, Nevada, Pleasant Valley Interceptor (PVI) Alternatives Evaluation Study. The PVI was to be constructed in four reaches, ultimately connecting the South Truckee Meadow Water Reclamation Facility (STMWRF) to Damonte Ranch Parkway, Dorothy Town Lift Station, and Pleasant Valley. Reach 3 was planned as a gravity interceptor and Reach 4 will provide sewer service to approximately 1,500 homes. The STMWRF Facility Plan Update included planning and wastewater collection system hydraulic modeling for the STMWRF service areas. Additional work efforts included updating the County's hydraulic model to InfoSWMM; providing a force main risk assessment and pump station capacity evaluation; interceptor, pump station, and forcemain preliminary and detailed design; and preparation of construction contract documents for PVI Reach 3, which included gravity conveyance and the Geiger Lift Station and associated force main.

→ Quality assurance/quality control for the Washoe County, Nevada, South Truckee Meadows Water Reclamation Facility (STMWRF) Facility Plan Update. The project involved an update to Washoe County's 2006 Facility Plan for the 4.1-mgd South Truckee Meadows Water Reclamation Facility, which had nearly reached 80 percent capacity. Working closely with the County, flow and load projections specific to the STMWRF service area were developed, which defined the planning.

→ Principal-in-charge for the City of Porterville Integrated Master Plan for water, wastewater, and storm drainage. The wastewater element also included an evaluation of the condition of the wastewater treatment plant. Carollo conducted a water demand analysis by looking at historical water production and consumption data as well as conducting an evaluation of per capita consumption.

→ Project engineer for the City of Modesto, California, Wastewater Collection System and Treatment Master Plan Update.Responsible for construction of the wastewater collection system hydraulic computer model using the City's existing maps and GIS database. Also responsible for collection system analysis to determine appropriate flow monitoring locations and sewer basin determination and assistance with the collection system condition assessment. Performed GIS data verification and updated existing data-bases to reflect current conditions. These responsibilities required the application of GIS and hydraulic modeling software.

→ Quality control engineer for the Padre Dam Municipal Water, California, 2015 Comprehensive Master Plan. This integrated master plan involved the District's water, wastewater, and recycled water infrastructure. The project included potable and recycled water demand and sewer flows forecasting, water supply analysis, hydraulic model updates for water and recycled water

systems, development and calibration of a new sewer system model, and field condition assessment of key facilities. In addition, the feasibility of the wastewater plant expansion for an indirect potable reuse project was evaluated. Findings were incorporated in a comprehensive capital improvement plan and water master plan report.

→ Project manager for the City of Fresno, California, Kings River Pipeline and Southeast Surface Water Treatment Plant (SESWTP) Design. Carollo designed and provided engineering services during construction of the new 80-mgd SESWTP as part of a 10-year Metro Water Plan. The 72-inch transmission pipeline will divert raw water from the Kings River to the SESWTP for treatment and potable water distribution.

→ Project manager for the Integrated Utility Master Plan, City of St. Helena, California. Developed a 20-year CIP and operational, business process, and asset management recommendations.

→ Collection system lead for the City of Grand Junction, Colorado, Persigo Wastewater Treatment Plant Master Plan Development. The project involved development of a flow monitoring program to collect data on system flows and calibrate them to wet weather system response. Carollo developed an InfoSWMM model based on the City's GIS. Responsible for scope development, quality control, and review of deliverables.

→ Technical advisor and collection system lead for the City of Riverside, California, Comprehensive Wastewater Master Plan, which included both treatment and wastewater collection systems. Carollo built the City's collection system model using the Innovyze InfoSWMM modeling software.

→ Project engineer for the Dominion Water and Sanitation District, Colorado, Collection System Master Plan. The project involved creation and implementation of a collection system master plan for the District's existing and future collection system. Modeling work included design flow development, sewer alignment/sizing, lift station and force main siting evaluations, and evaluation of improvements through the various planning horizons.

→ Project manager for City of Tulare, California, Sewer, Water, and Storm Drain Master Plans and Sewer System Management Plan. The project developed master planning documents for infrastructure improvements to serve rapid growth within the City. Responsible for coordination of the water, sewer, and storm drain computer models that integrate GIS databases into the modeling platform. The wastewater collection system included industrial and domestic collection systems with separate treatment facilities. The storm drain task required coordination with the Tulare Irrigation District for discharge of storm water from the City's drainage facilities.

→ Project engineer for the City of Modesto, California, Wastewater Collection System and Treatment Master Plan Update. Responsible for construction of the wastewater collection system hydraulic computer model using the City's existing plat maps and GIS database. Also responsible for collection system analysis to determine appropriate flow monitoring locations and sewer basin determination and assistance with the collection system condition assessment. Performed GIS data verification and updated existing databases to reflect current conditions. These responsibilities required the application of GIS and hydraulic modeling software.

→ Project manager for Vallejo Flood and Wastewater District, California, Collection System Master Plan. Responsible for day-to-day management and technical direction, including District and subconsultant coordination, progress meetings, and communication. Provided technical direction for development of the flow monitoring program, hydraulic model construction and calibration, and development of the inspection and rehabilitation program.

Education

MS Civil and Environmental Engineering, University of California, Davis, 2006

BS Civil Engineering, California State University, Fresno, 2004

Licenses

Civil Engineer, California, Nevada

Certification

10-Hour Construction Safety and Health, Occupational Safety and Health Administration, California, 10/18/2007

Professional Affiliations

California Water Environment Association

Water Environment Federation

American Water Works Association

Hydraulic Institute Canvassing Committee

Richard L. Gutierrez, PE

Ricky Gutierrez joined Carollo Engineers in 2001 and has been involved in a broad range of projects, including planning, design, and construction of wastewater treatment facilities, water treatment facilities, water reuse facilities, and infrastructure projects including water storage tanks, pipelines (including trenchless technology evaluations), intakes, river outfalls and diffusers, sewer lift stations and booster pump stations. He is also a pump expert and responsible for overseeing Carollo standard specifications related to various pump technologies.

Pump Stations

→ Project engineer for the Tahoe-Truckee Sanitation Agency, California, Master Sewer Plan. The project involved a detailed condition assessment of the Agency's sewer infrastructure, including visual assessments of all tanks, mechanical equipment, and electrical gear. The planning effort also included hydraulic modeling of the collection system, hydraulic and process modeling for the Water Reclamation Plant, and recommendations for capital improvements projects, including planning level cost estimates for all recommended projects.

→ Project engineer for the Sacramento Regional County Sanitation District, California, EchoWater Project $50 million Nitrifying Sidestream Treatment Project (NST). NST will use nitrifying sequencing batch reactors to reduce ammonia in the solids treatment system supernatant necessary to meet interim permit conditions. It will also produce nitrate-rich effluent for odor control. NST includes influent and effluent pumping and lime addition. The project was accelerated to save $1.1 million per year in avoided sodium hypochlorite costs.

→ Project manager for the Union Sanitary District, California Alvarado Influent Pump Station Improvements Project. This project involved seismic and mechanical upgrades to an existing lift station. The improvements increased the firm capacity of the lift station to 39 mgd and replaced the vertical shaft centrifugal pumps with centrifugal chopper pumps with immersible motors that will allow the pump station to continue to operate in the event that the dry well were to flood.

→ Project manager for preliminary design of the South County Ag Pump Station for the Sacramento Regional County Sanitation District, California, EchoWater Project Tertiary Treatment Facilities Project (TTF). TTF will provide filtration and disinfection of secondary effluent to a level equivalent to Title 22 requirements for tertiary disinfected recycled water for unrestricted reuse. Tertiary facilities include a 330-mgd filter influent pump station, 217 mgd of granular media filters, backwash equalization and treatment, chemical feed systems, covered disinfection contact basin, and a new area control center. The South County Ag Pump Station consists of an 80-mgd recycled water pump station to distribute recycled water for use within the unincorporated areas of south Sacramento County. The design consists of six vertical turbine pumps in cans, a meter vault structure, surge tanks, and a 54-inch-diameter discharge pipeline.

→ Project manager for the Sacramento Regional County Sanitation District, California, EchoWater Project $32 million Return Activated Sludge Pumping Project (RAS). RAS will replace existing return activated sludge pumps with new pumps designed to deliver the higher flow and head conditions required by the new biological nutrient removal (BNR) process. RAS will have a capacity of over 200 mgd and includes 48 pumps located at 24 secondary sedimentation tanks. Carollo completed preliminary design of the system including hydraulic modeling, recommendations on pump selection, an electrical load study that recommends changes to the existing power distribution system, and an instrumentation and control systems review that recommends changes for improved control and monitoring. The design also incorporated replacement of the coarse bubble channel aeration system in the mixed liquor channels as well as a condition assessment and structural improvements for the existing facilities. The preliminary design also included an in-depth construction implementation plan to allow

construction of improvements while minimizing the impact on the operation of the existing plant and a completion schedule that would allow timely commissioning of the new BNR facility.

→ Project engineer for the Sacramento Regional County Sanitation District, California, EchoWater Project $130 million Flow Equalization Project (FEQ). FEQ will provide an additional 110 MG of storage capacity for the facility. Additional features include roller-compacted concrete lined basins, spillways and interconnections structures, 84-inch-diameter final effluent distribution pipeline, underdrain pump station, and basin washdown system. The washdown system consists of manual and automated water cannons for efficient washdown of the over 60 acres of basin area.

→ Engineer for the City of Daly City, California, Wastewater Treatment Plant Feasibility Study for Tertiary Treatment Expansion. The project evaluated the feasibility of expanding the tertiary treatment facilities at the existing wastewater treatment plant and included an analysis of several disinfection and filtration technologies. Technologies evaluated included in-vessel UV, ozone disinfection, pasteurization, and microfiltration membrane systems. Responsible for analysis of disinfection and filtration technologies, site configuration and layout, cost analysis, development of design alternatives, and report preparation.

→ Design engineer for the City of Chico, California, Water Pollution Control Plant 12-mgd Expansion. The project expanded plant capacity from 9 to 12 mgd and included construction of a new headworks facility, grit basins, aeration tanks, secondary clarifier, digester, modifications to existing pump stations, and various other improvements. Responsible for design and engineering services during construction for aeration tanks, sludge drying beds, hydropneumatic plant water tank, primary effluent pump station modifications, thickened sludge pump station, yard piping, and civil site work.

→ Project manager for the Reno/Sparks, Nevada, TMWRF Filtration Expansion and Disinfection Improvements project. The project involved evaluating alternatives for expansion of the existing granular media tertiary filtration (GMF) process to a firm capacity of 38 mgd, including retrofit with cloth media disc filters. A cloth media disc filter pilot was conducted at the plant for 3 months to validate its performance and compare it to the existing GMF process. The other component of the project was to evaluate replacement of the chlorine contact disinfection system with ultraviolet (UV) disinfection for both river discharge and reuse effluent.

→ Project manager for the Reno/Sparks, Nevada, TMWRF Hot Water Loop System improvements project. The project consisted of evaluating the existing hot water loop and designing improvements for optimizing and rehabilitating the system. This included analysis of the heat sources and demands including cogeneration, digester heating, boilers, and heat exchangers. The project is being implemented in two phases, the first phase will address immediate concerns such as failing piping and inefficiencies and the second phase will look to centralize the heat sources for further optimization and simplification of the system.

→ Project engineer for the South Tahoe Public Utility District, California, Energy Optimization Study. The project involved collection and evaluation of relevant energy, process, and mechanical data to provide recommendations for reducing energy consumption within the secondary treatment process. The study evaluated current aeration practices and provided recommendations for implementation of more energy-efficient secondary treatment aeration practices. Conducted a plant-wide energy audit and suggested process optimization, data collection, and new monitoring stations to reduce energy for treatment and define future capital improvement program projects with a high return on investment.

→ Project manager for the South Tahoe Public Utilities District, California, Secondary Clarifiers Rehabilitation. The project included rehabilitation of the plant's three secondary clarifiers; replacement of the old organ pipe sludge collectors with new mechanisms.

Education

BS Civil Engineering, Arizona State University, 1974

Licenses

Civil Engineer, California, CE 27729

Professional Affiliations

Water Environment Federation

American Society of Civil Engineers

Michael J. Britten, P.E.

Michael Britten is a senior vice president with Carollo Engineers and has over 45 years of experience in master planning, design, and construction management of wastewater, water, and storm water facilities. His relevant experience includes:

Relevant Experience

→ Project Manager for the liquids-related projects as part of the overall $1.4 billion San Jose Regional Wastewater Facility Capital Improvement Program in San Jose, California. The projects under Mike's direction totaled $360 million. Major projects included aeration tanks rehabilitation, blower systems rehabilitation, tertiary filters rehabilitation, secondary clarifier rehabilitation, and a new headworks facility.

→ Project manager for the Central Contra Costa Sanitary District Comprehensive Wastewater Master Plan in Martinez, California. The plan encompassed a $1.8 billion capital improvement program for the collection system and wastewater treatment plant. The project included evaluations of nutrient removal alternatives at the wastewater treatment plant, including a membrane bioreactor (MBR) facility that would replace the existing conventional activated sludge system. The recommended alternative is to replace the activated sludge system with a new MBR facility.

→ Principal-in-charge/project manager for the City of Modesto, California Jennings Road Tertiary Treatment Facilities. Mike was responsible for the wastewater master plan and design of the facilities. During the planning phase, Mike's team evaluated alternatives to integrate tertiary/nutrient removal processes with the existing secondary treatment plant. The team worked closely with the City via the CAMP® process to select the recommended project. The project consists of a 20 million gallons per day greenfield MBR plant, designed for nitrification and denitrification, followed by UV disinfection. The City chose this process to provide the highest water quality that would be suitable for recycled water use. Following completion of the MBR plant, the City implemented the North Valley Regional Recycled Water Program for the Del Puerto Water District. All the Jennings Road Plant effluent is being sent to the Delta Mendota Canal where it is blended with the canal flow. Under agreements with the Bureau of Reclamation, customers of the water district can draw from the canal the equivalent flow contributed by the City's Jennings Road Plant.

→ Project Manager for the City of Turlock, California Regional Water Quality Control Facility expansion/improvement projects. Mike and his team worked with the City to evaluate alternatives to meet more stringent waste discharge requirements including the need to meet Title 22 tertiary levels, ammonia limits and disinfection byproducts limits. The resulting project included a new tertiary treatment train consisting of new aeration basins designed for nitrification/denitrification, ballasted flocculation, cloth disc filters and chlorine contact tanks. The plant effluent, currently at 12 million gallons per day, is conveyed through a new pipeline to combine with the effluent from the City of Modesto as part of the North Valley Regional Recycled Water Program.

→ Project Manager for the City of South San Francisco, California Water Pollution Control Plant expansions and improvements. Mike was responsible for the design of wet weather flow improvements and capacity expansions implemented over several projects. Effluent flow equalization was included to reduce peak flows to the Bay outfall.

→ Project Manager for the City of Daly City 7.0 million gallon per day wastewater treatment plant expansions and improvements. Implemented over several projects, the plant improvements included new primary and secondary clarifiers, continuous backwash tertiary filters, and chlorine contact tanks. The City supplies recycled water to four major golf courses. The project included underground flow equalization tanks that equalize dry and wet weather flows to allow a near-constant feed rate to the secondary treatment processes.

Jennifer Warren, PE

Jennifer Warren is an environmental engineer with more than 15 years of experience. She excels in various aspects of water and wastewater engineering, including project management, design, permitting, water quality analysis, technical writing, and construction administration. Jennifer is detail-oriented and diligent with excellent interpersonal skills and a constant focus on the budget and deadline of a project.

Education

MS Environmental Engineering, University of California, Davis, 2008

BS Civil Engineering, University of Texas at Austin, 2003

Licenses

Professional Engineer, Alaska, Montana

Professional Affiliations

Water Environment Federation (WEF)

WEF Delegate for State of Alaska

Alaska Water and Wastewater Management Association, Past President, Vice President, and Trustee

Awards

Civil Engineering Robert S. Braden Technical Communication Award, University of Texas at Austin

Department of Civil Engineering Leadership Award, University of Texas at Austin

Relevant Experience

→ Project engineer for Lucero Olive Oil, LLC, California, Report of Waste Discharge (ROWD) Technical Report Assistance. Prepared the ROWD for land application of process waters and worked with the Regional Water Quality Control Board to obtain Waste Discharge Requirements. Performed calculations to determine appropriate application rates to meet regulatory nutrient loading limits and conducted an evaluation of the stormwater runoff containment. Prepared process schematics and liquid and solid mass balances for the ROWD.

→ Senior engineer for the State of Montana Department of Environmental Quality Public Subsurface Wastewater Applications. Reviewed proposed public subsurface wastewater treatment systems to make sure they were in accordance with water quality standards, including non-degradation requirements for nitrogen and phosphorous in groundwater and surface water. Prepared legal approval documents for the State of Montana stipulating allowed discharges of wastewater effluent.

→ Senior review and process engineer for the Metlakatla Indian Community, Alaska, Water Treatment Plant Preliminary Engineering Report (PER). Calculated the water age throughout the community distribution system based on tracer study results. From these results, prepared the PER with recommendations to bring the facility back into compliance for disinfection byproduct formation. Project recommendations included mitigation for corrosion potential to avoid unintended increases in lead and copper concentrations.

→ Project engineer for the Anchorage Water and Wastewater Utility, Alaska, Eklutna Water Treatment Facility Filter to Waste (FTW) Upgrade. Designed the rehabilitation of the existing 30-mgd facility for upgrade to incorporate a pumped FTW system. Performed design calculations to size pumps, evaluated hydraulics of revised treatment train, and prepared plans and specifications for construction. Also performed construction administration services.

→ Project manager for a combined project titled the Anchorage Water and Wastewater Utility, Alaska, Eklutna Water Treatment Facility Polymer Upgrade and Eagle River Wastewater Treatment Facility Blower Upgrade. Served as project engineer for the polymer upgrade portion of the project. Conducted design calculations for the polyelectrolyte batch preparation and delivery system to dose polyelectrolyte to second-stage flocculation. Prepared construction plans and specifications for the polymer upgrade. As project manager, oversaw the creation of a unified, consistent submittal package for the entire project encompassing two contrasting designs and several subconsultants. Also performed engineering services during construction.

→ Project engineer for the City of Galt, California, NPDES Permit Renewal Assistance. Provided regulatory assistance for the Wastewater Treatment Plant and Reclamation Facility during the permitting process to obtain an NPDES permit. Prepared multiple letters to the Regional Water Quality Control Board and reports, including a Compliance Schedule Justification Statement and Analytical Methods Report.

→ Process engineer for the California Department of Corrections and Rehabilitation Deuel Vocational Institution Wastewater Treatment Plant. Assisted with the preparation of an NPDES permit application and Report of Waste Discharge. Provided regulatory assistance, including preparation of a Toxicity Reduction Evaluation Work Plan and coordination with the Regional Water Quality Control Board to relocate sampling locations.

Jennifer Warren, PE

Other Accomplishments

National Institute of Health Biotechnology Fellow at University of California, Davis.

2003 National Science Foundation-funded research assistant at the Montana State University Center for Biofilm Engineering on project using continuous flow reactors to evaluate oxidative species for disinfection.

2002 National Science Foundation-funded research assistant at the University of Colorado, Boulder, Environmental Engineering Department on project evaluating enhanced in-situ bioremediation.

→ Process engineer for the Holland America Denali Resort, Alaska, Wastewater Treatment Plant (WWTP) design. The project included a new 0.5-mgd WWTP consisting of fine screens, equalization tanks, aeration basins, membrane bioreactors (MBRs), ultraviolet disinfection, and centrifugation. Sized treatment units to achieve appropriate sludge retention time for new MBRs using biological modeling software. Sized new blowers and diffuser systems for the aeration systems throughout the plant.

→ Project manager and engineer for the City of Soldotna, Alaska, Wastewater Treatment Facility Improvements Design, which replaced the existing centrifugal blowers with dual-core high-speed turbo blowers and replaced the secondary clarifier mechanisms.

→ Senior review engineer for the Anchorage Water and Wastewater Utility, Alaska, Asplund Wastewater Treatment Facility Scum System Upgrade, which included novel heating systems to prevent freezing. Reviewed and aided in design plans for new scum beaches, hoppers, primary scum piping and pumps, concentrated scum piping and pumps, and heating systems, including water jackets and insulation for scum beaches and hoppers.

→ Project manager and project engineer for the Anchorage Water and Wastewater Utility, Alaska, Eagle River Wastewater Treatment Facility (WWTF) Rehabilitation Upgrade Phase 2. The project replaced the existing headworks with a new headworks building for the WWTF, consisting of flow monitoring, influent sampling, fine screens with integrated washing and compaction, grit basins, grit washing, screening/grit conveyance, plant drain system, drain and grit pumps, associated utility water systems, and odor control. Prepared evaluation reports comparing potential equipment technologies for equipment selection, conducted hydraulic calculations for the new headworks, and designed the new headworks, including preparation of plans and specifications. Provided quality assurance/quality control of design calculations and documents of contributing engineers for the grit pumps and odor control system. Provided engineering services during construction, including commissioning and startup.

→ Project manager and engineer for the Anchorage Water and Wastewater Utility, Alaska, Eagle River Wastewater Treatment Facility Rehabilitation Upgrade Phase I, which replaced the recycled activated sludge (RAS) and waste activated sludge (WAS) pumps and piping network. Prepared an evaluation report of RAS pumping options, with evaluation of design criteria, and a Basis of Design Report. Conducted design calculations and prepared plans and specifications for new RAS and WAS pumps and piping. Provided engineering services during construction.

→ Project engineer for the Anchorage Water and Wastewater Utility, Alaska, Ship Creek Water Treatment Facility Rehabilitation. Conducted an evaluation of chlorine contact time. Designed a clearwell hydraulic mixing system, new facility domestic water distribution pumps, and new 30-inch effluent valve and flow meter. Prepared plans and specifications and conducted engineering services during construction.

→ Project engineer for the Anchorage Water and Wastewater Utility, Alaska, Ship Creek Water Treatment Facility Rehabilitation. Conducted an alternative coagulant evaluation. Conducted bench-scale jar tests and full-scale treatment plant tests during various seasons to evaluate the performance of various coagulants to produce compliant finished water quality. Prepared technical reports, including a Testing Protocol Memo, Bench-Scale Test Report, Full-Scale Test Report, and Final Alternative Coagulant Evaluation Report.

→ Reviewed several non-community and community public water supply systems for the State of Montana Department of Environmental Quality. Reviewed proposed wells to ensure compliance with state and federal regulations. Issued technical legal approvals for public well location and construction, distribution, and treatment.

Education

MS Environmental Engineering, University of Illinois, 1986

BS Civil Engineering, California State Polytechnic University, Pomona, 1984

Licenses

Civil Engineer, Colorado, California

Professional Engineer, Hawaii

Professional Affiliations

Water Environment Federation

- Research Committee Chairman

American Water Works Association

California Water Environment Association

- Research Sub Committee Past Chair

John S. Fraser, PE

John Fraser is a Senior Vice President and Wastewater Practice Director with Carollo Engineers. He oversees a team of wastewater subject matter experts and process technology specialists who assist with all Carollo wastewater projects across the US. John serves in the planning, preliminary, and final design at treatment plants ranging in capacity from 1.0 mgd to more than 450 mgd. Project costs have ranged from less than $1 million to more than $4 billion and cover all aspects of wastewater treatment and solids handling. John is a technical leader/wastewater specialist who performs optimization evaluations at many plants nationally.

Wastewater Treatment

→ Project manager for the Kirie and Egan WRFs Phosphorus Removal Feasibility Study, Metropolitan Water Reclamation District of Greater Chicago, Illinois. Managed the phosphorus removal feasibility studies in preparation for upcoming effluent phosphorus criteria. As part of this study, Carollo identified and evaluated a range of measures for reducing phosphorus discharges from the treatment plant and possible source reduction measures, operational improvements, and minor facility modifications. Carollo also conducted a "feasibility study" including major operational and capital improvements, including new unit processes that would be required to consistently meet each potential effluent phosphorus tier.

→ Partner-in-charge for preliminary design of headworks facilities for City of Northglenn, Colorado. Work included a unique process strategy of blending screened and degritted raw wastewater and aerated lagoon effluent upstream of activated sludge to provide a primary effluent equivalent feed without the need to construct clarifiers. This approach supports denitrification while avoiding a significant cost for supplemental carbon addition through methanol. The headworks will include fine screens and vortex grit removal as well as odor control facilities.

→ Project manager for the preliminary and final design of Denver, Colorado's, Metro Water Recovery MWR South Secondary Improvements Project. The project incorporated a two year effort in design of a new 110-mgd BNR activated sludge secondary complex with an anticipated construction cost of $225 million. The facility will provide complete nitrification and denitrification and phosphorus removal. The design features six parallel activated sludge aeration basins each with a capacity of nearly 20-mgd. The treatment complex includes a common mechanical building featuring a 250-mgd primary effluent pump station and an aeration blower building housing five 2,000-hp blowers. The plant will be constructed on a new area of the existing site and incorporate centrate treatment facilities using a unique Centrate and RAS Re-aeration Basin (CaRRB) process. The new facility features an extensive network of piping and equipment galleries surrounding the complex to contain all piping pumping equipment and electrical cabling inside and protected from inclement weather. The project included planning to maintain plant operations while about $90 million of rehab occurs in and adjacent to operating facilities. The project incorporated over 2,500 drawing sheets and ten volumes of bid documents.

→ Partner-in-charge for preparation of wastewater utility plan for Breckenridge Sanitation District's Farmer's Korner and Iowa Hill WWTPs. Study included identifying facilities needs for future nit/denit and continued compliance with very low effluent phosphorus limits. Identified 20-yr. capital improvements program up to $80 million at both facilities.

→ Technical advisor and local project coordinator for Clark County Water Reclamation District's 40-mgd Central Plant South Secondary Treatment Facilities, resulting in one of the largest Biological Phosphorus Removal plants in the nation. As managing principal of Carollo's Las Vegas office, involved in consulting at all technical workshops associated with this project. Work included technical review, value engineering, and confirmation of client satisfaction.

John S. Fraser, PE

The work included planning and design of two activated sludge trains rated at 10-mgd each. The design included: two compartmentalized aeration basins capable of biological phosphorus removal, two 140 -foot-diameter secondary clarifiers, a utility tunnel and underground RAS/WAS pump station, and a single-stage centrifugal blower building designed to support 40-mgd capacity. The work also included conversion of the existing 80-mgd plant from chemical to biological phosphorus removal. The CCWRD facility is the largest Bio-P removal facility in the US. Also served in a similar role during the construction phase of this project.

→ Technical advisor and local project coordinator for the cities of Reno and Sparks, Nevada, Truckee Meadows Water Reclamation Facility (TMWRF) lime addition system pre-design project. The project included evaluation of lime addition for phosphorus removal. The lime system consisted of a slurry contact clarifier and lime slaking and handling system. Work included layout and costing of the facility and comparison to biological phosphorus removal.

→ Technical director for the City of Sioux Falls, South Dakota, Water Reclamation Facility Expansion and Improvements Project. Project entails upgrades and expansion upgrades and expansion to preliminary/ primary, secondary, and tertiary treatment, as well as solids handling facilities to take the plant from a 79 ML/d to 113 ML/d. John improved design evolution from a master plan layout developed by another consultant that wasn't optimized for performance, ease of operation, or cost, to a streamlined logical process and cost-conscious layout. Design included provisions to transition from trickling filter/activated sludge to a modern BNR capable of meeting future nutrient discharge criteria.

→ Technical advisor for the EchoWater Projects, Sacramento Regional County Sanitation District, California. Provided expertise for four major design contracts (totaling $550 million) as part of the $1.8 billion EchoWater Project. This massive upgrade will help Regional San meet strict new water quality requirements, provide for storage of peak flows in excess of 330 mgd, and maximize water recycling opportunities.

→ Technical director for the WPCP Secondary Treatment and Dewatering project, City of Sunnyvale, California. The project included a phased replacement of the aging secondary treatment system (oxidation ponds and trickling filters). The new conventional activated sludge (CAS) process designed in an MLE configuration will operate in parallel with the existing secondary treatment system, resulting in effluent total nitrogen removal to below 8 mg/L.

→ Project advisor for the City of Fargo, North Dakota, Wastewater Treatment Facility Phase IIB Expansion Final Design. Main elements of the solids stream improvements include design of a new centrifuge sludge thickening facility, a new anaerobic digester, new digested sludge pumps, new sludge heating system with heat exchangers, and a new compressed natural gas (CNG) system including digester gas treatment and an on-site fueling station. Design efforts include a significant focus on plant capacity while defining the construction sequencing and constraints.

→ Project engineer for final design of the South Tahoe Public Utility District, South Lake Tahoe, California 7.7-mgd upgrade. The design included grit chamber modifications, RAS pump station upgrades, chlorine contact basin baffling, and odor control systems for the multiple-hearth sludge furnace and centrifuge dewatering system.

→ Project engineer for the South Tahoe Public Utility District, California, emergency retention basin sealing project. The project was specially designed to prevent leakage from the basin and control odors associated with solids deposition. Responsibilities included overseeing the design of a compartmentalized storage basin using a high-density polyethylene liner system and odor control washdown system for a 56-million-gallon storage basin.

Education

MS Civil Engineering, Stanford University, 1981

BS Civil Engineering, Stanford University, 1981

Licenses

Civil Engineer, California

Professional Engineer, Maryland, Virginia

Professional Affiliations

American Chemical Society

American Society of Civil Engineers

International Water Association

Sigma Xi

Water Environment Federation

A. Ron Appleton Jr., PE

Ron Appleton has 39 years of civil engineering experience emphasizing biological, physicochemical, and aqueous chemistry aspects of municipal and industrial wastewater treatment, recycled water treatment, and solids handling. He specializes in process modeling, process evaluation and design, hydraulic analysis and design, and process mechanical design. Since 2011 he has taught a class he developed for the graduate Environmental Engineering and Science program at Stanford University, CEE271D – Introduction to Wastewater Treatment Process Modeling. He has provided company-wide training in the use of treatment plant hydraulics analysis software and subsequent assistance in modeling specific process configurations. He is expert in "whole plant" simulation using BioWin™, SUMO, and GPS-X software to integrate liquid and solids treatment train operations and performance.

Relevant Experience

→ Staff engineer for the Potomac Estuary Experimental Estuary Water Treatment Plant, US Army Corps of Engineers, Washington Aqueduct Division, Washington, DC. Evaluated operations and performance of a 1.0 mgd advanced water treatment plant (microscreens, air stripping, chemical addition/flocculation, sedimentation, filtration, granular activated carbon adsorption, reverse osmosis, and chlorine and/or ozone disinfection), which treated a 1:1 blend of Blue Plains WWTP nitrified effluent and Potomac River water to simulate predicted future river raw water quality. Evaluated influent water quality, interpreted synthetic organic chemical (SOC) removal across the plant, and summarized modeling of future Potomac River water quality.

→ Technical advisor for the Regional Water Quality Control Plant Copper Removal Performance Study, City of Palo Alto, California. Provided technical advice for evaluating copper removal at the 39.0 mgd Palo Alto RWQCP. Evaluated interconversion of dissolved and particulate copper through the various unit processes relative to compliance with a 4.9 ug/L total copper discharge limit. In an earlier local limits development study, evaluated headworks metals loadings from the domestic water supply.

→ Technical support for the Phase 1 and 2 Sewer Rehabilitation Projects, City of Concord, California. Provided technical support for evaluating impacts of constituents in spent cure water (esp. styrene) from cured in place pipe (CIPP) sewer rehabilitation projects on biological treatment facilities at the 45 mgd CCCSD WWTP. Reviewed two-stage granular activated carbon (GAC) contactor system proposed for styrene removal.

→ Process engineer for the San Luis Obispo Wastewater Treatment Plant Master Plan Update, City of San Luis Obispo, California. The master plan update was to increase capacity from 5.1 to 5.85 mgd and meet an anticipated monthly average total nitrogen discharge limit of 10 mg N/L. Collected performance data to calibrate rock trickling filter BOD removal model. Calibrated BioWin model of nitrifying activated sludge system using historical operations and performance data.

→ Project manager for Berkeley Farms Dairy Process Wastewater Odor Control & Solids Removal Systems Project, Dean Foods Corporation, City of Hayward, California. The project was for design of a package dissolved air flotation thickener (DAFT), centrifuge, and appurtenant systems for suspended solids removal downstream of the wastewater pretreatment system for off-site disposal. Project also included a three-stage, countercurrent foul air scrubber using hypochlorite and caustic soda.

→ Senior process engineer for the Naval Facilities Engineering Command (NAVFAC) Biological Nutrient Removal Process Modeling Project, Marine Corps Base, Camp Pendleton, California. The project included simulating biological nutrient removal (BNR) processes for simultaneous nitrogen and phosphorus removal at a new 5.0 mgd treatment plant. Calibrated BioWin simulator using wastewater characterization data from the existing plants to be replaced by the new BNR plant and nitrification rates measured

using bench-scale sequencing batch reactors (SBRs). Simulated five alternatives: (1) five-stage Bardenpho™, (2) phased isolation oxidation ditch, (3) concentric oxidation ditch (Orbal), (4) SBR, and (5) membrane bioreactor (MBR) processes to demonstrate compliance with anticipated monthly average discharge limits of 5.0 mg N/L and 1.0 mg P/L.

→ Technical support for the District of Columbia Water and Sewer Authority (DCWASA) Blue Plains WWTP Enhanced Nutrient Removal Program, Washington, DC. Provided technical support for evaluating post-denitrification aeration requirements at the 370 mgd WWTP. Developed a MathCAD worksheet to calculate nitrogen stripping at specified temperature and flow rates (up to 1,260 mgd peak mixed liquor flow rate) following a 34-ft SWD denitrification tank to mitigate potential nitrogen sludge flotation in denitrification clarifiers. Compared calculated results against BioWin gas-transfer model simulation.

→ Process engineer for the East Honolulu Wastewater Treatment Plant Comprehensive Study, City and County of Honolulu, Hawaii. The study included a capacity evaluation of the East Honolulu WWTP based on peak day nitrate and total phosphorus discharge limits of 9.0 mg N/L and 2.0 mg P/L. Calibrated BioWin model to simulate nitrifying activated sludge system using wastewater characterization and historical operations and performance data. Simulated sludge re-aeration weekday operating mode and plug-flow weekend operating mode, both with anoxic zone and mixed liquor recycle for denitrification, to handle significantly higher weekend loads. Simulated secondary clarifier performance using state-point analysis. Identified process modifications to increase treatment capacity from 2.8 to 5.0 mgd.

→ Project engineer for process mechanical design of new "flexible aeration basin" (anoxic selector) and modifications to existing aeration basins (inlet gates, internal baffles, ceramic fine-bubble diffusers, sloped bottom for grit removal). Provided QA/QC for simulation of modifications to handle a PWWF rate of 15.8 mgd (35.6 mgd peak mixed liquor flow rate, including 11.9 mgd peak mixed liquor recycle).

→ Process engineer for the Water Pollution Control Facilities Master Plan Update Project, City of Cedar Rapids, Iowa. The master plan at the 56 mgd (135 mgd domestic equivalent) WPCF included configuring a BioWin "whole plant" model that included upflow anaerobic sludge blanket (UASB) reactor, trickling filters, high-purity oxygen activated sludge (HPOAS), and low-pressure oxidation (LPO) sludge conditioning - to account for solids handling recycles on liquid-stream processes.

Calibrated simulator using wastewater characterization data and historical operations and performance data. Simulated secondary clarifier and nitrification clarifier performance using state-point analysis. Simulated plant performance to show impact of high solids recycles on HPOAS capacity; determine existing plant capacity; determine modifications necessary to handle increased loadings; with and without LPO sludge conditioning; and determine modifications necessary to meet lower phosphorus and nitrogen discharge limits.

→ Process Engineer for the Easterly Wastewater Treatment Plant Comprehensive Facilities Plan, Northeast Ohio Regional Sewer District (NEORSD), Cleveland, Ohio. Calibrated BioWin simulator using wastewater characterization (including VFA analysis) and historical operations and performance data. Calibrated a CFD-based dynamic clarifier model, 2Dc, based on measured mixed liquor characteristics to simulate sustained peak flow events, as a proposed CSO control plan will increase the design sustained secondary peak flow duration from less than 18 hours to up to 57 hours. Simulated existing nitrifying activated sludge system and determined existing sustained peak secondary capacity is 265 mgd. Simulated secondary clarifier modifications (energy-dissipating inlet (EDI), flocculating center well, inboard lauders, suction-type sludge removal) to improve performance during sustained peak flow events.

Education

PhD Civil and Environmental Engineering, Colorado School of Mines, 2015

MS Environmental Science and Engineering, Colorado School of Mines, 2013

BS Environmental Engineering, Colorado School of Mines, 2011

Licenses

Professional Engineer, Colorado

Professional Affiliations

American Water Works Association/Water Environment Association

- Rocky Mountain Section

Water Environment Federation

- Municipal Resource Recovery Design Committee Instrumentation and Controls Workshop, Vice-Chair

Water Leadership Institute

International Water Association

Affiliated Faculty – Colorado

Bryan D. Coday, PhD, PE

Dr. Bryan Coday is Carollo Engineers' Wastewater Tech Practice Lead for the Rocky Mountain Region and the company's Wastewater Advanced Automation and Control Innovation Lead. He also serves as vice-chair of the Instrumentation and Controls workshop of WEF's Municipal Resource Recovery Design Committee (MRRDC). He specializes in the planning and design of water resource recovery facilities, with experience in BNR secondary treatment design, regulatory permitting, detailed process performance evaluations and capacity assessments, whole-plant process modeling, and BNR optimization and stress testing through pilot- and full-scale evaluations. He has worked both as a consultant supporting utilities, as well as served as an operations engineer in the municipal sector.

Wastewater Treatment

→ Project engineer/process modeler for the WPCF Treatment and Nutrient Master Plan at City of Greeley, Colorado. Project goals included development of a long-term (20 years) sustainable strategy for meeting Regulation 85, future regulations, and population growth with a prioritized list of projects, their costs, and recommended timing for the WPCF. Responsibilities included dynamic BioWin process modeling, flow and load projections, detailed process performance and secondary treatment capacity evaluations, and development of full-scale optimization testing protocols with operations staff.

→ Assistant engineer for the Metro Water Recovery in Denver, Colorado, Milestone Testing of the PAR 1085 – South Secondary Improvements Project. Responsibilities included the evaluation of process performance during Milestone 1 and 2 process testing, and visualization of results.

→ Project engineer for the City of Montrose's WWTP Biological Nutrient Removal Optimization Project. In an effort to proactively plan for future nutrient limits associated with Regulation 85 and Regulation 31, this project investigated the existing facility's ability to meet future nutrient limits through optimization and capital projects. A Biowin model was developed for the facility to optimize the existing infrastructure to achieve simultaneous nitrification and denitrification conditions to meet future nitrogen limits. A full-scale demonstration study is ongoing at the facility currently to confirm the modeling results. Although not in the current discharge permit, alternatives for phosphorus removal are being evaluated to provide capital planning costs to the City for future phosphorus removal improvements. Project entailed preliminary modeling of the existing oxidation ditches to develop alternatives to meet future nutrient limits.

→ Assistant engineer for the City of Boulder, Colorado, 75th Street Wastewater Treatment Facility Nitrogen Upgrades Project - Engineering services during construction. Responsibilities included bench-scale analyses for nitrogen removal optimization in the Post Aerobic Digestion (PAD) system and process training for operations staff.

→ Lead process engineer and secondary treatment design lead for the $50+ million Eagle River Water and Sanitation District, Colorado, Avon Wastewater Treatment Facility Nutrient Upgrades Project. The project included major modifications and expansion of the secondary treatment process for compliance with total inorganic nitrogen and total phosphorus limits set by Colorado's Regulation 85, and an increase in the facility's rated treatment capacity. Conceptual design elements included dynamic BioWin process modeling. Final design elements included an A2O biological process with flexibility to seasonally operate in the Modified Ludzack-Ettinger and 5-stage Bardenpho configurations, and aeration, mixing, pumping, and secondary clarifier improvements, chemical feed design, coordination and permitting efforts with CDPHE, and engineering services during construction.

→ Project engineer for the Drake Water Reclamation Facility Sidestream-P Treatment Project at City of Fort Collins, Colorado. The project included design of a MagPrex sidestream phosphorus sequestering

Awards

Rudolfs Industrial Waste Management Medal, Water Environment Federation, 2016

system for treatment of anaerobically digested biosolids prior to centrifuge dewatering. The project was implemented by City of Fort Collins to sequester soluble phosphorus from the solids stream, thereby reducing recycled phosphorus loads to the secondary treatment process and improving the facility's overall BNR performance to achieve compliance with Colorado's Regulation 85. Responsibilities included design of mechanical facilities supporting the AirPrex system and coordination of permitting efforts with Colorado Department of Public Health and Environment.

→ Technical advisor for the City of Meridian, Idaho, Side Stream Treatment Project. The project included design of a MagPrex sidestream phosphorous sequestering system for treatment of anaerobically digested biosolids prior to dewatering. The project was implemented by the City to mitigate the effects of nuisance struvite formation in their digested sludge piping, centrifuges, and centrate return piping and equipment that has occurred since implementing biological phosphorus removal.

→ Process engineer for the City of Greeley, Colorado, Wastewater Treatment and Reclamation Facility Nitrification Project Phase II. Project entailed significant secondary treatment improvements to the WTRF to meet Regulation 85 nutrient limits, and meet City needs for redundancy and maintenance to existing infrastructure. The process design includes new selector basins with flexibility to operate RAS fermentation, anaerobic, and anoxic zones to achieve TP and TIN reduction. In addition, a new aeration basin is designed to operate as a redundant sidestream basin for treatment of high strength dewatering return streams. Chemical precipitation and alkalinity recovery systems are included for backup to BioP.

→ Assistant engineer/process modeler for the City of Loveland, Colorado's Biological Nutrient Removal Project. The project included modifications to influent screening and secondary treatment for compliance with Colorado's Regulation 85 total inorganic nitrogen and total phosphorus limits, and an increase in plant treatment and hydraulic capacity from 10 mgd to 12 mgd. Responsible for detailed analysis of the existing secondary treatment process, BNR modeling, diffuser system sizing, and air demand calculations, and development of operational tools to stabilize secondary treatment performance. Assisted in the evaluation of BNR process alternatives, which consisted of BioWin process modeling and calibration, defining of secondary treatment operational parameters, and evaluation of future capacity expansions.

→ Process engineer for the City of Longmont, Colorado, Nutrient Removal Planning Study. Developed compliance roadmap for the City to meet Regulation 85 and future Regulation 31 nutrient limits. Recommendations included near-term implementation of chemical phosphorus removal and long-term implementation sidestream enhanced biological phosphorus removal (S2EBPR) and sidestream phosphorus recovery. The project included full-scale demonstration testing of primary sludge fermentation in the gravity thickeners and sidestream biological phosphorus removal in the aeration basins, and assistance with regulatory permitting through CDPHE.

→ Lead process engineer/process modeler for the Broomfield Wastewater Reclamation Facility Pilot-scale Carbon Addition Optimization and Testing Project at City and County of Broomfield, Colorado. The goal of the project was to identify operational adjustments and potential capital improvements to optimize total inorganic nitrogen removal to achieve compliance with Colorado's Regulation 85. Responsibilities included dynamic BioWin process modeling of the existing integrated fixed film activated sludge (IFAS) process, full-scale pilot testing development and operational support, and coordination with Colorado Department of Public Health and Environment on behalf of the Utility.

Education

BS Chemical Engineering, University of Nevada, Reno, 2015

Licenses

Professional Engineer, Nevada

Chad R. Knight, PE

Chad Knight has 8 years of experience in civil and environmental engineering. He is a detail-oriented project engineer and designer supporting water and wastewater infrastructure projects in Northern Nevada. Chad's comprehensive experience covers both the analytical and design sides of water and wastewater planning, design, construction management wastewater treatment, potable and reclaimed water wells, pipelines, pump stations, field inspection, rate studies, and treatment facilities

Relevant Experience

→ Designer for the Old Forty West Motel, Reno, Nevada, Water System Consolidation. Mr. Knight assisted the Old Forty West Motel with consolidation into the Truckee Meadows Water Authority's water system. The project began with an alternative study reviewing options for a community water system using groundwater wells to reach compliance. He performed the initial engineering, and acquired grant funding through the Nevada State Revolving Fund and finalized engineering plans and moved into management of the construction phase of the project.

→ Lead Engineer for the Heat Loop Improvements Project at Truckee Meadows Water Reclamation Facility in Sparks, Nevada. Chad performed on-site investigations and document review to compile boiler, digester, and loading criteria, and assisted with heat load calculations for process and building demands. Chad also assisted with a condition evaluation of existing facility piping, and preliminary improvement layouts.

→ Project engineer for Silver Springs, Lyon County, Nevada, Water Reclamation Facility. Field verification and engineering services for WRF effluent management and irrigation applications. Performed field verification of infrastructure, drainage areas and crop conditions. Performed nutrient and crop loading and uptake calculations and provided future operating recommendations. Additionally, conducted a collection system capacity analysis.

→ Construction management and design services for water storage and distribution in Amador County, California. Chad performed construction observation, document control, and design coordination for construction of two water storage tanks, and approximately 3,000 linear feet of water lines. Chad processed submittals, RFIs, pay applications, and progress reports. At the construction site, Chad observed trenching, pipeline construction, concrete pouring, tie-ins and system shutdowns, as well as traffic control operations. Design coordination during construction included evaluation of alternate pipe routing, valve and hydrant installations, schedule and sequencing changes, and tank coating.

→ Project engineer for the City of Sparks, Nevada, Truckee Meadows Wastewater Reclamation Facility (TMWRF). Designed two plant chemical dosing systems for sulfuric acid and sodium hydroxide. Design of each system included chemical containment areas and piping, leak detection, heat tracing, flow controls and chemical pump retrofits. Piping alignment included existing piping galleries, new trenching, and exterior piping. Chad also performed document control during construction, reviewing and responding to submittals and RFIs. Performed design services for a potable water booster station and associated piping as well as engineering services for wastewater treatment plant and collection system capacity analysis.

