

SECTION 01010

LOCATION AND SUMMARY OF WORK

PART 1 GENERAL

1.1 DESCRIPTION

This section contains a description of the Work location and a summary of the Scope of Work.

1.2 PROJECT LOCATION

Work associated with this Project will take place at the City of Manteca Wastewater Quality Control Facility located at 2450 West Yosemite Avenue, Manteca, California.

1.3 ACCESS TO THE SITE

The Manteca Wastewater Quality Control Facility is a secure facility. All visitors must sign in at the Facility Administration office. Construction vehicles must park in designated areas as shown on the Plans. Due to prior incidences of theft at the Facility, construction personnel shall stay within the immediate vicinity of their work zones and not wander around the facility.

1.4 SCOPE OF WORK

The Contractor is required to provide a functionally complete project and furnish all labor, equipment, and materials necessary to construct the Project complete and ready for operation. The work generally involves the following Features of Work:

A. Maintain Operational Capability of Wastewater Quality Control Facility.

All wastewater flow from the City of Manteca enters an Influent Room which is part of the Influent Pump Station (IPS). All flow enters the Influent Room via one of two 60 inch pipelines referred to as the north and south trunk sewers.

Wastewater from the Influent Room flows into the portion of the IPS referred to as the Wet Well. The Wet Well contains two bar screens, a small reservoir, and pump intakes.

All wastewater entering the Wet Well is screened to 3/8 inch. The City's screening system includes two bar screens, conveyors, a grinder/compactor, and a trash bin. The City disposes of all solids removed by their solids removal system.

The pump intakes in the Wet Well are connected to pumps located in the Dry Well. The Dry Well is a separate room in the IPS. The Dry Well has four pumps that distribute flow to two treatment systems referred to as the north and south plant.

The north plant (located on the northern portion of the plant property) is the original wastewater treatment plant built in the 1970s. The south plant (located on the southern

portion of the plant property) is a parallel treatment system built in the 2000s. Both the north and south plants have grit tanks, settling basins, aeration basins, and secondary clarifiers. Both the north and south plants send water to a UV tertiary treatment system and solids to two digesters and a solids handling building.

Any and all work performed by the Contractor shall not interfere or impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat raw wastewater to the water quality limitations specified in the discharge permit. The status of the treatment facility shall be defined as “operational” when the facility is capable of treating the entire quantity of wastewater received to the water quality limits specified in the discharge permit. The Contractor shall cooperate fully with the Construction Manager and the City in scheduling work activities, arranging for and installing temporary utilities, deliveries, testing and acceptance procedures, and facility start-up to avoid disruptions to facility operations.

B. Mobilization.

Mobilization shall consist of the preparatory work and operations, including but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all contractor offices and other facilities necessary for work on the project; for all temporary utility services; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various Features of Work on the project site.

C. Bypass Pumping.

Bypass Pumping shall consist of all work necessary to bypass pump wastewater from the north and south trunk sewers to the IPS Wet Well thus bypassing the Influent Room. This work may also include bypass pumping south plant grit and recycle water into the south plant grit tanks. This work includes installing and removing bulkheads in the north and south trunk sewers and removing the buildup of solids in the pipelines.

D. Influent Pump Station Rehabilitation.

Influent Pump Station Rehabilitation shall consist of all work necessary for the repair of deteriorated concrete; lining of concrete surfaces; procurement and installation of an RFP hatch; and procurement and installation of an FRP grating system. This Feature of Work also includes removal and reinstallation of two 60” slide gates in the Influent Room, control of atmospheric conditions in the IPS, confined space entry, disposal of materials, and testing.

E. Modifications to the Foul Air System.

Modifications of the Foul Air System shall consist of all work necessary to extend, modify, and construct foul air ducting in the Influent Room, installation of a grease filter, installation of a new foul air fan connected to the Influent Pump Station dry well foul air duct, **installation of a new foul air fan connected to the Solids Handling Building foul air duct**, installation of an intake hood and replace exhaust registers. This Feature of Work

includes all excavation, backfill, compaction, testing, replacement of sidewalks, confined space entry, and air ventilation necessary to complete the work.