→ Project engineer for Dollar General, New Washoe City, Nevada. Performed design, permitting, construction services, and operations coordination for iron and manganese removal at a drinking water well.

→ Project Engineer for odor control improvements at the Truckee Meadows Wastewater Reclamation Facility in Sparks, Nevada. Chad used sampling equipment to quantify odorous compounds being released from dewatered solids storage at the facility. Using the results of the study, Chad performed a process evaluation to select a treatment technology, and provide design documents for expansion of the existing biofilter.

Chad R. Knight, PE

→ Designer for Silver Springs, Lyon County, Nevada, Effluent Management Plan. Mr. Knight produced an effluent management plan and the plan provided information related to the handling of effluent from the Silver Springs wastewater treatment plant, as well as recommendations for future growth. The plan involved investigation of projected population growth and planned connections into the sanitary sewer collection system as well as investigation into disposal capacities, percolation, effluent re-use, and storage.

→ General manager/project engineer for McCarran, Nevada, Tahoe Reno Industrial Center General Improvement District (TRIGID). Performed management services for TRIGID, including oversight of new facility utility connections and extensions and maintenance/repairs for public utility water and wastewater infrastructure. The project also included design and procurement of wastewater treatment plant effluent pump system and development and enforcement of an industrial pretreatment program. Responsible for the development and enforcement of an industrial pretreatment program to protect the TRIGID's wastewater treatment plant.

→ Project engineer for the Lyon County Public Works, Dayton, Nevada. Design and construction inspection services for a three-mile, 16-inch water transmission main and bypass valve station.

→ Project Engineer for tertiary treatment improvements for Title 22 reuse requirements, in Calaveras County, CA. As part of preliminary engineering efforts for the improvements, Chad created a bench testing procedure to simulate Dissolved Air Flotation Thickening (DAFT) of secondary effluent containing algae. After developing planning criteria and evaluating the bench testing results, Chad performed pre-design services for a new DAF process, solids handling, and expansion of the existing Ultraviolet disinfection system.

→ Project engineer for the City of Hawthorne, Nevada, Wastewater Treatment Plant. Nitrogen and BOD polishing alternative analysis/PER engineering services.

→ Project engineer for the Plumas-Eureka Community Services District, Blairsden-Graeagle, California. Project included pilot study coordination, field verification, and design services for an arsenic treatment plant.

Education

MS Environmental Engineering, University of Kansas, 2014

BS Environmental Engineering, New Mexico Institute of Mining and Technology, 2010

Licenses

Chemical Engineer, California

Environmental Engineer, Kansas

Certification

Certified, Envision™ Sustainability Professional, Institute for Sustainable Infrastructure, 2014

Professional Affiliations

Former Chair of Water Environment Federation (WEF) Greenhouse Gas Focus Group

California Water Environment Association (CWEA), Member

International Water Association (IWA), Management Committee of the Sludge Management Specialist Group (SG) Young Water Professional (YWP)

Christine A. Polo, PE, ENV SP

Christine Polo joined Carollo in 2018 as a senior technologist. She has 13 years of experience specializing in biosolids planning for wastewater utilities including working on many biosolids master plans, biogas use alternatives analysis, greenhouse gas accounting, and food waste co-digestion studies. She is the past chair of WEF's Greenhouse Gas Focus Group and is passionate about helping wastewater utilities reduce their greenhouse gas emissions through resource recovery.

Relevant Experience

→ Biosolids process engineer for the Sacramento Regional County Sanitation District (Regional San), California, Biosolids Management Plan. Performing evaluation of biosolids processing alternatives including mesophilic anaerobic digestion, recuperative thickening, thermal hydrolysis process, thermal drying, solar drying, pyrolysis, and thermo-chemical hydrolysis. Leading non-financial evaluation and estimating greenhouse gas emissions for each alternative.

→ Assistant project manager for the Ironhouse Sanitary District (ISD), California, Biosolids Master Plan. Coordinated team evaluating solids projections, regulatory review, land application vulnerability analysis, and biosolids technology and management alternatives analysis.

→ Biosolids process engineer for the Moorhead Wastewater Treatment Facility Plan, Moorhead, Minnesota. Evaluated mechanical dewatering alternatives and cake storage relative to the baseline of liquid biosolids land application. Dewatering alternatives include centrifuge, belt filter press, and screw press.

→ Biosolids process engineer for the Madison Metropolitan Sewerage District (MMSD), Wisconsin, 2020 Energy Management Master Plan. Performing evaluation of biosolids processing alternatives and emerging technologies including continued acid phase digestion followed by partial mesophilic and thermophilic digestion, mesophilic digestion, Temperature Phased Anaerobic Digestion (TPAD), pre and post-digestion thermal hydrolysis, low temperature drying, incineration, and composting, and emerging technologies including gasification and pyrolysis.

→ Biosolids process engineer for the Napa Sanitation District, California, Wastewater Treatment Plant Master Plan. Evaluating biosolids treatment use alternatives, including options for Class A biosolids production.

→ Biosolids process lead for the City of Watsonville, California, Watsonville Wastewater Treatment Facility Solids Thickening Evaluation. Performing thickening alternatives analysis including continued co-thickening of WAS and primary sludge in gravity thickeners, and separate thickening of WAS using mechanical thickening technologies.

→ Biosolids process engineer for the JEA Buckman Water Reclamation Facility Biosolids Management Study Update 2020, Jacksonville, Florida. Evaluated composting alternatives including open and covered aerated static pile and in-vessel composting.

→ Biosolids process lead for the Tahoe-Truckee Sanitation Agency (TTSA), California, Master Sewer Plan. Performing process performance and capacity assessment of existing processes including thickening in gravity thickeners and centrifuges, Temperature Phased Anaerobic Digestion (TPAD), and dewatering in centrifuges and plate and frame filter press.

→ Biosolids process lead for the City of Fresno, California, Regional Water Reclamation Facility Biosolids Master Plan. Performed evaluation of biosolids processing alternatives including continued use of mesophilic anaerobic digestion, recuperative thickening, composting, thermal hydrolysis, and thermal processing options including thermal drying, gasification, and pyrolysis. Estimated greenhouse gas (GHG) emissions for each alternative.

→ Biogas process lead for the Pima County Regional Wastewater Reclamation District (PCRWRD), Arizona, Tres Rios WRF, Energy Master Plan. Performing biogas utilization alternatives analysis including continued use

Awards

CWEA's Dr. Jenkins Research Achievement Award for the City of Oxnard's Food Waste Co-digestion Feasibility Study, 2023.

in boilers, cogeneration, and biogas upgrading to RNG.

→ Biogas process engineer for the City of San Diego, California, 2022 Energy Master Plan. Evaluated biogas use alternatives for several facilities including Point Loma and Metropolitan Biosolids Center (MBC).

→ Biogas process engineer for the Moorhead Wastewater Treatment Facility Plan, Moorhead, Minnesota. Evaluated biogas utilization alternatives including continued use in boilers, cogeneration, and biogas upgrading to RNG for vehicle fuel or pipeline injection.

→ Biogas process lead for the City of Turlock, California, Biogas Boiler and Flare. Performing biogas utilization alternatives analysis including continued use in boilers, cogeneration, and biogas upgrading to RNG.

→ Biogas process lead for the Orange County Utilities (OCU), Florida, Energy Sustainability Initiative, RNG Pipeline Injection Feasibility Analysis. Life-cycle cost analysis of upgrading biogas from the South Water Reclamation Facility (SWRF) to Renewable Natural Gas (RNG) for pipeline injection into the TECO pipeline.

→ Project engineer and assistant project manager for the City of Oxnard, California, 2023 Food Waste Co-digestion Feasibility Study. Evaluated food waste pre-processing technologies, food waste receiving station, and capacity and condition of existing biosolids processing and biogas utilization facilities to determine feasibility of co-digestion of food waste at the Oxnard Wastewater Treatment Plant.

→ Researcher for the Water Research Foundation (WRF) Feedstock Characterization Project. Part of international team evaluating source separated organics (SSO) and slurry characteristics, quality concerns, and resulting operational impacts, as well as pretreatment and codigestion practices in the US, Canada, and Central Europe. Coordinating utility feedstock characterization survey.

→ Codigestion process lead for the City of Watsonville, California, Wastewater Facilities Master Plan, Digestion Facility and FOG Receiving Station Evaluation. Assessed FOG receiving station, anaerobic digestion, and biogas utilization facilities to determine necessary improvements and expansions to meet the City's goals of maximizing the FOG program and biogas production, while fully utilizing the existing capacity and facilities.

→ Project engineer for the Metropolitan Water District (MWD), California, Climate Action Plan (CAP). Performing engineering evaluations including cost estimates and greenhouse gas (GHG) reduction estimates, for energy efficiency measures at Metropolitan's five conventional water treatment plants and six pump stations, as well as the planned advanced water treatment facility for indirect potable reuse.

→ Process support for the Public Utilities Board (PUB) of Singapore, Consultancy Services for the Expansion at Changi Water Reclamation Plant (CWRP) with Membrane Plant; Singapore (2011). Assisted in evaluating digester mixing and scum removal alternatives to develop recommendations for the existing and future egg-shaped digesters.

→ Process engineer for Shreveport, Louisiana, Wastewater Treatment Plant Master Plan (2015). Developed BioWin models for two facilities: Lucas WWTP and North Regional WWTP. Conducted capacity assessment, evaluated nitrification capacity, and evaluated nutrient removal alternatives including biological nutrient removal (BNR), integrated fixed-film activated sludge (IFAS), and chemical nutrient removal.

→ Researcher for confidential industrial client, Pilot Treatability Study (2012). Operated aerobic and anaerobic pilot reactors to assess biodegradation and inhibition concentrations for various waste compounds, including organic solvents, ammonia, and tetramethyl ammonium hydroxide (TMAH). Performed analysis of reactor influent and effluent including analysis of chemical oxygen demand (COD), total nitrogen, ammonia, nitrate, nitrite, alkalinity, reactive phosphate, and total phosphorous. Measured digester gas production and carbon dioxide concentration.

Education

PhD Environmental Engineering, University of Massachusetts, 2000

MS Environmental Engineering, University of Massachusetts, 1995

BS Mechanical Engineering, Johns Hopkins University, 1993

Licenses

Civil Engineer, California

Professional Affiliations

International Water Association

Water Environment Federation

Elisa A. Garvey, PhD, PE

Dr. Elisa Garvey's is Carollo's National Water Supply Planning Lead. Her time in water resources planning has required simultaneous attention to detailed planning analyses and long-term goals and strategies. Elisa's experience includes master planning with an emphasis on reuse, water resources management, water quality assessments, and regulatory and permitting support.

Wastewater Master Planning

→ Project engineer for the Sacramento Regional County Sanitation District, California, Sacramento Regional Wastewater Treatment Plant 2020 Master Plan. Responsible for providing technical support services for the 2020 Master Plan Environmental Impact Report (EIR), permitting process, and updates to the 2020 Master Plan technical documents. Types of services included preparing responses to EIR comments on a variety of issues from components of the source control program to estimates of filtration costs; and conducting a feasibility study on the efficacy of advanced treatment processes for removal of priority pollutants.

→ Project manager for the cities of Oxnard and Pleasant Valley, California, Salt and Nutrient Management Plan (SNMP). Responsible for leading the project team to develop the SNMP, which involves groundwater basins characterization, groundwater quality assessment, assimilative capacity evaluation, identification of sources of salts and nutrients, fate/transport modeling, management measures identification, anti-degradation analysis, and environmental review.

→ Project engineer for the Ventura County Watershed Protection District, California, Lower Santa Clara River Salt and Nutrient Management Plan (SNMP). Responsible for providing technical and regulatory support for SNMP development. Key tasks included synthesizing and evaluating existing data, identifying overall recycled water goals and objectives, quantifying sources of salts and nutrients, and developing management measures.

→ Project manager for the California Department of Public Health (CDPH)/Contra Costa Water District, California, Removal of NDMA, EDCs, and PPCPs from South Delta Waters Project. This research project, funded by CDPH, focused on pilot testing three advanced water treatment trains to determine removal efficiencies of trace organic compounds. Responsible for technical oversight of development of the experimental plan and plot-testing activities, as well as project team management.

→ Project manager for the Oregon Department of Environmental Quality (ODEQ)/U.S. Environmental Protection Agency Odell Lake TMDL Technical Support. The purpose of the project was to provide technical support to the ODEQ to help with development of TMDLs for Odell Lake. Responsible for oversight of technical evaluations that were used as the basis for developing a TMDL Workplan.

→ Project engineer for the Contra Costa Water District, California, CALFED Old River Water Quality Improvements in the San Francisco Bay Delta. The project goal was to reduce significant sources of water quality degradation along Old River, a drinking water intake. Conducted a field survey to identify and evaluate potential point and non-point sources of pollution (e.g., agricultural drainage, wet weather runoff, and groundwater seepage). Provided technical support services for selection and permitting of the preferred alternative.

→ Assistant project manager for the Inland Empire Utilities Agency, California, Facilities Balancing and Optimization Model. The Agency's system consists of liquids treatment at four reclamation plants and solids treatment at two treatment plants. Responsible for overall development of an optimization model designed to help the Agency better understand how the plants work as a system and to identify opportunities for improvements in operations and planning capital improvements.

Elisa A. Garvey, PhD, PE

→ Project engineer for evaluation of the biological availability of dissolved organic nitrogen (DON) for the Cities of Reno and Sparks, Nevada, Regional Wastewater Facilities Design Phase III. The project's goal was to evaluate the bioavailability of DON to develop a range of percent DON availability, which would be removed from the permit total nitrogen compliance calculation. Analysis of the data included statistical analysis and a mass balance evaluation. Determined a conservative estimate of the amount of non-bioavailable DON in treatment plant effluent and prepared a final summary report.

→ Engineer for the City of San Jose, California, San Jose/Santa Clara Water Pollution Control Plant Master Plan. Responsible for statistical evaluation and future predictions of historical flows, conventional pollutant loads, and non-conventional pollutant concentrations.

→ Project engineer for San Francisco Public Utilities District, California, Sewer System Improvement Program. Provided engineering services for the master planning of the District's collection and treatment facilities, including facilities planning for the 250-mgd Southeast Plant. Expedited the design of the $300 million all-weather headworks for the Southeast Plant on a fast-track schedule.

→ Engineer for the City of Los Angeles, California, One Water LA 2040 Plan. The integrated planning approach for this project incorporates surface water, groundwater, recycled water, desalination, and stormwater projects into an overall water supply planning process. Responsible for compiling information on stormwater related projects to be considered as components of system-wide portfolios.

→ Project engineer for City of Ventura, California, Recycled Water Market Study and Recycled Water Feasibility Study. Upon completion of the market analysis, the feasibility study developed a more detailed analysis of recycled water demands, required water quality (by type of use), and treatment trains required to meet water quality targets. Developed capital and operations and maintenance costs, provided oversight and direction to the City on the constructing a demonstration scale potable reuse plant, assisted in establishing operating conditions, and developed a monitoring plan for demonstrating treatment efficacy and attainment of water quality standards.

→ Project engineer for the U.S. Environmental Protection Agency/American Water Works Association Research Foundation Project No. 3004, "Advanced Water Treatment of Estuarine Water Supplies for Improving Water Quality." The goal of the project was to fill knowledge gaps with respect to treatment of estuarine supplies using existing and advanced technologies (GAC, PAC, MIEX® resin, membranes), as well as disinfectant combinations including chlorine, chloramines, chlorine dioxide, ozone, and UV disinfection. Primarily responsible for oversight of a demonstration-scale evaluation of medium-pressure and low-pressure UV disinfection, with a focus on assessing the operational issues associated with UV disinfection technologies.

→ Project manager for the Washoe County, Nevada, Arsenic Mitigation Sampling Plan Reevaluation.

→ Planning lead for the Orange County Water District (OCWD), California, PFAS Treatment Systems Planning Study. Led the planning for the assessment of alternatives, including blending, centralized treatment of individual wells, and possibly centralized treatment to meet OCWD's challenges with PFAS contamination in the Orange County Groundwater Basin.

→ Engineer for the Cities of Reno and Sparks and Washoe County, Nevada, Phase I, II, and III Permitting/Non-Structural Program. Responsible for identifying non-structural alternatives aimed at water quality benefits to form a basis for a watershed trading program for the Truckee Meadows Water Reclamation Facility. Also identified and quantified pollutant loads from point and non-point sources (including stormwater runoff). The estimates were incorporated into the watershed and water quality models to simulate river water quality and compliance with an existing TMDL.

Education

BS Civil Engineering, Arizona State University, 1996

Licenses

Civil Engineer, California

Structural Engineer, California, Nevada, Hawaii

Civil/Structural Engineer, Washington, Oregon

Professional Affiliations

American Society of Civil Engineers

Chi Epsilon (National Civil Engineering Honor Society)

Engineers Without Borders, Technical Advisory Committee

Structural Engineers Association of Northern California

Tau Beta Pi (National Engineering Honor Society)

NACE International

Society for Protective Coatings, Northern California Chapter Steering Committee

Governor's Office of Emergency Services, ATC-20 Trained Responder

Michael E. Dadik, PE, SE

Mike Dadik, a principal structural engineer and vice president with Carollo, has 31 years of experience in structural design of water, wastewater, transportation, and civil engineering projects. Since joining Carollo, he has overseen the structural design of numerous projects ranging from water and wastewater treatment plant construction and expansion to pump station seismic retrofits. Mike has extensive experience in rehabilitation and seismic vulnerability assessments. He also has extensive experience in coating and corrosion control and is Carollo's coating specialist responsible for maintenance of our coatings and finishes specifications.

Relevant Experience

→ Structural engineer for design of the City of Modesto, California, new $120 million Phase 2 Biological Nutrient Removal/Tertiary Treatment Facility. The project included preliminary and final design, including new 12.6-mgd aeration basins and MBRs, enclosed UV disinfection system, a large bridge crane structure and masonry buildings up to 6,750 square feet each. Site preparation required mitigation of soft soils including soil modification and development cost effective, below grade piping connections. Responsible for structural decisions during preliminary design. Structural Engineer of Record leading a team of five structural design engineers. Designed the aeration basins and MBR structures.

→ Structural engineer for the San Francisco Public Utilities Commission, California, Southeast Plant SEP 020 Headworks. The new headworks will improve the treatment efficiency of screening and grit removal, while maximizing the control of odors. The replacement headworks design has a capacity of 250 mgd and includes influent diversion, bar screens, screenings handling, grit basins, grit handling, primary flow splitting, odor control scrubbers, and an electrical building.

→ Structural engineer for the $10 million South Tahoe Public Utility District, California, Headworks Replacement. The project consists of new metering, screening, and grit removal systems in a new two-story, 4,500-square-foot, cast-in-place concrete and masonry building. Innovative approaches were utilized to mitigate the corrosive environment and maintain separation between building classification occupancies.

→ Structural engineer for the City of Richmond, California, Wastewater Treatment Plant (WWTP) Critical Improvements Project. This project features major process upgrades that improve the overall reliability and condition of the WWTP including plant-wide seismic evaluations. The major project elements include a new 40-mgd screening and grit removal facility and 15-mgd aeration and secondary clarifier upgrades. Two designs were developed for the grit removal facility to allow for competitive bidding of two different grit removal technologies. The aeration upgrades include replacing an existing surface aerator system with a more efficient diffused aeration system and included a seismic retrofit of the existing aeration basins.

→ Structural engineer for the City of Sunnyvale, California, $136 million Secondary Treatment and Dewatering Upgrades. The project includes expanding the secondary treatment process to a conventional activated sludge (CAS) process, adding dewatering and thickening facilities for sludge handling, and adding sidestream ammonia treatment. The CAS process will remove nitrogen in anticipation of upcoming nutrient regulations in the San Francisco Bay.

→ Structural engineer for the American Valley Community Services District, California, Wastewater Treatment Plant Improvements. The project includes upgrades to the headworks and secondary treatment (nitrification-denitrification) and new effluent pipeline, ancillary pumping stations, solids digestion and dewatering facilities, electrical service and backup power provisions, and motor control centers. SCADA improvements were also included to accommodate the new facilities.

Michael E. Dadik, PE, SE

→ Structural engineer for the Cities of South San Francisco and San Bruno, California, $49 million Wet Weather and Digester Improvements Project. This project included evaluation and design of replacing two existing digesters with a new high-solids anaerobic digester with recuperative thickening, addition of one new secondary clarifier, two new storm water pump stations, and retrofit of another anaerobic digester by replacing its cover and addition of a top-mounted linear motion mixer, two digester equipment buildings and concrete repair and coating to repurpose existing unused basins for wet weather storage.

→ Structural engineer for the Cities of South San Francisco and San Bruno, California, $4 million Standby Generator and Elevated Bus Duct Replacement Project. The project included design of a new standby generator building, replacement of all electrical equipment inside, and rehabilitation of the existing elevated cable bus supports. Detailed work sequencing steps were developed to assist the contractor in constructing the new generator building at the same location as the old building.

→ Structural engineer for the City of Burlingame, California, Wastewater Treatment Facility Master Plan. Responsibilities included leading the plant seismic evaluation and condition assessment of the City's wastewater treatment plant and developing repair and rehabilitation recommendations.

→ Structural engineer for design of the City of Woodland, California, Aeration Retrofit Project. The City's wastewater treatment plant is rated for 10.4 mgd but has insufficient aeration capacity for the rated flow. In addition, the plant is expected to have nitrate limits in the future, therefore, process modifications are needed. Performed design of improvements to increase aeration capacity and convert the oxidation ditch process to a Modified Ludzack-Ettinger (MLE) configuration. Improvements consist of replacing existing brush rotors in the oxidation ditch with more energy efficient diffused air and fine bubble aeration and partitioning the oxidation ditch and adding necessary mixers and internal pumping to convert to an MLE process. Converting to an MLE will further reduce energy demands. Construction costs for the plant improvements are estimated to be approximately $9 million.

→ Quality assurance/quality control for the Fairfield-Suisun Sewer District, California, Blower Replacement Project, which enhanced the reliability and efficiency of the secondary treatment process aeration system. The project consists of a secondary treatment process evaluation of the activated sludge process, replacement of the existing 600-hp aeration blowers with new high-speed turbo blowers, aeration piping repairs, standby power generation, and electrical system upgrades.

→ Technical advisor for the City of Chico, California, $45 million Water Pollution Control Plant Expansion to 12 mgd, average day average month capacity. New facilities provided include headworks, aeration tanks, aeration blowers, and a secondary clarifier. The project involved expanding the liquid and solids treatment processes and included construction of a new influent sewer, new headworks, aeration tanks, secondary clarifier, anaerobic digester, new centrifuge, cogeneration, and new outfall pipeline and river diffuser, as well as other plant-wide improvements.

→ Structural engineer for preliminary and final design of the City of Turlock, California, Headworks and Secondary Treatment Capacity Expansion Phase 1. This expansion replaced an existing outdated headworks and pump station facility and provided additional influent pumping capacity to handle future flows.

→ Structural engineer for the Union Sanitary District, California, Primary Digester No. 2 Rehabilitation Project. The work included replacement of heat exchanger, recirculating pump, gas thermal flow meter, and digester gas and sludge transfer piping, as well as concrete repairs and foam insulation repair to address structural retrofits and safety deficiencies.

Education

BS Electrical and Electronic Engineering, California State University, Sacramento, 2008

Licenses

Electrical Engineer, California

Professional Affiliations

Institute of Electrical and Electronic Engineers

Erik M. Bahneman, PE

Erik Bahneman has 17 years of experience in design and construction support of electrical and control systems for water and wastewater facilities. He has developed and overseen dozens of electrical system studies and routinely provides electrical condition assessments and electrical master planning. Erik is qualified in both low- and medium-voltage design and has specific expertise in the design of switchgear, motor controls, instrumentation, and SCADA systems.

Infrastructure

→ Lead electrical engineer for the Sacramento Regional County Sanitation District, California, EchoWater Project $50 million Nitrifying Sidestream Treatment Project (NST). NST will use nitrifying sequencing batch reactors to reduce ammonia in the solids treatment system supernatant necessary to meet interim permit conditions. It will also produce nitrate-rich effluent for odor control. NST includes influent and effluent pumping and lime addition. The project was accelerated to save $1.1 million per year in avoided sodium hypochlorite costs.

→ Electrical engineer for the Sacramento Regional County Sanitation District, California, EchoWater Project Return Activated Sludge Pumping Project (RAS). To meet new 2010 requirements for the State of California, the District implemented the $2 billion EchoWater Program. Carollo designed the $28.8 million RAS Project that replaced 48 activated sludge pumps (210 mgd of total capacity), designed to deliver the higher flow and head conditions required by the new biological nutrient removal process. The project also included above-ground piping, valves, and flow meter replacement; pump cans and underground piping replacement; and mixed liquor channel improvements. RAS received the 2020 Project of the Year Award from the Sacramento Chapter of the American Public Works Association in the Environmental category.

→ Instrumentation engineer for the Placer County Sewer Maintenance District, California, Wastewater Treatment Plant Upgrade and Expansion. Designed instrumentation upgrades for most of the plant facility, including new facilities for biological removal of nutrients and a new ultraviolet disinfection system. Authored specifications including complete, detailed control strategies for plant processes, and wrote addendums for electrical specifications.

→ Electrical and instrumentation engineer for the City of Arcata, California Arcata Wastewater Treatment Plant Improvements Final Design, Phase I. The project consisted of the final design for replacement and new treatment processes including headworks, pond improvements, wetlands improvements, pump stations, a new oxidation ditch and secondary clarifiers for nutrient removal, and a new UV disinfections step.

→ Electrical engineer for the City of Modesto, California, Tertiary Treatment Plant Phase II Biological Nutrient Removal engineering services during construction. The 12.6-mgd project included a primary effluent pump station, rotary drum fine screens, three new nitrifying/denitrifying aeration basins, turbo blowers, mixed liquor fine screens, six membrane bioreactors, 80-mgd return activated sludge pump station, in-channel UV system, and effluent and utility water pump station.

→ Electrical and instrumentation engineer for the South Tahoe Public Utility (STPUD) Tahoe Keys and Upper Truckee Pump Stations Replacement. Carollo designed the new pump station wet well, submersible pump installation, and seismic retrofits and developed a construction sequencing plan that minimized the amount of time required for bypass pumping.

→ Instrumentation engineer for the Georgetown Divide Public Utility District, California, Auburn Lake Trails Water Treatment Plant. Designed instrumentation for the plant upgrade from the preliminary design report. Authored specifications including complete, detailed control strategies for plant processes.

Erik M. Bahneman, PE

→ SCADA engineer for the Calaveras County Water District, California, Copper Cove Water Treatment Plant and Hunter Water Treatment Plant. Upgraded the existing Wonderware 7.0 to Archestra at two treatment plants, integrated systems and troubleshot conversion issues. The existing SCADAlarm systems were also converted to the latest version and software was scrutinized for optimization.

→ Electrical engineer for the Modesto Irrigation District, California, Regional Water Treatment Plant Phase II Expansion. The $70 million expansion included design and construction of process modifications to the ozone system, 36-mgd membrane system, membrane waste-washwater treatment system, high-service effluent pumps, 60-inch-diameter finished water piping, chemical systems, and numerous structural repairs/rework.

→ Electrical engineer for the West County Wastewater, California, Carriage Hills, D'Avila, La Honda, and Tara Hills Lift Stations Upgrades. Various improvements at each lift station included upgrades to electrical system including service modifications, new standby generators, sequencing evaluations, hazardous area evaluations, ventilation, pump and variable frequency drive replacement, new electrical gear replacement, site security communication system, and instrumentation.

→ Lead electrical and instrumentation engineer for the City of Woodland, California, Well Replacement. Designed the power distribution system, motor control center, and process controls for the new well site. Worked with the City to integrate site particulars with existing city standards. Coordinated new service connections with PG&E.

→ Lead electrical engineer for the Sacramento Regional County Sanitation District (Regional San), California, N19 Arden Pump Station Wet Well Assessment and Remediation. In order to help Regional San maintain this valuable asset and restore its working life to an acceptable level, Carollo thoroughly assessed the condition and structural integrity of the wet well structure and its components during this initial project.

→ Lead electrical engineer for the City of Menlo Park, California, Sharon Heights Pump Station Replacement. The project entailed replacing a 50-year old pump station that is the only source of water for the Sharon Heights area of Menlo Park. As such, the pump station could not be removed from service, and its site was severely constrained being surrounded by multi-million dollar homes. The project entailed coordination with the local community to build consent for the appearance of the new pump station. The design of the new pump station includes extensive sound control measures, and the construction of a temporary pump station to maintain service while the new pump station is being built.

→ Lead electrical engineer for the Sacramento Regional County Sanitation District, California, EchoWater Project $400 million Tertiary Treatment Facilities Project (TTF). TTF will provide filtration and disinfection of secondary effluent to a level equivalent to Title 22 requirements for tertiary disinfected recycled water for unrestricted reuse. TTF includes a 330-mgd filter influent pump station, 217 mgd of granular media filters, backwash equalization and treatment, chemical feed systems, covered disinfection contact basin, three electrical substations, and a new area control center.

→ Electrical engineer for the Sacramento Regional County Sanitation District, California, EchoWater Project $130 million Flow Equalization Project (FEQ). FEQ will provide an additional 110 MG of storage capacity for the facility. Additional features include roller-compacted concrete lined basins, spillways and interconnections structures, an 84-inch diameter final effluent distribution pipeline, underdrain pump station, and a basin washdown system. The washdown system consists of manual and automated water cannons for efficient washdown of 60 acres of basin area.

Education

BS Civil Engineering, South Dakota School of Mines and Technology, 1995

Licenses

Professional Engineer, Colorado

S. Jason Rozgony, PE

Jason Rozgony is a construction professional with 28 years of experience specializing in cost estimating for water and wastewater treatment plants, pump stations, and distribution systems. The majority of his work experience was obtained while working for general contractor emphasizing CMAR delivery. Prior to his cost estimating experience, he worked as a project engineer, superintendent, and construction manager on a variety of water treatment and remediation projects in Illinois, Texas, Michigan, Iowa, Missouri, Connecticut, Colorado, Utah, and Wyoming. Since transitioning from a construction operations role to cost estimating he and his teams have developed at-risk bids and guaranteed maximum price proposals exceeding $2 billion for water/wastewater treatment plant work while producing of over 500 opinion of probable cost estimates.

Relevant Experience

→ Estimator for the City of Sunnyvale, California, Water Pollution Control Plant Secondary Treatment and Dewatering Facilities Design. This project included expanding the secondary treatment process to a conventional activated sludge (CAS) process, adding dewatering and thickening facilities for sludge handling, and adding sidestream ammonia treatment. The CAS process will remove nitrogen in anticipation of upcoming nutrient regulations in the San Francisco Bay. Construction value estimated at $50 million.

→ Estimator for the City of Richmond, California, Veolia Wastewater Treatment Plant Critical Improvement project. Carollo provided design and engineering services during construction for Veolia Water's Critical Improvements to the Richmond WWTP. The project included grit removal, fine screen, and odor control system upgrades at the headworks; aeration basin diffuser improvements; secondary effluent splitter box modifications; a new blower building; and secondary clarifier mechanism replacement for early implementation of critical facility components in parallel with the Facility Plan. Construction value estimated at $34 million.

→ Estimator for the Eagle River Water and Sanitation District, Colorado, Avon Wastewater Treatment Facility Nutrient Upgrades. This project included improvements to the Avon Wastewater Treatment Facility secondary treatment process to meet Regulation 85 nutrient limits. The recommended process configuration included an Anaerobic/Anoxic/Oxic (A2O) process with flexibility to operate in the 5-Stage Bardenpho configuration. Design elements included expanded and modified aeration basins, secondary pumping, a new secondary clarifier, and condition assessment improvements to screening, grit removal, primary sedimentation, and equalization basins. The project was delivered via a CMAR delivery model to include construction sequence and constructability approach in the design process. Construction value estimated at $50 million.

→ Estimator for Pasco County Utilities, Florida, Southeast Wastewater Treatment Plant Expansion – Phase 1. The Phase 1 engineering services included a condition assessment, process evaluation, capacity analysis report, and facility plan for the expansion and improvements of the Southeast WWTP. The scope also included a force main and route analysis for two force mains coming into the plant.

→ Cost estimator for the Water Delivery Comprehensive System Assessment and Update, Dallas Water Utilities, Texas. Carollo performed a comprehensive investigation of projected water demands, aging infrastructure, service reliability, benchmarking, water quality, risk management, and efficiency improvements. The project involved the analysis of many different hydraulic scenarios, predict the consequences, and identify the optimum approach to address those consequences.

→ Cost estimator for the City of Oklahoma City, Oklahoma, WC-1006 Water System Hydraulic Evaluation Citywide. Carollo is updating the City's distribution system model and performing a master plan. The project team is performing modeling and preliminary routing and connection analysis; developing

flushing and disinfection practices for the Hefner-Draper Interconnect project, developing water demand projections, updating the hydraulic model demands with recent billing data and allocate future demand, calibrating the model, evaluating the existing and future system, and identifying improvements.

→ Estimator for the Polk Regional Water Cooperative, Florida, PRWC Water Supply Improvements, Phase 1. Project included the conceptual and preliminary design of two RO water treatment plants (15 mgd and 30 mgd), routing studies, conceptual design of 120 miles of pipeline, and completion of an integrated water supply study of the Peace Creek Watershed.

→ Estimator for the City of Odessa, Texas, Water Quality Improvements – Phase III. This 55-mgd surface water treatment project included a new 20 mgd high rate flocculation/sedimentation facility which replaced existing facilities. This project included the Water Treatment Plant Rehabilitation and Miscellaneous Upgrades in which Carollo conducted a process evaluation to improve the water quality, which has high levels of hardness and total dissolved solids (TDS). The improvement project includes structural rehabilitation, new chemical and electrical facilities with advanced water treatment in mind, city-wide SCADA upgrades, and the construction of new plate settlers in lieu of aging flocculation and sedimentation basins. Construction value estimated at $154 million.

→ Estimator for the City of Kansas City, Missouri, Blue River Wastewater Treatment Plant Biosolids Upgrades. This project includes the preliminary and conceptual design of a new THP system and necessary improvements for processing biosolids from three of the City's wastewater treatment facilities. Project included providing assistance to the City for procurement strategy development, packaging evaluations, development of preliminary design of the THP system, comprehensive evaluation of proposal submittals, and negotiation of a long-term service contract. Construction value estimated at $155 million.

→ Estimator for the North Texas Municipal Water District, Texas, South Mesquite Regional Wastewater Treatment Plant Solids Handling Improvements. The project involved providing a new solids dewatering facility to process solids for the current 33-mgd plant capacity and including consideration for future equipment to process solids for the 41-mgd plant capacity. Construction value estimated at $31 million.

→ Cost estimator for the City of Aurora, Colorado, Sand Creek WRF PLC Conversion and Improvements. Provided cost estimating support for the PLC conversion. The project included redesign of the PLC and SCADA infrastructure, including network block diagram, control cabinet and server rack design, P&IDs, control descriptions redevelopment, and PLC and SCADA hardware and software specifications. Construction value estimated at $2.6 million.

→ Cost estimator for the City of Aurora, Colorado, North Campus Electrical Phase II. In order to improve electrical safety and standardize on control across the North Campus Well Field, Carollo provided the design for the electrical, control, and programming replacement for 17 wells. This included the separation of power from control for arc flash safety and the re-programming of each well to provide consistency across the wellfield as well as the City. Control narratives were developed to simplify and optimize operation based on experience from historical production.

→ Cost estimator for the City of Aurora, Colorado, North Campus Horizontal Well Pilot. The Carollo team evaluated several alternative horizontal well technologies to improve yield over conventional vertical wells. Ultimately, radial collector wells predicted the highest yield per dollar spent, and two wells are currently in design and permitting through Colorado Department of Public Health and Environment and the Division of Water Resources.

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Paul Shouse, Maintenance Manager
Item: V-2
Subject: Approval of Consultant Services to Develop Network Upgrade Preliminary Design Report for the SCADA/IT Master Plan

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Background
In August of 2021, the Board of Directors awarded Jacobs Engineering (CH2M Hill) a contract to provide the Agency with a comprehensive SCADA/IT Master Plan. The SCADA/IT Master Plan assessed the current condition of the Agency's technology systems and components, compared existing technology against industry standards, and provided implementation planning for identified improvements.

On June 15, 2022, the final SCADA/IT Master Plan was presented and accepted by the Board of Directors. The Plan recommended three major phases of implementation, broken into eight sub-projects. One of the foundational projects included in phase one of the SCADA/IT Master Plan, is to "Upgrade Networks and Security", which aligns with CIP-14 of the Master Sewer Plan.

In November of 2023, staff requested a proposal from Jacobs Engineering for the development of a Network Upgrade Preliminary Design Report to assist T-TSA in evaluating design alternatives, provide a budgetary cost estimate, and recommend the most suitable design approach to meet the goals of the SCADA/IT Master Plan.

Due to the significant amount of data and information gathered to assess T-TSA's technology infrastructure for the preparation of the SCADA/IT Master Plan, Jacobs was recognized as uniquely qualified to provide consultation services. As a professional service and in accordance with the Agency's Purchasing Ordinance No. 3-2023, only one proposal was solicited with the intent of a sole source award to Jacobs Engineering.

Jacobs Engineering has provided a task order to the Master Services Agreement between Tahoe-Truckee Sanitation Agency and CH2M Hill and a proposal for consultation services in the amount of $61,505.00.

Fiscal Impact
The project total of $61,505.00 is less than the approved budget amount of $188,000.00.

Attached
Jacobs Engineering (CH2M Hill, Inc.) Task Order No. 40

Recommendation
Management and staff recommend approval of Task Order No. 40 of the Master Services Agreement between Tahoe-Truckee Sanitation Agency and CH2M Hill to Develop Network Upgrade Preliminary Design Report in the amount of $61,505.00 and allow the General Manager to negotiate contingencies up to $67,655.00.

Review Tracking

Submitted By: _____
Paul Shouse
Maintenance Manager

Approved By: _____
Richard Pallante
General Manager

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Suite 600
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February 14, 2024

Attn: Paul Shouse
Maintenance Supervisor
Tahoe-Truckee Sanitation Agency
13720 Butterfield Drive
Truckee, CA 96161

Subject: Proposal for SCADA Network Upgrade Preliminary Design Report

Dear Mr. Shouse,

We are delighted to present our proposal to develop a Preliminary Design Report (PDR) for the SCADA Network Upgrade Project, as described in the May 2022 SCADA Master Plan.

Attached is a Scope of Services, Compensation, and Schedule in the format used for previous task orders in Jacobs on-call contract.

Thank you for considering Jacobs to develop your Network Upgrade Preliminary Design Report. If you have any questions about this proposal, please contact Jason Hise at Jason.Hise@jacobs.com or

Sincerely,

John Schoonover
Designated Project Executive

Jason Hise, PE
Project Manager

Date: 14 February 2024

Subject: Proposal for SCADA Network Upgrade Preliminary Design Report

Task Order No. 40
to Agreement between
Tahoe-Truckee Sanitation Agency
and
CH2M HILL, Inc.

This TASK ORDER is for the AGREEMENT dated June 14, 1995, including subsequent Amendments dated December 11, 2002, March 25, 2003, January 1, 2009, January 1, 2014, and June 12, 2019, between Tahoe-Truckee Sanitation Agency (T-TSA or Agency) and CH2M HILL, Inc. (Consultant). The purpose of this TASK ORDER is to provide engineering assistance to the Agency for a Project generally described as follows:

Network Upgrade Preliminary Design Report

Article 1 – Scope of Services

The purposes of the PDR are to identify the network upgrade goals and objectives, conduct a comprehensive examination of the current system, evaluate design alternatives, provide a budgetary cost model/estimate, and recommend the most suitable design approach for the network upgrade.

Task 1 – Network Upgrade Preliminary Design Report

Our scope of work to develop the PDR consists of the following activities:

1. Network Review Meeting and Site Visit
2. Preliminary Design Workshop
3. Preliminary Design Report (Draft/Final)

Subtask 1.1 – Network Review Meeting and Site Visit

Consultant will prepare a request for documentation related to the existing network, fiber, electrical plans, raceways, duct banks, and other information crucial to the network infrastructure. Based on our review of this documentation, Jacobs will prepare materials for a network review meeting.

The network review meeting will present a summary description of T-TSA's current network and key concepts such as networking resiliency, fiber technology, Ethernet switch technology, and strategies for potentially reusing existing raceways. During this meeting, we will also identify the project's goals and objectives.

After the meeting, Consultant will conduct a site visit investigation to examine precise locations and conditions of all SCADA-related Ethernet switches. The site visit investigation will identify available space for new equipment and any other relevant considerations affecting replacement of the network infrastructure. Consultant will document the results of the documentation review, network review meeting, and site visit investigation in detailed meeting notes.

Subtask 1.2 –Preliminary Design Workshop

Based on results of the network review, Consultant will develop two to three network architecture alternatives, with relative cost estimates. The purpose of this phase is to select the most suitable network architecture and outline a transition plan.

Consultant will prepare materials and conduct a Preliminary Design Workshop with Agency staff to examine the architecture alternatives to guide preliminary design of the new network.

Subtask 1.3 – Preliminary Design Report (Draft/Final)

After the Preliminary Design Workshop, Consultant will develop a draft PDR equivalent to a 10% Design stage, including a budgetary cost model. The cost model is a tool that breaks the project into segments with an associated cost that can later be included in the project or removed from the project based on available budgets. This Draft PDR will describe network design criteria, including the design topology, estimated fiber patch distances, the number of Ethernet switches, a preliminary cutover sequence, and other cost-related design elements.

Following the completion of the draft PDR, Consultant will conduct up to two review meetings to refine the scope and cost model of the network upgrade project. Results of these meetings may produce updated cost estimates for scope adjustments. The final PDR will include a clear design scope of the network upgrade, a transition plan with key milestones, and a budgetary cost estimate for the duration of the transition plan.

Task 1 Deliverables:

1. Network Review Meeting
    a. Presentation
    b. Meeting Notes
    c. Supporting Materials
2. Preliminary Design Workshop
    a. Presentation
    b. Meeting Notes
    c. Supporting Materials
3. Draft Preliminary Design Report
    a. Review Meeting Presentation (2)
    b. Meeting Notes (2)
    c. Supporting Materials
4. Final Preliminary Design Report

Assumptions

The scope and fee for the above-described Consultant services include the following assumptions:

1. Agency will make its facilities accessible to Consultant as required for Consultant's performance of its services.
2. The duration of Consultant's services described herein is anticipated to be approximately four (4) months, starting with the authorization to proceed through final deliverable.
3. The focus to this report is for the treatment plant and not remote site radio systems.
4. Travel includes two personnel for up to two days.
5. Costs will be based on scale sketches of existing plant electrical drawings.

6. No CAD drawings will be created for this effort. Sketches and Visio diagrams will be created to convey concepts to support the PDR.
7. Inaccuracy of existing drawings may affect the cost estimates.

Additional Services

The services listed below are not included in this Task Order but can be performed if requested and approved by Agency and Consultant. Time, scope, and fee have not been budgeted for the tasks listed hereunder. Authorization to proceed shall be in the form of an amendment to this Task Order or a separate Task Order specifying the work to be performed and the additional payment for such services rendered. The amendment or Task Order, after execution by both parties, shall become a supplement to and a part of the AGREEMENT FOR PROFESSIONAL SERVICES.

- Design services for Network Upgrade Projects
- Workshops or field visits in addition to those listed above

Article 2 – Compensation

Compensation by Agency to Consultant will be as follows:

1. Cost-Reimbursable Multiplier (Time and Expense)

For services enumerated in ARTICLE 1, Consultant's Salary Costs multiplied by a factor of 2.05 plus Direct Expenses, plus a service charge of 5 percent for Direct Expenses.

A minimum and maximum bill rate of $90 per hour and $290 per hour, respectively, will be applied.

The budgetary estimate established for services described under ARTICLE 1 is summarized in the following table.

Task	Description	Budget
1	Network Upgrade Preliminary Design Report	$61,505
	Total	**$61,505**

It is recognized that actual costs required to complete the work may vary from the estimate provided due to additional or unforeseen requirements. Consultant will provide periodic progress reports to the Agency and the scope and/or fee will be adjusted as necessary to complete the work required. The authorized budgetary fee estimate amount will not be exceeded without prior authorization from the Agency's Board of Directors.

When any budget has been increased, Consultant's excess costs expended prior to such increase will be allowable to the same extent as if such costs had been incurred after the approved increase.

Amount invoiced each month will be based on time and expenses expended to date. Invoices shall be accompanied by a listing of charges that make up the invoice total, including employee names, billing rates, and hours of Project staff, plus direct expenses.

2. Salary Costs

Salary Costs are the amount of wages or salaries paid Consultant's employees for work directly performed on the Project plus a percentage applied to all such wages or salaries to cover all

payroll-related taxes; vacation, holiday, and sick pay; group insurance; and pension plan contributions.

3. Direct Expenses

Direct Expenses are those necessary costs and charges incurred for the Project including, but not limited to: (1) the direct costs of transportation, meals and lodging, mail, subcontracts, and outside services; special Agency-approved Project-specific insurance, letters of credit, bonds, and equipment and supplies; (2) Consultant's current standard rate charges for direct use of Consultant's vehicles, computing systems, laboratory test and analysis, word processing, printing and reproduction services, and certain field equipment; and (3) Consultant's standard project charges for special health and safety requirements of Occupational Safety and Health Administration (OSHA) and telecommunications services. Consultant's current standard rates for direct expenses shall be used. These rates are subject to change following internal audits and reviews.

Article 3 – Schedule

The Project schedule was developed assuming that work will begin by May 2024 and be completed by July 2024. The scope of engineering services and activities associated with this Task Order will be completed in accordance with the following approximate Project milestones:

- Project Authorized and Notice to Proceed by Agency – April 2024
- Final Preliminary Design Report – July 2024

The scope of engineering services covered by this Task Order shall be considered complete when final deliverables are deemed acceptable by Agency. Efforts will be made by the Consultant to complete the work in a timely manner. However, it is agreed that the Consultant cannot be responsible for delays occasioned by factors beyond Consultant's control, or factors which would not reasonably have been foreseen at the time this Task Order was executed.

Other Provisions

This TASK ORDER shall be subject to the terms and conditions of the referenced AGREEMENT, as amended.

IN WITNESS WHEREOF, TASK ORDER NO. 40 is effective when approved by the Agency's Board of Directors, and is executed as shown below:

For Agency,

TAHOE-TRUCKEE SANITATION AGENCY

By:

	General Manager
Richard Pallante	Title

Date: _____,2023

For Consultant,

CH2M HILL, Inc.

By:

	Designated Project Executive
John Schoonover	Title

Date: November 14, 2023

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Luke Swann, Information Technology Supervisor
Item: V-3
Subject: Approval to Award Procurement of SCADA/IT Servers Upgrade & Replacement

---

Background
In August of 2021, the Board of Directors approved an award to Jacobs Engineering (CH2M Hill) to provide the Agency with a comprehensive SCADA and IT Master Plan (Plan) to assess the current condition of the Agency's technology systems and components, compare existing technology against industry standards, and to provide implementation planning for identified improvements.

The final SCADA/IT Master Plan was presented to the Board of Directors on June 15, 2022. The Plan recommended an implementation schedule of three major phases, broken into eight sub-projects. One of the foundational projects included in Phase One of the Plan, is to "Replace Servers" and is included in fiscal year 2023-2024 budget. The current server hardware is beyond the end-of-life (EOL) and needs urgent replacement. This upgrade is a pre-requisite to upgrade the SCADA software, as noted later in Phase One of the Plan.

In January of 2024, staff requested a quote from REDESIGN for replacement hardware and installation services to "Upgrade Servers" to a hyperconverged system configuration. REDESIGN is a titanium partner with Dell Inc and an OMNIA purchasing partner, Contract #C000001105509. Staff researched technology designs, compared upfront and reoccurring costs, and approach to work. Current SCADA hardware is manufactured by Dell and staff advocate keeping with the current make for familiarity along with efficiencies in management, replacement, and support.

REDESIGN, with Dell Inc, provided a quote for hardware and installation services in the amount of $104,908.73.

Fiscal Impact
The project total of $104,908.73 is less than the approved budget amount of $167,000.

Attachment
REDESIGN quotation.

Recommendation
Management and staff recommend approval to award the procurement of parts and services as quoted from The REDESIGN Group to install SCADA server and networking equipment in the amount of $104,908.73.

Review Tracking

Submitted By: Luke Swann
Luke Swann
Information Technology Supervisor

Approved By:
Richard Pallante
General Manager

[re]DESIGN

Q-005137 Version 1
Friday, February 2

Azure Stack HCI

Tahoe Truckee Sanitation

by Sarah Reynolds
Senior Account Manager and Team Lead
The [RE]DESIGN Group
sreynolds@redesign-group.com

for Luke Swann
Tahoe Truckee Sanitation
lswann@ttsa.ca.gov

Contract Code

Description	Qty
NCPA 01-143 Contract Code **C000001105509**	

Azure Stack HCI

Description		Price	Qty	Ext. Price
BUILD	**(3) Node Azure Stack HCI Cluster with 36 Months ProSupport 4 Hour**	**$95,274.00**	**1**	**$95,274.00**
379-BEID	**10x2.5 Front Storage**		3	
379-BDSS	**SAS/SATA Backplane**		3	
210-BBSO	**Dell EMC AX-650**		3	
379-BEHU	**Windows Server Operating System**		3	
350-BCBP	**All Flash Node, Azure Stack HCI**		3	
350-BCBR	**Luggage Tag Label, Azure Stack HCI**		3	
350-BCGW	**Lug Tag, Azure Stack HCI AX-650**		3	
350-BCKF	**IDM, AX-650**		3	
461-AAIG	**Trusted Platform Module 2.0 V3**		3	
321-BGHN	**2.5" Chassis with up to 10 Hard Drives (SAS/SATA), 3 PCIe Slots, 2 CPU**		3	
338-CBWI	**Intel Xeon Silver 4309Y 2.8G, 8C/16T, 10.4GT/s, 12M Cache, Turbo, HT (105W) DDR4-2666**		3	
338-CBWI	**Intel Xeon Silver 4309Y 2.8G, 8C/16T, 10.4GT/s, 12M Cache, Turbo, HT (105W) DDR4-2666**		3	
379-BDCO	**Additional Processor Selected**		3	
412-AAVP	**Heatsink for 2 CPU configuration (CPU less than or equal to 165W)**		3	
370-AAIP	**Performance Optimized**		3	
370-AEVR	**3200MT/s RDIMMs**		3	
780-BCDI	**No RAID**		3	
405-AAXY	**Dell HBA355i Controller Front**		3	
750-ACFQ	**Front PERC Mechanical Parts, rear load**		3	
800-BBDM	**UEFI BIOS Boot Mode with GPT Partition**		3	

Description		Price	Qty	Ext. Price
384-BCUJ	**4 Very High Performance Fans for 2 CPU**		3	
450-AIQZ	**Dual, Hot-plug, Power Supply Redundant (1+1), 1400W, Mixed Mode, NAF**		3	
330-BBRP	**Riser Config 0, 2CPU, Half Length, Low Profile, 3 x16 Slots, SW GPU Capable**		3	
329-BFGW	**PowerEdge R650 Motherboard with Broadcom 5720 Dual Port 1Gb On-Board LOM**		3	
528-CRVW	**iDRAC9 Datacenter 15G**		3	
528-CJIT	**OpenManage Integration with MS Windows Admin Center Premium License for MSFT HCI Solutions, Perpetual**		3	
540-BCOC	**Broadcom 57414 Dual Port 10/25GbE SFP28, OCP NIC 3.0**		3	
325-BCHH	**Standard Bezel**		3	
403-BCMG	**BOSS-S2 controller card + with 2 M.2 240GB (RAID 1)**		3	
403-BCNP	**BOSS Cables and Bracket for R650**		3	
350-BBXM	**No Quick Sync**		3	
379-BCSG	**iDRAC,Legacy Password**		3	
379-BCQY	**iDRAC Group Manager, Disabled**		3	
634-BYJS	**Windows Server 2022 Datacenter,16CORE,FI,No MED,UnLTD VMs,NO CALs, Multi Language**		3	
528-CSCT	**Windows Server 2022 Datacenter,16CORE,DF Recovery Image, Multi Lang, (Downgrade not included)**		3	
528-CSCO	**Windows Server 2022 Datacenter,No Media,WS2016 DC Downgrade DF Media, Multi Language**		3	
634-BYLN	**Windows Server 2022 Datacenter,No Media, WS2016 DC Downgrade w/DVD Media,Multi Lang**		3	
528-CSCS	**Windows Server 2022 Datacenter,No Media,WS2019 DC Downgrade DF Media, Multi Language**		3	
634-BYLR	**Windows Server 2022 Datacenter,No Media, WS2019 DC Downgrade w/DVD Media,Multi Lang**		3	
770-BDMT	**Cable Management Arm**		3	
770-BECD	**ReadyRails Sliding Rails Without Cable Management Arm or Strain Relief Bar**		3	

Azure Stack HCI

Description		Price	Qty	Ext. Price
631-AACK	**No Systems Documentation, No OpenManage DVD Kit**		3	
340-CUQR	**PowerEdge R650 Shipping**		3	
340-CUQN	**R650 Ship 4x3.5, 10x2.5, 8x2.5 NVMe**		3	
343-BBQY	**R650 Dell/EMC label (BIS) for 2.5" Chassis**		3	
389-DYHY	**PowerEdge R650 CE Marking, No CCC Marking**		3	
865-4702	**Dell Hardware Limited Warranty Plus Onsite Service**		3	
886-8082	**ProSupport 4-Hour 7x24 Onsite Service 3 Years**		3	
886-8454	**ProSupport 4-Hour 7x24 Technical Support and Assistance 3 Years**		3	
989-3439	**Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355**		3	
825-8623	**Certified Deployment Partner T1 or Distributors**		3	
370-AEVQ	**16GB RDIMM, 3200MT/s, Dual Rank**		48	
345-BCSK	**1.92TB SSD vSAS Mixed Use 12Gb ps 512e 2.5in Hot-Plug ,AG Dri ve SED, 3DWPD**		15	
450-AALV	**Power Cord - C13, 3M, 125V, 15A (North America, Guam, North Marianas, Philippines, Samoa, Vietnam)**		6	
492-BBDH	**Jumper Cord - C13/C14, 0.6M, 250V, 13A (North American, Guam, North Marianas, Philippines, Samoa)**		6	
540-BDIN	**Mellanox ConnectX-5 Dual Port 10/25GbE SFP28 Adapter, PCIe Low Profile, V2**		6	
470-ACET	**Dell Networking, Cable, SFP28 to SFP28, 25GbE, Passive Copper Twinax Direct Attach Cable, 2 Meter**		6	
470-ACEV	**Dell Networking, Cable, SFP28 to SFP28, 25GbE, Passive Copper Twinax Direct Attach Cable, 3 Meter**		6	
			Subtotal:	**$95,274.00**

S5212F Switches

Description		Price	Qty	Ext. Price
BUILD	**(2) Dell S5212F Switches with 36 Months ProSupport 4 Hour**	**$13,682.00**	**1**	**$13,682.00**
210-APHZ	**Dell EMC S5212F-ON Switch, 12x 25GbE SFP28, 3x 100GbE QSFP28 ports, PSU to IO air, 2x PSU**		1	
343-BBRX	**VLT Tech Sheet Document**		1	

S5212F Switches

Description		Price	Qty	Ext. Price
343-BBLP	**Dell EMC S52XX-ON Series User Guide**		1	
634-BRXD	**OS10 Enterprise, S5212F-ON**		1	
818-3530	**Dell Hardware Limited Warranty 1 Year**		1	
892-0640	**ProSupport 4-Hour 7x24 Onsite Service 1 Year**		1	
892-0641	**ProSupport 4-Hour 7x24 Onsite Service 2 Years Extended**		1	
892-0852	**ProSupport 4-Hour 7x24 Technical Support and Assistance 3 Years**		1	
975-3461	**Dell Limited Hardware Warranty Extended Year(s)**		1	
989-3439	**Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355**		1	
997-6306	**Info 3rd Party Software Warranty provided by Vendor**		1	
825-8623	**Certified Deployment Partner T1 or Distributors**		1	
848-8544	**3 Years ProSupport OS10 Enterprise Software Support-Maintenance**		1	
407-BCZR	**Dell Networking, Transceiver, SFP+, 10GbE, SR, 850nm Wavelength, 300m Reach**		4	
407-BCZT	**Dell Networking, Transceiver, SFP, 1000BASE-T**		4	
470-ABOU	**Dell Networking Cable, 100GbE QSFP28 to QSFP28, Passive Copper Direct Attach Cable, 0.5 Meter**		2	
470-ACLK	**Dell Networking Cable, OM4 LC/LC Fiber Cable, (Optics required), 5 Meter**		4	
450-AAFH	**Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13**		1	
450-AAFH	**Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13**		1	
210-APHZ	**Dell EMC S5212F-ON Switch, 12x 25GbE SFP28, 3x 100GbE QSFP28 ports, PSU to IO air, 2x PSU**		1	
343-BBRX	**VLT Tech Sheet Document**		1	
343-BBLP	**Dell EMC S52XX-ON Series User Guide**		1	
634-BRXD	**OS10 Enterprise, S5212F-ON**		1	
770-BDGQ	**Dell NW Dual Tray, 4-post, S5212F-ON**		1	
818-3530	**Dell Hardware Limited Warranty 1 Year**		1	
892-0640	**ProSupport 4-Hour 7x24 Onsite Service 1 Year**		1	
892-0641	**ProSupport 4-Hour 7x24 Onsite Service 2 Years Extended**		1	

S5212F Switches

Description		Price	Qty	Ext. Price
892-0852	**ProSupport 4-Hour 7x24 Technical Support and Assistance 3 Years**		1	
975-3461	**Dell Limited Hardware Warranty Extended Year(s)**		1	
989-3439	**Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355**		1	
997-6306	**Info 3rd Party Software Warranty provided by Vendor**		1	
825-8623	**Certified Deployment Partner T1 or Distributors**		1	
848-8544	**3 Years ProSupport OS10 Enterprise Software Support-Maintenance**		1	
450-AAFH	**Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13**		1	
450-AAFH	**Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13**		1	
			Subtotal:	**$13,682.00**

Implementation

Description		Price	Qty	Ext. Price
IMPLEM1	**(1) Onsite Resource Fixed Scope White Glove Implementation**	$0.00	1	$0.00
			Subtotal:	**$0.00**

Incentives

Description		Price	Qty	Ext. Price
DELLEOQ	**Time-Bound Incentive for PO by March 29**	($8,000.00)	1	($8,000.00)
			Subtotal:	**($8,000.00)**

Cost breakdown

Description	Qty
Cost Breakdown: HW: $71,867.86 SW: $11,928.29 SVC/SUP: $17,159.84	

Contract Code

Description	Qty
NCPA 01-143 Contract Code **C000001105509**	

Azure Stack HCI

Prepared by:

The [RE]DESIGN Group

Sarah Reynolds
405.831.8395
sreynolds@redesign-group.com

Prepared for:

Tahoe Truckee Sanitation

13720 Butterfield Drive
Truckee, CA 96161
Luke Swann
lswann@ttsa.ca.gov

Quote Information:

Quote #: 005137

Version: 1
Delivery Date: 02/02/2024
Expiration Date: 03/01/2024

Quote Summary

Description	Amount
Azure Stack HCI	$95,274.00
S5212F Switches	$13,682.00
Implementation	$0.00
Incentives	($8,000.00)
Subtotal:	**$100,956.00**
Estimated Tax:	**$3,952.73**
Total:	**$104,908.73**

Acceptance and Incorporation by Reference

Acceptance of this Quote is binding and the above item(s) will be purchased in reliance thereon. All sales are final. Payment Terms are Net 30. After orders are placed, a final invoice will be provided that shall include all applicable taxes and shipping charges not included herein.

This Order together with the Master Services Agreement and Service Attachments and other terms and conditions identified on Exhibit A, all of which are incorporated herein by reference (collectively, the “Agreement”) is between REDESIGN Group (sometimes referred to as “we,” “us,” “our,” or “Provider”), and the customer found on the signature block at the end of this Order (sometimes referred to as “you,” “your,” or “Client”). This A reement is effective as of the date both parties have signed below (the “Effective Date”). Both Provider and Client are sometimes referred to individually as a “Party”, or together as the “Parties”. Any capitalized terms in this Order not directly defined are referred to in the applicable document identified on Exhibit A of this Order. If there is a conflict between this Order, the Master Services Agreement, any Service Attachment, or Exhibit, this Order will control.

By signing or accepting this Order, Client acknowledges, represents, and warrants that it has read and agrees to the terms and conditions identified on Exhibit A to this Order which are incorporated as if fully set forth herein.

The parties hereby agree that electronic signatures to this Order shall be relied upon and will bind them to the obligations stated herein. Each party hereby warrants and represents that it has the express authority to execute this Agreement(s). This Order supersedes all prior negotiations, proposals, orders, agreements and communications between the parties regarding Provider’s Services.

Provider may make changes to the Agreement at any time. If there are changes, Provider will revise the date at the top of the document. Provider may or may not provide Client with additional notice regarding such changes. Client should review the terms and conditions regularly. Unless otherwise noted, the amended terms and conditions will be effective immediately, and your continued use of the Services thereafter constitute your acceptance of the changes. If you do not agree to the amended terms and conditions, you must stop using the Services immediately. Please note, you may incur a termination fee or other third-party fees, if applicable. You may access the current version of the terms and conditions at any time by visiting http://redesign-group.com/legal.

The parties, acting through their authorized officers, hereby execute this Agreement.

The [RE]DESIGN Group		Tahoe Truckee Sanitation	
Signature:		Signature:	
Name:		Name:	Luke Swann
Title:		Title:	It Systems Specialist
Date:		Date:	

Exhibit A

Agreement	Description
Master Services Agreement	General terms and conditions applicable to all Provider products and services
Services Attachment for Managed Services	Core managed services including monitoring, remote management, and help-desk
Data Processing Agreement	Data security and privacy agreement including statutorily required terms
Service Level Objectives	Targeted response times by tier of severity
Schedule of Services	Description of managed services offered by Provider
Schedule of 3rd Party Services	Notice of third-party services and waiver of claims

[re]DESIGN

The [RE]DESIGN Group
2629 Manhattan Ave, Suite 307
Hermosa Beach, CA 90254

The Future Belongs to the Curious

redesign-group.com

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Paul Shouse, Maintenance Manager
Item: V-4
Subject: Presentation of the SCADA/IT Master Plan Standards – Phase 1

Background
In November 2022, the Board of Directors approved a proposal from Jacobs Engineering for the development of SCADA Design Standards as outlined in phase one of the approved SCADA/IT Master Plan. The scope of the service was to establish a design guide for supervisory control and data acquisition SCADA system equipment, SCADA system programming, and SCADA information technology IT interfaces.

In January 2024, the final revisions to the SCADA/IT Design Standards were approved by staff and management.

Fiscal Impact
None

Attachments
SCADA Design Standards Presentation
SCADA Design Standards Report by Jacobs Engineering (CH2M Hill)

Recommendation
None. Presentation only.

Review Tracking

Submitted By: _____
Paul Shouse
Maintenance Manager

Approved By: _____
Richard Pallante
General Manager

SCADA Design Standard Project with Jacobs Engineering

Objective: Create a standardized control language and common set of control principles, which enhances communication efficacy throughout the control process.

Database Naming	Control Objects	HMI (Graphical Interface)	Hardware
Consistency	Modularity	Consistent Design	Consistent design and hardware
Clarity	Reusability	End User Centric	Replacement Schedule
Scalability	Scalability		Wiring Standards

Database Naming

- Database naming involves tags/tagging. It is used in marking data that resides in programming logic controllers (PLCs).
  - Consistent tag creation helps all users understand the system works in a detailed way
  - Increases technician efficiency by helping them identify specific criteria regarding the data
  - Scalability allows the system to expand without interrupting current processes

Tagging Example

- Tag numbers used in programming PLCs and HMIs must use the following format.

LSH99901A

- LSH is the ISA 5.1 identification
- 99 is the facility code corresponding to plant area/process
- 901 is the loop number
- A is the suffix

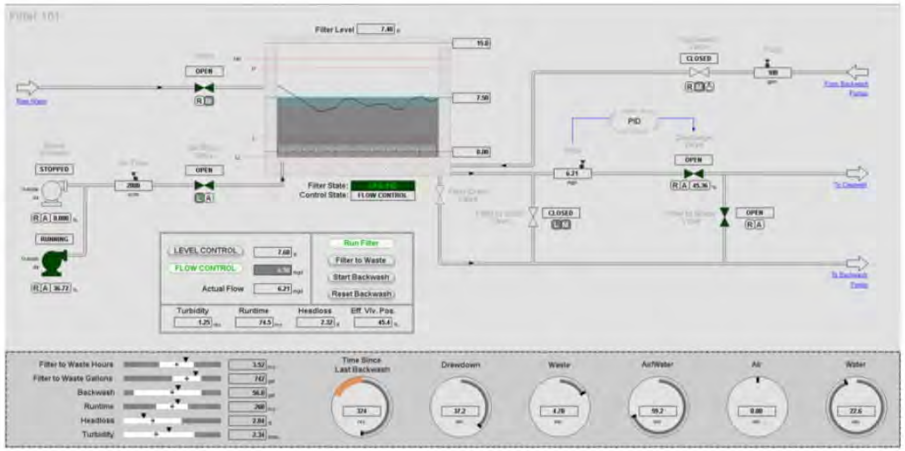
Control Objects

- Control Objects are how PLCs manipulate the data and control external equipment
  - Modularity and Reusability for control objects create functional code that is predefined and can be applied to control multiple external plant equipment types (e.g. pump, valve, etc)
  - Scalability allows the expansion of the plant control system by using the same control objects from area to area (e.g. a pump control object is used in MPPS, BIPS, and 2-Water)
  - Standardized control objects ensure minimized logic creation errors and quicker troubleshooting

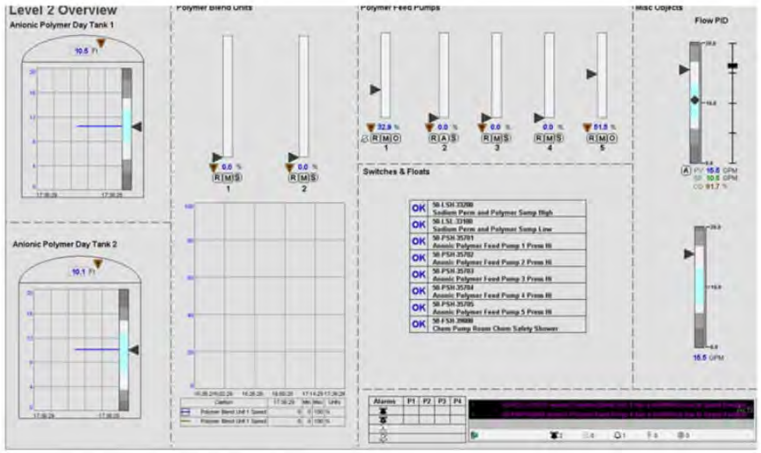
HMI

- HMI Design and Alarm standards are paramount to presenting data to operators, so they make informed, timely, and correct process control decisions.
  - Level 1, 2, and 3 screens
  - High-performance graphic layouts
  - Alarm display management

Difference Between P&ID and High Performance



P&ID Presentation

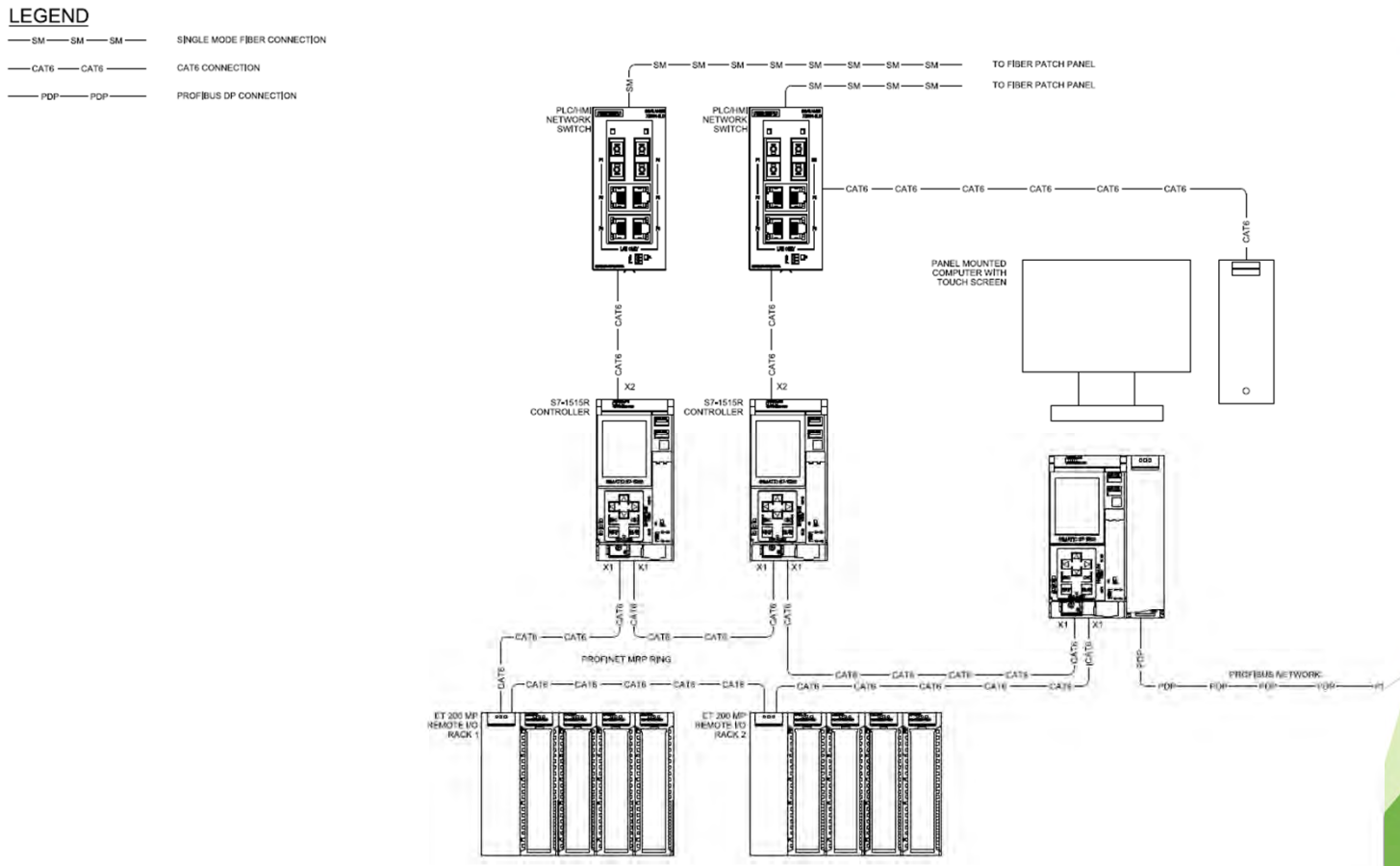


High Performance Presentation

Hardware

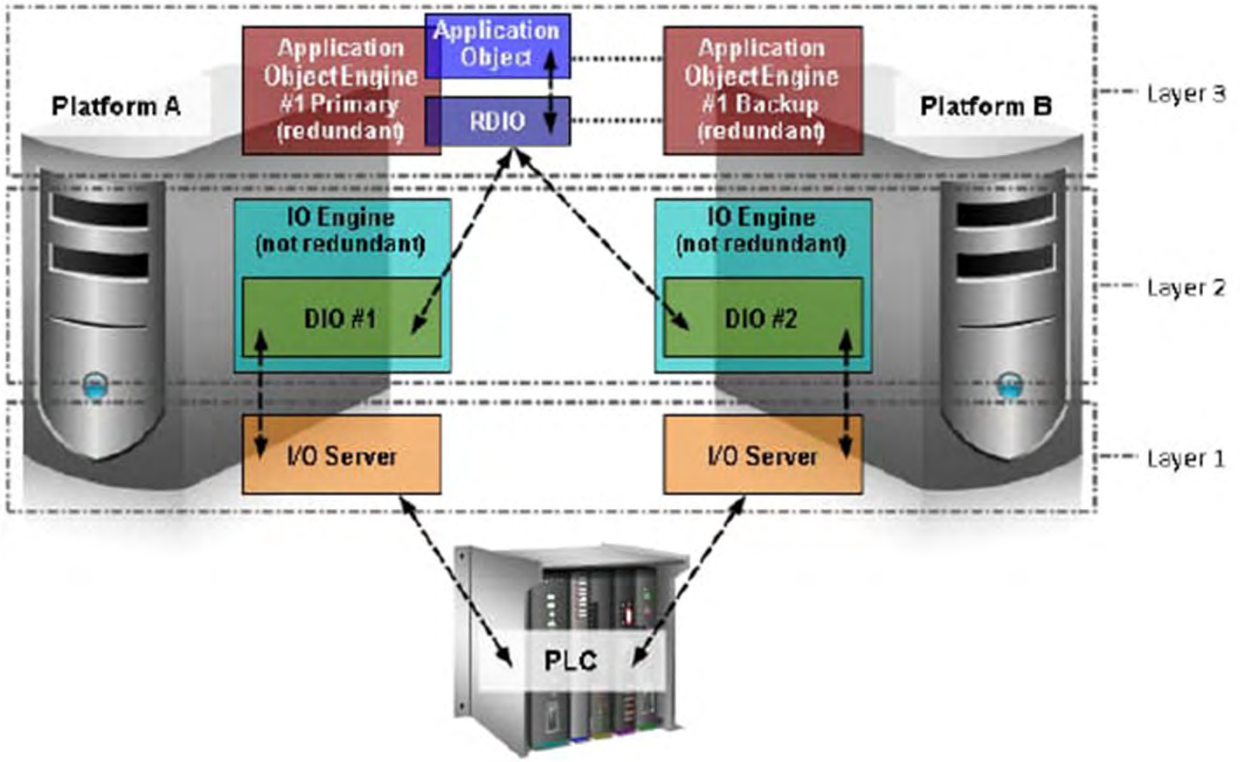
- PLC and Networking equipment with interconnection, design, and replacement standards
  - Standardization on industrial manufacturer(s)
  - Robust network design with redundant links
  - Consistent panel layouts, equipment, wire colors, and labels

Redundant PLC Architecture



Redundant Server Architecture

Figure 6 Redundant Device Integrated Object



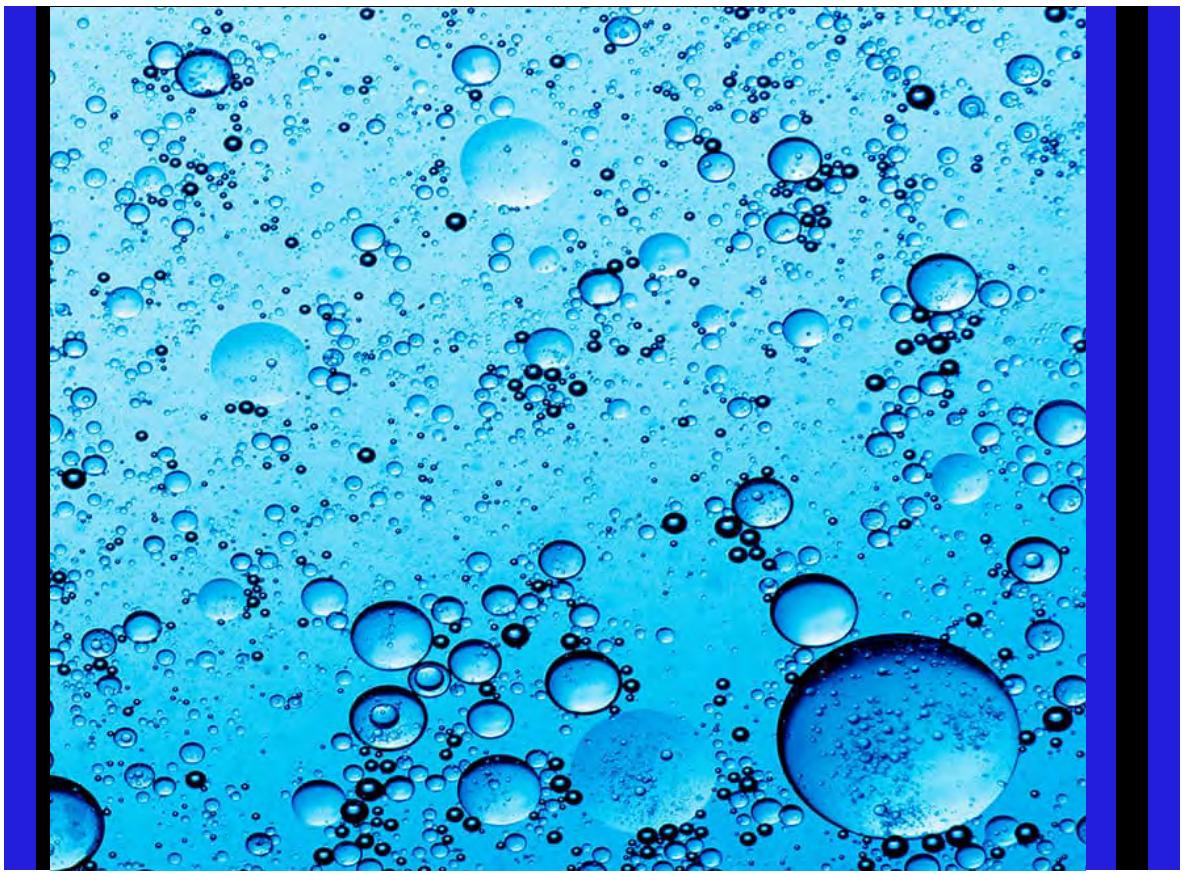
Questions?

SCADA Design Standards

Document no: SCADA Design Standards
Revision no: Final

Tahoe-Truckee Sanitation Agency

SCADA Design Standards Project
February 5, 2024



SCADA Design Standards

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Acronyms and abbreviations

AIMS	asset information mapping system
C&CT	Conventional & Chemical Treatment
CMMS	computerized maintenance management software
DHS	Department of Homeland Security
DMZ	demilitarized zone
FMS	financial management system
GIS	geographic information system
HMI	human-machine interface
I&C	instruments and control devices
I/O	input/output
ISA	International Society for Automation
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
IT	information technology
KPI	key performance indicator
LIMS	laboratory information management system
OT	operational technology
PPE	personal protective equipment
PID	proportional-integral-derivative
PIS	plant information system
PLC	programmable logic controller
RFID	radio frequency identification
RTU	remote telemetry unit
SCADA	supervisory control and data acquisition (generally refers to all control equipment including PLCs, HMIs, Instruments, etc.)
SQL	structured query language
SSL	secure sockets layer
T-TSA	Tahoe-Truckee Sanitation Agency
TRI	Truckee River Interceptor
UPS	uninterruptible power supply
VFD	variable frequency drive
VM	virtual machine
VPN	virtual private network
WIMS	water information management system
WRP	water reclamation plant
WQIS	water quality information system

1. Executive Summary

1.1 Control Philosophy

The foundation of SCADA design standards was established through a collaborative control philosophy workshop, which served as a pivotal forum for comprehensive discussions on control system matters. This workshop united the expertise of both the SCADA Team, comprised of Jacobs and TTSA, and a diverse group of control system consultants, blending their extensive project experiences with the intricate knowledge of the plant staff. This strategic convergence cultivated a shared learning environment and facilitated the identification of critical topics for further exploration. Additionally, the workshop created a standardized control language and a common set of control principles, thereby enhancing communication efficacy throughout the entire process.

1.2 Database Naming Convention

Implementing and enforcing a standard convention for database naming (also known as tag naming) in control systems is vital because it brings consistency and clarity to the way we name and organize tags. Here's why it's crucial to rigorously follow such standards:

- Consistency: Standards ensure that all tags are named in the same systematic way. This uniformity makes it easier for everyone to understand and work with the system.
- Clarity: Properly named tags provide clear information about the function and location of specific items, making it easier to navigate and manage the system.
- Efficiency: Consistent tag names speed up troubleshooting and maintenance, helping personnel quickly identify and address issues.
- Documentation: Tag standards act as a form of documentation, aiding in system understanding and making it easier for new team members to learn.
- Scalability: Standards allow the system to expand without disrupting the existing structure.
- Interoperability: Common naming standards make it simpler to integrate different systems and devices.
- Quality Control: Enforcing standards reduces errors caused by unclear or inconsistent tag names.
- Data Management: Well-named tags facilitate the retrieval and analysis of historical data.

By strictly adhering to these standards, we ensure that the control system operates effectively and efficiently, reducing confusion and errors while promoting uniformity and compliance.

1.3 Control Objects

Before we provide a summary of control objects standards, its necessary to explain what they are and how to use them. Object-oriented programming techniques (objects or control objects) can be explained with the following analogy. Imagine building a city without any plan or organization. Each building is constructed independently, and there's no uniformity. It's like constructing houses, offices, and schools randomly, without clear blueprints. The city becomes chaotic, and maintenance is a nightmare. Fixing a problem in one building often leads to unexpected issues in others.

Now, think of object-oriented code as a way to bring order and structure to this city. In object-oriented code, we create "objects" just like we have different types of buildings. Each object has a specific role and properties, like a house has bedrooms, a roof, and doors. These objects are created based on templates or blueprints for buildings defining what each object will be like. Objects can perform actions using "methods." For example, a school can have a method to "teach" and a hospital can have a method to "heal." These methods define what each building can do.

One of the more significant costs of implementing and maintaining a SCADA system includes programming PLCs and HMIs software. Implementing a control object library using object-oriented programming methods offers numerous advantages.

- Modularity and Reusability: Control objects allow the creation of reusable, modular code components, streamlining development and maintenance efforts. Most wastewater treatment facilities (this Agency included) have similar equipment controlled in similar ways. Predefined and reusable code (aka an object or control object) are like templates that can be applied to pumps, valves, and other equipment.
- Efficient Maintenance: With only a few control objects, staff can easily learn the entire code library which simplifies troubleshooting and reduces response to failures.
- Scalability: Control objects facilitate the expansion of control systems by creating new instances of objects from a library when new facilities are added or changed. A well designed control object library for a wastewater treatment facility requires about a dozen control objects which can be used for most of the programming needs of the facility. Some custom code development is always required; however, this is usually a small fraction of the coding that can be replaced using a control object library.

The Agency has an aging control system infrastructure and much of the hardware and software will need replacement to improve future reliability. If properly planned, implementing a control objects library will save on implementation costs and offers compelling long-term benefits:

- Consistency: Standardized logic ensures uniformity, simplifying system operation, maintenance, and training.
- Error Reduction: Standardized logic minimizes errors, promoting best practices and reducing the risk of system failures and downtime.
- Efficient Maintenance: Maintenance becomes cost-effective and efficient, as personnel can quickly troubleshoot and repair the system.
- Interoperability: Standardized logic eases integration of new and existing systems, reducing complexities and costs.
- Documentation: Standardized logic serves as self-explanatory documentation, facilitating onboarding and reducing training costs.
- Longevity: Control systems with standardized logic are easier to maintain, adapt to changing requirements, and offer a sustainable, efficient, and reliable solution.

1.4 HMI and Alarming Standards

The HMI Standards workshop developed guidelines for establishing graphical standards. Specific standards development must be executed during the implementation phase of a pilot project when the software is available for programming and operations can provide feedback on the functionality. To establish HMI graphic standards, it's essential to involve operational staff in evaluating new graphic approaches to ensure they align with operational needs.

A recommended process involves creating an implementation alternative for part of the plant and remote sites. After selecting the best alternative that meets operational requirements and budget, a small-scale pilot project is implemented. This allows operational staff to provide feedback and gain experience without significant costs.

During the pilot project, upgrading the PLC in sync with the new HMI implementation is crucial. This ensures that control objects, including PLC logic and HMI graphics, are developed together. Once the pilot project is complete, HMI standards and object libraries are established, guiding future SCADA projects.

The HMI workshop also covers alarm management standards for effective alarm handling. It encompasses alarm graphics, criteria definition, generation, acknowledgement, severity and priority assignment, KPI tracking, performance reports, shelving vs. disabling, handling redundant alarms, control system status, change management, and training. By thoroughly addressing these topics, the Agency can establish a robust alarm system, ensuring operators can easily identify, prioritize, and respond to alarms while enhancing overall operational safety and efficiency.

1.5 PLC Control Panel & HMI Equipment Standards

The Agency has standardized on Siemens PLCs for at least the last 20 years. Siemens is a globally recognized manufacturer of control system hardware and is well respected in the control industry. Some of the older Siemens PLCs are becoming obsolete, or will be obsolete soon, making it necessary to upgrade the older PLC systems.

The PLC control equipment standards are designed with a specific focus on Siemens PLC controllers. This implies that the selection of PLC equipment must be exclusively sourced from Siemens to fully leverage the benefits of these standards. To illustrate this, consider it akin to a scenario where all computers used are Microsoft Windows-based. Microsoft computers seamlessly integrate with each other, much like Siemens PLCs, ensuring compatibility and efficiency. However, mixing Siemens PLCs with other manufacturers, such as Allen-Bradley, would be equivalent to combining Windows and Linux computers. The programming that functions on Windows does not align with that on Linux. Consequently, the Agency would need to invest in programming licenses for both Siemens and Allen-Bradley PLCs and maintain duplicate control object libraries due to the inherent software differences. This exclusivity streamlines the implementation and ensures optimal performance of the PLC control equipment standards.

Excluding the PLC equipment, the other equipment in the control panels like power supplies, terminal blocks, control relays, etc., all have competing manufacturers that produce similar equipment without much variation in the products quality or functionality. As such, there is more flexibility in the manufacturers that can be supplied. This gives the manufacturer some flexibility in procuring equipment for control panel fabrication.

In addition to equipment standards, the document emphasizes the importance of proper signal interface in industrial control systems. It discusses the selection of appropriate controllers, I/O module configurations, and the organization of field terminal blocks to simplify wire terminations. Additionally, it details requirements for analog input and output modules, addressing aspects like signal types, internal wiring, and grounding.

The standards address control system redundancy which is crucial for critical systems that rely on automation to ensure water treatment within permit limits. The document explores methods of implementing control system redundancy through unit process redundancy and PLC redundancy. It outlines network architecture, distributed I/O drops, and interface considerations, emphasizing the need to eliminate single points of failure.

The document provides insights into the Agency's preference for utilizing panel-mounted touch screens and industrially hardened computers or thin clients rather than Siemens Basic or Comfort series operator interface terminals (OITs). It mentions exceptions for packaged system suppliers and the importance of replicating OIT functionality on the HMI.

These guidelines ensure the reliability and efficiency of control systems in industrial applications, particularly in the context of signal interfaces, control redundancy, and standardized HMI equipment selection.

2. Introduction

The Tahoe-Truckee Sanitation Agency (T-TSA) provides regional wastewater conveyance and treatment to several Lake Tahoe area communities and is governed by five member districts. The five districts are as follows:

- Tahoe City Public Utility District
- North Tahoe Public Utility District
- Olympic Valley Public Service District
- Truckee Sanitary District (includes Northstar Community Services District)
- Alpine Springs County Water District

T-TSA owns, operates, and maintains the Truckee River Interceptor (TRI) and the 9-million-gallon-per-day (MGD) Water Reclamation Plant (WRP). The TRI conveys wastewater from Tahoe City to the WRP in Martis Valley, east of the town of Truckee, California. The TRI collects flows from the member districts, is approximately 17 miles in length, and varies in diameter from 18 inches to 42 inches. The six telemetry sites along the TRI that communicate flows to the WRP are as follows:

- Alpine
- Dollar Hill
- Granite Flats
- Olympic Valley
- Ramparts
- Tahoe City North/West (includes two flow meters)

T-TSA uses a Supervisory Control and Data Acquisition (SCADA) system to monitor and control the WRP and six flow measurement sites. The SCADA system and the data it collects are critical to supporting operations and regulatory reporting functions. SCADA data is often useful in business applications, such as Computerized Maintenance Management Systems (CMMS), and can be integrated with T-TSA's Information Technology (IT) system. The SCADA/IT Master Plan (dated June 2022) identified eight implementation projects, including a project to develop SCADA conventions and component standards.

The SCADA Standards project consists of a series of workshops designed to develop two main chapters: Convention Standards and Component Standards. Each workshop produced a technical memorandum (TM) that forms a section in each chapter. The SCADA Standards chapters are shown in Table 1-1.

Table 1-1. SCADA Standards Outline

Chapter Title/TM Topic	Workshop Conducted	Chapter/TM Delivered
Control Philosophy	2/23/2023	3/17/2023
Database Naming	3/23/2023	5/12/2023
PLC/HMI Control Objects [a]	4/20/2023	5/12/2023
HMI Graphics and Alarm Management [a]	5/24/2023	7/14/2023
Instrumentation and Control Panels	6/29/2023	7/21/2023
PLC/HMI Control Equipment	7/27/2023	8/16/2023
SCADA System Design Guide	Draft 10/15/2023	*11/3/2023*

[a] Includes Operations participants

Tentative dates are in *italics*.

The T-TSA staff who participated in workshops and reviewed TMs and Design Guide chapters were:

SCADA System Team		Operations
Paul Shouse	Kevin Woods	
Luke Swann	Ryan Schultz	

3. Control Philosophy

The control philosophy establishes the basis for all convention standards and some component standards. The control philosophy will guide development of the following standards:

- Convention Standards
  - Database Naming
  - PLC/HMI Control Objects
  - HMI Graphics
  - Alarm Management
- Component Standards
  - Control Panels
  - Control Equipment

The Control Philosophy includes the following topics:

- Control Modes and Hierarchy
- Equipment Monitoring
- Process Monitoring
- Automatic Controls

3.1 Control Modes and Hierarchy

Controlled equipment in a water utility includes pumps, valves, and other motorized devices. Controlled equipment falls into one of three categories; non-SCADA controlled, SCADA controlled equipment, and SCADA controlled package systems.

- Non-SCADA controlled: This equipment may be monitored by SCADA, and operation of this equipment only occurs locally.
- SCADA controlled: This equipment is monitored by SCADA, and normally operated through SCADA.
- Packaged: This equipment is monitored by SCADA and controlled through the packaged system control panel. The SCADA system may issue commands and setpoints to the packaged system.

SCADA control is the default mode of operation for most controlled equipment. All interlocks that protect personnel and equipment as well as the critical safety alarms, will be hardwired at the local control panels. E-stop selectors or pushbuttons will always be hardwired and located at the equipment. SCADA will monitor all these alarms and will only apply selected software interlocks.