F. Demobilization and Contract Closeout.

Demobilization and Contract Closeout shall include, upon substantial completion of the work, the removal of all signs, construction trailers, storage trailers and bins, temporary fencing, garbage, construction debris, equipment, utility services not to remain, portable toilets, and all excess construction materials. Work shall also include the repair, restoration and/or replacement of facilities damaged by the Contractor and/or subcontractors, including driveways, parking areas, streets, pipelines, and landscaping, and the submittal of Record Drawings. Work area shall be policed clean and restored to original condition or better.

END OF SECTION

SECTION 01015

CONTRACT TIME AND WORK SEQUENCING

PART 1 GENERAL

1.1 COMPLETION DATE

- A. Time for Substantial Completion: 90 days
- B. Time for Final Completion: 105 days

1.2 WORK SEQUENCING

- A. General: The intent of work sequencing is to minimize bypass pumping. Work shall proceed in the order described below.
- B. Rehabilitation Phase 1: Contractor shall repair concrete and install PVC liner system in the Influent Room starting approximately two feet above the grating up to the ceiling. Bypass pumping should not be required for Phase 1.
- C. Rehabilitation Phase 2 (After Phase 1 is complete): Contractor shall repair concrete, install PVC liner system, and install new grating system. Bypass pumping will be required for Phase 2.
- D. Other Work: Repairing concrete, installing PVC liner system, installing hatch, and other miscellaneous work may be schedule during or after any of the phases as long as bypass pumping is restricted to Phase 2.

END OF SECTION

SECTION 01020

SCHEDULING AND SHUTDOWNS

PART 1 GENERAL

1.1 BACKGROUND

The City of Manteca Wastewater Quality Control Facility continuously receives and treats wastewater. The Contractor's work shall be planned and executed without interfering or interrupting City personnel, plant operations or treatment processes. Reliability of plant systems, operations, and utilities shall be maintained at all times. Access to facilities and shutdown of operating systems or processes will only be allowed when approved by the City, following a minimum of five (5) day notification provided by the Contractor. Contractor work associated with shutdowns may have to occur during off-peak hours, such as late nights and weekends. Contractor shall take into account the need to work during said off-peak hours within its bid proposal and no additional costs to the City will be allowed.

1.2 GENERAL SCHEDULING REQUIREMENTS

A. Project Schedule.

Contractor shall provide a baseline project schedule and monthly updates using Microsoft Project. Submit four color hard copies and an electronic version in pdf and Project formats. The schedule shall show critical path.

B. 3 Week Look Ahead Schedule.

Contractor shall provide a three week look ahead schedule to the Construction Manager and City every week.

1.3 SHUTDOWNS

A. Wastewater Flow Data. Wastewater flow data is attached to the end of this section as follows:

1. Average total daily influent flow per month for a twelve month period (May 2012 to April 2013) and daily total influent flows for the same period.
2. 24-hour graph of IPS discharge flows from Monday, May 20, 2013 to Sunday, May 26, 2013.
3. Portion of total influent flow from South Trunk Sewer: 25%
Portion of total influent flow from North Trunk Sewer: 75%

4. Highest instantaneous flow per day on a month to month basis from April 2012 to April 2013.

B. Sewer Overflow Conditions.

When the north trunk sewer is closed at or near the influent pump station, it is anticipated that the first place the sewer will overflow is in the farm field on the north side of Yosemite Avenue, at an elevation of _____ ft.

When the south trunk sewer is closed at or near the influent pump station, it is anticipated that the first place the sewer will overflow is in the field between the influent pump station and the headmaker, at an elevation of _____ ft.

C. City's Ability For Wastewater Flow Reduction.

The City has the ability to reduce wastewater flow in the north and south trunk sewers by shutdown of the City's wastewater distribution pump stations. However, the City does not have the capability to completely stop wastewater flow in the north and south trunk sewers. The City has in the past, and anticipates for this project, the shutdown of the wastewater distribution pump stations to reduce wastewater flow in the north and south trunk sewers. The distribution pump stations are anticipated to be shutdown at 11 p.m. and remain shutdown until 4 a.m. at which time they would need to be turned on and flow would then significantly increase in the north and south trunk sewers.