3.1.1 Control Modes

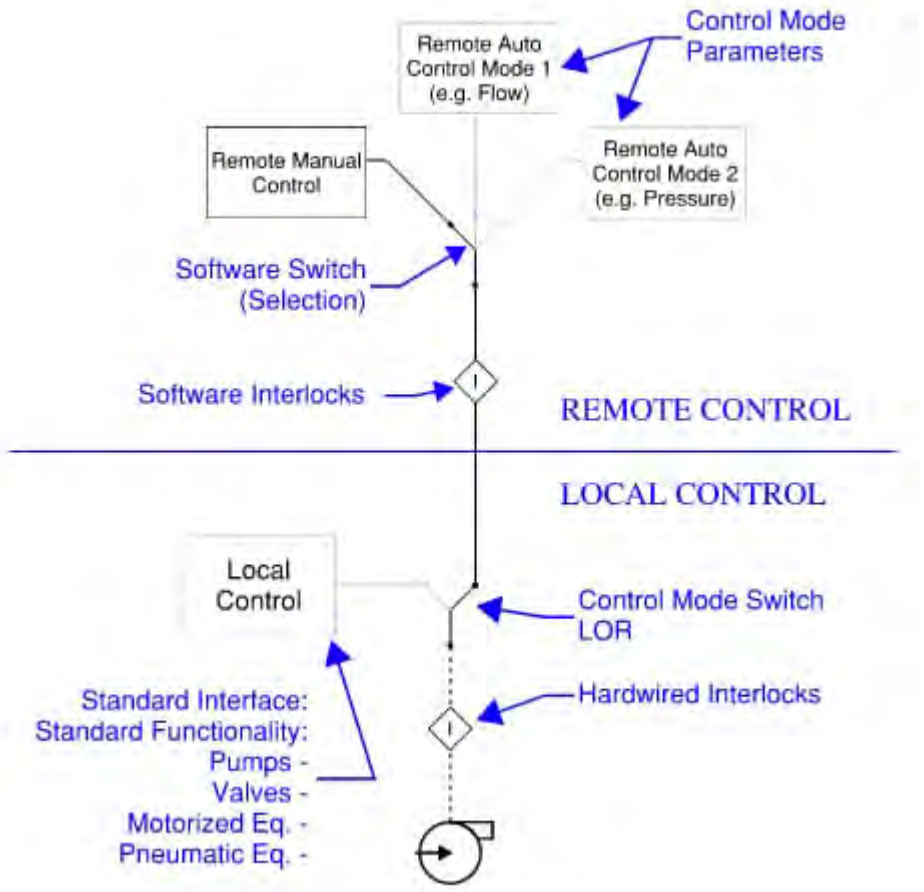
All SCADA-controlled equipment includes a LOCAL / OFF / REMOTE (LOR) or LOCAL / REMOTE (L/R) selector switch in the field. In LOCAL, the control of the equipment will be based on the local pushbuttons and hardwired interlocks. The hardwired interlocks will be active irrespective of the position of the L/R selector switch. The REMOTE status (of the LOR or L/R selector switch) will be monitored at SCADA.

Some pumps and motor operated loads may include another level of control at the MCC or VFD typically located in an electrical room. The field L/R selector must be in the LOCAL position and the MCC/VFD selector must be in LOCAL mode for control through the MCC/VFD panel. The motor load can now be operated from the local panel. Control from the local pushbuttons at the field panel will be disabled in this option. SCADA will also monitor the LOCAL / REMOTE status of the OIT module.

When the device is in REMOTE in the field and in REMOTE at the MCC/VFD panel, control will be transferred to the SCADA system. The operator may select MANUAL or AUTO control modes at the SCADA display for each device in REMOTE mode. In the REMOTE MANUAL mode of operation, the operator can

manually operate each device from the SCADA displays. In the REMOTE AUTO mode of operation, the equipment is controlled by the automatic control strategy for each device. Software interlocks will be active for this mode of control. Mode selections, by either field switches or software switches, are mutually exclusive. A diagram of these equipment control modes is shown on Figure 1.

Figure 1 Control Mode Selection



3.1.2 Control Mode Interlocks

All control modes are implemented in a hierarchical fashion and only one control mode is active at a time. For example, selecting local control disables all other control modes. The following describes each level of the equipment control hierarchy.

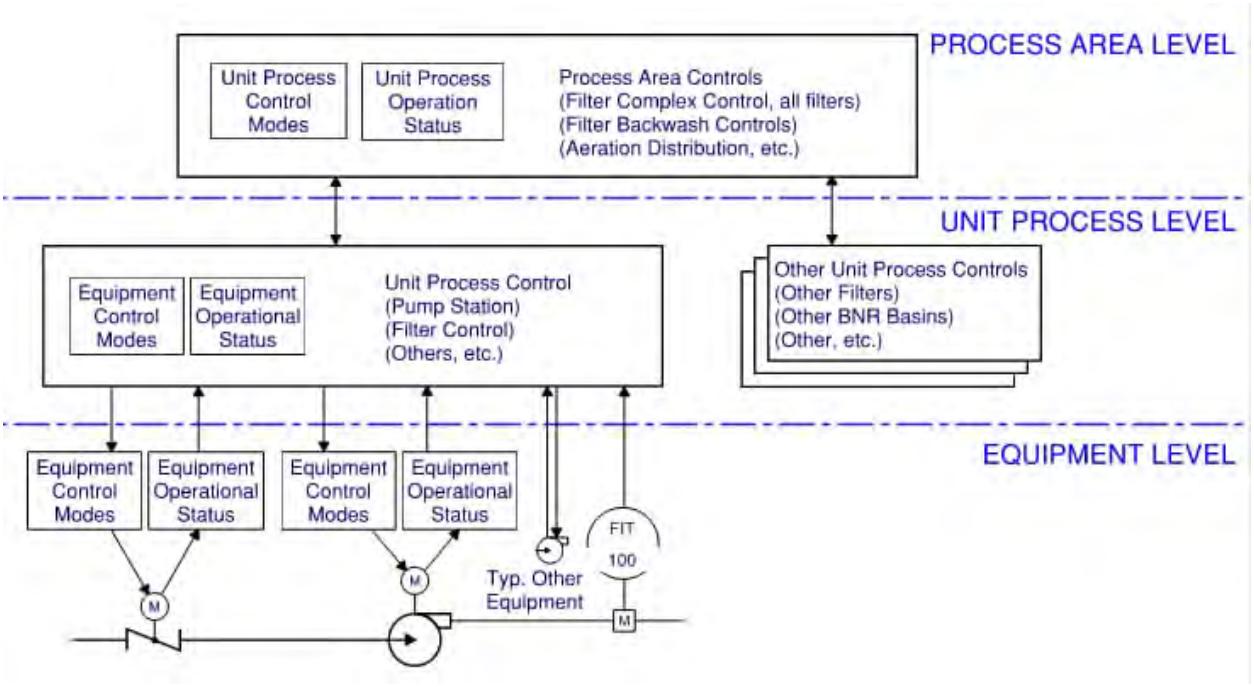
- All life safety and equipment safety interlocks are implemented (typically hardwired) at the root of the hierarchy and active in all control modes. The design engineer must coordinate with the Agency regarding interlocks functionality and any circumstances where they're bypassed.
- Local controls, traditionally hardwired, do not bypass life safety; however, it may bypass equipment safety interlocks provided the interlocks are coordinated with the Agency and O&M. One example of an equipment interlock that might be bypassed is a low level cutout in a wet well; the operation staff may want to pump as much water out of the wet well as possible while ignoring equipment safety. Local controls typically operate independently of the SCADA system to provide equipment functionality under extreme failure conditions.

- Software interlocks add another safety layer and some basic process operations. Software interlocks are typically active for all remote-control modes; however, software interlocks can be implemented for specific mode of controls as needed.
- Remote control modes enable remote manual operation or process automation.

3.1.3 Automation Hierarchy

Higher levels of control and automation build on grouping control devices into unit processes and grouping unit processes into process areas. Unit processes can be as complex as a filter control or as simple as flow control using a single valve actuator. Figure 2 shows the automation hierarchy concept.

Figure 2 Automation Hierarchy



In the figures above we illustrate device control mode hierarchy and automation hierarchy. In each of these diagrams there is a box around some implied functionality, local controls, unit process control, etc. Breaking down this functionality into easily understandable pieces make it easy to develop code for a specific purpose. It's not a far step for these boxes to be developed into modular reusable code sometimes referred to as objects. Object oriented coding maximizes the reuse of code with the same or similar functionality and has a variety of other benefits. The Agency has expressed a desire to build and maintain a code library.

3.2 Equipment Monitoring

This section describes general monitoring functions applicable to broad classifications of equipment, such as motors, valves, and other equipment. These functions may be applied as desired to any equipment monitored by SCADA. These functions are assumed in the individual control strategies.

3.2.1 Field Selection of Control Mode

Every device directly controllable by SCADA must include REMOTE status (or equivalent) monitoring. SCADA monitors the device's L/R switch state to determine when the device is being locally controlled, or the PLC has control of the associated equipment. Current L/R status is displayed in SCADA. Existing device

switches may have some variation of HAND/LOCAL, OFF, or AUTO/REMOTE. As new switches are added or replaced, the hardwired logic should be migrated to LOR style controls in place of HAND / OFF / AUTO (HOA) or other control methods.

3.2.2 Operational Status

All controlled equipment and equipment with monitoring only capabilities will monitor the operational status of the equipment regardless of the control mode. Examples of operational status monitors include out of service, alarm, running, stopped, etc. Examples of unit process operational status monitors for a filter include backwashing, filter to waste, in service, out of service, standby, etc.

3.2.3 Hardwired interlocks

Safety related and equipment protective alarms (i.e., E-Stop, High Discharge Pressure) will be hardwired and not programmed within the drives. Latched interlocks (i.e., E-Stop, High Discharge Pressure, Motor Overload) will require the operator to reset the interlock at the local control panel or at the face of the MCC. Unlatched interlocks (i.e., Low Suction Level, Moisture Alarm) do not require an operator reset. Once the process condition returns to its normal operating range, the equipment will return its available status for REMOTE control. Active interlocks will not impact the LOCAL / REMOTE status into the PLC. Certain system related and SCADA generated alarms (i.e., 'No Pumps available for Remote Control' alarm, PLC to PLC communication Fail alarm) will be reset from the SCADA displays.

3.2.4 Runtime Calculation

The PLC will maintain an elapsed run time for any equipment that provides a RUN status. The total elapsed time will be displayed on SCADA in units of hours, with a resolution of 0.1 hours. A Supervisor or Administrator will be able to reset the total run time.

3.2.5 Equipment Faults

If the PLC issues a command and if the correct motor feedback status is not registered within a specific time, the PLC will issue an alarm and place the device in a 'Failed' state. The PLC will also generate an 'Unsolicited Change' alarm and put the device in a 'Failed' state, if a running device (in REMOTE) stops without a command from the PLC. These alarms must be reset at SCADA to re-establish control of this device (from a failed state).

3.2.6 Energy Information

Energy data will be collected where available (i.e. Smart MCCs) and the data will be typically collected via an Ethernet link. The energy information monitored by the SCADA system includes the following where available.:

- Power in kilowatts
- Power in kilovolt-amperes reactive
- Power in kilovolt-amperes
- Power Factor
- Volts (each phase)
- Amperes (each phase)

3.3 Process Monitoring

3.3.1 Analog Input Filtering

Analog signal quality (over/under range.) will be monitored and flagged by SCADA. Points with unacceptable quality must not be used for control or calculation purposes.

3.3.2 Digital Input Filtering

When required, the PLC will use an adjustable time delay function for the purpose of de-bouncing discrete input variables. De-bounce timers will be used on all discrete alarm inputs. The time delays are adjustable only by qualified technicians familiar with PLC programming. By default, discrete inputs are configured with de-bounce timers set to zero (0) seconds.

3.3.3 Position/Speed Indication

For modulating valves/gates and for VFDs, the PLC will generate a discrepancy alarm if the position or speed feedback is not within an adjustable percentage (initial setting is 3 %) of the output command within an adjustable time (initial setting 60 seconds). Both parameters must be adjustable (in the PLC control objects) for each controlled device.

3.3.4 Flow Totalizers

Every liquid flow rate transmitted to the SCADA system will have a flow total calculated as follows:

- The current day's total flow (midnight to midnight) is calculated at the PLC and displayed at SCADA.
- The previous day's total flow (as of midnight) is calculated at the PLC and displayed at SCADA.
- A running total flow is calculated at the PLC and displayed at SCADA. This total may be reset by the supervisor at SCADA. When this total is reset, the PLC creates a timestamp of the reset action and SCADA displays this time and date next to the running total.

3.3.5 Communication Statistics

The SCADA system will track all communication errors for remote and in-plant PLCs. Any in-plant communication fault, which results in three or more (user adjustable) consecutive failed retries, will generate an appropriate communication alarm describing the problem. A SCADA communication summary will display the status of each SCADA node on the network.

3.4 Automatic Controls

3.4.1 Pump Call Order

Where two pumps are available in a unit process and no more than one pump may run at a time, the PLC program will use a lead / standby strategy. Where both pumps may be required to run simultaneously, the PLC program provides lead / lag logic. Where 3 or more pumps are available, and more than one pump may be required to run simultaneously, the PLC program will provide lead / lag / standby logic. The operator will select which pump is lead, lag, etc. at the SCADA display. The PLC will change the lag and standby selection after the lag pump has run and stopped. The lead pump will be changed based on an operator-input at SCADA.

3.4.2 Equipment Runtime Balancing

The goal of runtime balancing will be to provide more wear and tear on some equipment while sparing other equipment. The intent is to space out the replacement of the equipment instead of having all the equipment fail at or near the same time. A secondary goal of the runtime balancing will include running equipment with enough regularity that it remains useful when needed.

3.4.3 PID Control

Automatic process control will require Proportional Integral Derivative (PID) control loops to achieve stability over a range of process conditions. PID control loops will adjust pump speed, valve position, or other control variables in response to the difference between the process variable and a setpoint.

PID control modes will be selected at the SCADA displays. Tuning parameters will be adjusted only by qualified maintenance technicians familiar with process control. All adjustable parameters can be changed through the PLC program or at the HMI displays, provided the user has appropriate security clearance.

When the PID controller is inactive, the control variable will track the process variable. When the PID controller switches to active control the PID will adjust the control variable based on tuning parameters to provide bumpless transfer of control for analog controlled devices.

3.4.4 Chemical Dosing

Chemical dosing will use compound control methods. Compound controls include combinations of feed forward, and feedback signals. Flow pacing and residual trim are examples of compound controls. Chemical dosing methods with the most effective results will be used. Alternative control methods should be provided in the event of instrument outage or failure.

3.4.5 Restart after a Power Outage

Most pieces of equipment will be re-started manually after a power outage. However, some process areas (i.e., hypochlorite pumps) may be automatically re-started after a power outage. These process areas will be identified during design and programming activities.

4. Database Naming Conventions

4.1 SCADA Tag Naming Components

The Agency has a well-established tag naming convention that consists of smaller components. These components are combined in a few formats depending on the system that is using the tags. The components consist of the following.

- AA = Facility Number (AA)
- BBB = Loop Number (BBB)
- LLLL Device Identifier (LLLL)
- S = Device Suffix (S)
- EEEE Tag Extensions (EEEE)

4.1.1 Facility Code (AA)

The facility code is a 2 to 3 character identifier based on a facility map of the whole treatment plant that identifies each area or building at the plant. Table 1 Facility Code (AA) below provides a list of the facility codes and descriptions.

Table 1 Facility Code (AA)

AA	Description
UDS	UPSTREAM DIVERSION STRUCTURE
PDS	PLANT DIVERSION STRUCTURE
1	OPERATIONS BUILDING
2	ADVANCED WASTE TREATMENT BUILDING
3	SHOP & OXYGEN GENERATION/LUNCH ROOM
4	SOLIDS HANDLING BUILDING
5	BACKWASH EQUALIZING TANK
6	CORRIDOR (6A, 6B, 6C, 6D SECTIONS)
7	HEADWORKS BUILDING
8	GRIT CHAMBER
9	PRIMARY SLUDGE PUMP STATION
10-11	PRIMARY CLARIFIER - DOME COVER
12	OXYGENATION BASINS
13	C&CT BUILDING
14-15	SECONDARY CLARIFIER
16	RAPID MIX AND FLOCCULATION BASINS
17-18	CHEMICAL CLARIFIER
19	FIRST STAGE RECARBONATION BASIN
20-21	RECARBONATION CLARIFIER

AA	Description
42	DIESEL STORAGE TANK
43	CARBON DIOXIDE STORAGE
44	GASOLINE PUMP STATION
46	AWT SPILLAGE VAULT
47	SHS SPILLAGE VAULT
48	2-WATER RETENTION BASIN
50	PRIMARY CLARIFIER - DOME COVER
51	PRIMARY SLUDGE PUMP STATION
52	OXYGENATION BASINS
53	C&CT BUILDING
54	SECONDARY CLARIFIER
55DB	SECONDARY EFFLUENT DISTRIBUTION BOX
55VV	SECONDARY EFFLUENT VALVE VAULT
56	STRIPPER DISTRIBUTION BOX
57-58	STRIPPER BASIN
59	DEWATERING PUMP STATION
60	SEPTAGE RECEIVING STATION
61	STORAGE BUILDING
62	TSD POND DEWATERING P.S. (NOT SHOWN)

AA	Description
22	SECOND STAGE RECARBONATION BASIN
23	CHEMICAL SLUDGE PUMP STATION
24	MULTIPURPOSE PUMP STATION
25-26	BALLAST PONDS
27	ELECTRICAL SUPPLY BUILDING
28	ELECTRICAL SUBSTATION
29-30	DIGESTER FIXED-TOP
31	DIGESTER FLOATING-COVER
32	DIGESTER BUILDING
33	DIGESTER
34	BIOLOGICAL FILTRATION EFFLUENT DISTRIBUTION BOX, BIOLOGICAL FILTRATION EFFLUENT POND
35	EMERGENCY RETENTION BASIN BYPASS STRUCTURE
35A	EMERGENCY RETENTION BASIN
36	AMMONIUM SULFATE STORAGE TANK
37	PLANT WASTE WET WELL
38	BALLAST POND DISTRIBUTION BOX
41	LIQUID OXYGEN STORAGE

AA	Description
63	GREEN ACRES P.S.
64	STRIPPER BASIN
65	NOT ASSIGNED
66	PRIMARY CLARIFIER - DOME COVER
67	PHOSPHORUS STRIPPER SLUDGE CONTROL ROOM
68	SECONDARY CLARIFIER
69	ODOROUS AIR FAN STATION SECONDARY CLARIFIER
69A	BIOFILTERS
70	MAINTENANCE BUILDING
71	DEWATERING BUILDING
75	CHLORINE FACILITY
80	BNR INFLUENT PUMP STATION
81	BNR SUPERSTRUCTURE
82	BNR SUPPORT FACILITY
83	ENGINE GENERATOR FUEL STORAGE
99	EFFLUENT DISPOSAL FIELD

4.1.2 Loop Number (BBB)

The loop number is a 3 digit number use to identify unique instrumentation or equipment. The 900 series loop numbers are reserved for support systems like building HVAC, UPS Alarms, etc. All other loop numbers are assigned to process related equipment. It is good practice to assign loop numbers systematically to equipment that is clustered together. For example, the BNR process has developed a convention where 410 series loop numbers are used for denitrification cell 1, and 420 series loop numbers are used for denitrification cell 2, etc. Any user assigning new loop numbers should work with the maintenance staff to develop a systematic approach to assign loop numbers that is both compact to minimize the number of loops used and helpful for identifying the instrument in some meaningful way relative to the process. Design engineers must conduct meetings early in the design to establish this numbering system with input from the Agency. Maintenance activity where new loop numbers are assign should back fill gaps in the numbering and leave large groups of loops open for future design projects.

4.1.3 Device Identification (LLLL)

The device identification is a 1 to 5 character abbreviation that applies generally to both instrumentation (a subcategory of equipment) and equipment such as pump, valves, motor operated equipment, etc. For instrumentation the ISA 5.1 identification table will be used for interfacing to instruments and pilot devices. Refer to Table 2 Instrument Identification Letters below.

Table 2 Instrument Identification Letters

INSTRUMENT IDENTIFICATION LETTERS TABLE

LETTER	FIRST-LETTER		SUCCEEDING-LETTERS		
	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	READOUT OR PASSIVE FUNCTION	READOUT OR PASSIVE FUNCTION
A	ANALYSIS (+)		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE (*)	USER'S CHOICE (*)	USER'S CHOICE (*)
C	USER'S CHOICE (*)			CONTROL	
D	DENSITY (S.G.)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT, SENSOR		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE (*)		GLASS, GAUGE VIEWING DEVICE	GATE	
H	HAND (MANUAL)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTION	MOMENTARY			MIDDLE, INTERMEDIATE
N	TORQUE		USER'S CHOICE (*)	USER'S CHOICE (*)	USER'S CHOICE (*)
O	USER'S CHOICE (*)		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTI VARIABLE		MULTI FUNCTION	MULTI FUNCTION	MULTI FUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED (*)	X AXIS	UNCLASSIFIED (*)	UNCLASSIFIED (*)	UNCLASSIFIED (*)
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION	Z AXIS		DRIVE, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

There is some room for interpreting the instrument identification table above and in some cases the same type of device could be labeled differently.

For equipment that does not fit into the instrumentation category, a specific list of abbreviations will be used. These abbreviations generally apply to mechanical equipment such as pumps, valves, conveyors, and other equipment that may or may not be monitored by the SCADA system.

Refer to the pre-approved abbreviations list in Table 3 Equipment Abbreviations (Non-Instrumentation).

Table 3 Equipment Abbreviations (Non-Instrumentation)

ABB.	DESCRIPTION
AC	AIR CONDITIONER
ARV	AIR RELEASE VALVE
BFD	BUTTERFLY VALVE DAMPER
BFP	BACK FLOW PREVENTER

ABB.	DESCRIPTION
BFV	BUTTERFLY VALVE
BLO	BLOWER
BO	BLOW OFF VALVE
BOL	BOILER
BV	BALL VALVE
CB	CATCH BASIN
CCS	CENTRAL CONTROL SYSTEM
CMP	CHEMICAL PUMP
CON	CONVEYOR
CV	CHECK VALVE
DEC	DECANT
DMP	DAMPER
ELC	ELECTRICAL LOAD CENTER
EXH	EXHAUST FAN
FAN	FAN
FHY	FIRE HYDRANT
FLR	FLARE
FLTR	FILTER
GV	GATE VALVE
HTR	HEATER
HV	HOSE VALVE
MH	MANHOLE
MIX	MIXER
PMP	PUMP
PV	PLUG VALVE
TNK	TANK
VLV	VALVE
VTR	VENT THRU ROOF
WH	WATER HEATER

4.1.4 Device Suffix (S)

A suffix is an optional 1 to 2 alphabetic character to distinguish unique devices that have similar functions and are related to the same equipment or process. For example, if a pump or pump station has both a suction pressure transmitter and a discharge pressure transmitter, the same loop number can be used followed by a suffix “A” and “B”. The use of suffixes must be used to help limit the number of loop numbers. Where possible avoid using suffix letter “I” and “O” so they do not get confused with the numbers one (1) and zero (0) respectively.

4.1.5 Extension (EEE)

Tag extensions apply specifically to programming and are used to describe a function or state of a signal or memory in the PLC or HMI. Refer to the Table 4 Tag Extensions for a list of approved extensions.

Table 4 Tag Extensions

Extension	Extension Description	Data Type
A_CLS	Auto mode Close command	BOOL
A_OPN	Auto mode Open command	BOOL
A_RUN	Auto Run control from an automatic sequence	BOOL
A_RUN1	Auto Run equipment #1 control from an automatic sequence	BOOL
A_STRT	Auto Start	BOOL
ALRM	Alarm	BOOL
ANFAIL	Analogue signal fail	BOOL
AUTO	Auto Mode Command	BOOL
AUTOs	Auto Mode Status	BOOL
AVAIL	Equipment is available.	BOOL
AVAIL1	Equipment #1 is available.	BOOL
AVAILG	Gas valve is available	BOOL
AVAILW	Water valve is available	BOOL
CASCs	Cascade Mode Status	BOOL
CALIB1	Calibrate signal #1	BOOL
CHANL	Channel	ANL_IN
CLOSEG	Close output to Gas valve	BOOL
CLOSEo	Close output	BOOL
CLOSEW	Close output to Water valve	BOOL
CLSD	Closed input from I/O	BOOL
CLSDG	Closed input from Gas valve	BOOL
CLSDs	Closed status to SCS	BOOL
CLSDW	Closed input from Water valve	BOOL
COUNT	Alternator sequence counter	INT
DBAND	Dead band	REAL
DEV	Deviation, as in allowed signal deviation	REAL
EN_I	Enable loop integral operation	BOOL
ENABL	Enable	BOOL
EUMAX	Engineering units maximum	REAL
EUMIN	Engineering units minimum	REAL
FAIL	Fail Status (PLC generated fail)	BOOL
FLDFL	Field Fail input	BOOL
FLDFLs	Field Fail status	BOOL
FLTMR	Fail timer; timer before fail	TIME
FLTLAG	Filter lag, in seconds	TIME
HI	HI alarm setpoint	REAL
Hifb	HI setpoint feed back to SCS	REAL
HIHI	HI-HI alarm setpoint	REAL
HIHIfb	HI-HI setpoint feed back to SCS	REAL

Extension	Extension Description	Data Type
HIHIs	HI-HI alarm bit Status	BOOL
His	HI alarm bit status	BOOL
HOURS	Runtime hours	INT
IN1	Input 1	BOOL
INTRLK	Interlock input to block, true to permit operation	BOOL
BIAS	Bias component of loop controller output	REAL
ERR	Loop err (PV-SP)	REAL
GAIN	Loop controller proportional gain	REAL
LO	LO alarm setpoint	REAL
Lofb	LO setpoint feed back to SCS	REAL
LOLO	Low-Low setpoint	REAL
LOLOfb	LO-LO setpoint feed back to SCS	REAL
LOLOs	LO-LO alarm bit status	BOOL
Los	LO alarm bit status	BOOL
LOUT	Loop controller output scaled from 0-4095	INT
PV	Process variable	REAL
SP	Setpoint command, scaled in engineering units	REAL
SPs	Setpoint status, scaled in engineering units	REAL
YOUT	Controller manual mode output command	REAL
YOUTs	Controller manual mode actual output	REAL
TI	Loop integral time, in seconds	REAL
MAN	Manual Mode Command	BOOL
MANs	Manual Mode Status	BOOL
MAXOUT	Maximum value of the output SCALOUT	REAL
NOFLTR	No filtering, bypass filter	BOOL
ON1	Motor 1 ON input	BOOL
Oni	On Input from I/O (note ON is a reserved word, thus the “i”)	BOOL
Ons	On Status to SCS	BOOL
OPENG	Open output to Gas valve	BOOL
OPENo	Open output	BOOL
OPENW	Open output to Water valve	BOOL
OPND	Opened input from I/O	BOOL
OPNDG	Opened input from Gas valve	BOOL
OPNDs	Opened status to SCS	BOOL
OPNDW	Opened input from Water valve	BOOL
OUT	Output	
OUT1	Output 1	BOOL
PV	Process variable	REAL
PWRFL	Power Fail	BOOL
REM	Remote input from hand switch	BOOL

Extension	Extension Description	Data Type
REMs	Remote mode status	BOOL
RESET	Fail reset; counter reset	BOOL
RUN	Manual mode Run command	BOOL
RUNo	Run output	BOOL
S12	Sequence selection desired is 1,2	BOOL
S21	Sequence selection desired is 1,2	BOOL
S12s	Sequence is 1,2	BOOL
S21s	Sequence is 2,1	BOOL
S123	Sequence selection desired is 1,2,3	BOOL
S231	Sequence selection desired is 2,3,1	BOOL
S312	Sequence selection desired is 3,1,2	BOOL
S123o	Sequence is 1,2,3, time delayed	BOOL
S231o	Sequence is 2,3,1, time delayed	BOOL
S123o	Sequence is 1,2,3, time delayed	BOOL
S231s	Sequence is 2,3,1, instantaneous	BOOL
S312s	Sequence is 3,1,2, instantaneous	BOOL
S312s	Sequence is 3,1,2, instantaneous	BOOL
SCALOUT	Scaled output with a range specified by 0 to maxout	REAL
SCALOUT	Scaled output with a range specified by 0 to maxout	REAL
SEL1	Select signal #1	BOOL
SEL1s	Signal #1 is selected	BOOL
SELSIG	Selected signal	BOOL
SET	Set or load value	BOOL
SIG1	Signal 1	REAL
SIG1FL	Signal 1 Fail	BOOL
SIGDEV	Signal Deviation (is above limit) alarm	BOOL
SIGFL	Signal Fail, common signal fail	BOOL
START	Manual mode Start command	BOOL
STARTo	Start output	BOOL
STOP	Manual mode Stop command	BOOL
STOPo	Stop output	BOOL
TESTM	Test input	BOOL
TESTEU	Test Engineering Unit input	REAL
TMR	Timer input	TIME
TMRs	Time remaining on timer status; timer setpoint feedback	TIME
VALUE	Value input	
VALUE1	Value #1 input	
YMIN	Lower limit on controller output (0-100%)	REAL
YMINs	Controller output is at the YMIN lower limit	BOOL
YMAX	Upper limit on controller output (0-100%)	REAL

Extension	Extension Description	Data Type
YMAXs	Controller output is at the YMAX upper limit	BOOL
ETM	Elapsed Time Meter	REAL

Some tag extensions include a lower-case extension suffix. The extension suffix provides information about the tag's I/O type and how a point is used. Refer to Table 5 Tag Extension Suffix for a definition of the extension suffixes.

Table 5 Tag Extension Suffix

Extension Suffix Letter	Function
o	Output Point
i	Input Point
s	Status Point

4.2 SCADA Tag Formats

The tag naming components are combined and displayed in different ways depending on the type of equipment and the type of document displaying the tags. The following paragraphs illustrate requirements for combining the tags naming components and displaying them on or in various systems. To simplify references to different tag naming formats, they will be referred to as numbered syntaxes. The following is a list of used syntaxes.

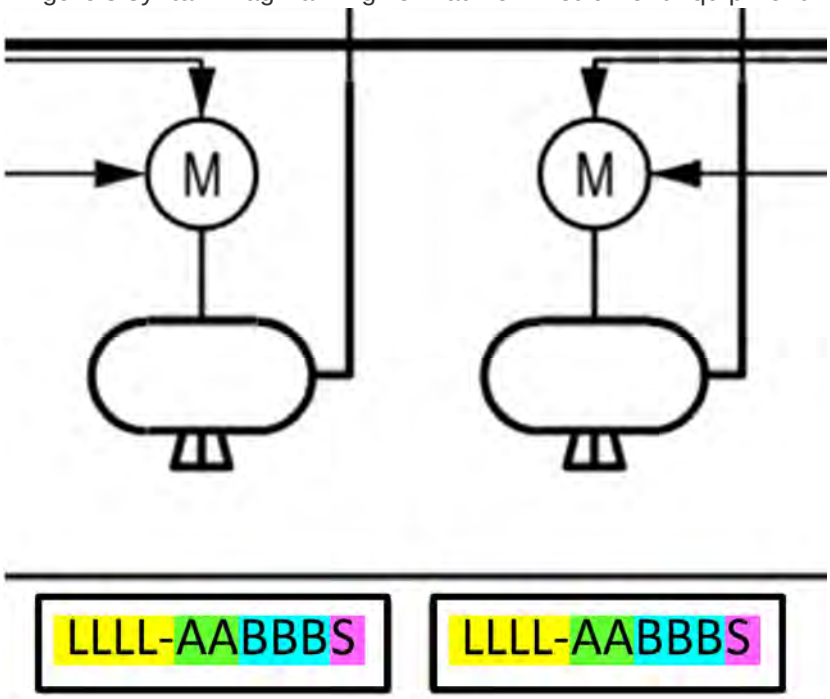
- Syntax1 – Non-Instrumentation equipment tags shown on a P&ID, Design Drawings, & Equipment lists
- Syntax1 – Instrumentation and pilot devices shown on a P&ID and instrument lists.
- Syntax2 – Object tags numbers used in PLC or HMI code
- Syntax3 – Object tags names used in PLC or HMI code

Note: the codes illustrated in the various symbols below correspond to the codes in the title of each of the tag naming components described in the paragraphs above. For example, when AA is used in each syntax, it will correspond to the facility code described in paragraph 4.1.1 above.

4.2.1 Syntax1 Tag Naming Format Non-Instrument Equipment

Syntax1 is used for non-instrument related equipment shown on P&IDs and other design drawings or equipment lists. Refer to Figure 3 Syntax1 Tag Naming Format Non-Instrument Equipment below for an example of how the tag would be displayed on a P&ID.

Figure 3 Syntax1 Tag Naming Format Non-Instrument Equipment



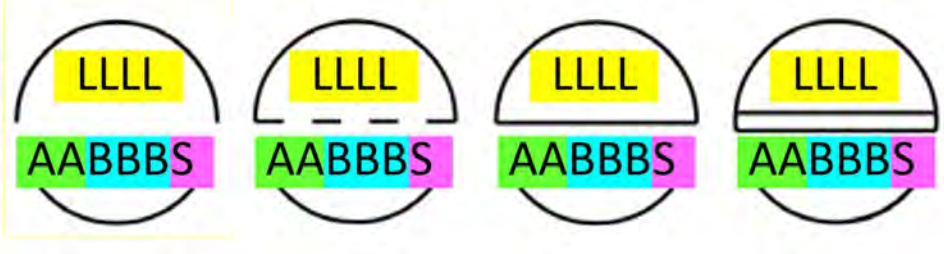
Note: syntax1 for non-instrument equipment can be used in equipment lists or on other design drawings. It must use the following format.

LLLL-AABBBS

4.2.2 Syntax1 Tag Naming Format Instrumentation

Syntax1 can also be used for instrumentation on P&IDs and instrumentation lists. Refer to Figure 4 Syntax1 Tag Naming Format Instrumentation and Pilot Devices for example of how to display syntax 1 on a P&ID.

Figure 4 Syntax1 Tag Naming Format Instrumentation and Pilot Devices



Syntax2 tag naming format can also be used in instrument lists and will generally follow the format below.

LLLL-AABBBS

4.2.3 Syntax2 PLC and HMI Tag Numbering

Tag numbers used in programming PLCs and HMIs must use the following format.

LSH99901A

An example of the equipment level switch high instrument might look like LSH99901A where:

- LSH is the ISA 5.1 identification
- 99 is the facility code corresponding to effluent disposal field
- 901 is the loop number
- A is the suffix

4.2.4 Syntax3 PLC and HMI Tag Name

Tag name used in programming PLCs and HMIs must use the following format.

99_001E_P_AUTO

An example of the pump auto switch status might look like 99_001E_P_AUTO where:

- 99 is the facility code corresponding to effluent disposal field
- 001 is the loop number
- E is the suffix
- P is the device identifier “Pump”
- AUTO is the extension

5. Control Objects

This document will promote understanding on how object-oriented programming is used. After establishing object-oriented key concepts, this standard will establish the key programming objects that must be used for the Agency. To ensure compliance with the standards this document will explain naming conventions within the HMI (AVEVA) and the PLC (Siemens 1200 and 1500 series Controllers) to support programming objects. Note: database tag naming conventions still apply, refer to Article 4 Database Tag Naming above for additional requirements.

5.1 Control Object Concepts

5.1.1 Overview

In AVEVA, a tag name is the name of an ArchestrA object, and an attribute name is the name of a variable that is part of the object. For Example, 99012V would be the name of an open close valve object. Variables within the object could include the following:

- Auto status
- Local status
- Open Command
- Close Command
- Open Status
- Close Status
- Etc.

In Siemens, derived function blocks (DFBs) are objects that contain data and control functionality. For example, 99012V could be the name of an open close valve object. It would have all the same data as the HMI object 99012V and it would include logic for monitoring and controlling the valves.

For complete functionality, objects must be created in pairs including DFBs in the PLC and Objects in the HMI. The data and functionality will need to be coordinated between both systems.

5.1.2 AVEVA Specific Addressing

Historically, HMIs would rely upon a tag database where individual tags would be defined along with the communication channel created for polling a specific address or block of addresses in a specific PLC. Each address would have links to graphical symbols, applied security, historical logging configuration details, and scripting. These are all tasks that would need to be done individually for every instance of data processed by the HMI.

A modern approach utilizing object-oriented HMI design, will use “Application Objects” that represent not just a single value for a piece of equipment, but the entire device itself. An object can contain any number of Attributes that can connect to PLC addresses, any number of graphics, scripting, alarming, security, and historical logging details. These programming tasks can be organized into templates (Application Objects) where the logic and data are created and tested once. The template (object) can then be applied to multiple instances associated with similar devices.

An example of this may be a PLC DFB for a discrete alarm, which could represent a control anomaly, or even a physical device like a level switch. Within the PLC DFB there are several values representing the different parts of the alarm, such as the alarm itself, whether it is a latching alarm, deadband setup, etc. The AVEVA System Platform will contain a template that contains an exact duplicate of the value names from the PLC DFB desired to bring into the HMI system.

I/O auto-building capabilities allow these objects to simply have an Instance of the template named the same as the DFB instance in the PLC, and the system will bind all of the attributes configured as I/O to the values within the DFB for the instance.

For example, a level switch hi alarm DFB was created in the PLC and named “99_001_LSH”. Within System Platform an Instance shall be derived from the template name representing the DFB, in this case $Alarm, and the system will automatically link the “ALRMo” attribute to the PLC address “99_001_LSH. ALRMo”. This would apply for all other attributes of the object. Note: template refers to a generic set of data and functions of an object. Different templates are created for different types of objects. An instance of a template is an object for a specific device or signal.

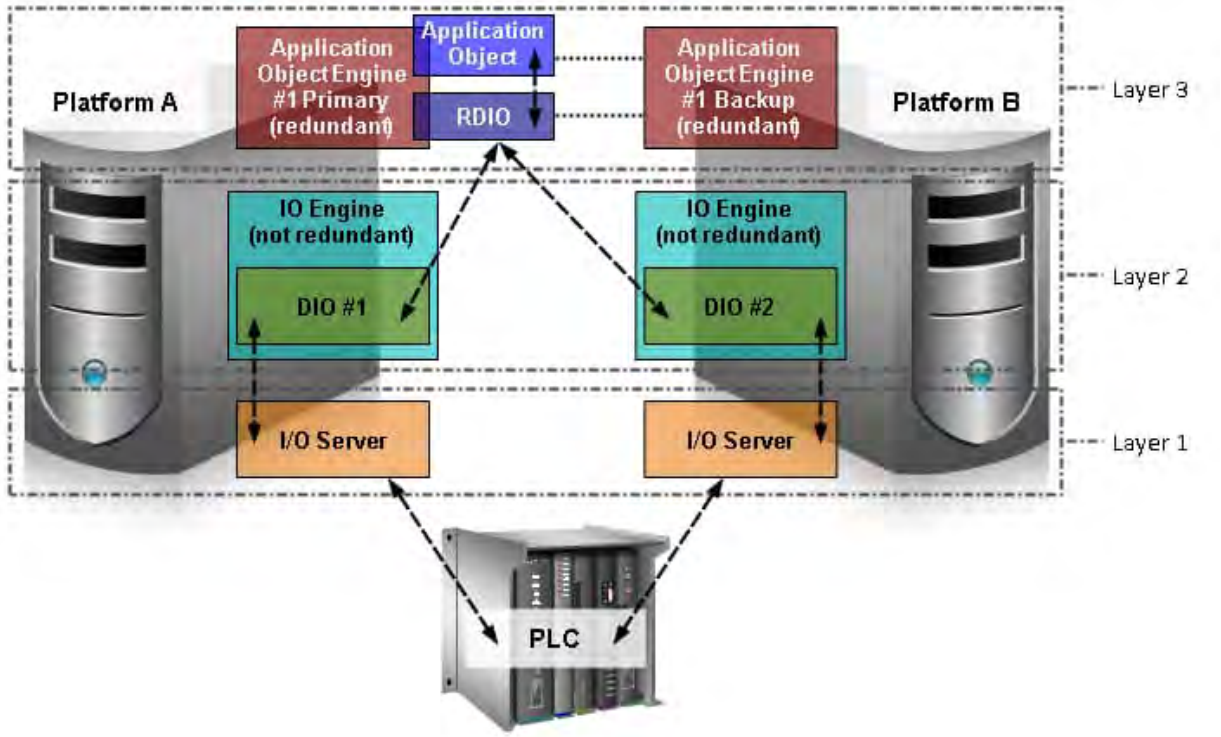
In this environment, the entire block is either connected or not, no middle area. This can speed up development greatly by removing the need for HMI addressing and human error. Field testing is also improved as only a single value truly needs to be tested to ensure function of the block.

Figure 5 Example Object Code

Redundant Device Integration Objects (RDIOs) are single instant objects placed on a redundant engine in system platform and they’re capable of failing between a pair of application object servers (AOSs) nodes. Device Integration Objects (DIOs) cannot be placed on redundant engines; therefore, all object instances must be configured as RDIOs.

RDIO objects can be configured to monitor redundant IO Engines as shown in Figure 6 below. Some of the key advantages of this type of configuration is the ability for the object to determine both a failure of the IO Engine and a failure of a communication link to the IO Engine.

Figure 6 Redundant Device Integrated Object



5.1.3 Siemens Specific Addressing

Siemens PLCs can be programmed using symbolic or absolute addressing depending on the specific model. Generally, newer PLCs can be programmed by using symbolic or absolute addressing and older PLCs use absolute addressing only.

Code written using symbolic addressing is easier to read and maintain since the device name can be used. For example, if you had a flow transmitter named FIT34100 you could use that same name in the code. Not only does this make reading and searching the code easier it can also assist in aligning the code with the field device and design documents such as P&IDs and I/O lists. Maintenance of code is also easier. To modify a tag name, you only need to change it in one place to correct it everywhere in the code. Refer to Figure 7 Symbolic Addressing below for an example.

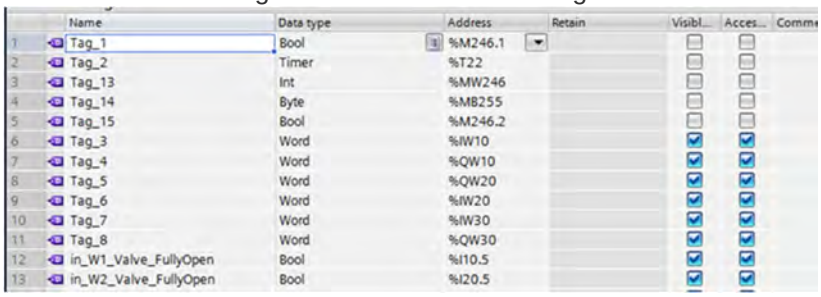
Figure 7 Symbolic Addressing

FIT34100

	Name	Data type	Start value	Retain	Accessible f...	Visible in ...	Setpoint	Con
1	Static							
2	Tag1	Bool	false					
3	Tag2	Int	0					
4	Tag3	DInt	0					

Absolute addressing comprises an address identifier and a memory location. For example, Q 4.0, I 1.1, M 2.0, are absolute addresses. “Q” is an output address, “I” an input address, and “M” is program memory address. Absolute addressing is still used in many PLCs today, but symbolic addressing is recommended because of its increased readability. Refer to Figure 8 Absolute Addressing below for an example.

Figure 8 Absolute Addressing



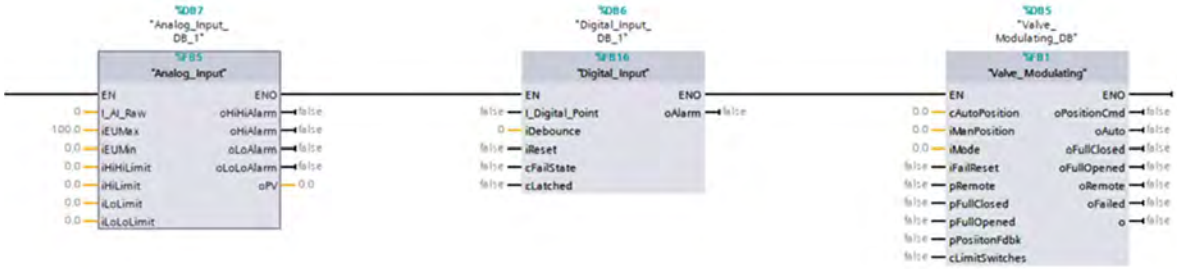
	Name	Data type	Address	Retain	Visibl...	Acces...	Comm
1	Tag_1	Bool	%M246.1				
2	Tag_2	Timer	%T22				
3	Tag_13	Int	%MW246				
4	Tag_14	Byte	%MB255				
5	Tag_15	Bool	%M246.2				
6	Tag_3	Word	%IW10				
7	Tag_4	Word	%QW10				
8	Tag_5	Word	%QW20				
9	Tag_6	Word	%IW20				
10	Tag_7	Word	%IW30				
11	Tag_8	Word	%QW30				
12	in_W1_Valve_FullyOpen	Bool	%I10.5				
13	in_W2_Valve_FullyOpen	Bool	%I20.5				

For all new Siemens Series 1200 and 1500 PLCs, symbolic addressing must be used to implement the code. Absolute addressing will be avoided unless there is a good argument for its use. Coordinate with the Agency before utilizing absolute addressing.

5.2 Control Objects

Control objects are used to make SCADA programming efficient, accurate, and easy to maintain and troubleshoot. They make code simpler by having one object perform the exact same function instead of having to create the same lines of code over and over. For example, if you have multiple motors that are similar you can create an object for that piece of equipment. Once the new motor object is developed a new motor can be added simply by dragging and dropping it into the code. When the object is developed in the PLC, a similar object is created in the HMI for display and alarming purposes. Listed below are the recommended objects that must be developed for any new SCADA project utilizing 1200 or 1500 series PLC controllers.

Figure 9 Example PLC Control Objects



5.2.1 I/O Handling Objects

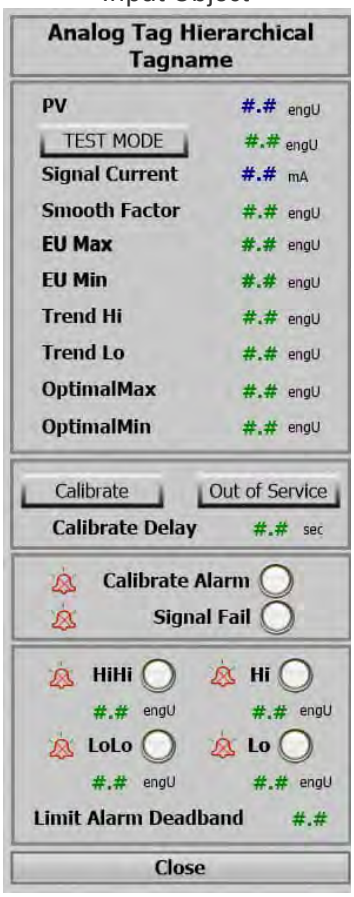
Field devices that are connected to the PLC module contain hardwired signals that need to be processed for utilization in the PLC and HMI code. Hardwired signal types include discrete and analog. A discrete input could be a field device such as a switch and a discrete output could be a command to start a motor. An analog input could be a temperature value and an analog output could be a speed command to a VFD. Efficient handling of these different types of I/O is important during the development of a SCADA system. An object-oriented programming approach should be used whenever possible to promote standardization. Objects or PLC function blocks should be developed for each type of I/O.

5.2.1.1 Analog Input Object

This object is intended to be used for each hardwired analog input signal. Analog inputs require scaling of a raw input signal into engineering units for use in the PLC and HMI code. Each analog input object must be equipped with the following:

- Engineering Units Max
- Engineering Units Min
- Low Low Alarm
- Low Alarm
- High Alarm
- High High Alarm
- Signal failure alarm or bad quality signal. Alarms triggers when signal is below 3.8 mA provided the signal is a 4-20ma signal.

Figure 10 Example Analog Input Object



5.2.1.2 Alarm Object (Discrete Input)

This object is intended to be used for each hardwired discrete input alarm signal. Each discrete input alarm object must be equipped with the following:

- Adjustable debounce setpoint
- Alarm reset
- Alarm fail state configuration
- Alarm latching configuration

Figure 11 - Alarm Object

5.2.1.3 Analog Output Object

This object is intended to be used for each hardwired analog output signal. Each analog output object must be equipped with the following:

- Engineering Units Max
- Engineering Units Min
- Raw Output Max
- Raw Output Min
- Raw Output in milliamps (useful for troubleshooting)

5.2.2 Equipment Handling Objects

Equipment handling objects are developed for equipment that is commonly found in a facility. Objects include multiple types of valves and motors. Equipment handling also includes objects to sequence on and off equipment based on process conditions.

5.2.2.1 Modulating Valve – 4-20mA Position Output Object

This object is intended to be used with electrically or pneumatically modulated valves that accept a 4-20 mA position reference signal. The reference position signal is in the range of 0-100%. The modulating valve object must be equipped with the following:

- The object executes HMI and automatic commands to set valve position, as well as report valve position status and monitor alarms. Valve position feedback is from actual valve position feedback where available. If actual position feedback is not available, then the position reference signal will be used in place of feedback.
- Valve fail is based on relation of reference position to feedback. If feedback position is not within allowable tolerance of reference position within preset timer period, then fail is activated.

5.2.2.2 Modulating Valve – Discrete Output Object

This object is intended to be used with electrically or pneumatically modulated valves that accept discrete outputs to command the valve to move in the open or close directions. The reference position signal is in the range of 0-100%. This object must be equipped with the following:

- The object executes HMI and automatic commands to set the valve position, as well as report valve position status and monitor alarms. Valve position feedback is from actual valve position feedback where available. If actual position feedback is not available, then the position reference signal will be used in place of feedback.
- Valve fail is based on relation of reference position to position feedback. If feedback position is not within allowable tolerance of reference position within preset timer period, then fail is activated.

Figure 12 Modulating Valve - Discrete Outputs Object

5.2.2.3 Open-Close Valve

This object is intended to be used with electrically or pneumatically actuated valves that accept separate open and close commands. This object must be equipped with the following:

- The object can be used with actuators that require open/close outputs to be maintained on until the valve reaches the end position or actuators that require momentary open/close commands.
- The object executes HMI and automatic commands to open and close a valve, as well as report valve position status and monitor alarms.

Figure 13 Open-Close Valve Object

5.2.2.4 Open-Stop-Close Valve

This object is intended to be used with electrically or pneumatically actuated valves that accept separate open and close commands. This object must be equipped with the following:

- This object is used with actuators that require the open/close outputs to be maintained on until the valve reaches the end position or actuators that require momentary open/close commands.
- This object can be used with actuators that accept a STOP command.
- The object executes HMI and automatic commands to open, stop, and close a valve, as well as report valve position status and monitor alarms.

5.2.2.5 Solenoid Valve (Single Output Maintained)

This object is intended to be used with solenoid valves that accept a single maintained open command and it must be equipped with the following:

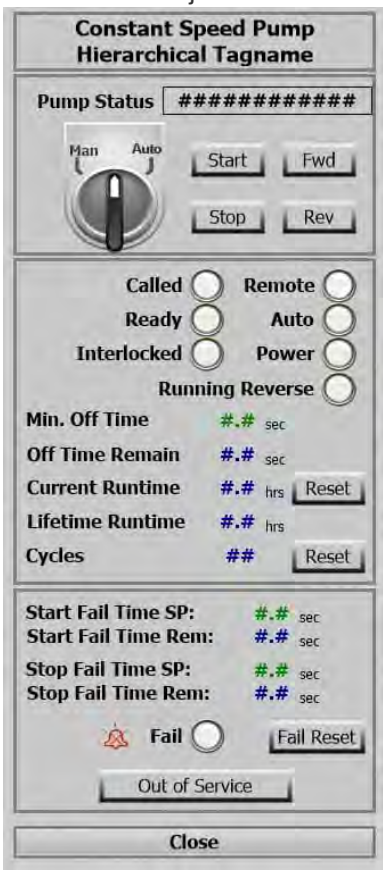
- The object executes HMI and automatic commands to open and close a valve, as well as report valve position status and monitor alarms.

5.2.2.6 Fixed Speed Motor

This object is intended to be used for control of a fixed speed motor and it must be equipped with the following:

- The object can be used for both non-reversing and reversing control. The default setting will be for a non-reversing motor but can be selected for reversing control by setting a constant on the function block.
- The object includes motor run time hours, number of starts (cycles) and motor ready status.
- The object includes a setting for maximum number of starts per hour.
- The object executes HMI and automatic commands to run and stop the motor, as well as monitor alarms.

Figure 14 Fixed Speed Motor Object



5.2.2.7 Adjustable-Speed Motor

This object is to be used to control a VFD motor and it must be equipped with the following.

- The object can be used for both non-reversing and reversing control. The default setting will be for a non-reversing motor but can be selected for reversing control by setting a constant on the object.
- The object includes motor run time hours, number of starts (cycles) and motor ready status.

- The object executes HMI and automatic commands to run and stop the motor, as well as monitor alarms.

Figure 15 Lead-Lag / Duty-Standby Object

5.2.2.8 Lead-Lad/Duty-Standby (2 Units)

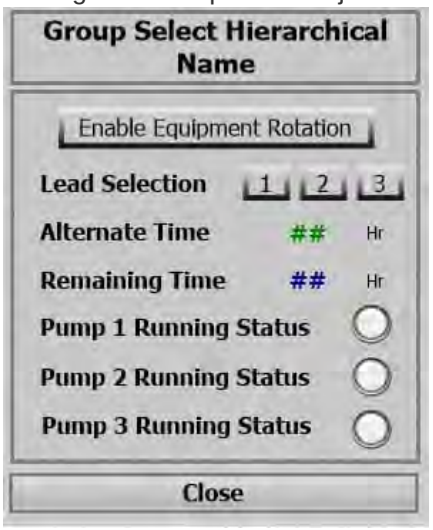
This object executes program logic to choose which equipment in a lead/lag pair should run and it must be equipped with the following.

- In lead/lag control, the selected lead equipment will start first when the lead start input is energized. The lead equipment will continue to run until the lead stop input is toggled. If the lead equipment should fail, the lag equipment will become lead and start running as required.
- If the lead equipment is not capable of keeping up with the required process conditions, the lag start input will be energized for the lag equipment.

5.2.3 Sequencer (Two or More Units)

This object executes program logic to choose which equipment in a lead/lag/lag-X lineup should run and it must be equipped with the following.

Figure 16 Sequencer Object



- The sequencer control will command the lead equipment to run and then command additional units to run based on process conditions or equipment failures.
- The object will be configured to run the number of units that is necessary for the equipment being sequenced. A constant will be set in the program logic to set the number of units.

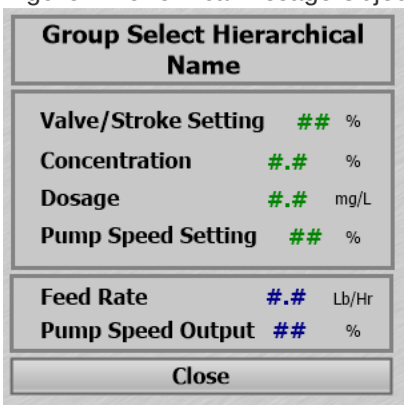
5.2.4 Process Handling Objects

Process handling objects are used for facility processes that are used frequently. Chemical dosage and PID are frequently used process handling objects.

5.2.4.1 Chemical Dosage

This object calculates the flow rate setpoint for chemical addition based on a pacing flow rate and chemical dosage setpoint. Chemical concentration and specific gravity are required for proper calculations. This object must be equipped with the following.

Figure 17 Chemical Dosage Object



- The object calculates a speed command that can directly control a variable speed pump base on the calculated flow setpoint and the pump capacity in GPM. The speed output is calculated as Flow Rate Setpoint / Pump Capacity * 100.0.
- The object offers two different setpoint modes, pacing and flow. In pacing mode, the setpoint (output) is calculated by the chemical dosage setpoint formula. In flow mode, the desired chemical addition flow rate (from the HMI) is input directly into the block and no further manipulations are done on the value.

- Calculated chemical dosage setpoint: Remote
  Setpoint (GPH) = (Pacing Flow * Dosage * 4.166) / (Specific Gravity * Concentration)

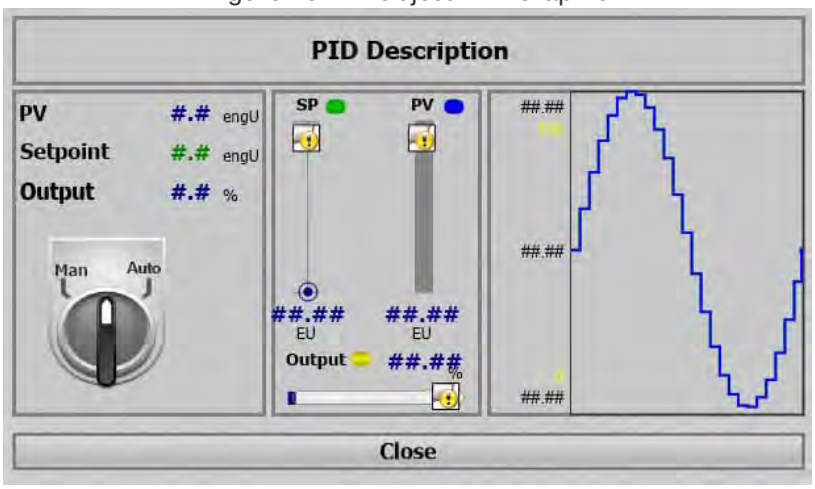
5.2.4.2 Proportional Integral Derivative (PID)

Siemens PLCs use several different types of PID instructions for different process control conditions. The object used with these PID instructions allows for HMI access to PID parameters. This object must be equipped with the following.

- Status Information associated with the PID controls including manual/auto status, process variable engineering units, setpoint in engineering units, and output information.
- Trending graphic showing the key information for monitoring the performance of a P&ID.

Figure 18 Example PID PLC Object Code

Figure 19 PID Object HMI Graphic



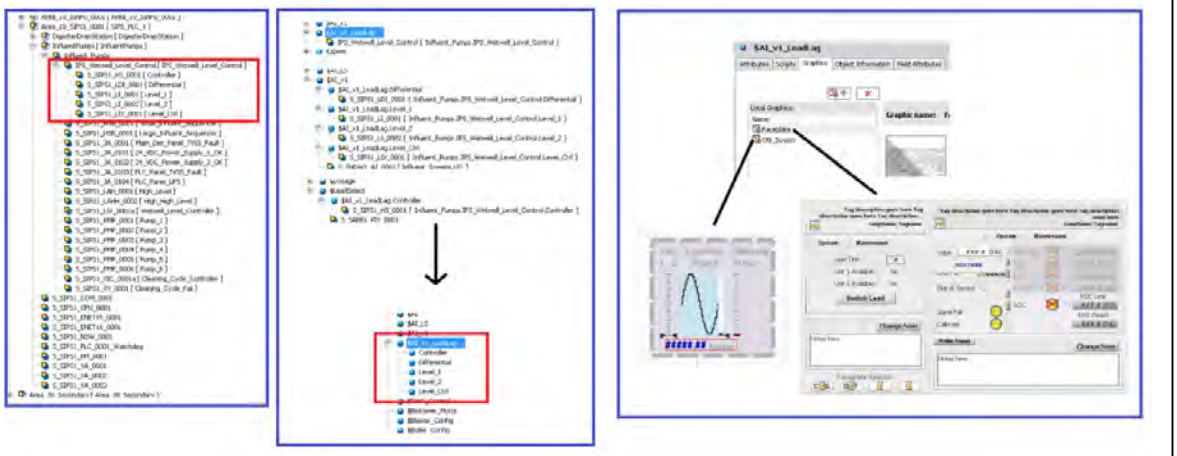
5.2.5 Nested Templates

Nested templates are containers representing a commonly used set of devices for a specific need or process.

For example, with redundant analog devices there are typically 4 analog objects (the 2 actual analog devices as well as a “Controlling” analog to be used by the process and a “Differential” analog to see the

difference between the 2 meters) and a Lead/Lag control. Rather than having to recreate this collection of objects every time, a single pre-built container of all required objects can simply be instantiated.

Figure 20 Nested Template HMI Code Example



6. HMI Standards

Given the diverse and intricate nature of the concepts presented at HMI Standards workshop, arriving at a specific standard proved to be a challenge. It is crucial to develop graphical standards during the implementation phase of a project. Before incorporating new graphic approaches, it is necessary to subject them to evaluation by the operational staff to ascertain their feasibility. This involves developing and programming concepts that align with the wants and needs of the operations group for HMI graphics.

A recommended process for establishing HMI graphic standards is to devise an implementation alternative for a representative portion of the plant and remote sites. Once an alternative is chosen that best meets the requirements of the operational staff and budget, the programmer would implement it as the initial standard in a small-scale pilot project. This enables the operational staff to gain valuable experience and insights during and after the project's commissioning phase, and empowers them to provide feedback on how effectively the new standards address their needs. As the pilot project is of smaller scope, any necessary changes to the standard can be implemented without significant cost implications on the new system before full scale implementation.

To fully leverage the benefits of new HMI graphics, it is necessary to upgrade the PLC as part of the pilot project, concurrently with the implementation of the new HMI. This synchronization enables the implementation of control objects to be carried out simultaneously with the completion of the HMI work. Control objects encompass both PLC logic and HMI graphical functionality, as documented in Control Objects article above. At the end of the pilot project HMI standards and object libraries will be fully established and will serve as the guide for implementation of all new SCADA and SCADA related projects.

The Agency’s HMI portion of this document is divided into two parts.

- Part I: Framework and Visualization
  - Application Administration
  - Graphics Display Hierarchy/Navigation
  - Security
  - Software Application Tuning
  - Control Object Library
  - Graphical Element Styles
  - Historical Logging

- Part II: Alarming
  - Alarm Management

6.1 Part I: Framework and Visualization

6.1.1 Application Administration

By understanding and incorporating key concepts and standards, we can enhance communication, streamline file management, and foster successful collaboration with stakeholders. These guidelines address essential aspects such as SCADA administration, software updates, file management, custom content development, display style, field communications, and operation-specific development needs.

The objective of these guidelines is to provide maintenance personnel with a comprehensive framework for developing and maintaining HMI graphic software effectively. By adhering to these guidelines, we aim to enforce standards, improve efficiency, reduce errors, and ensure consistent quality in our software development process.

Guidelines Include:

- SCADA Administration and Software Updates:
  - Maintain up-to-date SCADA administration personnel information for effective coordination and support.
  - Select and utilize a version of software within the vendor's mainstream support cycle, ensuring compatibility and access to the most advanced features and bug fixes.
  - Establish procedures for implementation of Operating System and HMI related software updates.
- File Management and Version Control:
  - Establish procedures for file management and version control, ensuring efficient maintenance of the HMI system.
  - Foster shared understanding, common goals, and good housekeeping practices among maintenance personnel to streamline file management activities.
- Display Style Selection:
  - Determine the most appropriate display style for HMI graphic software development.
  - Utilize HPHMI graphics to present real-time data and key performance indicators.
  - Opt for P&ID style process displays for detailed process information and equipment interconnections.
  - Consider hybrid graphics that combine aspects of both display styles for specialized cases.
- Field Communications Overview:
  - Develop a comprehensive understanding of communication protocols and technologies used for data exchange between the HMI software and field devices or systems.
  - Stay updated with driver updates to ensure proper connectivity to field hardware firmware updates.
- Operation-Specific Development:
  - Address and incorporate operation-specific development needs or requests into the software development process.
  - Ensure the final product aligns with operations expectations and needs.

By adopting these guidelines, we can navigate the HMI graphic software development and runtime environments more effectively, resulting in improved communication, tailored content, and successful collaboration with stakeholders. We propose the detailed documentation of these guidelines during the implementation phase of the first project or pilot project, enabling standardized practices.

6.1.2 Graphics Display Hierarchy

As part of the HMI development standard, the pilot project will likely adopt an "HMI Pane" approach for the graphics display hierarchy, deviating from the conventional Window style.

This proposed pane style will display the following:

- Title bar
- Button to open navigation menu
- Navigation breadcrumb display
- A "one-level-up" Key Performance Indicator (KPI) display
- A process display area
- A reserved area for control
- And two alarm displays:
  - One alarm display to show the current critical alarms for the system
  - One alarm display for the current critical/high alarms present for the current location within the navigation tree

Figure 21 Example HMI Pane Layout

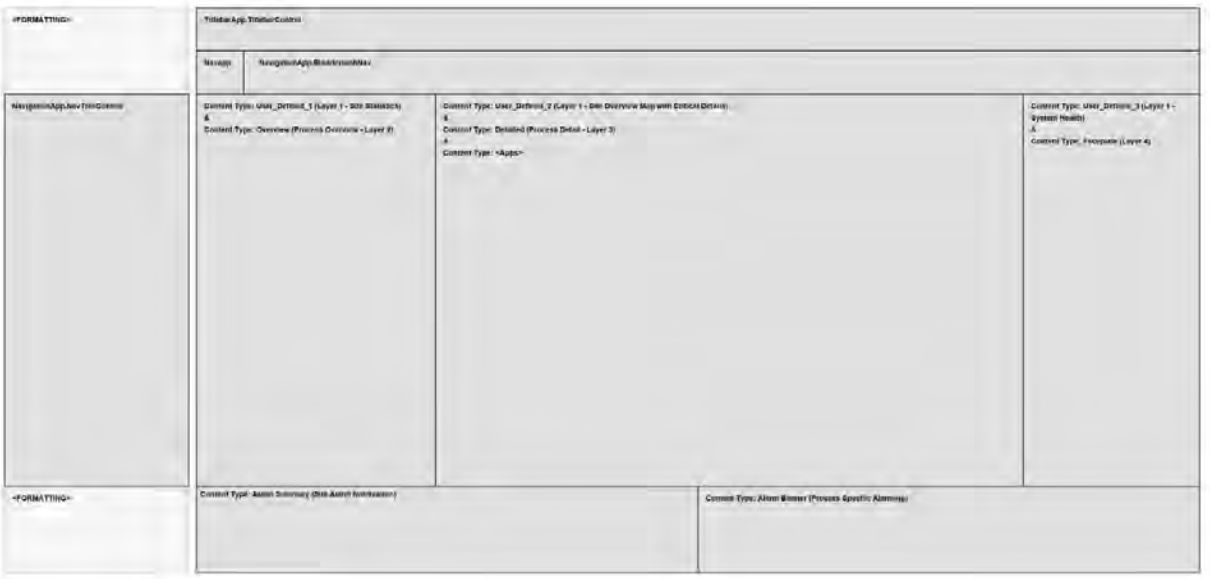
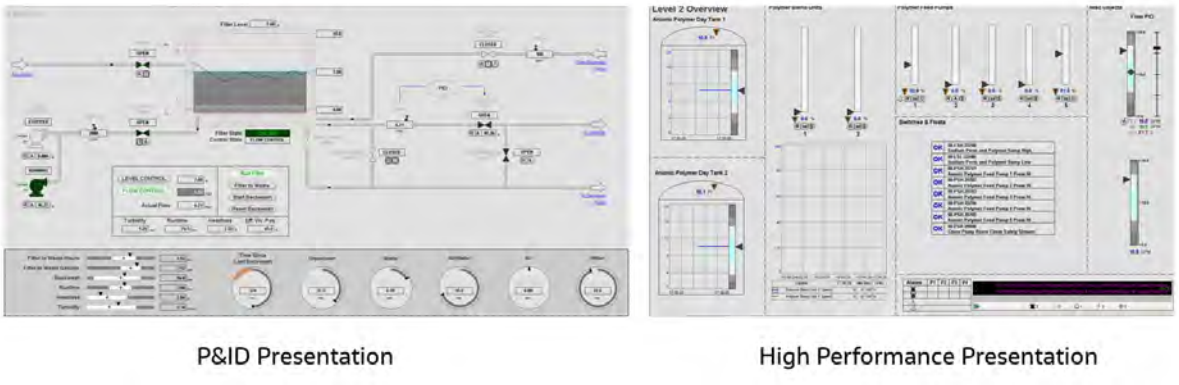


Figure 22 Difference Between P&ID and High Performance



The images above illustrate the different style graphics to be displayed in process display pane which is the largest pane just off center to the right in the layout shown above.

6.1.3 Security

The security of an AVEVA System Platform application is crucial to safeguarding process control. To ensure comprehensive protection, the following requirements are essential:

- Microsoft Active Directory (AD) Group Associations: The HMI system should integrate with Microsoft Active Directory for user management and access control. By leveraging AD group associations, administrators can easily assign appropriate privileges and permissions to users, ensuring that only authorized personnel can access and interact with the system.
- Password Policy: A strong password policy should be implemented to enforce secure authentication. This includes requirements for password complexity, expiration, and lockout after multiple failed login attempts. By adhering to a robust password policy, the HMI system enhances security by reducing the risk of unauthorized access due to weak or compromised passwords.
- Application Development Security: Access to the HMI development environment should be tightly controlled. Only authorized individuals with appropriate privileges should be allowed to access and

modify the system's configuration and design. This includes the ability to modify global templates, which serve as the foundation for consistent and standardized graphical displays across the application.

- Ability to Un-deploy/Deploy Content: The HMI system should provide secured access to un-deploy and deploy content, such as application objects and graphical displays. This capability ensures that changes and updates can be carefully managed and verified before being implemented in the live environment, minimizing the risk of unauthorized or erroneous modifications.
- Navigation Access: Access to different areas and functions within the HMI system should be carefully controlled based on user roles and responsibilities. Only authorized users should be able to navigate through specific sections of the application, ensuring that sensitive information and critical functionalities are protected from unauthorized access or misuse.

By adhering to these HMI security requirements within an AVEVA System Platform application, the Agency can establish a robust security framework to protect process control, data storage, and control assets from unauthorized access, data breaches, and potential operational disruptions.

6.1.4 Software Application Tuning

Software application tuning in AVEVA System Platform is crucial for efficient operations. The various tuning strategies include:

- Adjusting Application Object Engine (AOE) scan times to balance real-time data updates and system performance.
- Defining PLC polling intervals to optimize data acquisition and network congestion.
- Optimizing script execution speeds through efficient coding practices.
- Implementing load balancing techniques for distributed architectures to ensure resource utilization and prevent bottlenecks.
- Defining Key Performance Indicators (KPIs) to measure and monitor application performance of the software to identify areas for future optimization.

6.1.5 Control Object Library

The Control Object Library of the Standards document defines the standard “building blocks” that should be used for development (e.g. analogs, valves, pumps, etc…). It is known that not every single process implemented will be able to utilize the Agency standards, generally this happens with skid or “packaged” systems. The template library should have a mechanism in place for these special needs for organization, tracking, and troubleshooting.

6.1.6 Graphical Element Styles

Within AVEVA System Platform Industrial Graphics, graphical element styles play a crucial role. These styles define the visual properties and behaviors of graphical elements such as text, buttons, gauges, charts, and trends. They provide a consistent and standardized approach to configuring and displaying graphical elements throughout the application.

The best way to implement element styles for efficient configuration of the software is by establishing a well-defined and organized style library. This library should include predefined styles for commonly used graphical elements, ensuring consistency in appearance and behavior across the enterprise. By leveraging

these preconfigured styles, developers and programmers can easily apply them to new graphical elements, saving time and effort in the configuration process.

The use of graphical element styles offers several benefits:

- Consistency: By applying predefined styles, graphical elements across the application maintain a consistent look and feel. This consistency enhances user experience and simplifies navigation, as operators become familiar with the appearance and behavior of different elements.
- Efficiency: Using predefined element styles streamlines the configuration process. Rather than manually configuring each graphical element from scratch, developers can quickly apply the appropriate style, reducing development time and effort. This efficiency is especially valuable when creating and updating large-scale applications.
- Standardization: Element styles promote standardization in design and functionality. They ensure that graphical elements adhere to predefined guidelines and best practices, leading to a cohesive and harmonized user interface. Standardization simplifies maintenance and updates, as changes made to a style can be automatically reflected across all elements within the runtime environment.
- Reusability: With element styles, graphical configurations can be easily reused across different projects and applications. This reusability improves development efficiency and consistency across multiple instances of the system.

The use of element styles benefits various stakeholders involved in the application:

- Developers and Configuration Engineers: Element styles streamline the configuration process, enabling efficient and consistent development. Developers can focus on application logic and functionality, relying on predefined styles for the visual representation of graphical elements.
- Operators and Engineers: Standardized graphical element styles enhance usability and ease of navigation. Operators and engineers benefit from a consistent and familiar interface, facilitating their ability to monitor and control industrial processes effectively.
- Maintenance and Support Teams: The use of element styles simplifies maintenance and updates. Changes made to a style can be automatically propagated throughout the application, reducing the effort required to maintain and troubleshoot graphical elements.

AVEVA System Platform Industrial Graphics leverage graphical element styles to ensure consistency, efficiency, standardization, and reusability in configuring graphical elements. Implementing a well-defined style library promotes efficient configuration, benefits developers, and configuration engineers, enhances user experience for operators and engineers, and simplifies maintenance for support teams. Styles library development should be done simultaneously to the control objects development. Control objects requirements are identified above in article 5, control objects. Note: HMI objects will be coordinated with PLC objects in most cases.

6.2 Part II: Alarming

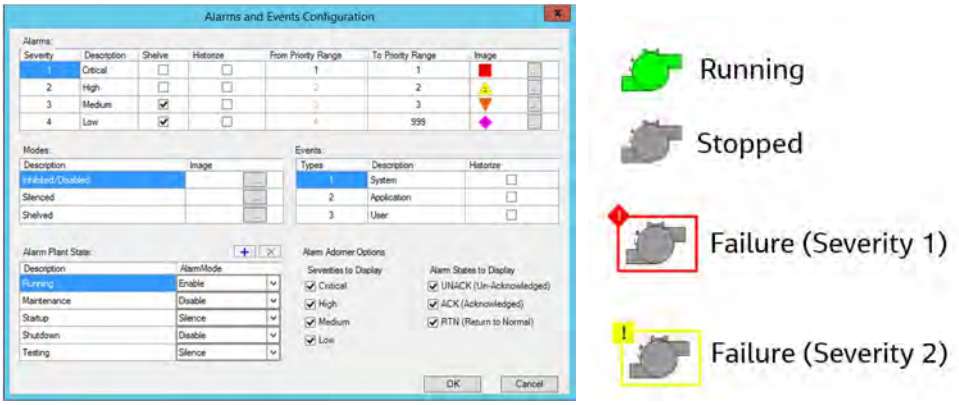
6.2.1 Alarm Management

The HMI Alarm Management system covers a comprehensive range of topics to ensure effective alarm handling and management within industrial applications. The following provides aspects of alarm management that must be addressed prior to implementation of any new project.

1. Alarm Graphics and Colors: This topic addresses the visual representation of alarms within graphical displays. It defines the use of colors, symbols, and animations to convey alarm status

and severity, ensuring operators can easily identify and differentiate alarms based on their urgency and importance.

Figure 23 Example Alarms & Events Configuration and Visualization



2. Alarm Definition and Criteria: This section focuses on establishing clear guidelines for defining alarms. It includes criteria such as process conditions, deviation thresholds, and abnormal situations that trigger an alarm. By defining consistent and meaningful alarm criteria, operators can promptly respond to abnormal events and potential issues.
3. Alarm Generation: This topic covers the mechanisms for generating alarms within the system. It outlines the sources of alarms, including data points, system events, and external inputs. Proper configuration ensures that alarms are generated accurately and timely, providing operators with relevant information for decision-making.
4. Alarm Acknowledgement: This aspect deals with the process of acknowledging alarms by operators. It defines the procedures for acknowledging alarms, setting acknowledgment requirements, and tracking the status of acknowledged alarms. Proper alarm acknowledgement promotes accountability and helps operators prioritize their actions effectively.
5. Severity and Priority Definition and Determination: This topic focuses on categorizing alarms based on severity and priority levels. It provides guidelines for assigning appropriate levels based on the impact on safety, production, and equipment. This ensures that alarms are prioritized and managed effectively, enabling operators to respond to critical situations promptly.

Figure 24 Example Prioritization

Criteria / Priorities	Level 1 / Urgent	Level 2 / High	Level 3 / Medium	Level 4 / Low
Cost / Financial Loss / Downtime / Permits	- Cost Greater than $100K - Requires Snr Management Reporting - Shutdown of Treatment	- Cost between $10K and $100K - Requires Reporting - Short duration of outage	- Cost less than $10K - Requires internal reporting - No outage	No loss
Environmental Damage / Public Perception	- Involves community and complaints - Uncontained release of hazardous materials - Extensive cleanup	- Contamination causes non-permanent damage - Single or few complaints	- Contained release - Internal report	No effect
Response Time	- Less than 5 minutes	- Between 5 and 15 minutes	- Between 15 minutes and 1 hour	Over 1 hour
Health and Safety	- Extremely Hazardous	- Dangerous conditions		

6. Alarm KPIs for tracking Alarm Rate Efficiency: This section introduces key performance indicators (KPIs) to evaluate alarm system performance. KPIs such as alarm rate efficiency measure the rate at which alarms occur within a specific time frame. Monitoring these KPIs helps identify potential issues, optimize alarm configurations, and enhance overall system performance.

7. Alarm Performance Reports: This topic emphasizes the importance of generating alarm performance reports. These reports provide insights into alarm occurrences, durations, and operator response times. Analyzing these reports helps identify alarm flood situations, recurring issues, and opportunities for improvement in alarm management practices.

8. Alarm Shelving vs. Disabled: This section discusses the distinction between alarm shelving and disabling. It provides guidance on when and how to use each option effectively. Alarm shelving allows temporarily suppressing alarms without disabling them permanently, while disabling alarms removes them from the active alarm list entirely. During workshop 4 the Agency expressed interest in not allowing broad access to alarm disabling; this should only be possible at a programming level as required.

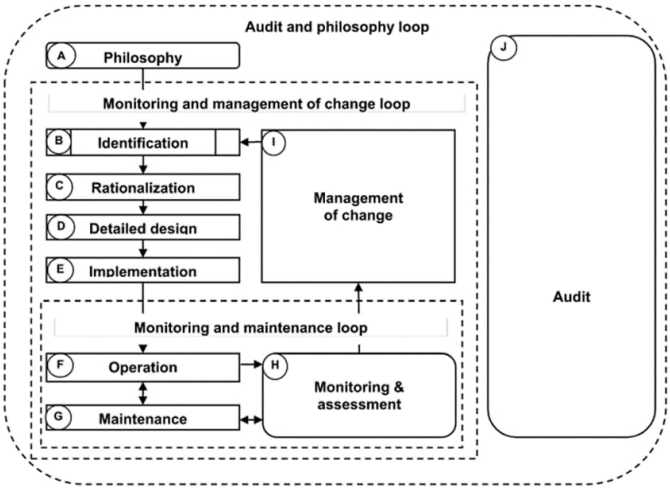
9. Redundant or Duplicate Alarms: This topic addresses the issue of redundant or duplicate alarms. It outlines strategies for identifying and eliminating duplicated alarms to prevent alarm flooding and confusion among operators. Proper management of redundant alarms helps maintain alarm clarity and facilitates effective decision-making.

10. Control System Status: This aspect focuses on incorporating the control system status within alarm management. It defines how the alarm system should reflect the operational state of the control system, such as Engine redundancy states, node availability, resource utilization. Incorporating control system status provides operators with a comprehensive view of the system's operational state.

11. Management of Change: This topic highlights the importance of managing changes to the alarm system. It emphasizes the need for proper change management procedures when modifying alarm configurations, ensuring that any modifications do not compromise system integrity, safety, or reliability.

12. Training: This section emphasizes the significance of training operators and personnel on alarm management practices. It includes guidelines for conducting alarm management training programs, ensuring operators are knowledgeable about alarm handling procedures, alarm prioritization, and effective response strategies.

Figure 25 Alarm Management Lifecycle



NOTE 1 The box used for stage B represents a process defined outside of this standard per 5.2.2.3.
NOTE 2 The independent stage J represents a process that connects to all other stages per 5.2.2.11
NOTE 3 The rounded shapes of stages A, H, and J represent entry points to the lifecycle per 5.2.3.
NOTE 4 The dotted lines represent the loops in the lifecycle per 5.2.5.

By addressing these alarm management topics, the Agency can establish robust and efficient alarm systems, enabling operators to respond promptly and effectively to critical events and improve overall operational safety and efficiency.

7. Control Panels

This standard applies to PLC control panels, remote input/output panels, control stations, communication panels, and other enclosures used for control purposes. All enclosures procured must be fabricated by a UL508 certified panel shop per UL508A standards with appropriate label; however, enclosures do not need to be listed. The control panel standards cover the following design and procurement requirements.

- Layout
- Lighting
- Enclosure Rating
- External Power
- 120VAC Power Distribution, Protection, and Coordination
- 24VDC Power Distribution, Protection, and Coordination
- Wire Coloring
- Wire Labeling (Internal Only)
- Environmental Control
- Lightning Protection
- Intrinsically Safe Barriers
- Lightning Surge Suppression
- Documentation

7.1 Layout

In general, the designer is free to develop unique layouts to fit the size and shape of the control panel with the following general requirements.

- PLC equipment must be located near the top of the panel.
- All new panels must include 25% spare space for new I/O terminal blocks and circuit breakers for powering additional instrumentation.
- Where possible 120VAC circuits must not be in proximity to 24VDC circuits.
- Where 120VAC wiring and 24VDC wiring have to cross in the wireways make provisions so they cross at 90-degree angles to minimize inductive interference.
- All field wiring terminal blocks must be oriented vertically. Power distribution terminal blocks may be oriented horizontally or vertically.
- Provide a separate area of the control panel for any intrinsically safe barrier equipment that might be required for classified areas. Follow all NEC requirements for intrinsically safe installations.
- All terminal blocks must be single level with the exception of terminal block relay modules. Terminal block relay modules must be grouped by discrete output card and shall be spaced on the DIN rail with a minimum of 2 inches on either side of the relays to simplify changes in wiring.
- Refer to example control panel drawings for more information.

[Note: Example layout drawings will be provided for review as a separate submittal.]

7.2 Lighting

Provide one LED light for every 36 inches of panel width. If a panel is 48 inches wide two lights will be required. Lights shall be equipped with a motion sensor and can be attached to the top of the panel via magnets. This is a requirement for all new panel construction and retrofits of existing enclosures.

7.3 Enclosure Rating

- The following is a table for determining enclosure NEMA 250 ratings based on application or location.

Application	NEMA Rating	Requirements
Indoors, dry air-conditioned space	Type 12	None
Indoors, wet or washdown locations	Type 4	Painted Steel
Corrosive or Outdoor location	Type 4X	Stainless Steel
Classified Locations: Class 1	Type 7	Control Stations only (No PLCs)
Classified Location: Class 2	Type 9	Control stations only (No PLCs)

7.4 External Power

- Control enclosure with PLCs and PLC related equipment are prohibited from including 480 VAC equipment and wiring. Note: this requirement includes packaged system equipment; VFDs, starters, and wiring that operate at 480V or higher must be in physically separate enclosures or enclosures that have completely sealed compartments.

- Each control panel must be provided with two external circuits, utility and control. The utility feeder circuit is intended to power the panel's utilities that are not associated with controls which may include the following:
  - Lighting
  - Convenience Receptacle
  - Heater
  - Heat Exchanger
  - Fans
  - HVAC
  - Battery Panel Heater

- The control feeder circuit must be dedicated to control specific devices. For in plant control panels, provide the control feeder power from an external UPS if possible; otherwise, provide a UPS for the control panel. For remote site control panels, provide the control feeder circuit separate from the utility power primarily for the battery charger. Utilize the control feeder circuit to power the following types of equipment:
  - 4-Wire Instrumentation (e.g. Magmeters)
  - PLC Power Supplies
  - 24VDC Power Supplies
  - Battery Charger
  - Communication Equipment
  - Computers with Touch Screens
  - Etc.

7.5 120VAC Power Distribution, Protection, & Coordination

- For both utility and control power circuits of all control panels, external wiring must land on a main circuit breaker with the same rating as the feeder circuit breaker at the source panelboard, typically 20 amps. The main purpose of the circuit breaker is to isolate power within the panel.

- The main utility circuit breaker must feed all utility loads through dedicated and appropriately sized breakers. Similarly, the main control circuit breaker must feed all control loads through dedicated and

appropriately sized breakers. This requirement provides flexibility when executing maintenance activities in the panel and it provides some level of coordination if a fault occurs.

- A transient voltage surge suppressor (TVSS) must be provided on its own circuit breaker for the main utility circuit. Similarly, a TVSS must be provided for the main control circuit if the circuit is not fed by an external UPS. If the panelboard supplying power has a TVSS, installation of another in the control panel is not required. All TVSSs for power distribution must be monitored via dry contact at the PLC.

- If an external UPS circuit is not available for in-plant control panels, the main control circuit must feed a manual bypass switch for a UPS. Size the UPS to last through a 30 minute power outage at 100% of full load. The bypass switch must fully isolate the UPS from the panel for maintenance purposes while passing power to the control loads. All UPS/control loads must have a dedicated circuit breaker appropriately sized for the application. This requirement provides flexibility when executing maintenance activities in the panel and it provides some level of coordination if a fault occurs.

7.6 24VDC Power Distribution, Protection, & Coordination

- In-plant control panels must be supplied with two 24VDC, 10A rated power supplies wired to a redundancy module. The output of the redundancy module must include circuit breakers for every device, I/O module, or I/O module field terminal block. Circuit breakers and fuses must be sized appropriately for each load to limit the effect of shorts and faults.

- Remote site control panels must utilize battery backup in place of UPS power; therefore, the control feeder circuit will primarily be dedicated to the battery charger. Similar to in-plant control panels, the output of the battery charger and/or batteries must include circuit breakers for every device, I/O module, or I/O module field terminal block. Circuit breakers and fuses must be sized appropriately for each load to limit the effect of shorts and faults. The batteries shall be sized per IEEE 485 and must provide power to all control equipment for a 24 hour power outage.

- Provide a separate insulated enclosure with a heater for all batteries. Insulation should achieve R rating greater than 15. On loss of power the heater will not be capable of functioning, so insulation is critical for maintaining battery enclosure temperatures relative to the outside temperature. The battery enclosures shall have a gooseneck vent for hydrogen discharge.

7.7 Wire Coloring

- In general wire coloring internal to the panel shall follow UL 508A and/or NFPA 79 standards. External wiring colors are not included in the scope of these requirements. UL standards shall take precedence over NFPA-79 standards where there are any conflicts. Wire color requirements are listed below by application and/or voltage type.

- Power Distribution
  - Black — 120VAC Line (Hot)
  - White — 120VAC Neutral
  - Green — Ground
  - Blue — 24VDC Positive
  - White /w Blue Stripe — 24VDC Negative
- Signal Wiring
  - Red — 120VAC Discrete Signals
  - Blue — 24VDC Discrete Signal
  - Black — 24VDC Positive Conductor (Twisted Shield Pair)
  - White — 24VDC Negative Conductor (Twisted Shield Pair)
  - Yellow — 120VAC Discrete Output signals with Foreign Voltage (e.g. Control Power Transformer in MCC)

7.8 Wire Labeling

Signal wiring between field terminal blocks and PLC input/output modules must use the following label components and format defined below.

- Signal Type: One of the following
  - AI for Analog Input
  - AO for Analog Output
  - DI for Discrete Input
  - DO for Discrete Output
- I/O Drop or Rack (X)
- Slot (YY)
  - Position Starting from the left of the I/O Drop
- Point (01, 02, 03, etc.)
- Sign (+, -)
- Shield ground wires are not labeled.

The following is the required format of the tag color coded to match the colors of the tag components.

Format = [Signal Type]:[I/O Drop][Slot]-[Point][Sign]

The following is an example for analog input card in I/O Drop 1, slot 6, point 3.
AI:106-03+ (Wire with positive voltage relative to ground)
AI:106-03- (Wire with negative/zero voltage relative to ground)
Shield Wire unlabeled

7.9 Environmental Control

The designer and/or fabricator must perform heat loss calculations for each new or existing enclosure based on environmental conditions and altitude. Provide equipment when necessary to control enclosure temperatures. Provide a record of all temperature calculations to the Agency for future reference. For in-plant control panels, maintain temperatures between 32 and 104 degrees Fahrenheit. For remote site control panels, maintain temperatures between 32 and 104 degrees Fahrenheit. For enclosures that have batteries greater than 150 amp-hours, maintain temperatures between 55 and 104 degrees Fahrenheit. The use of panel insulation is encouraged for outdoor winter conditions.

Enclosure vents holes with fans and filters are not permitted. All cooling equipment provided for the enclosure must have the same rating as the enclosure, typically NEMA 250 Type 12, 4, or 4X SS. Provide an adjustable thermostat for controlling air conditioners, heaters, and/or heat exchangers.

All control panels must be equipped with a temperature transmitter (4-20mA signal) to validate temperature control system functionality. Additionally, provide any available monitoring on air conditioners, heaters, and/or heat exchangers. SCADA monitoring of equipment, where possible, and panel temperature is required. Alarming parameters will be set by the Agency.

7.10 Lightning Protection

Provide transient voltage surge suppression where the wiring terminates to an instrument outside and above grade. For discrete signal wiring utilize metal oxide varistors (MOV) terminal blocks. For analog signal wiring utilize electrode gas discharge tubes with fast-clamping diodes. Where lightning protection is required, provide provisions for three spare signals or 25% spare signals which ever is greater. For example, a new panel included 1 level transmitter located above grade outdoors and one float switch located above grade outdoors; therefore, the panel fabricator must provide four pair of MOV terminal blocks, one for the float signal and three spares. They are also required to provide four TVSS devices with

electrode gas discharge tubes, one for the level transmitter and three spares. If a panel has no interface to an instrument located outdoors and above ground, lightning protection is not required.

7.11 Intrinsically Safe Barriers

Intrinsically safe barriers are devices designed to interface between the hazardous area and the safe area. Their primary purpose is to limit the amount of electrical energy transmitted to intrinsically safe equipment located in the hazardous area. The purpose of an intrinsically safe barrier is to ensure that even if a fault occurs in the safe area, it does not result in a hazardous spark or temperature rise in the hazardous area. Energy limiting equipment (barriers) and wiring on the field side of must be separated from all other components in the panel, refer to manufacturer specific requirements for barriers and follow all guidelines. Wiring for intrinsically safe equipment must be routed in conduits separate from other wiring to prevent surges and transient voltages in hazardous areas.

7.12 Documentation

All control panels must be provided with accurate documentation. The following are the minimum requirements for panel documentation.

- Title Sheet
- Drawing List(s)
- Legend(s)
- Bill of Material Drawings or Schedule
- Layout Drawings
- Name Plate Schedules and Details
- Equipment Details (Included PLC Details)
- Terminal Block Details
- Communication or Network Connection Drawings
- Power Distribution Drawings
- I/O Module Connection Diagram (a.k.a Wiring Diagrams or Loop Drawings)

7.13 Control Panel Component Manufacturers

The following is a list of preferred manufacturers for control panel equipment.

- UPSs American Power Company

7.14 Control Panel Health Monitoring Summary

The following is a summary of control panel health monitoring requirements.

- (DI) Power TVSS Failure if provided, refer to external power requirements.
- UPS Health Monitoring if provided. The following signals shall be monitored via dry contacts.
  - (DI) Loss of Power (Power to the UPS is lost)
  - (DI) Battery Low (UPS Battery is low)
  - (DI) Common Alarm (Alarm indicating the UPS has failed or is in jeopardy of failure.)
- Battery Charger Monitoring, if provided.
  - (DI) Loss of Power
  - (DI) Low Battery
  - (DI) Common Alarm
- 24VDC Power Supply Monitoring, Common alarm for each power supply if provided.
  - (DI) Power Supply 1

  - (DI) Power Supply 2
  - (DI) Redundancy Module Failure
- (AI) Panel Temperature
- (DI) Panel Open (a.k.a. Intrusion Detection)

8. PLC Control Equipment

8.1 PLC Control Hardware Requirements

8.1.1 Remote Sites

Remote site PLCs must utilize the Siemens S7-1200 series controllers. The controllers must have redundant communications utilizing both cellular and microwave radio technology for telemetry. PLC power supply modules and/or power to the PLC must be powered from a 24VDC source.

8.1.2 Plant Site PLC

Plant site PLCs must utilize either Siemens S7-1200 or S7-1500 series controllers for non-redundant applications. For redundant applications the designer must utilize S7-1500R or S7-1500H series controllers. For additional requirements on redundant application refer to the control redundancy paragraphs herein. PLC power supply modules and/or power to the PLC must be powered from a 24VDC source.

8.1.3 Hardwired Signal Interface Requirements

For S7-1200 series controllers select the appropriate controller to accommodate the I/O for the application. Supplement the I/O with expansion modules as needed.