Flow reduction in the north and south trunk sewers is estimated to be _____ gpm in north trunk sewer and _____ gpm in the south trunk sewer after the distribution system pump stations have been shut down for a period of 2 hours.

D. South Trunk Sewer Bypass Logistics.

The South Trunk Sewer flow will be bypassed as follows (See Sheets C2 and C7):

1. South flow from headmaker (24" force main): Tie into headmaker tee and route temporary pipeline to IPS. Since this is a force main, Contractor will not need to pump this line for normal operation.
2. Roberts Estates (8" force main): Add a tee with valving to force main in the vicinity of the headmaker and route temporary pipeline to IPS. Since this is a force main, Contractor will not need to pump this line for normal operation.
3. Grit Tank Drain (10" SD) and South Plant Recycle Line (18" SD): Bulkhead South Trunk Sewer manhole adjacent to IPS and pump this flow to the IPS with a temporary pipeline. Wastewater levels in the south trunk sewer shall not exceed XX feet above the crown of the south trunk sewer.

E. North Trunk Sewer Bypass Logistics.

The North Trunk Sewer flow will be bypassed as follows (See Sheet C2):

1. Bulkhead the north trunk sewer manhole adjacent to the grinder/compactor. Wastewater levels in the north trunk sewer shall remain **XX feet** below the crown of the north trunk sewer.
2. Parts of the north trunk sewer **from xx to xx is** severely deteriorated. This sewer runs under **XXX**. There is a possibility of pipe collapse if wastewater reaches the crown of the pipe. The normal operating wastewater level in the north trunk sewer shall be maintained per 01020-1.3.E.1 and the bypass system shall be designed to maintain the maximum wastewater level at 01020-1.3E.1. **However, in the case of pipeline collapse or rupture, the City will repair the pipeline at no cost to the Contractor.**

END OF SECTION

CITY OF MANTECA WQCF
INFLUENT FLOW
MAY 2012-APRIL 2013

DAY	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13
1	6.44	5.95	6.55	6.67	6.88	6.25	6.69	6.47	5.90	5.99	5.99	6.72
2	5.89	5.99	6.30	6.42	6.11	6.25	6.47	7.47	6.25	6.01	6.10	5.99
3	6.03	5.92	6.15	6.57	6.69	6.37	6.84	6.36	6.08	6.10	6.34	6.17
4	5.92	6.17	6.29	6.65	6.25	6.75	7.15	5.95	6.06	6.51	6.04	6.73
5	6.20	6.32	6.24	6.82	6.37	6.50	6.73	6.66	6.36	5.73	6.04	5.64
6	6.35	5.97	6.10	6.85	6.04	6.67	6.95	6.28	6.94	5.96	5.95	6.42
7	6.07	5.92	6.21	7.21	6.07	6.93	7.45	6.12	6.30	6.01	5.69	6.55
8	6.04	5.96	6.25	6.90	6.18	6.42	7.28	6.31	6.47	5.84	6.05	6.28
9	5.91	6.04	6.26	7.10	6.53	5.88	7.08	6.51	6.13	6.16	6.17	6.05
10	5.93	6.05	6.19	6.42	6.36	5.95	7.45	6.12	6.11	6.25	6.31	6.17
11	5.70	6.04	6.12	6.40	6.28	6.16	7.06	6.31	6.04	6.20	6.17	5.97
12	6.25	5.96	6.21	6.50	5.89	6.37	7.14	6.61	6.22	5.93	6.16	6.24
13	6.32	5.93	6.18	6.38	6.20	6.71	6.48	6.52	6.41	5.80	6.15	7.94
14	6.04	5.86	6.25	6.33	6.35	6.84	6.73	6.38	6.07	5.95	5.94	8.09
15	6.26	5.91	6.29	6.18	6.66	6.28	6.69	6.56	6.07	5.95	5.85	7.19
16	6.43	5.85	5.92	6.59	7.17	6.06	6.60	6.87	6.05	6.16	6.08	7.33
17	*	5.98	6.13	6.13	6.83	6.19	6.96	6.55	6.03	6.04	6.03	6.09
18	6.50	6.37	6.35	6.22	6.86	6.38	7.11	6.45	5.91	6.33	6.23	6.02
19	6.54	6.57	6.21	6.56	6.72	6.64	6.30	6.52	6.19	6.18	5.86	6.10
20	6.55	6.45	6.32	7.19	6.82	6.92	6.30	6.33	6.13	6.02	5.87	6.12
21	6.94	6.34	6.25	7.02	6.70	7.12	6.19	6.38	6.69	5.80	5.76	6.38
22	6.71	6.23	6.33	6.27	6.91	6.92	6.47	6.81	6.37	6.09	5.72	6.47
23	6.45	6.22	6.43	6.43	7.12	6.91	5.86	7.49	5.95	6.16	6.03	6.55
24	6.26	6.52	6.58	5.95	6.82	6.62	6.19	6.81	5.93	6.20	5.86	6.60
25	6.00	6.23	6.63	6.30	6.97	6.59	6.52	6.34	5.97	6.14	6.03	6.57
26	5.92	6.31	6.56	6.49	6.72	6.56	6.07	6.53	6.11	5.97	5.74	6.46
27	6.00	6.23	6.38	6.32	6.82	6.89	6.14	6.30	6.55	5.77	6.00	6.59
28	6.12	6.14	6.48	6.07	6.67	7.08	6.00	6.05	5.99	6.31	6.03	6.24
29	6.10	6.20	6.47	6.30	6.78	6.56	5.86	6.32	5.98		5.93	6.76
30	6.11	6.59	6.49	6.44	6.60	6.69	6.91	6.30	5.86		6.04	6.33
31	5.96		6.52	6.43		6.38		6.22	5.63		7.59	