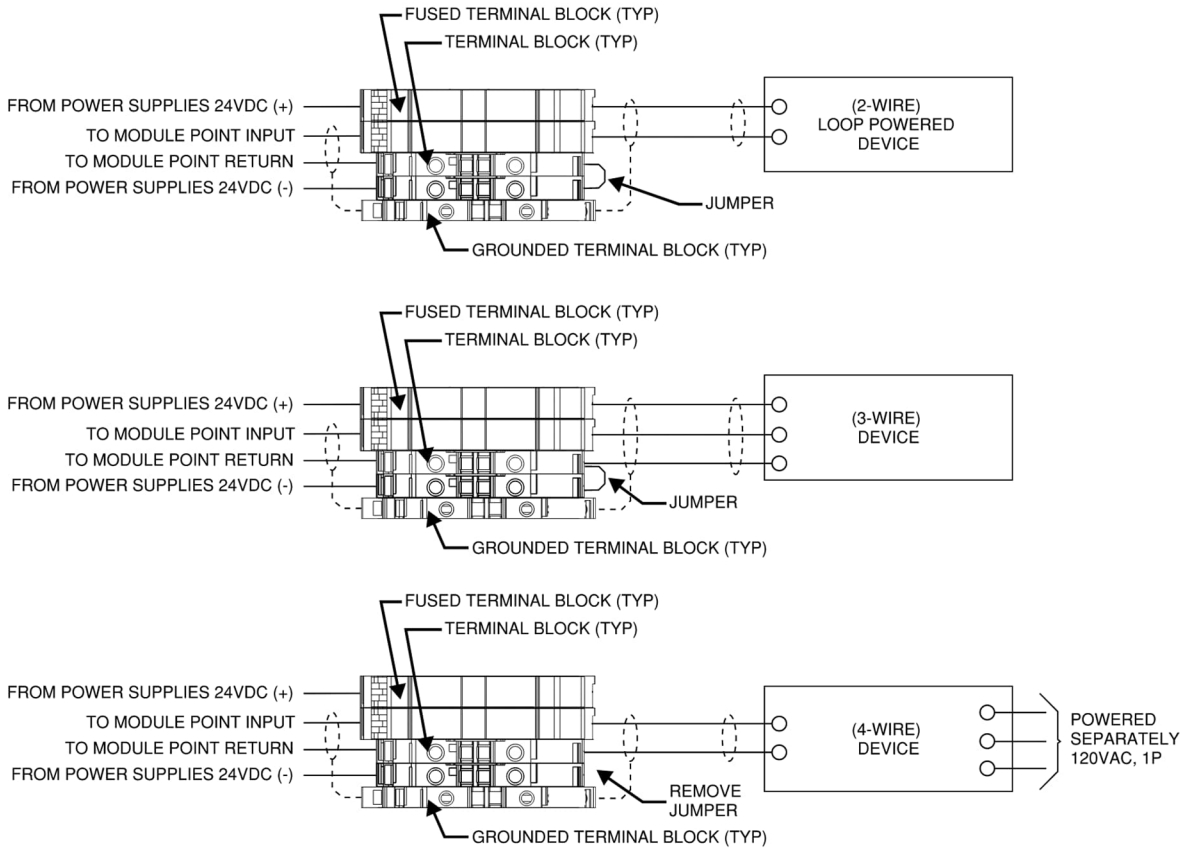
For S7-1500, S7-1500R, and S7-1500H series controllers all new I/O modules must use the ET 200 MP series I/O modules.

For each new control system enclosure, provide field terminal blocks to simplify wire terminations and maximize flexibility of hardwired signals. Field terminal blocks must be organized or grouped in the enclosure by module and signal type. Provide internal wiring between the I/O module (PLC) and the field terminal blocks.

Analog Input Module & Signal Interface Requirements:

- Where possible, hardwired signals must be 4-20mA, 24VDC.
- Isolated analog input modules must be used to accommodate multiple types of instrument signals.
- Provide internal panel wiring for all points in all modules. Partial wiring of some signals is unacceptable.
- Ground the drain wire of twisted shielded pair cables at the field terminal blocks for signals without a Transient Voltage Surge Suppressor, (TVSS) or intrinsically safe device. For signal cables with a TVSS, ground drain wires at TVSS. For intrinsically safe devices follow the signal grounding requirements of the manufacturer.
- Field terminal blocks must be supplied to support 2-wire, 3-wire, and 4-wire signal arrangements for each point. The figure below shows terminal block grouping requirements for each point, and it shows example interfaces for each type of point.

Figure 26 Analog Input Terminal Block Arrangement per Point



Analog Output Module & Signal Interface Requirements:

- Where possible, hardwired signals must be 4-20mA, 24VDC.
- Provide internal panel wiring for all points in all modules. Partial wiring of some signals is unacceptable.
- Ground the drain wire of twisted shielded pair cables at the field terminal blocks for signals without a TVSS or intrinsically safe device. For signal cables with a TVSS, ground drain wires at TVSS. For intrinsically safe devices follow the signal grounding requirements of the manufacturer.
- For each signal, provide two unfused terminals for signal interface to the module and provide a grounded terminal block for the shield drain wire. Group these terminal blocks together for each signal.

Discrete Input Module & Signal Interface Requirements:

- Provide sinking input configuration for discrete input modules.
- Provide internal panel wiring for all points in all modules. Partial wiring of some signals is unacceptable.

- If possible, interface discrete inputs to dry contacts; otherwise, provide interposing relays at the equipment control interface. Where possible, do not locate interposing relays for discrete input signals in the control panel.
- For each signal, provide a fused terminal for 24VDC wetting voltage, and an unfused terminal to pass the signal through to the discrete input module.

Discrete Output Modules & Signal Interface Requirements:

- Provide sourcing output configuration for discrete output modules.
- Provide internal panel wiring for all points in all modules. Partial wiring of some signals is unacceptable.
- All discrete outputs must drive terminal block interposing relays. The terminal block relays will serve as the field terminal blocks. The relay coils must operate on 24VDC.
- For every two discrete output signals, provide one fused terminal block with 120VAC from a ground fault interrupt circuit breaker. The fuses should be sized for loads that don't have an external power supply like solenoid valves.

8.2 Control Redundancy

PLCs located in the plant must implement some form of redundancy for critical systems which are defined as follows.

- Critical systems are those that rely on automatic controls to ensure water treatment stays within permit limits. Without these automatic controls, the plant's staff at minimal staffing levels, would struggle to manually control the process within permit limits.

8.2.1 Control Redundancy via Unit Process Redundancy

One practical way to implement control system redundancy is to utilize process redundancy if it exists. For example, the filtration process typically includes multiple individual filters (individual unit processes) with extra filters to ensure capacity if a filter fails for mechanical reasons. To ensure control system redundancy, a non-redundant PLC can be provided for each filter. If one filter PLC fails another filter with a functioning PLC can be brought into service accomplishing some level of redundancy in the control system by utilizing the process redundancy where it exists. If there is no spare capacity in the filter complex, process redundancy is not feasible.

When using process redundancy, the designer should analyze failures thoroughly, from the HMI level to the PLC and from the PLC to the I/O connectivity. The main goal of this analysis is to find and fix any single points of failure during the design phase. In the example above, control system redundancy was achieved for regular operation of the filters without consideration of the backwash process and other common control functionality that can span multiple controllers. If individual non-redundant controllers are provided for the control of individual filter functionality, then common functionality for all filters (like backwashing) may need to be implemented on a redundant controller.

8.2.2 PLC Redundancy & Network Architecture

When using redundant PLC controllers, the designer should analyze failures thoroughly, from the HMI level to the PLC and from the PLC to the I/O connectivity. The main goal of this analysis is to find and fix any single points of failure during the design phase. The following are minimum requirements for PLC Redundancy.

- The control system shall consist of two types of networks; HMI and Distributed I/O networks.
  - The HMI network serves as a plant wide network and must be utilized for communication between the PLC and the HMI or in some cases between PLCs in different process areas of the plant.

- Distributed I/O networks serve as media to connect devices and I/O modules to the PLC controller. Each pair of redundant PLC controllers shall have a dedicated Distributed I/O network configured in ring topology utilizing ProfiNet and Media Redundancy Protocols, (MRP). In general, Distributed I/O networks must be physically separate from the HMI network; however, dedicated and Isolated VLANs may be used to extend I/O connectivity to other areas of the plant if they're not within proximity of the redundant controller.

- The primary and backup PLC controllers must be connected to separate HMI network switches utilizing the X2 ProfiNet ports. The controller must monitor the status of the Ethernet connection to each switch; in the event of a communication failure at the switch, the controllers must programmatically failover PLCs to the Ethernet connection that is active. This failover must be demonstrated during factory testing.
- Redundant PLC controllers must utilize the S7-1500R or S7-1500H series CPUs.

8.2.3 Distributed I/O Drops & Hardwired Assignments

When using redundant PLC controllers, a minimum of 2 distributed I/O drops must be provided. If only 2 I/O drops are provided, then half of the I/O assignments must be landed on one I/O drop and the rest must be landed on the other I/O drop. For example, if a redundant PLC is utilized to control a critical pump station with six (6) pumps, then three (3) of the pump's control signals must be interfaced to modules on the first I/O drop. Similarly, the remaining three (3) pump's control signals must be interfaced to the second I/O drop. If one of the I/O drop experiences a failure at least three of the pumps can still be controlled until the I/O drop can be repaired.

8.2.4 Profibus Device Interface

The Agency has several legacy Profibus networks that may need to be interfaced to a new redundant PLC controller. There are two main methods of accomplishing the interface, and both methods required the use of a subordinate PLC controller (non-redundant).

- The first method involves installing the subordinate PLC controller (non-redundant) on the X1 network of the redundant PLC using a PN/PN coupler with ProfiNet S2 connectivity. The subordinate PLC must be equipped with both ProfiNet ports and ProfiBus ports and will serve as the master for the Profibus communication. Data transfer through the PN/PN coupler is limited to 254 bytes input data and 253 bytes of output data. If more input data or more output data transfer is needed, utilize the second method describe below.

- The second method involves installing the subordinate PLC directly on the X1 network of the redundant PLC and establishing and open user communication. The subordinate PLC must be equipped with both ProfiNet ports and ProfiBus ports and will serve as the master for the Profibus communication. The open user communication will require additional coding to accomplish. Use the common IP Address for redundant controllers to ensure communication to the subordinate PLC even if the Primary controller fails.

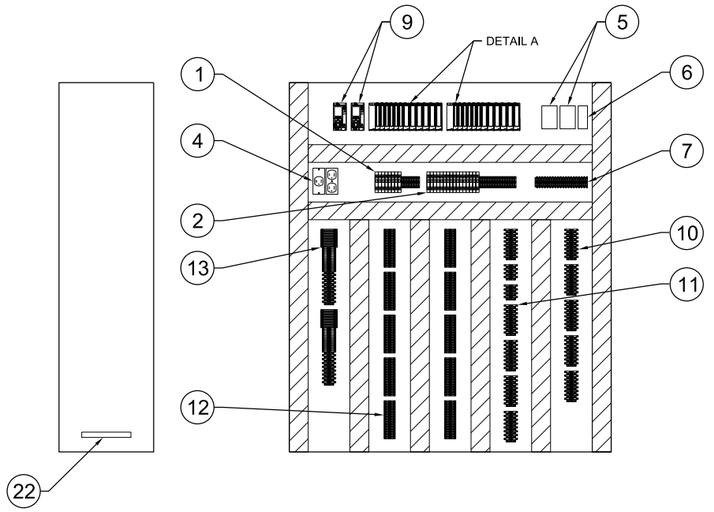
Subordinate PLCs must be S7-1200 or S7-1500 series.

9. HMI Control Equipment

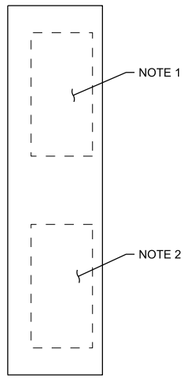
In general, the Agency does not utilize the Siemens Basic or Comfort series operator interface terminal (OIT) products or other products like them. OITs typically required additional programming, separate from the HMI and PLC programming efforts, and increases the complexity, costs, and effort associated with maintenance of these types of systems. In place of OITs, the Agency utilizes panel mounted touch screens and industrially hardened computers or thin-clients.

Packaged system suppliers that supply complex single purpose equipment, like high-speed blowers, standby generators, or other pre-engineered products, may supply OITs provided they are part of the product offering and the designer receives written approval from the Agency allowing their use. If OITs are approved for use, all functionality of the packaged system must be replicated on the HMI, including configuration and tuning settings. This will allow full functionality of the product from the HMI in the event of a OIT failure.

Appendix A – PLC Control Panel Example Drawings

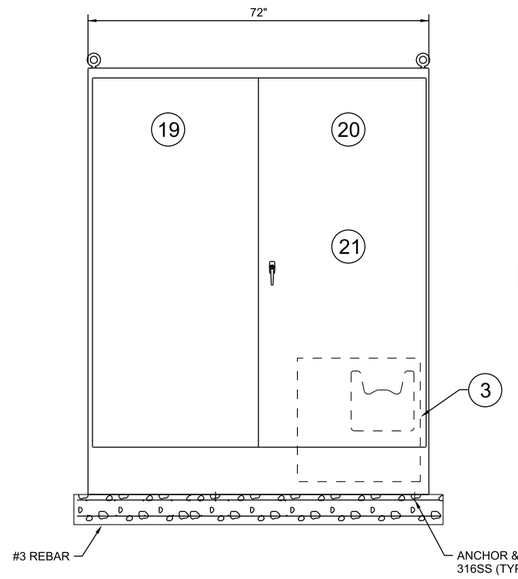


LEFT VIEW
3/4" - 1'-0"

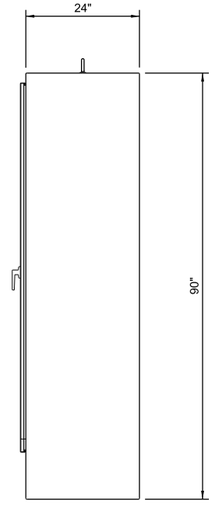


INTERIOR FRONT VIEW
3/4" - 1'-0"

RIGHT VIEW
3/4" - 1'-0"



EXTERIOR FRONT VIEW
3/4" - 1'-0"

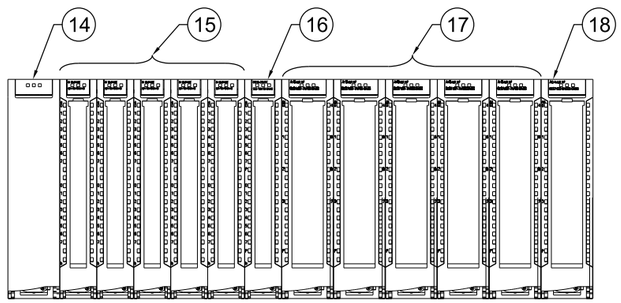


SIDE VIEW
3/4" - 1'-0"

NOTES:

1. AREA RESERVED FOR TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES FOR SIGNAL WIRING.
2. AREA RESERVED FOR INTRINSICALLY SAFE DEVICES.
3. REFER TO THE DESIGN STANDARD FOR ADDITIONAL REQUIREMENTS.
4. PROVIDE A GROUNDING KIT FOR THE ENCLOSURE. ALL EXPOSED METAL PARTS OF THE PANEL MUST BE GROUNDED.

CONTROL PANEL COMPONENTS			
ITEM	**DESCRIPTION**	**MANUFACTURER**	**MODEL / NOTES**
1	120VAC UTILITY POWER DISTRIBUTION	ROCKWELL	1489-M1, 1492-J4, 1492-JG4
2	120VAC EXTERNAL UPS CONTROL POWER DISTRIBUTION	ROCKWELL	1489-M1, 1492-J4, 1492-JG4
3	UNINTERRUPTABLE POWER SUPPLY	APC	SIZE FOR 30 MINUTES
4	CONVENIENCE OUTLET	HUBBLE	DRUB15
5	24VDC POWER SUPPLY, 40A	SOLA	SDN 20-24-100C
6	24VDC POWER SUPPLY REDUNDANCY MODULE	SOLA	SDN-2.5-20RED
7	24VDC POWER DISTRIBUTION	ROCKWELL	1492-WFB4, 1492-W4
8	NOT USED		
9	S7-1500R PLC	SIEMENS	
10	ANALOG INPUTS TERMINAL BLOCKS	ROCKWELL	
11	ANALOG OUTPUT TERMINAL BLOCKS	ROCKWELL	
12	DISCRETE INPUT TERMINAL BLOCKS	ROCKWELL	
13	DISCRETE OUTPUT TERMINAL BLOCKS	ROCKWELL	
14	PROFINET INTERFACE S2 (MRP)	SIEMENS	6ES7515-5AA00-0AA0
15	S7-1500, DI 16X24VC BA	SIEMENS	6ES7521-1BH10-0AA0
16	S7-1500, DQ 16X24VDC/0.5A BA	SIEMENS	6ES7522-1BH10-0AA0
17	S7-1500, AI 8XU/I HF	SIEMENS	6ES7531-7NF00-0AB0
18	S7-1500, AQ 4XU/I HF	SIEMENS	6ES7532-5ND00-0AB0
19	PANEL LABEL		PLC EXAMPLE
20	PANEL LABEL		PLC EXAMPLE
21	ENCLOSURE AND PANELS	NVENT	90" BY 72" BY 24"
22	GROUNDING BAR AND PANEL GROUND KIT	NVENT	



DETAIL A
6" - 1'-0"

FIGURE 1 -
EXAMPLE PLANT
CONTROL PANEL LAYOUT

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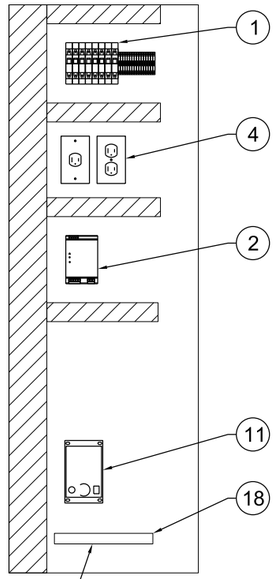
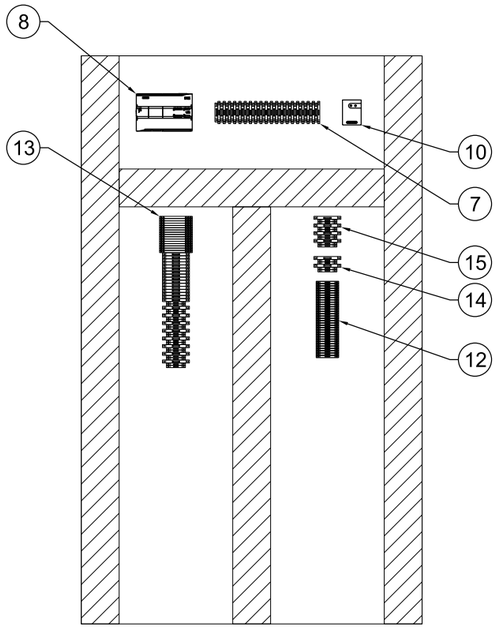
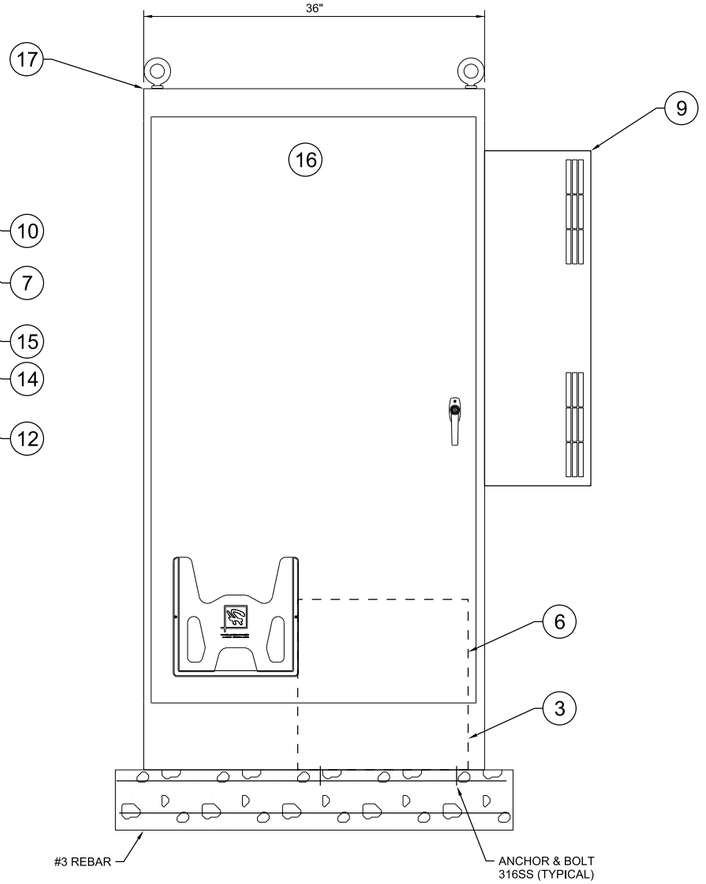
TRUCKEE, CALIFORNIA



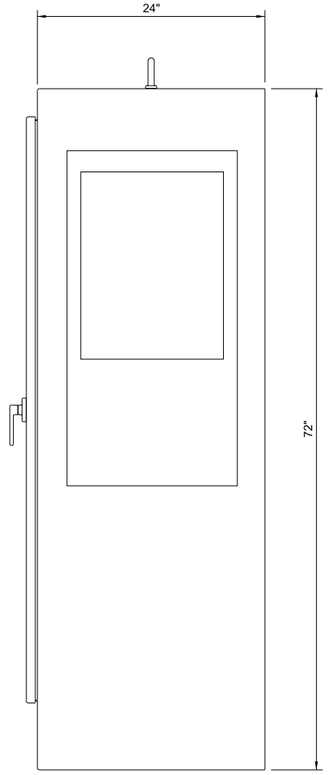
LEFT VIEW
1 1/2" - 1'-0"



INTERIOR FRONT VIEW
1 1/2" - 1'-0"



EXTERIOR FRONT VIEW
1 1/2" - 1'-0"



SIDE VIEW
1 1/2" - 1'-0"

NOTES:

1. REFER TO THE DESIGN STANDARD FOR ADDITIONAL REQUIREMENTS.
2. PROVIDE A GROUNDING KIT FOR THE ENCLOSURE. ALL EXPOSED METAL PARTS OF THE PANEL MUST BE GROUNDED.

ITEM	DESCRIPTION	MANUFACTURER	MODEL / NOTES
1	120VAC UTILITY POWER DISTRIBUTION	ROCKWELL	1489-M1, 1492-J4, 1492-JG4
2	120VAC BATTERY CHARGER	MEAN WELL	DRS-240-24
3	24VDC BATTERY	EXIDE, OR C&D	SIZE FOR 24 HOURS (VRLA)
4	CONVENIENCE OUTLET	HUBBLE	DRUB15
5	24VDC BATTERY DISCONNECT	ROCKWELL	1489-M2
6	BATTERY RACK		
7	24VDC POWER DISTRIBUTION	ROCKWELL	1492-WFB4, 1492-W4
8	S7-1217C	SIEMENS	6ES7217-1AG40-0XB0
9	AIR CONDITIONER	KOOLTRONICS	KNA4C5DP33LV
10	DUAL THERMOSTAT	KOOLTRONICS	KSDT72
11	HEATER	KOOLTRONICS	KSEHT 800
12	DISCRETE INPUT TERMINALS	ROCKWELL	
13	DISCRETE OUTPUT TERMINALS	ROCKWELL	
14	ANALOG INPUT TERMINALS	ROCKWELL	
15	ANALOG OUTPUT TERMINALS	ROCKWELL	
16	PANEL LABEL		REMOTE PLC EXAMPLE
17	ENCLOSURE AND PANEL	NVENT	72" BY 36" BY 24"
18	GROUNDING BAR AND PANEL GROUND KIT	NVENT	

FIGURE 2 -
EXAMPLE REMOTE SITE
CONTROL PANEL LAYOUT

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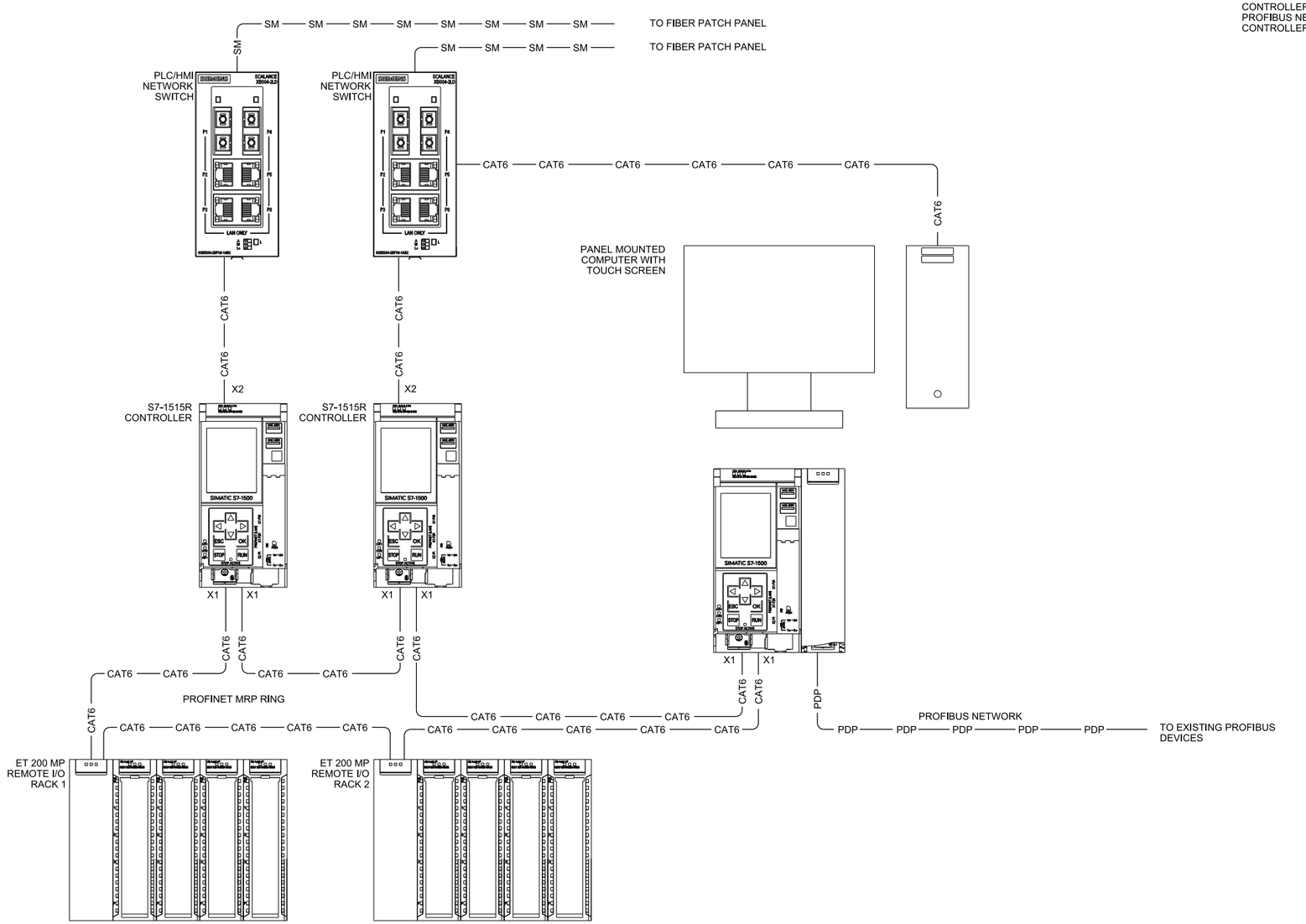
TRUCKEE, CALIFORNIA

LEGEND

SM — SM — SM	SINGLE MODE FIBER CONNECTION
CAT6 — CAT6	CAT6 CONNECTION
PDP — PDP	PROFIBUS DP CONNECTION



NOTES:

1. USE A NON-REDUNDANT PLC WITH A PROFIBUS DP MASTER MODULE AND ESTABLISH OPEN USER COMMUNICATION (OUC) TO THE REDUNDANT CONTROLLERS WHEN INTERFACING EXISTING PROFIBUS NETWORKS TO REDUNDANT CONTROLLERS.

FIGURE 3 -
EXAMPLE COMMUNICATION
CONNECTION DIAGRAM

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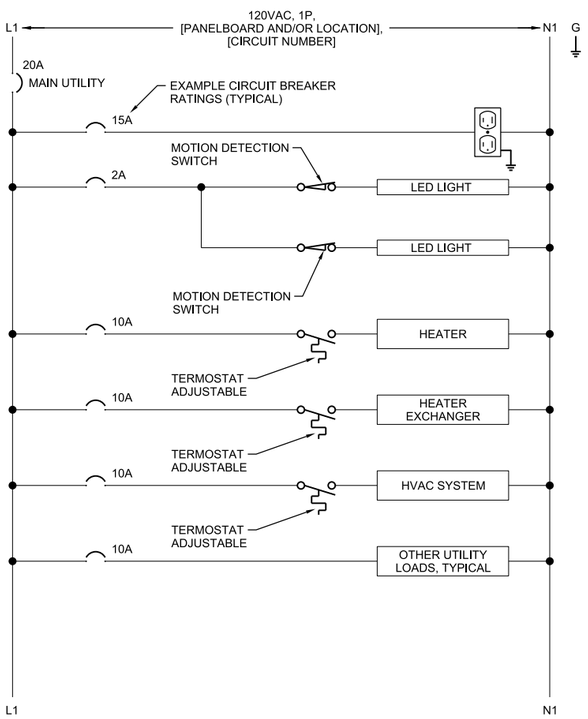
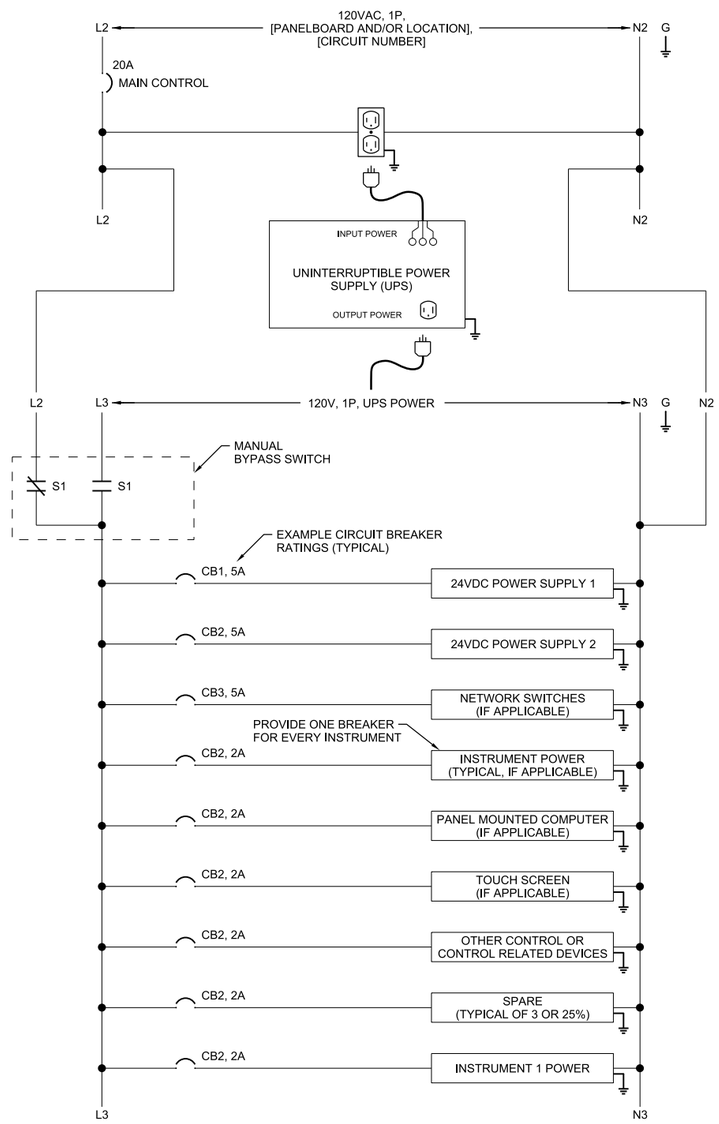
TRUCKEE, CALIFORNIA

EXAMPLE UTILITY POWER DISTRIBUTION



EXAMPLE 1 NO EXTERNAL UPS CONTROL POWER DISTRIBUTION



EXAMPLE 2 EXTERNAL UPS CONTROL POWER DISTRIBUTION

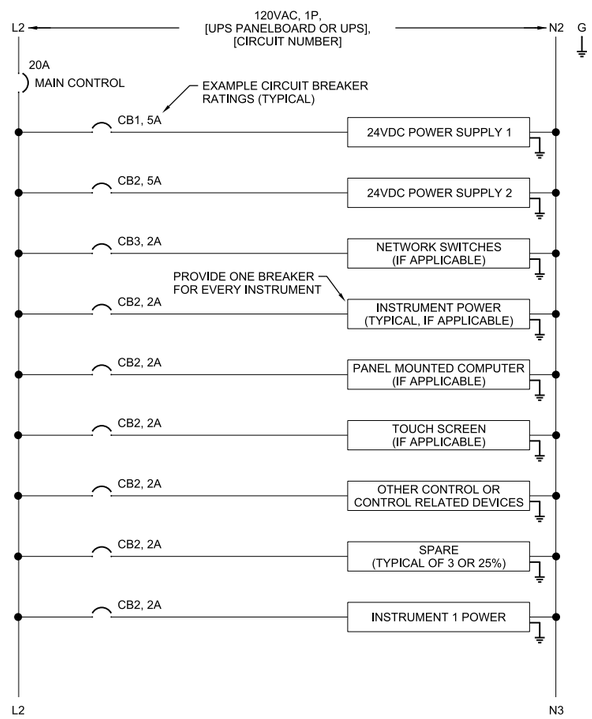


FIGURE 4 -
POWER DISTRIBUTION
EXAMPLES 1 OF 2

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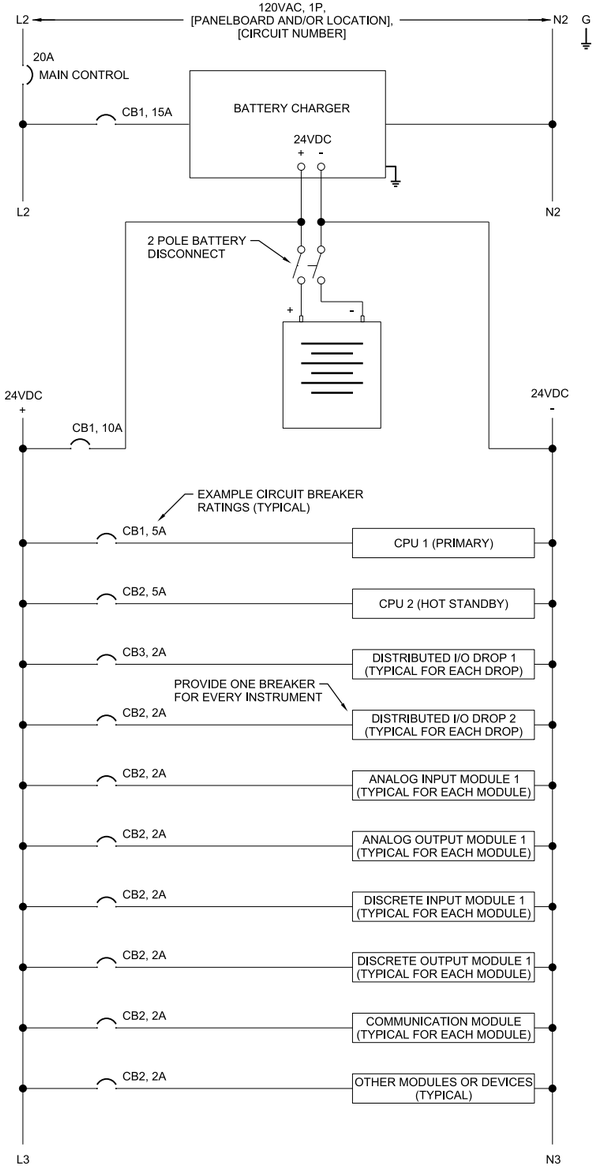
REGIONAL WASTEWATER TREATMENT FACILITY
TRUCKEE, CALIFORNIA

EXAMPLE 3 BATTERY CHARGER CONTROL POWER DISTRIBUTION AND 24VDC POWER DISTRIBUTION



EXAMPLE 4 24VDC POWER DISTRIBUTION

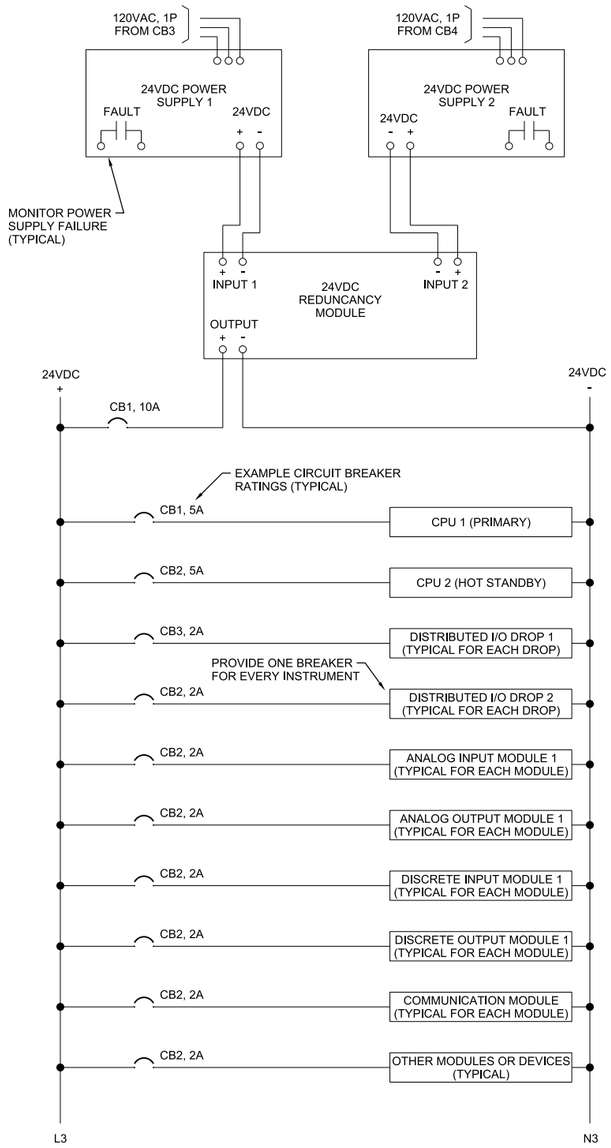


FIGURE 5 -
POWER DISTRIBUTION
EXAMPLES 2 OF 2

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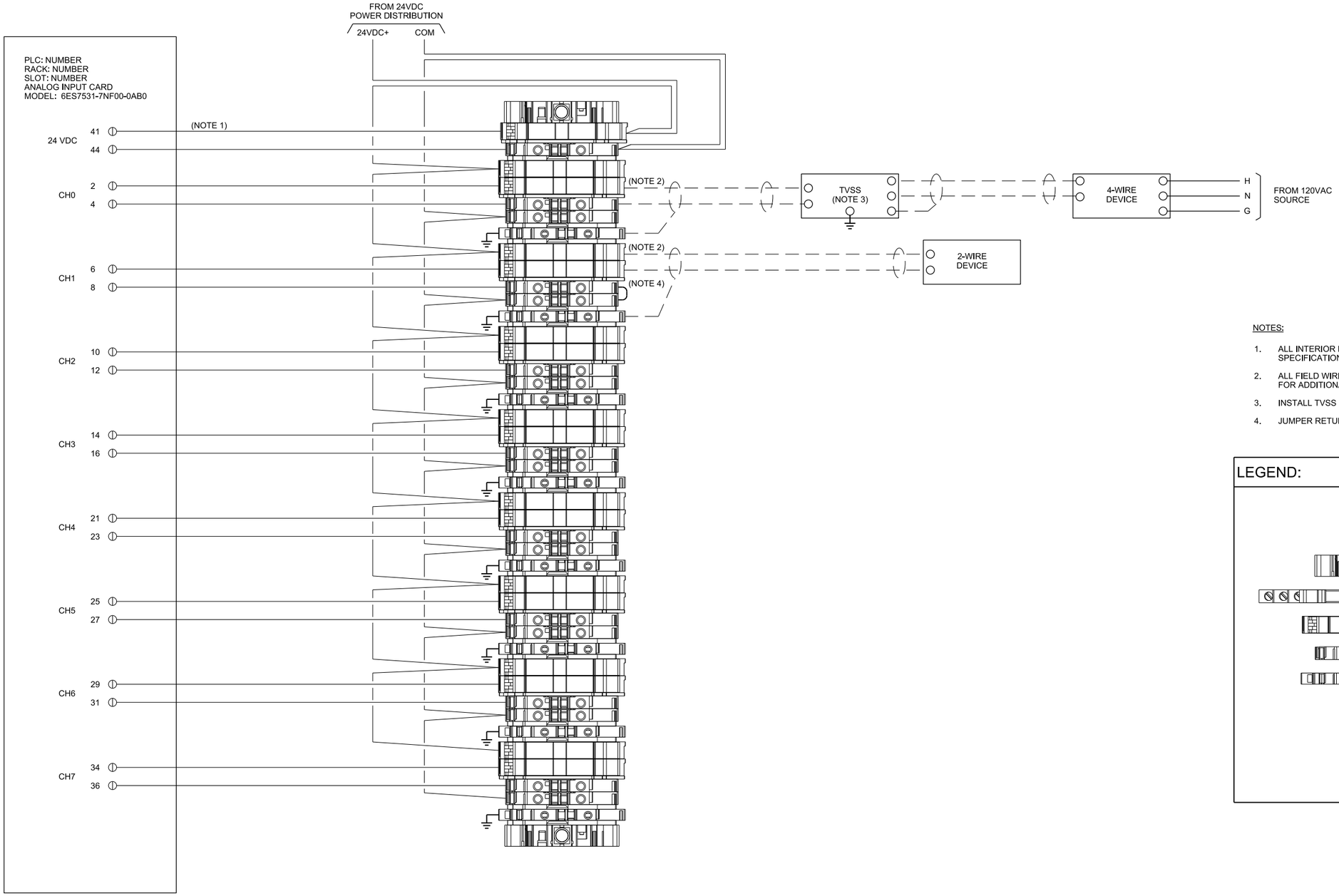
TRUCKEE, CALIFORNIA



NOTES:

1. ALL INTERIOR PLC PANEL WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
2. ALL FIELD WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENT.
3. INSTALL TVSS ON INSTRUMENTS LOCATED OUTSIDE OF BUILDING.
4. JUMPER RETURN WIRE FOR 2-WIRE DEVICES.

LEGEND:

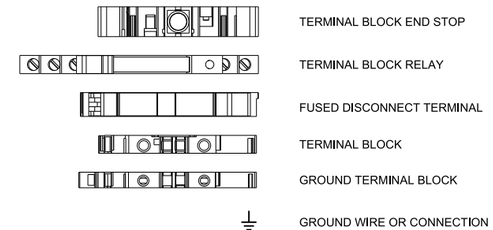


FIGURE 6 -
EXAMPLE ANALOG INPUT
CONNECTION DIAGRAM

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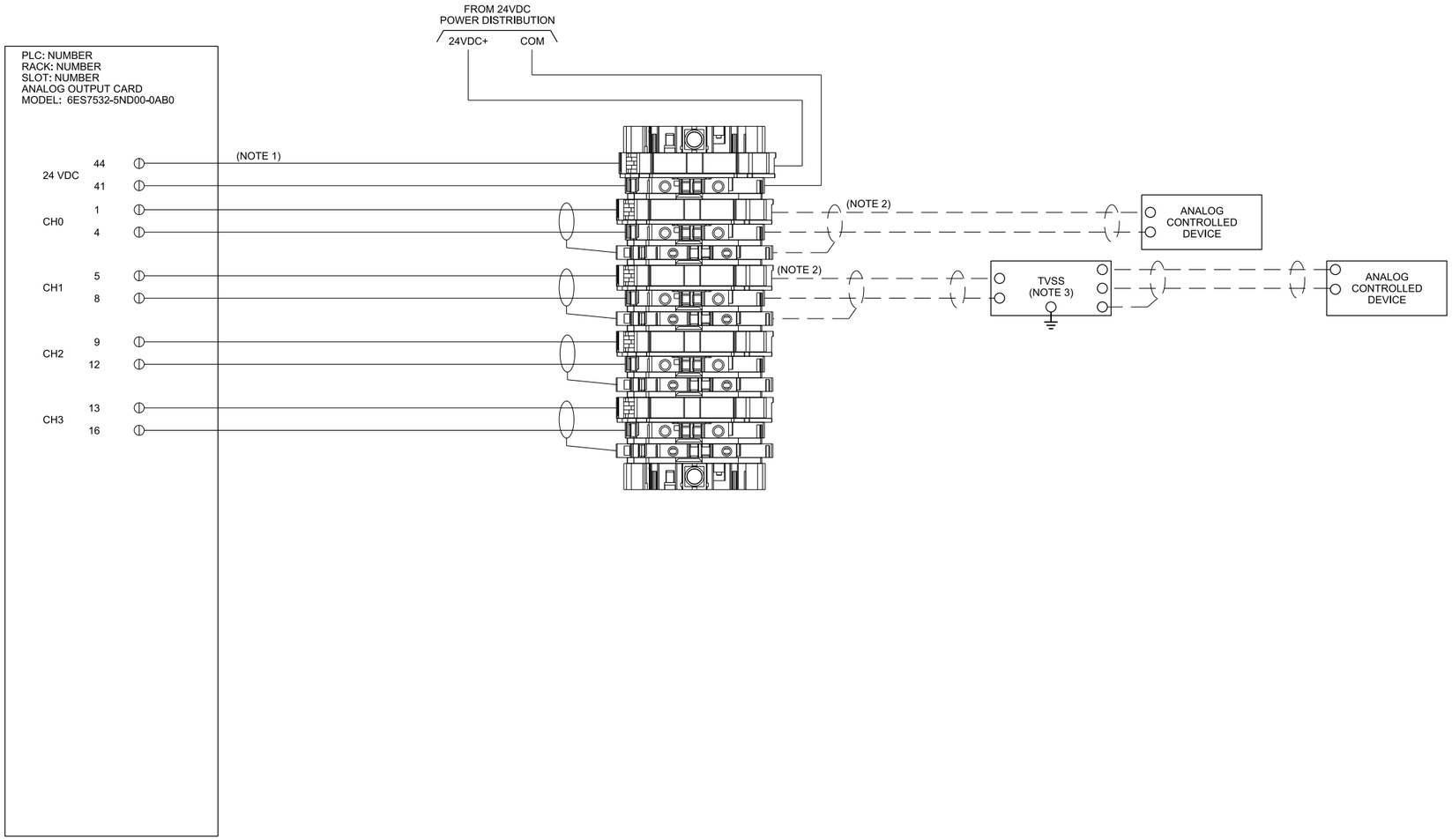

NOTES:

1. ALL INTERIOR PLC PANEL WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
2. ALL FIELD WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENT.
3. INSTALL METAL OXIDE VARISTER (MOV) ON INSTRUMENTS LOCATED OUTSIDE OF BUILDLING.