MO AVG	6.20	6.14	6.31	6.52	6.58	6.54	6.66	6.48	6.15	6.06	6.06	6.49
MAX DAILY	6.94	6.59	6.63	7.21	7.17	7.12	7.45	7.49	6.94	6.51	7.59	8.09

Note: Daily values represent total flow for one day.

6 Hour

12 Hour

24 Hour

7 Day

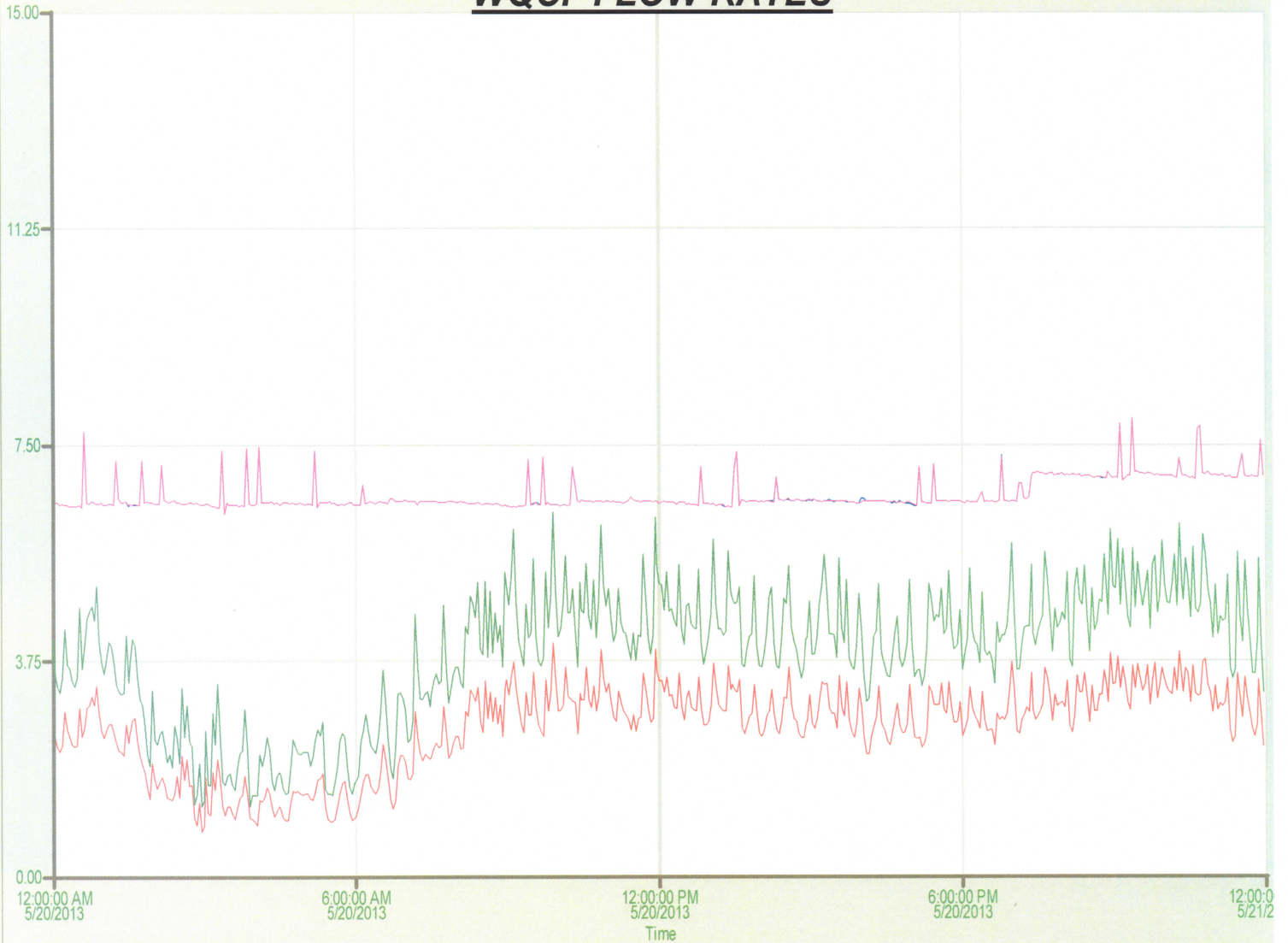
14 Day

30 Day

Custom Time

Scroll Time

WQCF FLOW RATES



		5.12	mgd	6.33	1.22	3.89
Hist.WQCF1.PLC301SP402862.F_CV	ips south side flow (F_CV)	3.41	mgd	4.06	0.80	2.59
Hist.WQCF1.PLC301SP402864.F_CV	ips north side flow (F_CV)	6.49	MGD	7.96	6.31	6.63
Hist.WQCF1.0801_FID0801.F_CV	Discharge Flow (F_CV)	6.49	MGD	7.96	6.31	6.63
Hist.WQCF1.0801_FI0801.F_CV	UV Influent Flow (F_CV)					

This graph provides a representation of influent flow fluctuation throughout a typical day. Sum flows shown by Green Pen + Red Pen to calculate total flow at a particular time of day.
Green Pen = Flow Into South Treatment Plant (not south trunk sewer flow)
Red Pen = Flow Into North Treatment Plant (not north trunk sewer flow)
 Ignore **Purple Pen**
 Ignore **Blue Pen**