LEGEND:

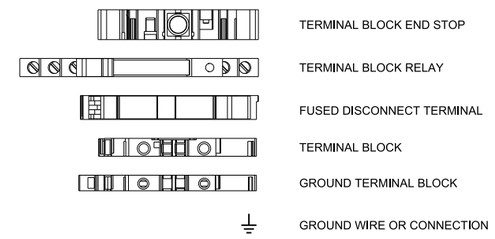

FIGURE 7 -
EXAMPLE ANALOG OUTPUT
CONNECTION DIAGRAM

TAHOE-TRUCKEE SANITATION AGENCY
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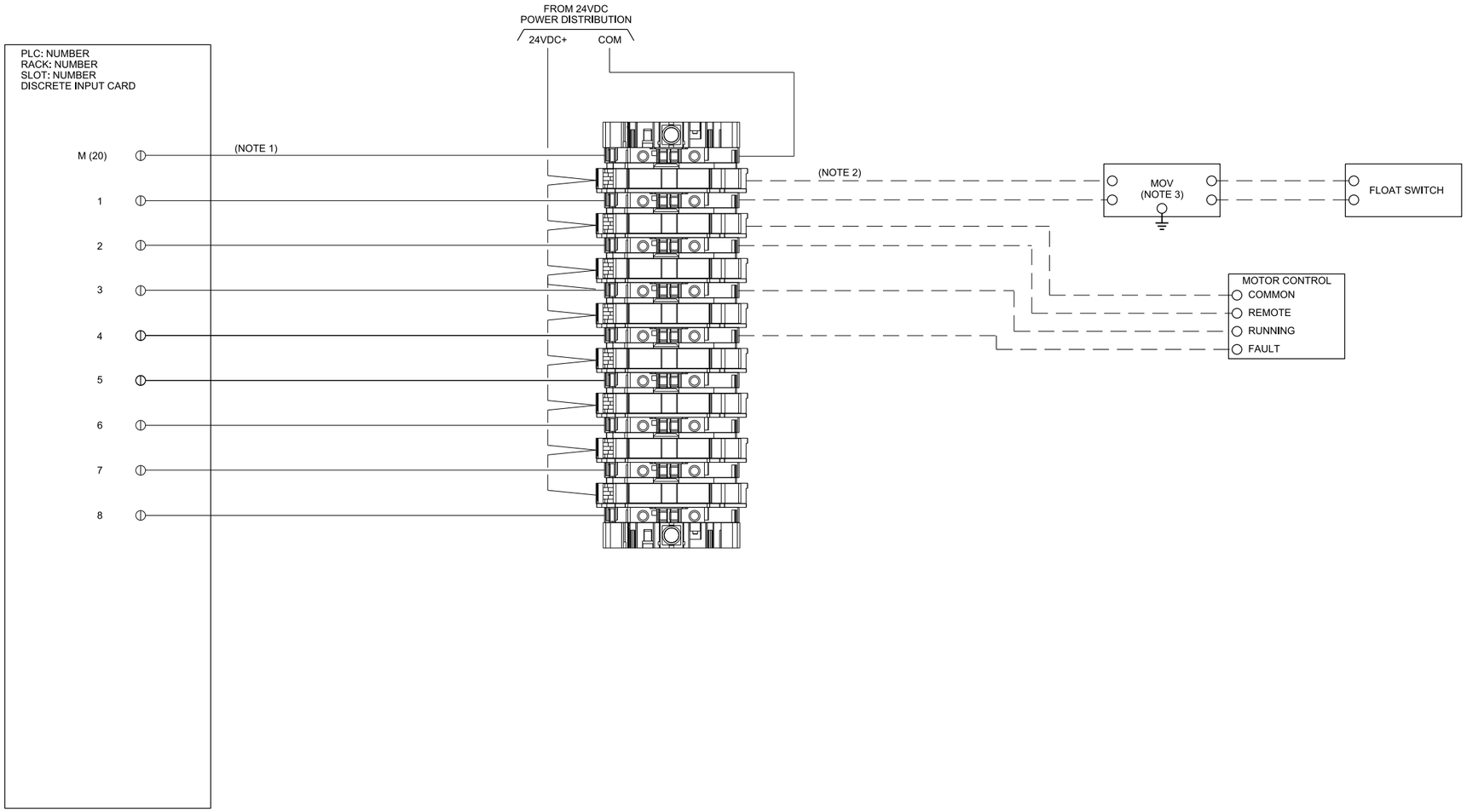
TRUCKEE, CALIFORNIA



NOTES:

1. ALL INTERIOR PLC PANEL WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
2. ALL FIELD WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENT.
3. INSTALL METAL OXIDE VARISTER (MOV) ON INSTRUMENTS LOCATED OUTSIDE OF BUILDLING.

LEGEND:

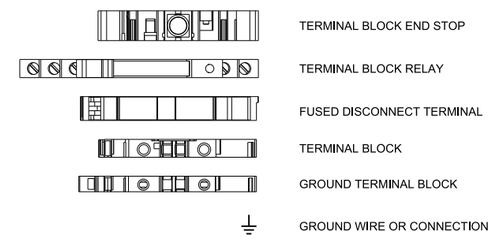


FIGURE 8 -
EXAMPLE DISCRETE INPUT
CONNECTION DIAGRAM

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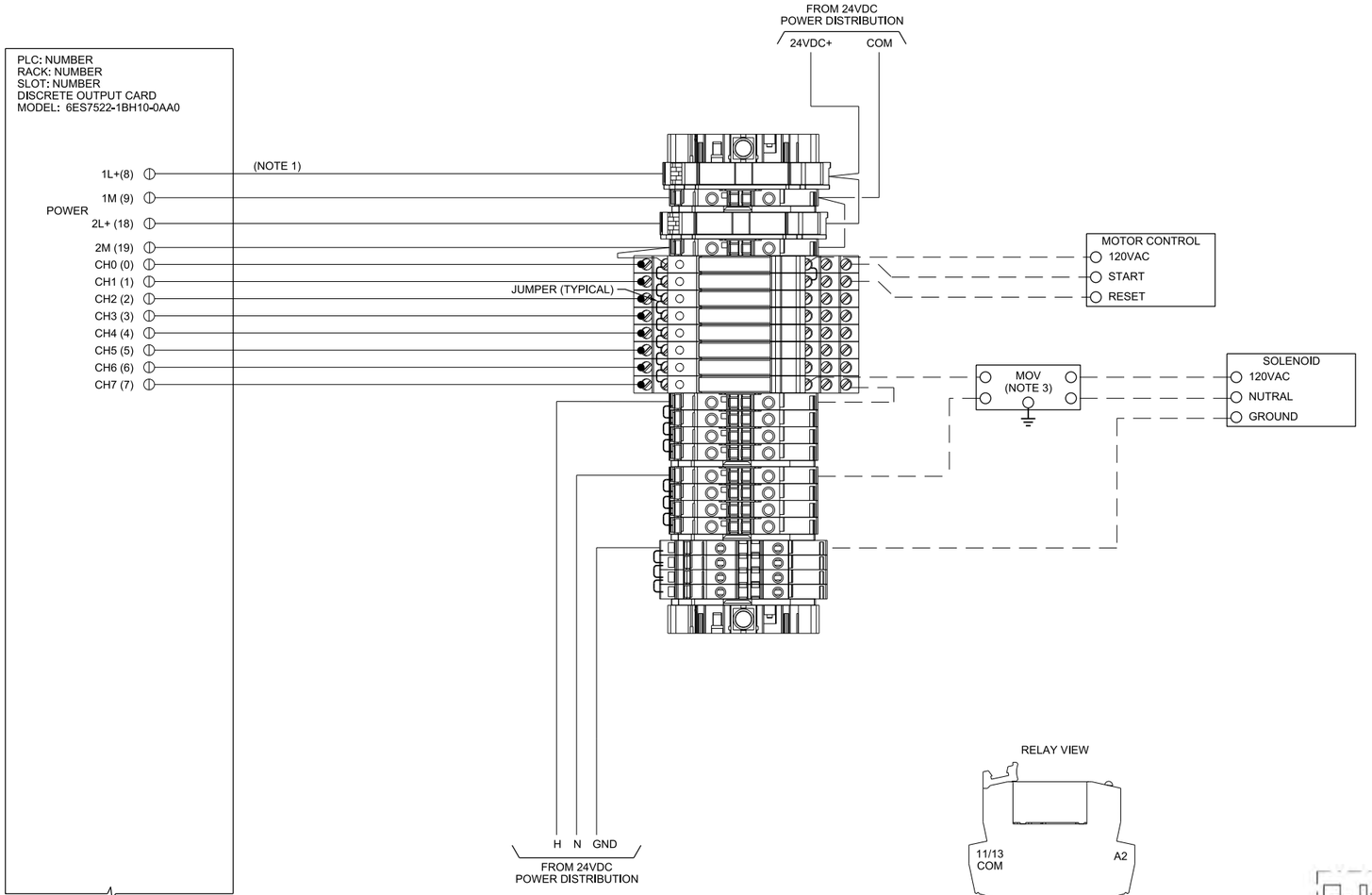
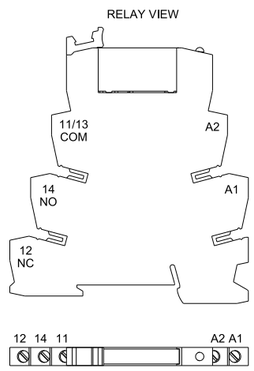
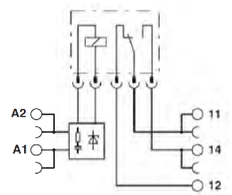
TRUCKEE, CALIFORNIA







RELAY CIRCUIT DIAGRAM

DETAIL - 120VAC DECRETE OUTPUT

1:1

NOTES:

1. ALL INTERIOR PLC PANEL WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
2. ALL FIELD WIRING SHALL BE LABELED. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENT.
3. INSTALL METAL OXIDE VARISTER (MOV) ON INSTRUMENTS LOCATED OUTSIDE OF BUILDLING.

LEGEND:

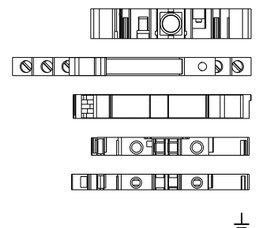


FIGURE 9 -
EXAMPLE DISCRETE OUTPUT
CONNECTION DIAGRAM

TAHOE-TRUCKEE SANITATION AGENCY
REGIONAL WASTEWATER TREATMENT FACILITY
TRUCKEE, CALIFORNIA

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Richard Pallante, General Manager
Item: V-5
Subject: Placer County LAFCO Notice of Upcoming Vacancies and Call for Nominations

---

Background
Placer County Local Agency Formation Commission (LAFCO) will soon have a vacancy of one (1) voting special district member and one (1) alternate voting member on its Commission due to the current member's term expiration on April 30, 2024. LAFCO is requesting that as member of the Independent Special District Selection Committee, T-TSA may nominate a candidate to run for one or both upcoming vacant seats on LAFCO to serve a four (4) year term beginning May 1, 2024.

Valid nominations must include the following:

1) Name and position of the nominee
2) Name of the nominating District
3) Signature of the Presiding Officer of the District's Board of Directors
4) Up to a one-page statement of qualifications for the nominee with their nomination form

Nominations are due in writing on or before Friday, February 22, 2024, at 4:00 pm.

Fiscal Impact
None.

Recommendation
None.

Review Tracking

Approved By: _____
Richard Pallante
General Manager

PLACER COUNTY

LOCAL AGENCY FORMATION COMMISSION

DATE: January 17, 2024

TO: Presiding Officers of Placer County Independent Special Districts

FROM: Michelle McIntyre, LAFCO Executive Officer

SUBJECT: Notice of Upcoming Vacancies on Placer LAFCO and Call for Nominations

Dear Special District Presiding Officer:

Placer County Local Agency Formation Commission (LAFCO) has two voting special district members and one alternate voting member seated on its Commission. The purpose of this letter is to inform you that one of the voting members and the alternate voting member's terms will soon expire on April 30, 2024, and that as a member of the Independent Special District Selection Committee, you may nominate a candidate to run for one or both upcoming vacant seats on LAFCO.

You may nominate *any* director serving on a Placer County Independent Special District Board, including the current sitting regular and alternate voting member, to serve a four-year term beginning no sooner than May 1, 2024. The current members, whose terms will expire, are Commissioner Joshua Alpine with Placer County Water Agency and Alternate Commissioner William Kahrl with Newcastle Fire Protection District.

The nomination period begins today, January 17, 2024, and ends on **Thursday, February 22, 2024, at 4 pm**. Nominations must be submitted in writing using the attached nomination forms – there are two nomination forms, one for each seat. You may nominate a director for one or two seats. If you are nominating one director for two seats, you must complete two nomination forms. Please send each nominee's one-page statement of qualifications with their nomination form. We will not accept nominations after the due date.

Once the nomination period ends, LAFCO staff will send ballots and voting instructions to your district via email. If you have any questions, please get in touch with LAFCO staff at (530) 889-4097 or lafco@placer.ca.gov.

PLACER COUNTY

LOCAL AGENCY FORMATION COMMISSION

Placer County Independent Special District Selection Committee
Nomination Form
Alternate Voting Member

Please use this form to nominate a director on a Placer County Independent Special District board to run for the upcoming vacant alternate voting member seat on the LAFCO Commission.

Nominee's Name	Position of Nominee	Originating District

Name of Nominating District: _____

Printed Name of Presiding Officer: _____

Signature of Presiding Officer: _____

(Signature Required)[1]

Minutes Attached (Optional): ☐ Yes ☐ No

Please email completed nomination forms to lafco@placer.ca.gov by **Thursday, February 22, 2024, at 4 PM**

[1] *The nominating district's presiding officer must sign this form unless the district's board has delegated authority to another person to nominate a director on behalf of the district. If this form is signed by such a delegee, please include the district's meeting minutes or minute order evidencing the delegation.*

110 Maple Street Auburn, CA 95603
(530) 889-4097
https://www.placer.ca.gov/lafco

PLACER COUNTY

LOCAL AGENCY FORMATION COMMISSION

Placer County Independent Special District Selection Committee Nomination Form

Regular Voting Member

Please use this form to nominate a director on a Placer County Independent Special District board to run for the upcoming vacant regular voting member seat on the LAFCO Commission.

Nominee's Name	Position of Nominee	Originating District

Name of Nominating District: _____

Printed Name of Presiding Officer: _____

Signature of Presiding Officer: _____

(Signature Required)[1]

Minutes Attached (Optional): ☐ Yes ☐ No

Please email completed nomination forms to lafco@placer.ca.gov by **Thursday, February 22, 2024, at 4 PM**

[1] *The nominating district's presiding officer must sign this form unless the district's board has delegated authority to another person to nominate a director on behalf of the district. If this form is signed by such a delegee, please include the district's meeting minutes or minute order evidencing the delegation.*

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Richard Pallante, General Manager
Item: VI-1
Subject: Department Reports

Background
Department reports for previous and current month(s).

Fiscal Impact
None.

Attachments

1. Operations Department Report.
2. Maintenance Department Report.
3. Technical Services Department Report.
4. Administrative Department Report.

Recommendation
No action required.

Review Tracking

Submitted By: _____
Richard Pallante
General Manager

TAHOE-TRUCKEE SANITATION AGENCY
OPERATIONS DEPARTMENT REPORT

Date: February 21, 2024

To: Board of Directors

From: Michael Peak, Operation Department Manager

Subject: Operations Department Report

- **Compliance:**
  - All plant waste discharge requirements were met for the month.

- **Operations Update:**
  - The plant performed well throughout the month.
  - Chemical and Recarbonation clarifier launders were repaired and are back in service.
  - Submitted request for WDR update, received notice of receipt from Lahontan water board.
  - Provided support for installation of the new final effluent flow meter.

- **Work Orders:**
  - Completed this month: 0
  - Pending: 5

- **Plant Data:**

Influent Flow Description	MG
Monthly average daily (1)	3.35
Monthly maximum instantaneous (1)	6.07
Maximum 7- day average	4.46

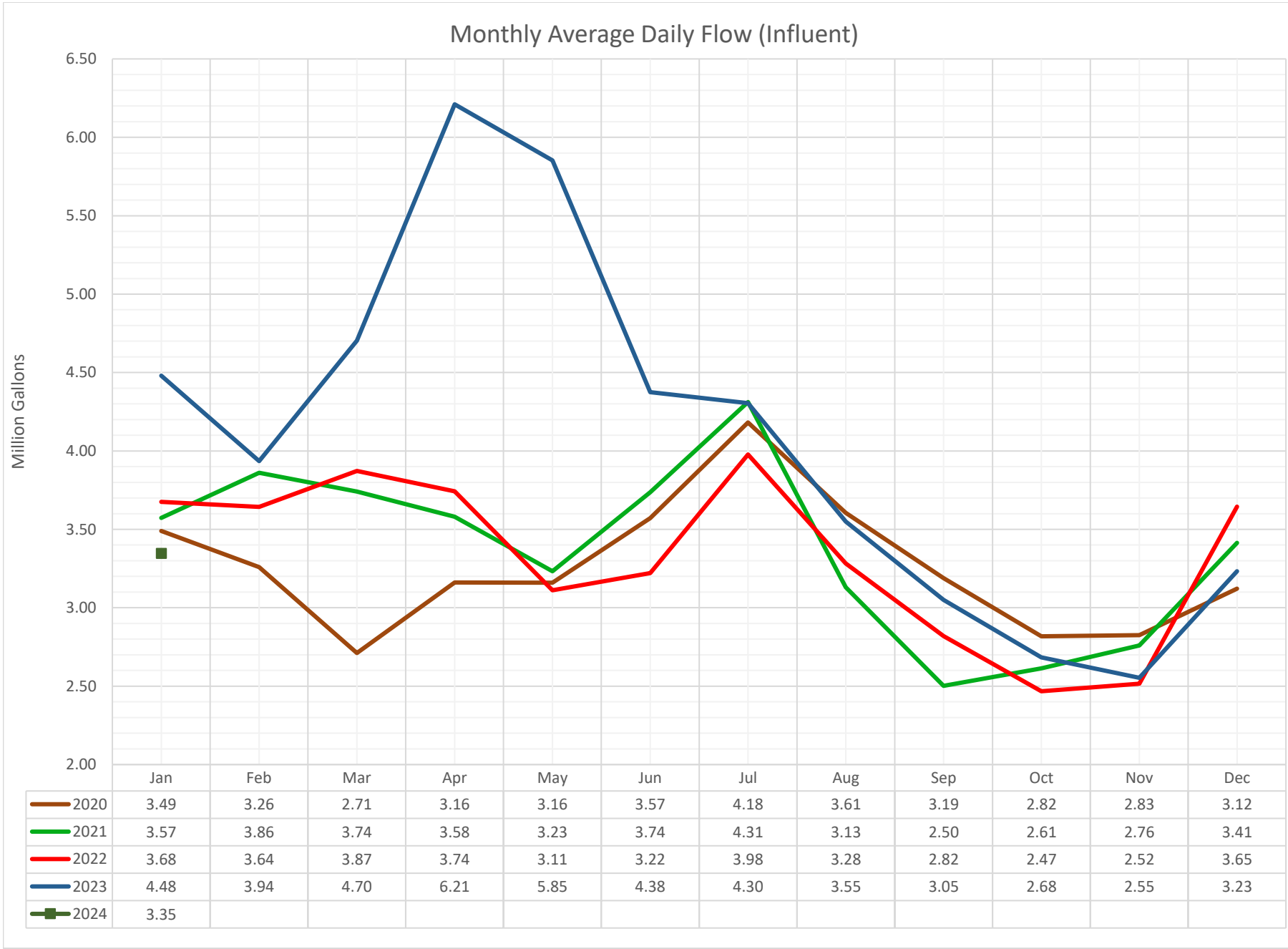
Effluent Limitation Description (2)	*WDR Monthly Average*		*WDR Daily Maximum*	
	Recorded	*Limit*	*Recorded*	*Limit*
Suspended Solids (mg/l)	*1.3*	*10.0*	*1.3*	*20.0*
Turbidity (NTU)	*NA*	*NA*	*2.1*	*10.0*
Total Phosphorus (mg/l)	*0.39*	*0.80*	*0.84*	*1.50*
Chemical Oxygen Demand (mg/l)	*36*	*45*	*49*	*60*

Notes: 1. Flows are depicted in the attached graph.
2. Effluent table data per WDR reportable frequency. The attached graphs depict all recorded data.

Review Tracking:

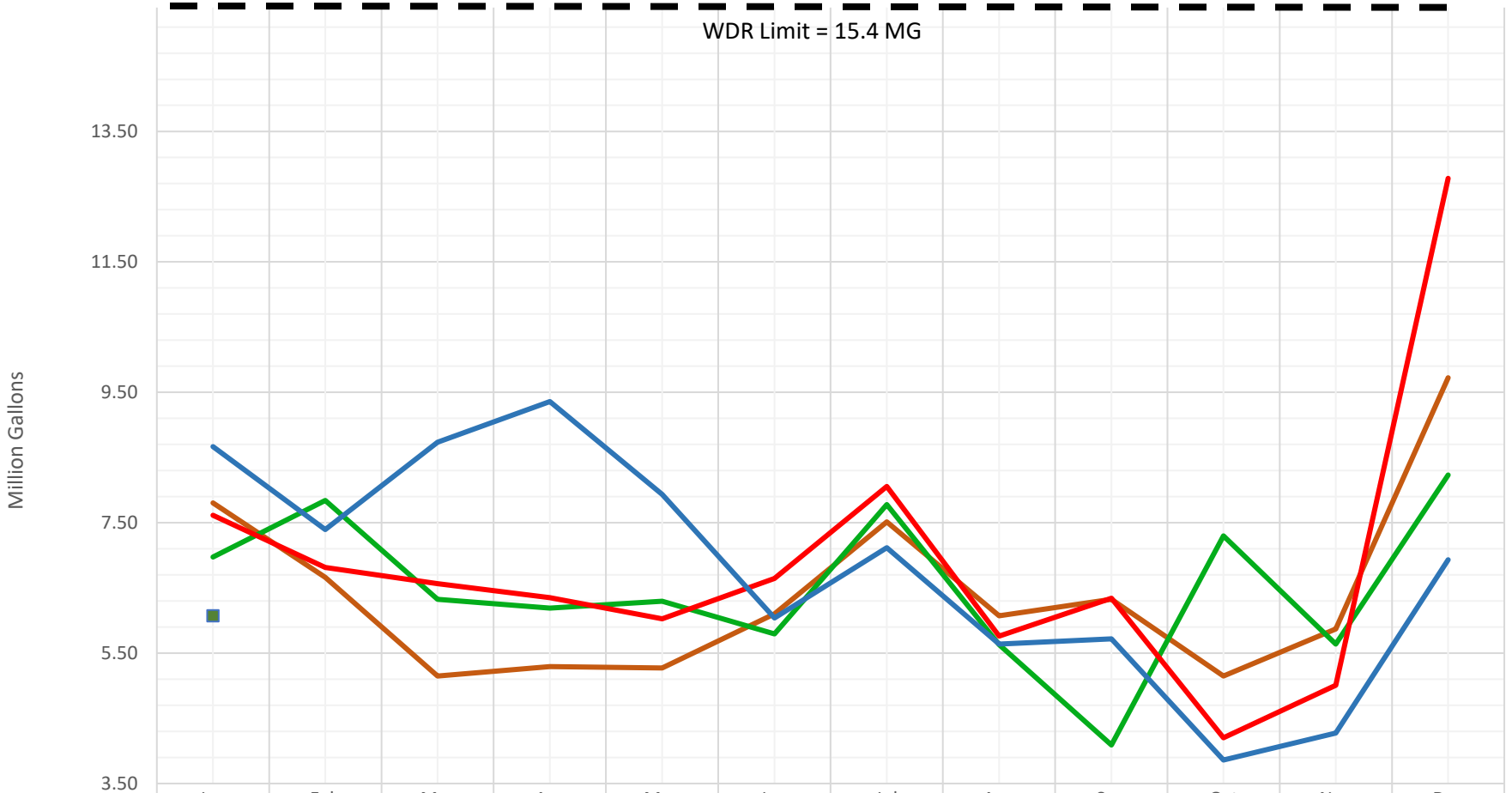
Submitted By: _____
Michael Peak
Operation Manager

Approved By: _____
Richard Pallante
General Manager

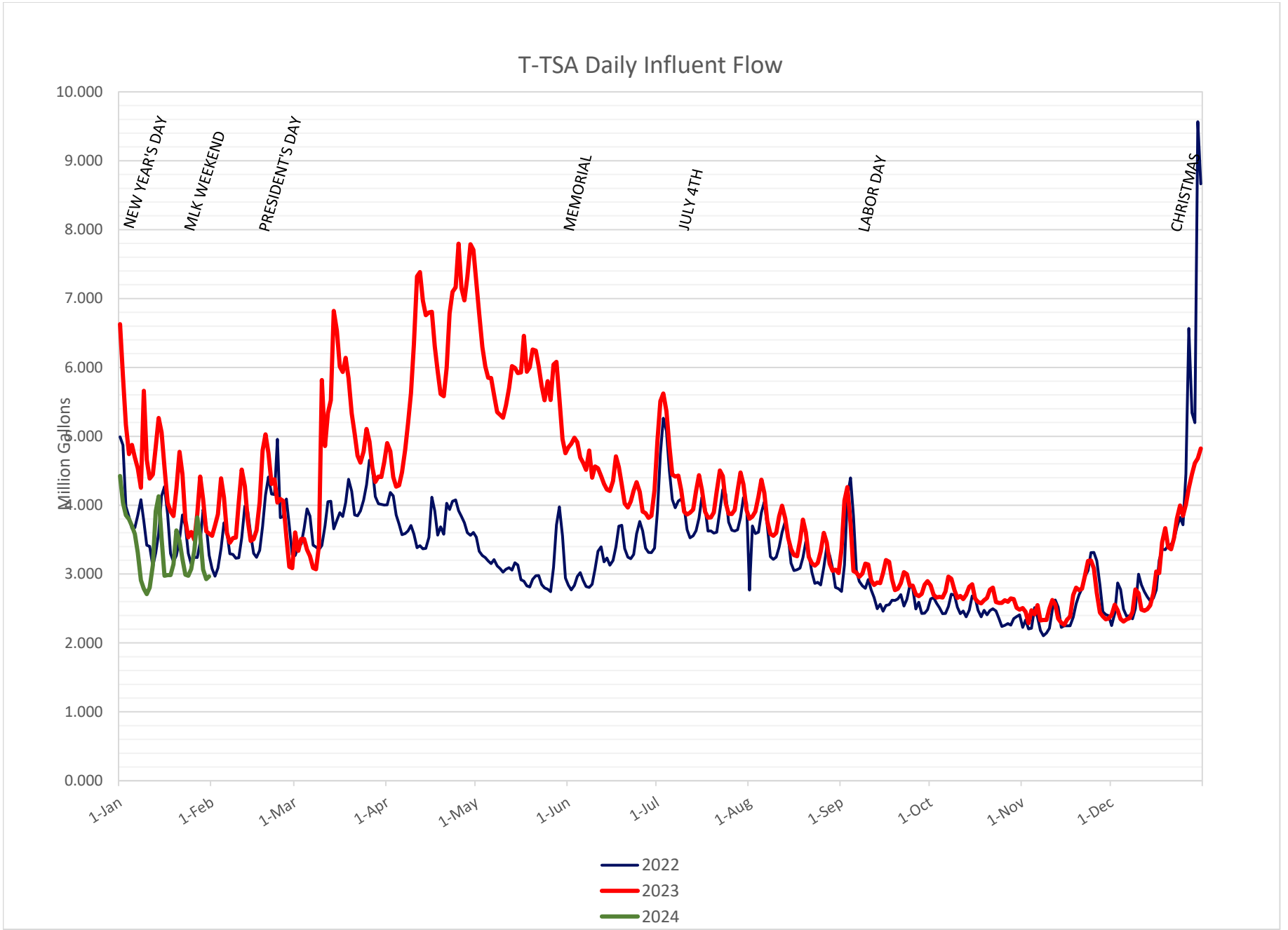


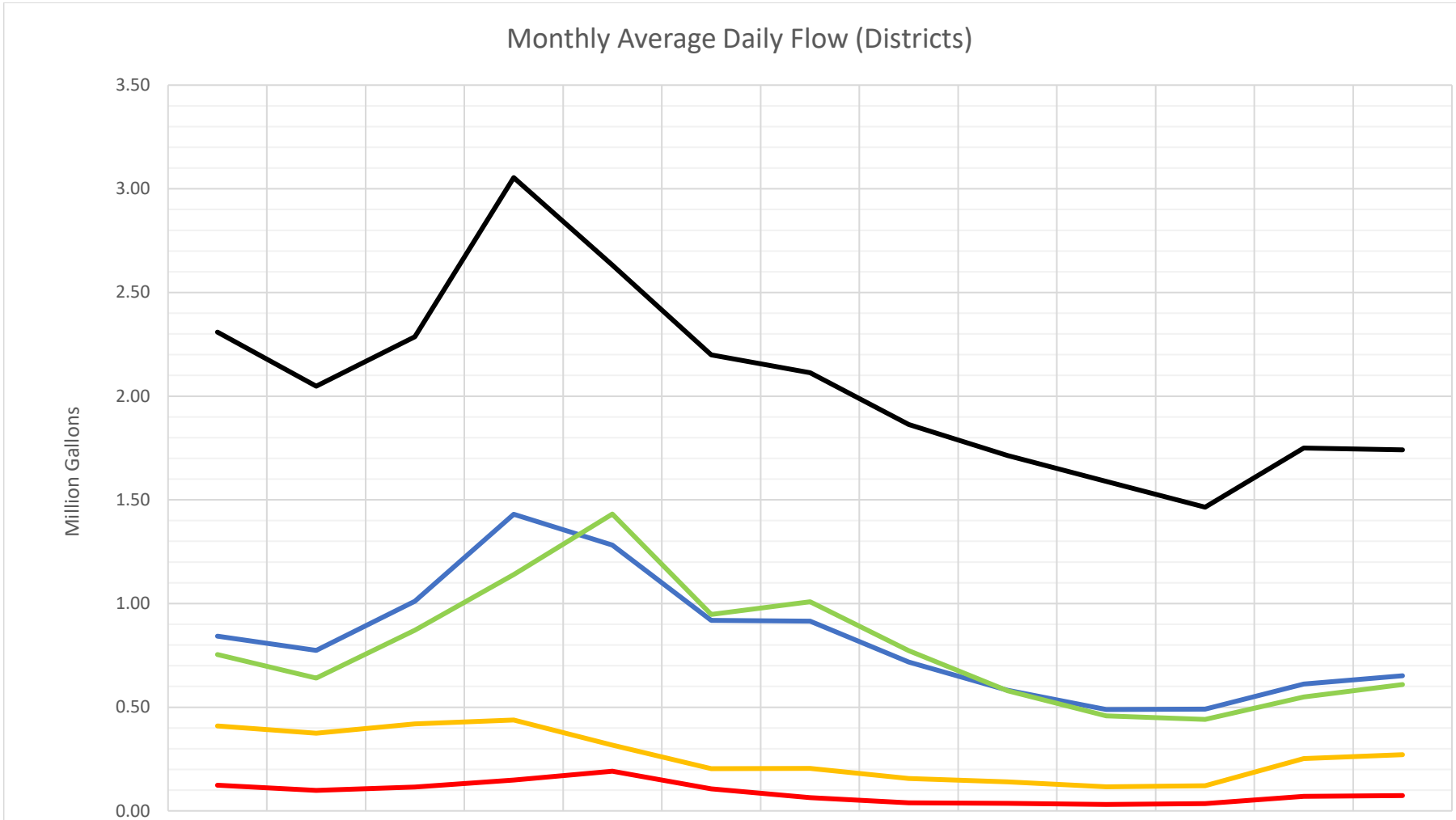
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	3.49	3.26	2.71	3.16	3.16	3.57	4.18	3.61	3.19	2.82	2.83	3.12
2021	3.57	3.86	3.74	3.58	3.23	3.74	4.31	3.13	2.50	2.61	2.76	3.41
2022	3.68	3.64	3.87	3.74	3.11	3.22	3.98	3.28	2.82	2.47	2.52	3.65
2023	4.48	3.94	4.70	6.21	5.85	4.38	4.30	3.55	3.05	2.68	2.55	3.23
2024	3.35											

Monthly Maximum Instantaneous Flow (Influent)



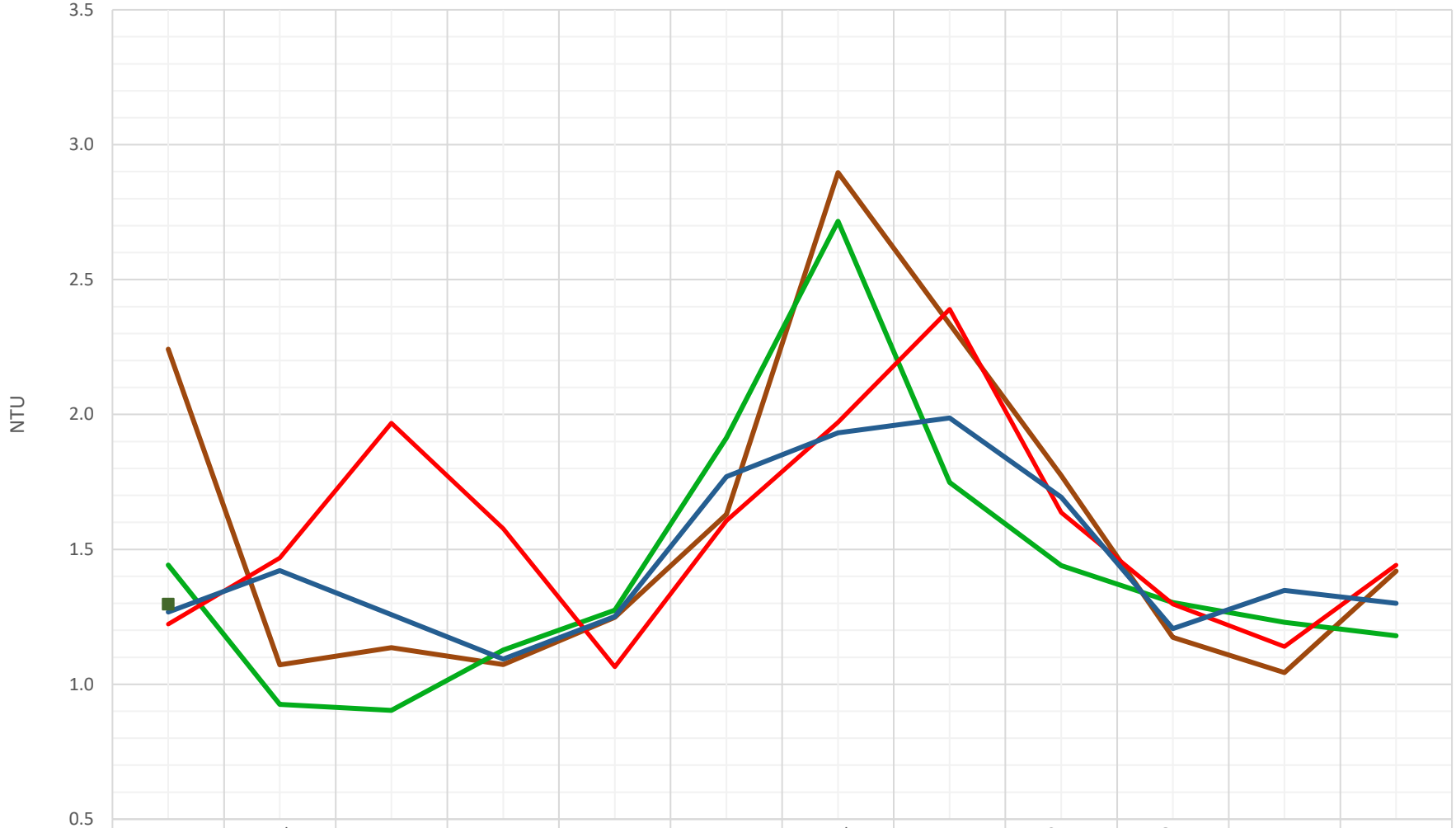
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	7.81	6.66	5.15	5.29	5.27	6.10	7.51	6.07	6.33	5.15	5.87	9.72
2021	6.98	7.84	6.33	6.19	6.29	5.79	7.78	5.63	4.09	7.30	5.64	8.23
2022	7.61	6.81	6.57	6.35	6.03	6.65	8.06	5.76	6.34	4.20	5.01	12.78
2023	8.67	7.40	8.73	9.36	7.93	6.04	7.12	5.64	5.72	3.86	4.27	6.93
2024	6.07											


T-TSA Daily Influent Flow
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
Million Gallons
NEW YEAR'S DAY
MLK WEEKEND
PRESIDENT'S DAY
MEMORIAL
JULY 4TH
LABOR DAY
CHRISTMAS
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
2022
2023
2024



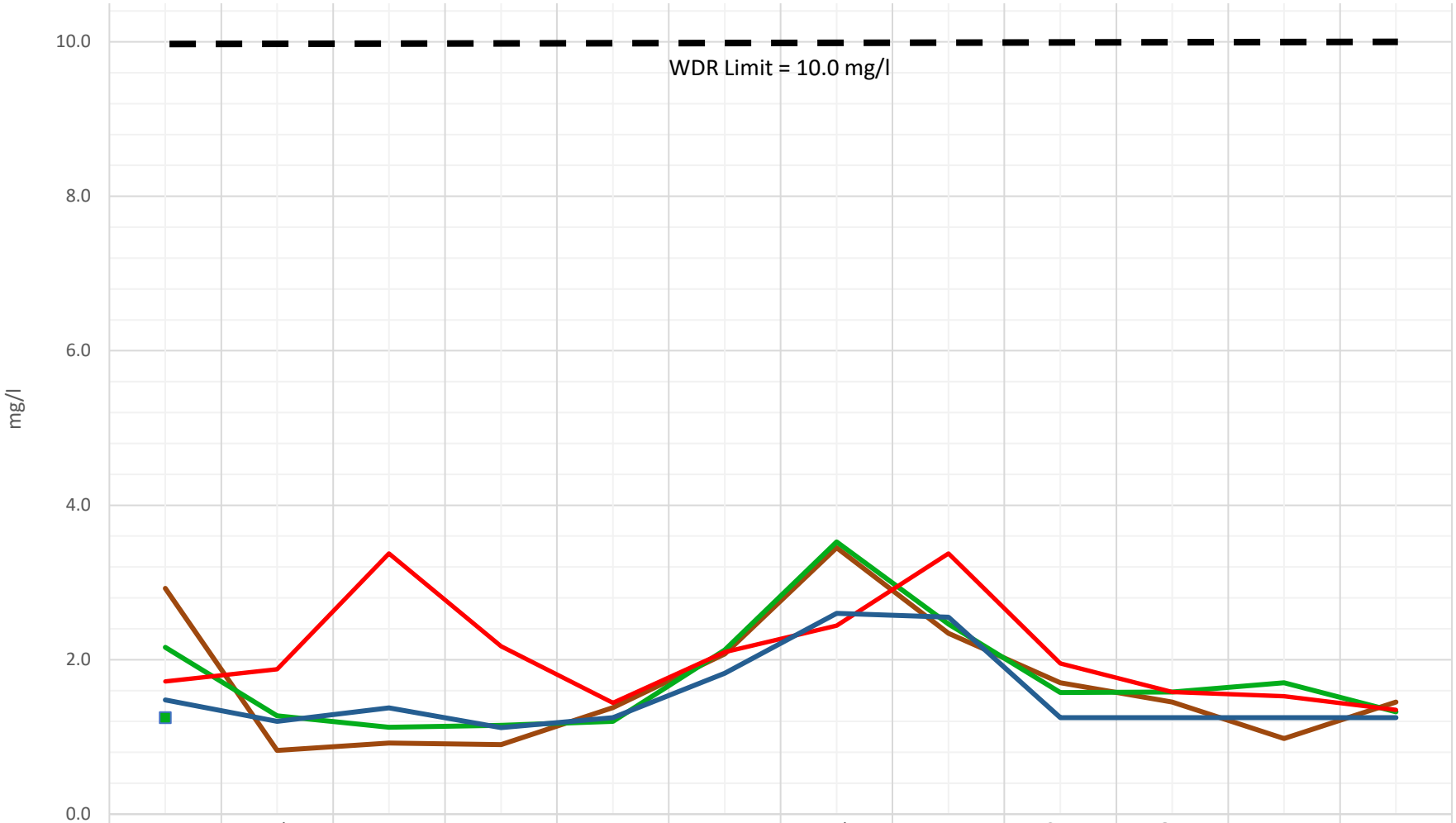
	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24
NTPUD	0.84	0.77	1.01	1.43	1.28	0.92	0.91	0.72	0.58	0.49	0.49	0.61	0.65
TCPUD	0.75	0.64	0.87	1.14	1.43	0.95	1.01	0.77	0.58	0.46	0.44	0.55	0.61
ASCWD	0.12	0.10	0.12	0.15	0.19	0.11	0.06	0.04	0.04	0.03	0.04	0.07	0.07
OVPSD	0.41	0.37	0.42	0.44	0.32	0.20	0.21	0.16	0.14	0.12	0.12	0.25	0.27
TSD	2.31	2.05	2.29	3.05	2.63	2.20	2.11	1.86	1.71	1.59	1.46	1.75	1.74

Monthly Average Daily Turbidity (Effluent)

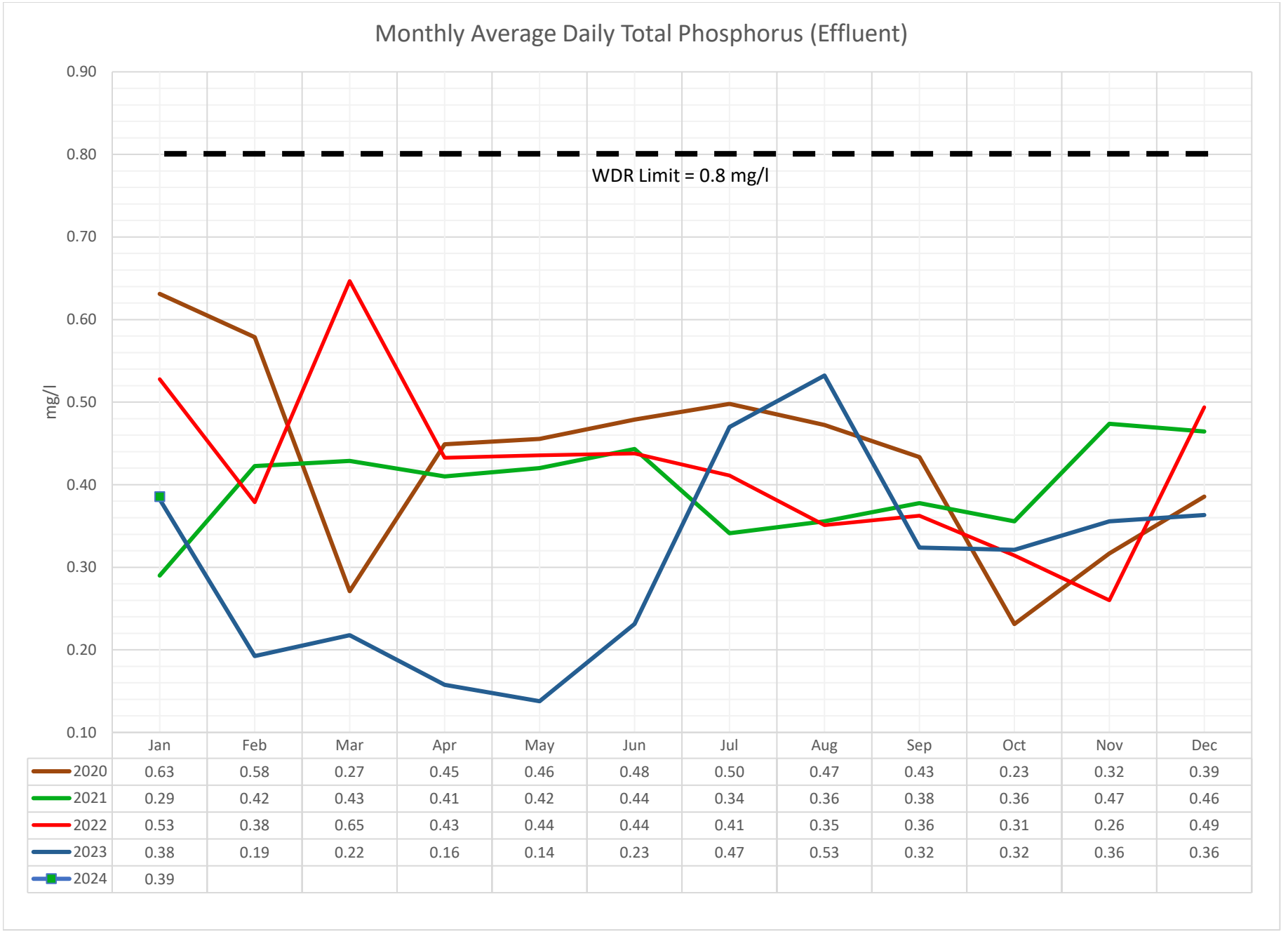


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	2.2	1.1	1.1	1.1	1.2	1.6	2.9	2.3	1.8	1.2	1.0	1.4
2021	1.4	0.9	0.9	1.1	1.3	1.9	2.7	1.7	1.4	1.3	1.2	1.2
2022	1.2	1.5	2.0	1.6	1.1	1.6	2.0	2.4	1.6	1.3	1.1	1.4
2023	1.3	1.4	1.3	1.1	1.3	1.8	1.9	2.0	1.7	1.2	1.3	1.3
2024	1.3											