6 Hour

12 Hour

24 Hour

7 Day

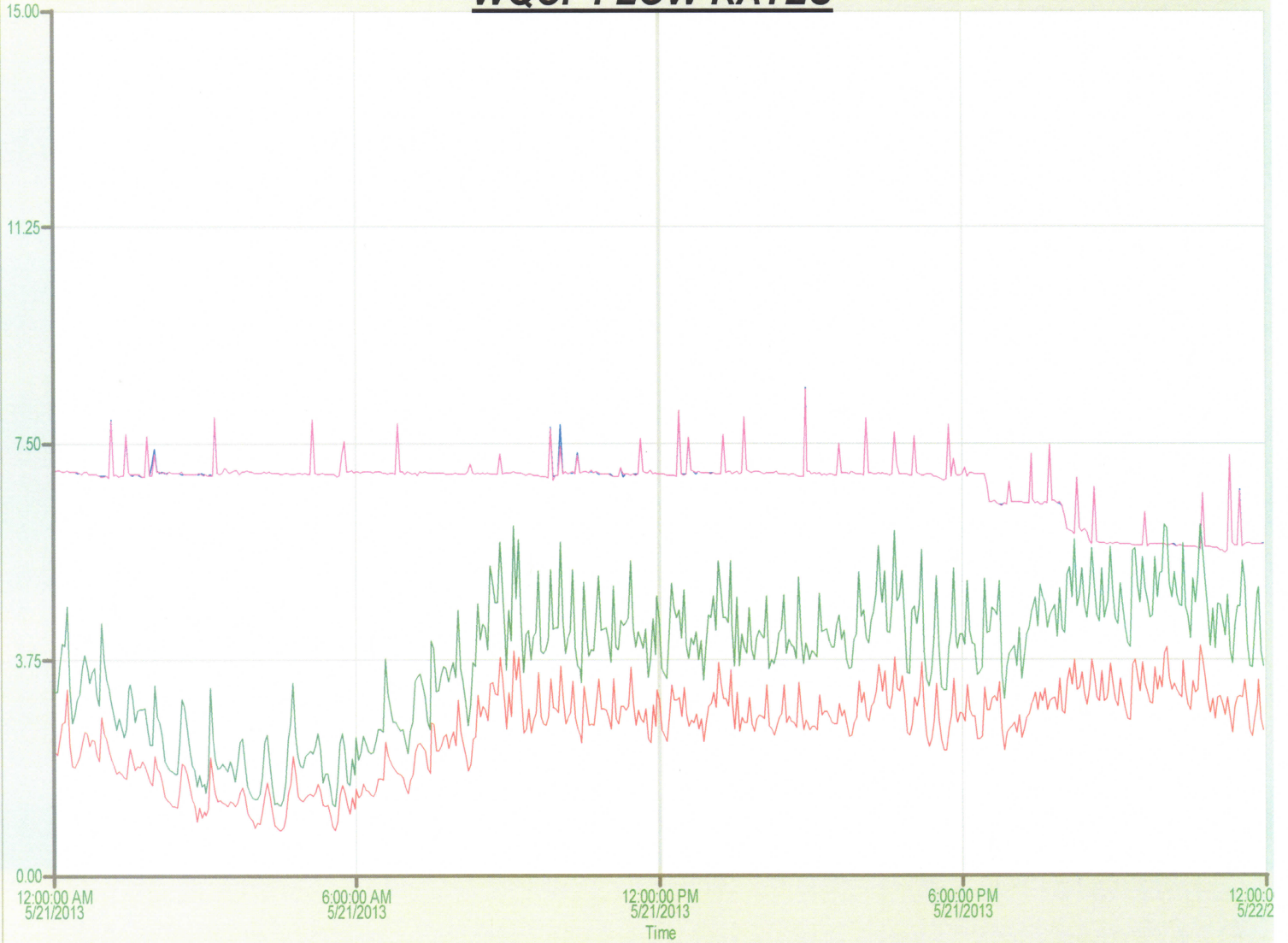
14 Day

30 Day

Custom Time

Scroll Time

WQCF FLOW RATES



Hist.WQCF1.PLC301SP402862.F_CV	ips south side flow (F_CV)	4.48	mgd	6.11	1.20	3.77
Hist.WQCF1.PLC301SP402864.F_CV	ips north side flow (F_CV)	3.06	mgd	4.01	0.79	2.52
Hist.WQCF1.0801_FID0801.F_CV	Discharge Flow (F_CV)	6.97	MGD	8.46	5.61	6.80
Hist.WQCF1.0801_FI0801.F_CV	UV Influent Flow (F_CV)	6.97	MGD	8.45	5.61	6.80