Monthly Average Daily Suspended Solids (Effluent)

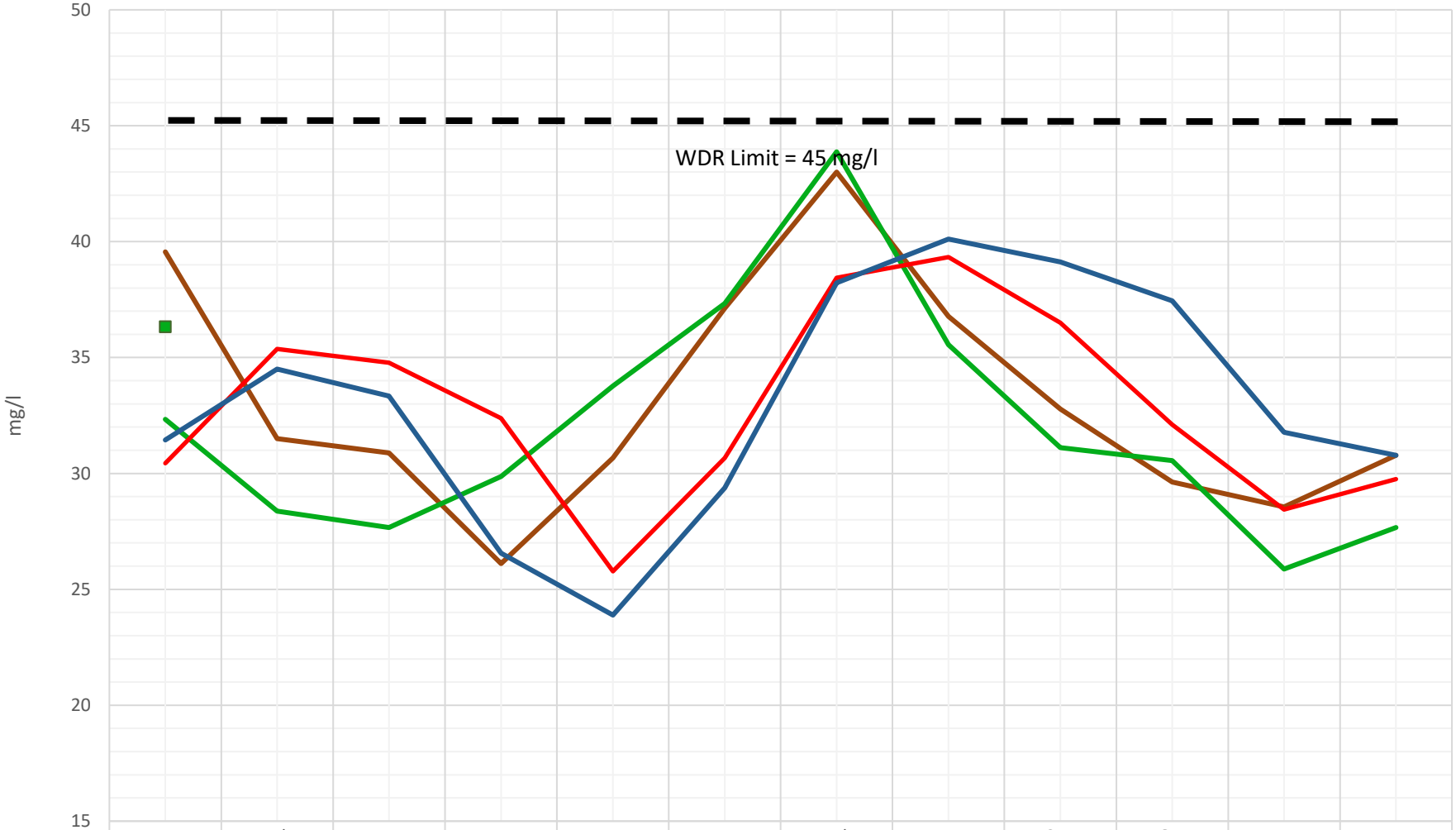


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	2.9	0.8	0.9	0.9	1.4	2.1	3.5	2.3	1.7	1.5	1.0	1.5
2021	2.2	1.3	1.1	1.2	1.2	2.1	3.5	2.5	1.6	1.6	1.7	1.3
2022	1.7	1.9	3.4	2.2	1.4	2.1	2.4	3.4	2.0	1.6	1.5	1.4
2023	1.5	1.2	1.4	1.1	1.3	1.8	2.6	2.6	1.3	1.3	1.3	1.3
2024	1.3											

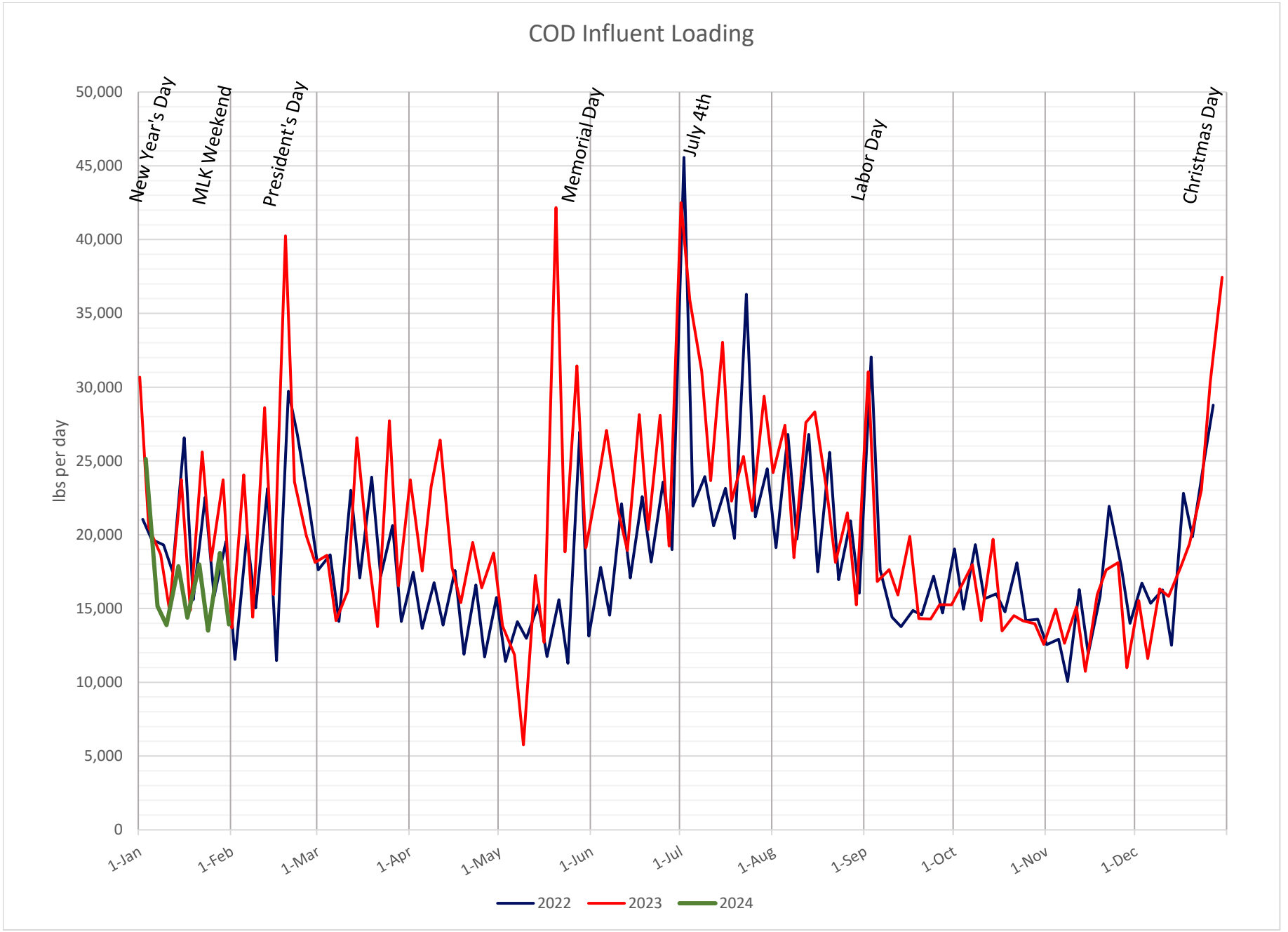


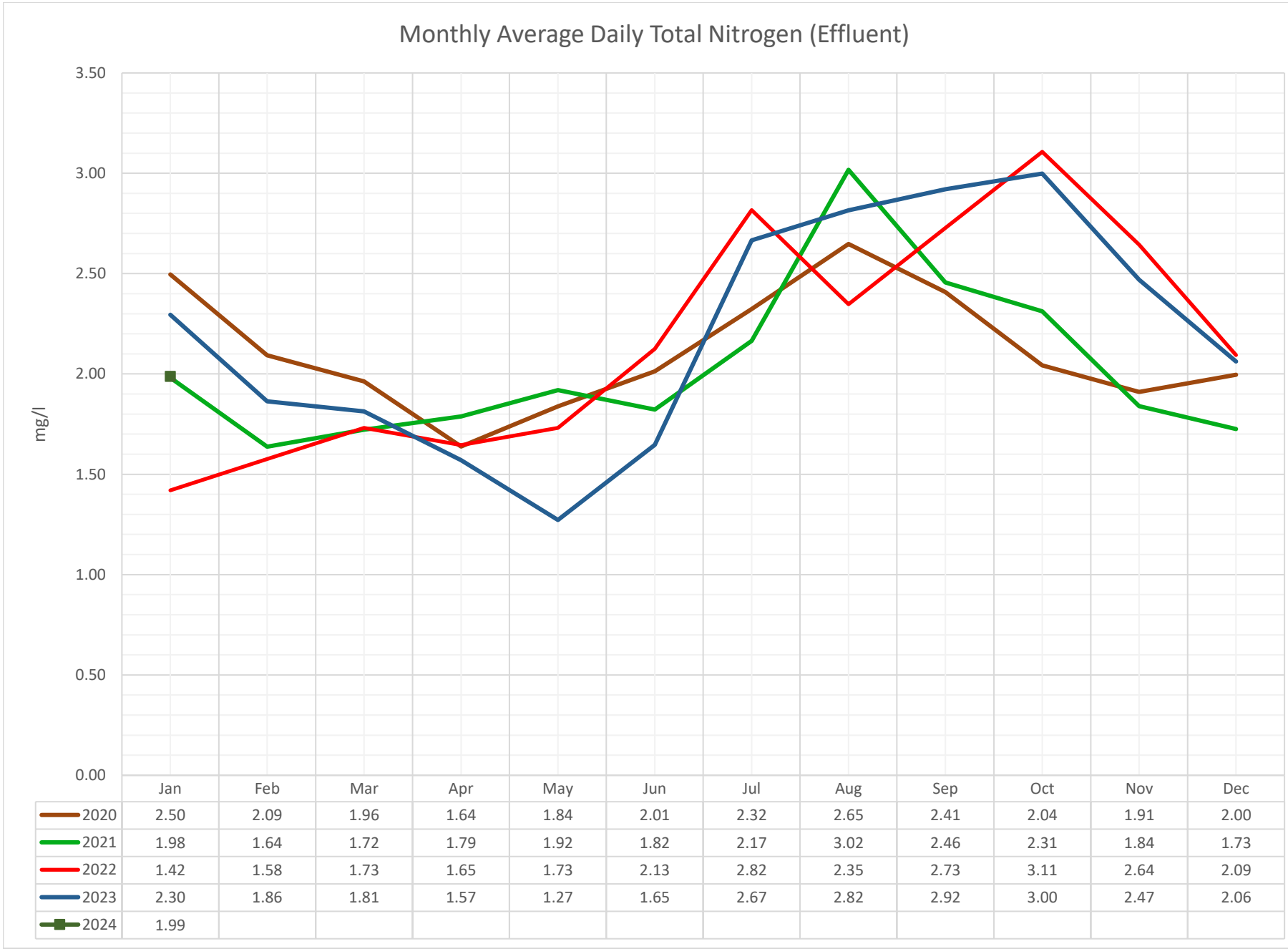
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	0.63	0.58	0.27	0.45	0.46	0.48	0.50	0.47	0.43	0.23	0.32	0.39
2021	0.29	0.42	0.43	0.41	0.42	0.44	0.34	0.36	0.38	0.36	0.47	0.46
2022	0.53	0.38	0.65	0.43	0.44	0.44	0.41	0.35	0.36	0.31	0.26	0.49
2023	0.38	0.19	0.22	0.16	0.14	0.23	0.47	0.53	0.32	0.32	0.36	0.36
2024	0.39											

Monthly Average Daily Chemical Oxygen Demand (Effluent)

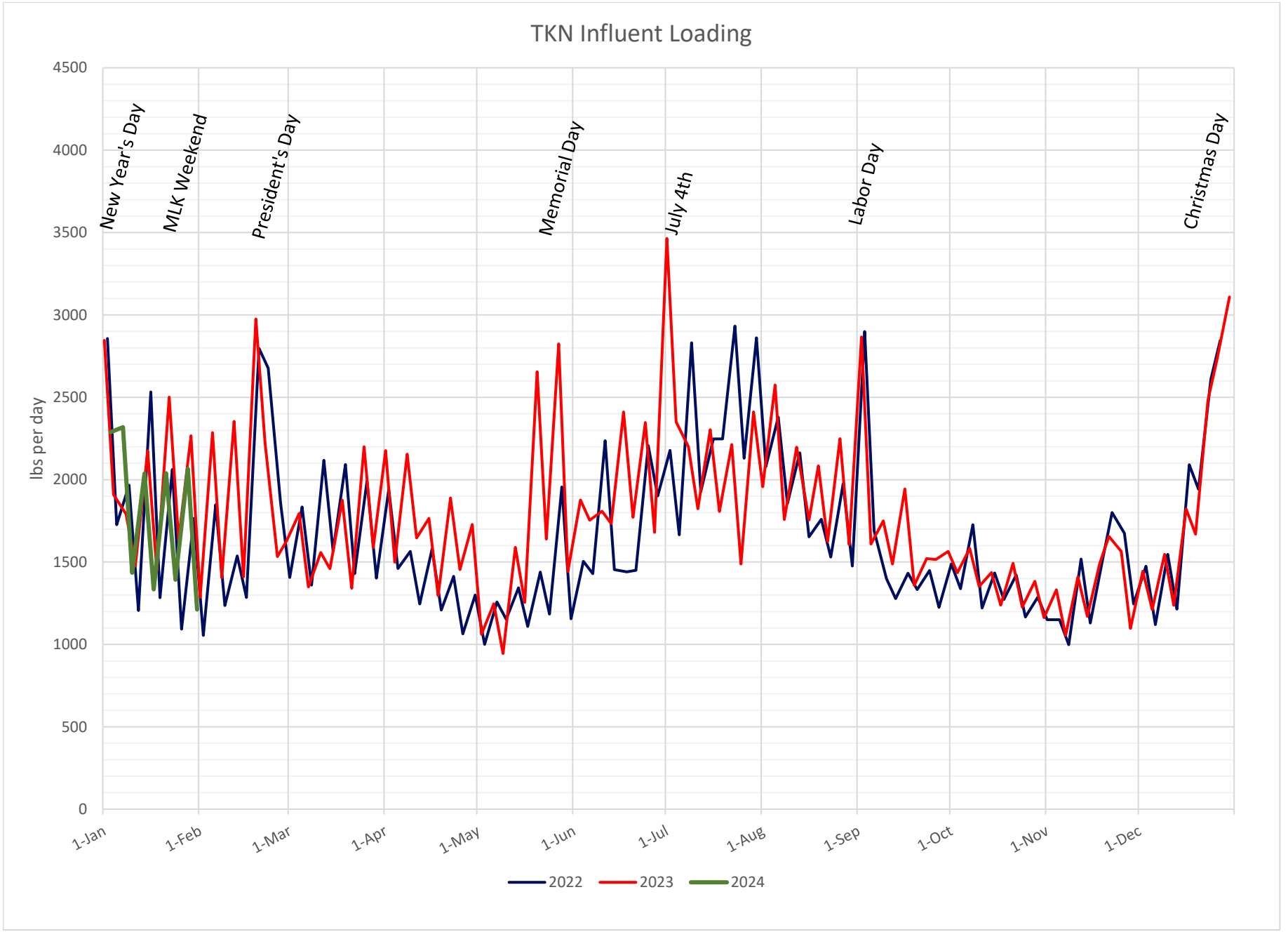


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	40	32	31	26	31	37	43	37	33	30	29	31
2021	32	28	28	30	34	37	44	36	31	31	26	28
2022	30	35	35	32	26	31	38	39	37	32	28	30
2023	31	35	33	27	24	29	38	40	39	37	32	31
2024	36											

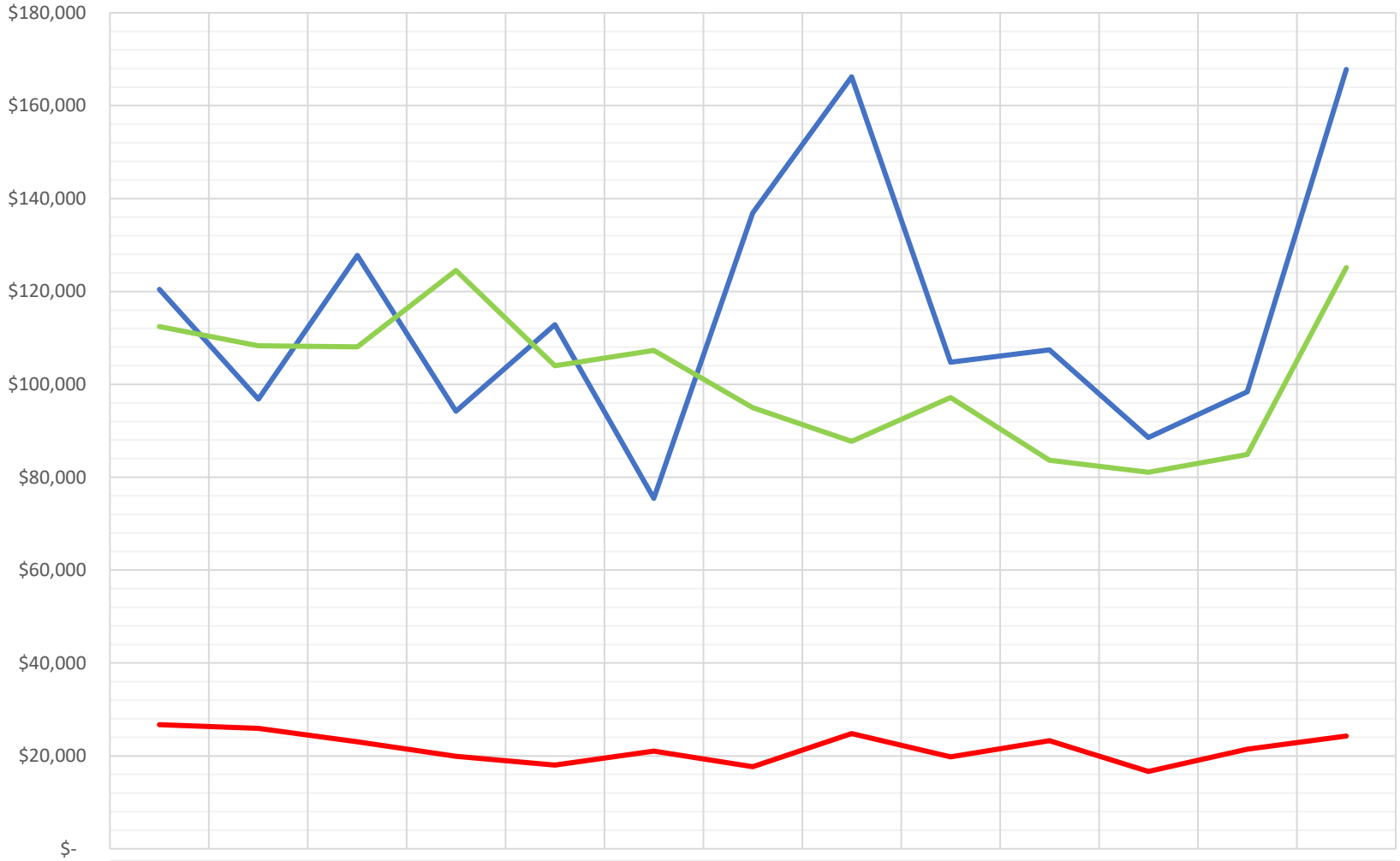

COD Influent Loading
lbs per day
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
New Year's Day
MLK Weekend
President's Day
Memorial Day
July 4th
Labor Day
Christmas Day
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
2022
2023
2024



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	2.50	2.09	1.96	1.64	1.84	2.01	2.32	2.65	2.41	2.04	1.91	2.00
2021	1.98	1.64	1.72	1.79	1.92	1.82	2.17	3.02	2.46	2.31	1.84	1.73
2022	1.42	1.58	1.73	1.65	1.73	2.13	2.82	2.35	2.73	3.11	2.64	2.09
2023	2.30	1.86	1.81	1.57	1.27	1.65	2.67	2.82	2.92	3.00	2.47	2.06
2024	1.99											


TKN Influent Loading
lbs per day
4500
4000
3500
3000
2500
2000
1500
1000
500
0
New Year's Day
MLK Weekend
President's Day
Memorial Day
July 4th
Labor Day
Christmas Day
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
2022
2023
2024

Chemical, Power and Sludge Disposal Costs



	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24
Chemicals	$120,444	$96,819	$127,789	$94,188	$112,871	$75,453	$136,937	$166,243	$104,787	$107,401	$88,547	$98,377	$167,809
Power	$112,421	$108,330	$108,071	$124,505	$104,022	$107,321	$94,973	$87,706	$97,138	$83,675	$81,072	$84,894	$125,145
Sludge Disposal	$26,725	$25,917	$23,068	$19,905	$18,018	$21,060	$17,679	$24,789	$19,774	$23,281	$16,654	$21,460	$24,278

TAHOE-TRUCKEE SANITATION AGENCY
MAINTENANCE DEPARTMENT REPORT

Date: February 21, 2024

To: Board of Directors

From: Paul Shouse, Maintenance Manager

Subject: Maintenance Report

- **Project support:** During the months of January, Maintenance staff provided support for the following projects:
  - Sodium Hypochlorite Project.
  - SCADA/IT Master Plan – Phase 1.
  - Warehouse Inventory Project.
  - Lucity Work Order and PM Implementation.

- **Plant Maintenance activities:** Maintenance staff performed tasks on the following items:
  - Completed Final Effluent Flow Meter installation.
  - Completed installation of upgraded Dewatering Loadout Heater.
  - Converted Blower #5 from Roots to Tuthill.
  - Removed Moyno Filter Press Feed Pump to prep for Seepex installation.
  - Continuing vehicle repairs due to rodent damage.
  - Removed Primary Clarifier #3 & #4 flowmeters for cleaning.
  - Added project updates and photos to TTSA website.
  - Performed warehouse checkout training for Operations department.
  - Repaired Plant Loop Effluent flow meter.
  - Strategic Planning Meeting.

- **Work Orders**
  - Completed: Mechanical-58, Fleet-27, Electrical & Instrumentation-33, IT-15.
  - Pending: Mechanical-99, Fleet-48, Electrical & Instrumentation-50, IT-95.

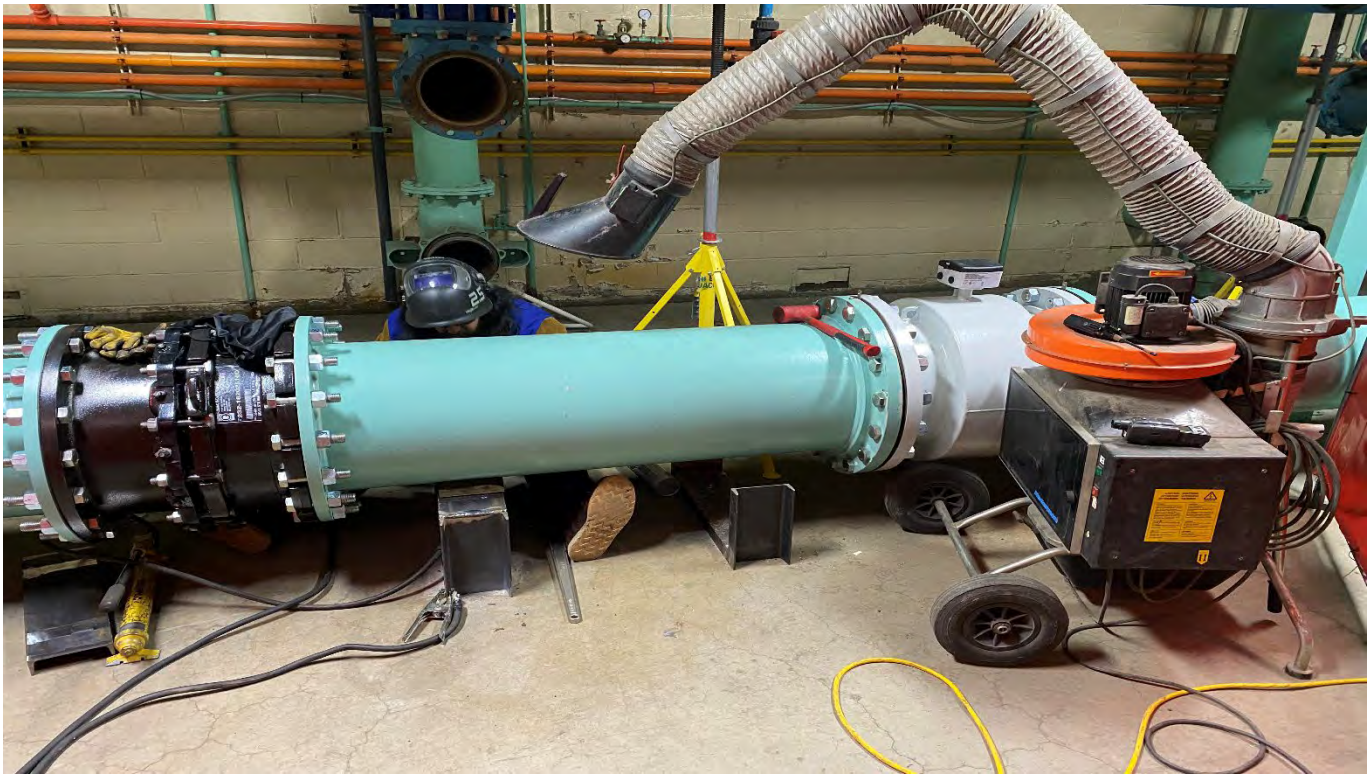
Review Tracking:

Submitted By: _____
Paul Shouse
Maintenance Manager

Approved By: _____
Richard Pallante
General Manager

Final Effluent Flow Meter Installation

Final Effluent Flow Meter Installation



Final Effluent Flow Meter Installation

Blower #5 Replacement

Final Effluent Flow Meter Startup

Sodium Hypochlorite Electrical Installation

Moyno Filter Press Feed Pump Removal

The Winning Strategic Plan Workshop Bridge

TAHOE-TRUCKEE SANITATION AGENCY
TECHNICAL SERVICES DEPARTMENT REPORT

Date: February 21, 2024

To: Board of Directors

From: Jason Hays

Subject: Technical Services Department Report

Engineering

- **Projects:** In the month of December, Engineering staff continued working on the following projects:
  - Sodium Hypochlorite Foundation Project
    - Final concrete pour in place and curing
    - Internal staff work underway
  - Emergency Launder Repair Project
    - Project completed
  - Digestion Improvements Project
    - Active RFP
  - TRI Alpine Meadows to Olympic Valley Rehabilitation Project
    - Reviewing Proposals
  - Front Parking & Landscaping Improvements Project
    - In Design

Laboratory

- **Laboratory Activities:**
  - Started collecting samples for CDPH COVID wastewater monitoring
    - Staff to provide brief demonstration
    - Several datapoints available on CDPH website
  - Ongoing recruitment for Lab Director
- **Laboratory Corrective Actions:**
  - Completed this month: 0
  - Pending: 0

Public Outreach

- **Plant Tours:**
  - Tahoe Expedition Academy – 15, 5th graders
- **Public Outreach Team**
  - Group of TTSA employees from all departments tasked with planning and implementing public outreach.
  - Several events planned for attendance this year.

Review Tracking:

Submitted By: Jason Hays
Jason Hays
Technical Services Manager

Approved By:
Richard Pallante
General Manager

TAHOE-TRUCKEE SANITATION AGENCY
ADMINISTRATIVE DEPARTMENT REPORT

Date: February 21, 2024

To: Board of Directors

From: Michelle Mackey, Accounting Supervisor

Subject: Administrative Report

- Finance
  - Completed monthly A/P, A/R, payroll, general ledger processes, and bank reconciliation.
  - Continued work with U.S. Bank to set up P-cards.
  - Attended Finance Committee Meeting on January 10th, 2024
  - Prepare for Final Audit
  - Welcomed Lizz Cook as our Consultant

- Billing/Customer Service.
  - General assistance with customer accounts, utility demands, adjustments, and plan review.
  - Activated new account permits and prepared letters, reports and invoices.
  - Continued work on Connection Fee Study.
  - Two (2) commercial property inspections.
  - Direct Billing for January 2024.

- Purchasing/Administration
  - General purchasing responsibilities for monthly requisitions, purchase orders and ordering.
  - General responsibilities to customer service, front gate and front desk.

- General Administration
  - Performed various administrative duties to assist Interim General Manager and Board of Directors.
  - Final audit planning and preparation.

Review Tracking

Submitted By: Michelle Mackey
Michelle Mackey
Accounting Supervisor

Approved By: _____
Richard Pallante
General Manager

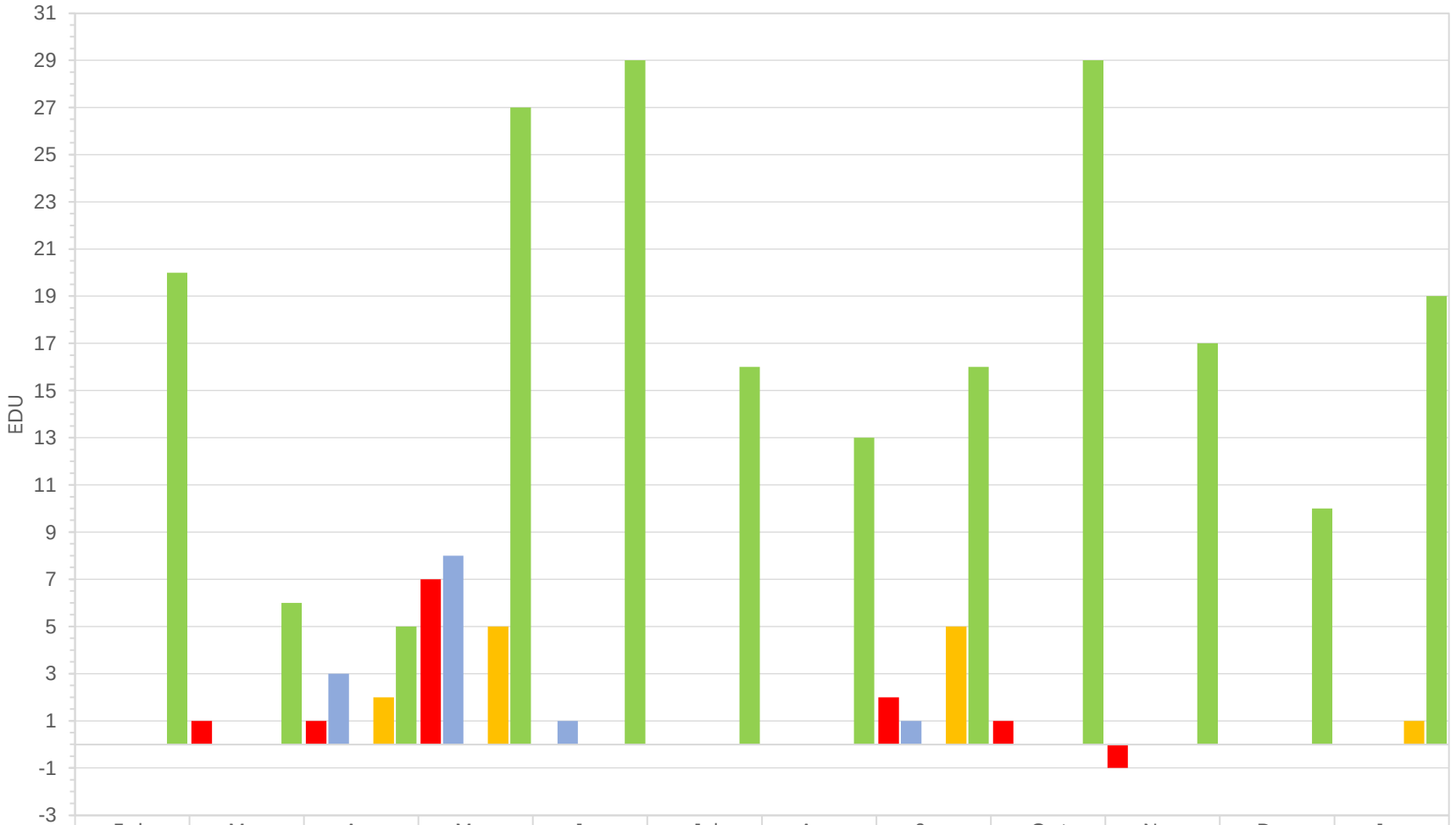
CONNECTION FEES - JANUARY 2024

Connection Fee Type	MTD Count (#)	MTD Total Ft²	MTD Total $	YTD Count (#)	YTD Total Ft²	YTD Total $
Residential	0	0	$ -	0	0	$ -
Residential Ft² Additions	0	0	$ -	0	0	$ -
Residential Ft² Additions - Exempt	0	0	N/A	0	0	N/A
Accessory Dwelling Unit (ADU)	0	0	$ -	0	0	$ -
Accessory Dwelling Unit (ADU) - Exempt	0	0	N/A	0	0	N/A
Commercial	0	N/A	$ -	0	N/A	$ -
Industrial	0	N/A	$ -	0	N/A	$ -
Grand Total	**0**	**0**	**$ -**	**0**	**0**	**$ -**

INSPECTIONS - JANUARY 2024

Inspection Type	MTD Count #	MTD Total	YTD Count #	YTD Total
Commercial	2	2	2	2
Residential (Drive-by of Suspended Accounts)	0		0	

Residential EDU Summary

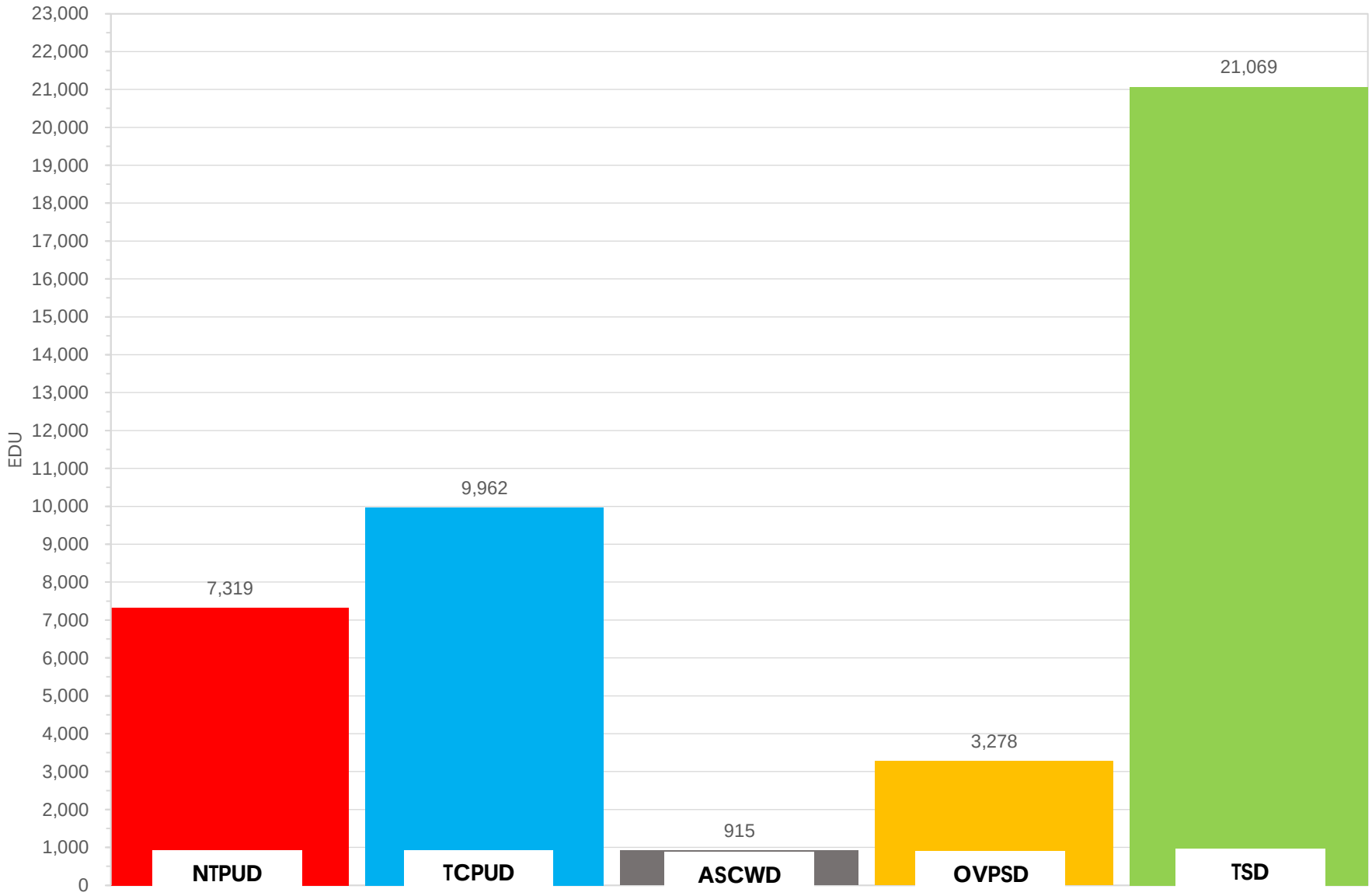


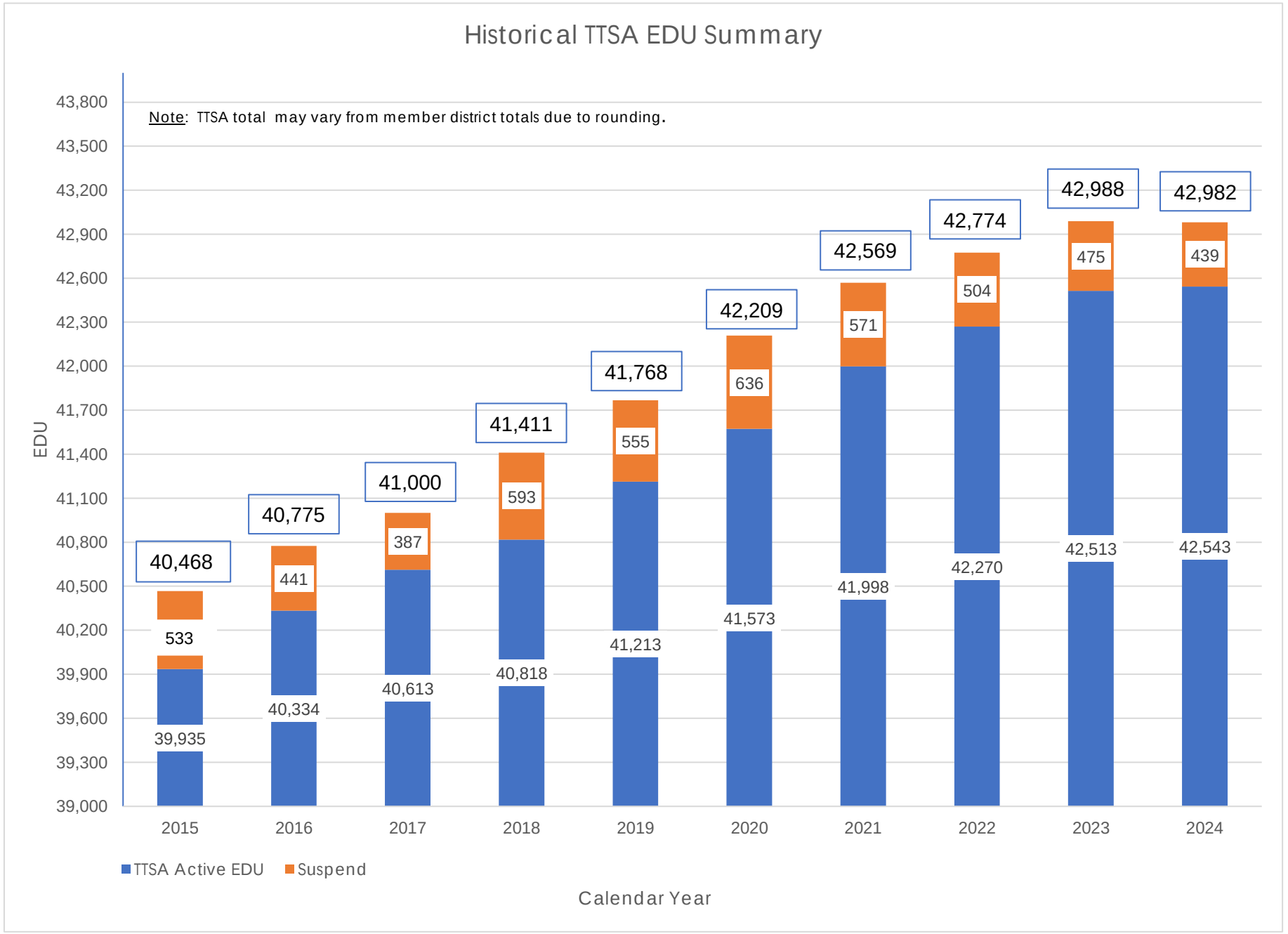
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
NTPUD	0	1	1	7	0	0	0	2	1	(1)	0	0
TCPUD	0	0	3	8	1	0	0	1	0	0	0	0
ASCWD	0	0	0	0	0	0	0	0	0	0	0	0
OVSPD	0	0	2	5	0	0	0	5	0	0	0	1
TSD	20	6	5	27	29	16	13	16	29	17	10	19

Other EDU Summary

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
NTPUD	0.0	0.2	0.0	0.0	1.7	0.0	3.0	0.0	0.0	0.0	0.0	0.0
TCPUD	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
ASCWD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVSPD	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
TSD	0.5	0.0	0.0	0.0	2.3	3.7	(11.6)	5.2	0.0	0.0	0.0	9.5

Current EDU Summary
By Member District




Historical TTSA EDU Summary
Note: TTSA total may vary from member district totals due to rounding.
EDU
43,800
43,500
43,200
42,900
42,600
42,300
42,000
41,700
41,400
41,100
40,800
40,500
40,200
39,900
39,600
39,300
39,000
40,468
533
39,935
40,775
441
40,334
41,000
387
40,613
41,411
593
40,818
41,768
555
41,213
42,209
636
41,573
42,569
571
41,998
42,774
504
42,270
42,988
475
42,513
42,982
439
42,543
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
TTSA Active EDU
Suspend
Calendar Year

TAHOE-TRUCKEE SANITATION AGENCY
GENERAL MANAGER REPORT

Date: February 21, 2024

To: Board of Directors

From: Richard Pallante, General Manager

Item: VI-2

Subject: General Manager Report.

♦ Highlights From Previous Month

- HR Consultant scheduling kickoff of leadership development for Agency Managers, Supervisors, and Interested Staff.
- Consultant began recruitment for a Finance and Administration Manager.
- Financial Consultant, Lizz Cook, arrived in January to become acquainted with Administrative staff to oversee and assist in a Management Capacity.
- Staff discussing recycle flow pilot project to lower Methanol use and evaluate loading reduction to BNR.
- Staff working on cash flow analysis to finalize staff recommendation for connection fees.
- Municipal Advisor, Steven Gortler joined us in a meeting with S&P to update Bond Rating Renewal.
- Management and staff continue in depth discussion on Master Plan projects and direction of implementation.
- Continued Land exchange with Tahoe Truckee Airport District, identified path forward to address parcel leases.
- Attended the Truckee River Revitalization Steering Committee Meeting.
- Staff held Community Involvement Team Meeting.
- HR scheduled and held Interviews for Operators and E&I Technicians.
- Second Strategic Planning Session was held January 30th.
- Staff celebrated all January birthdays with cake.
- All staff meeting to update on Class & Comp, and new Mission, Vision, Guiding Principles.

♦ Upcoming Items Of Interest

- Budget kickoff

Review Tracking

Submitted By: _____

Richard Pallante
General Manager

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024

To: Board of Directors

From: Richard Pallante, General Manager

Item: VII

Subject: Board of Director Comment

Background

Opportunity for directors to ask questions for clarification, make brief announcements and reports, provide information to staff, request staff to report back on a matter, or direct staff to place a matter on a subsequent agenda.

TAHOE-TRUCKEE SANITATION AGENCY
MEMORANDUM

Date: February 21, 2024
To: Board of Directors
From: Richard Pallante, General Manager
Item: VIII
Subject: Adjournment