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6 Hour

12 Hour

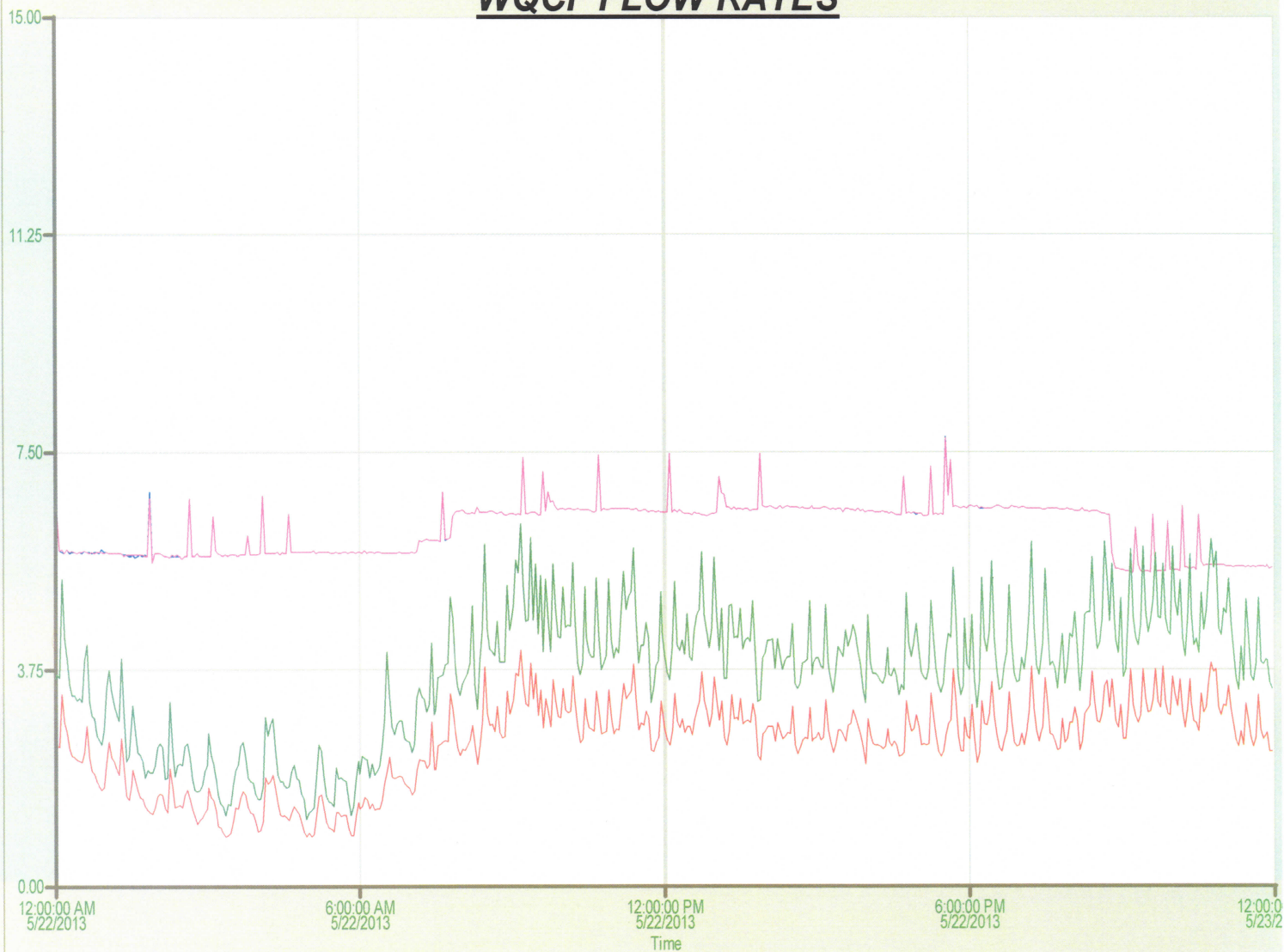
24 Hour

7 Day

14 Day

30 Day

Custom Time

Scroll
Time**WQCF FLOW RATES**

		4.01	mgd	6.27	1.16	3.70
Hist.WQCF1.PLC301SP402862.F_CV	ips south side flow (F_CV)	2.72	mgd	4.08	0.85	2.47
Hist.WQCF1.PLC301SP402864.F_CV	ips north side flow (F_CV)	6.46	MGD	7.76	5.42	6.17
Hist.WQCF1.0801_FID0801.F_CV	Discharge Flow (F_CV)	6.46	MGD	7.74	5.42	6.17
Hist.WQCF1.0801_FI0801.F_CV	UV Influent Flow (F_CV)					

This graph provides a representation of influent flow fluctuation throughout a typical day.
Sum flows shown by Green Pen + Red Pen to calculate total flow at a particular time of day.

Green Pen = Flow Into South Treatment Plant (not south trunk sewer flow)

Red Pen = Flow Into North Treatment Plant (not north trunk sewer flow)

Ignore **Purple Pen**

Ignore **Blue Pen**

6 Hour

12 Hour

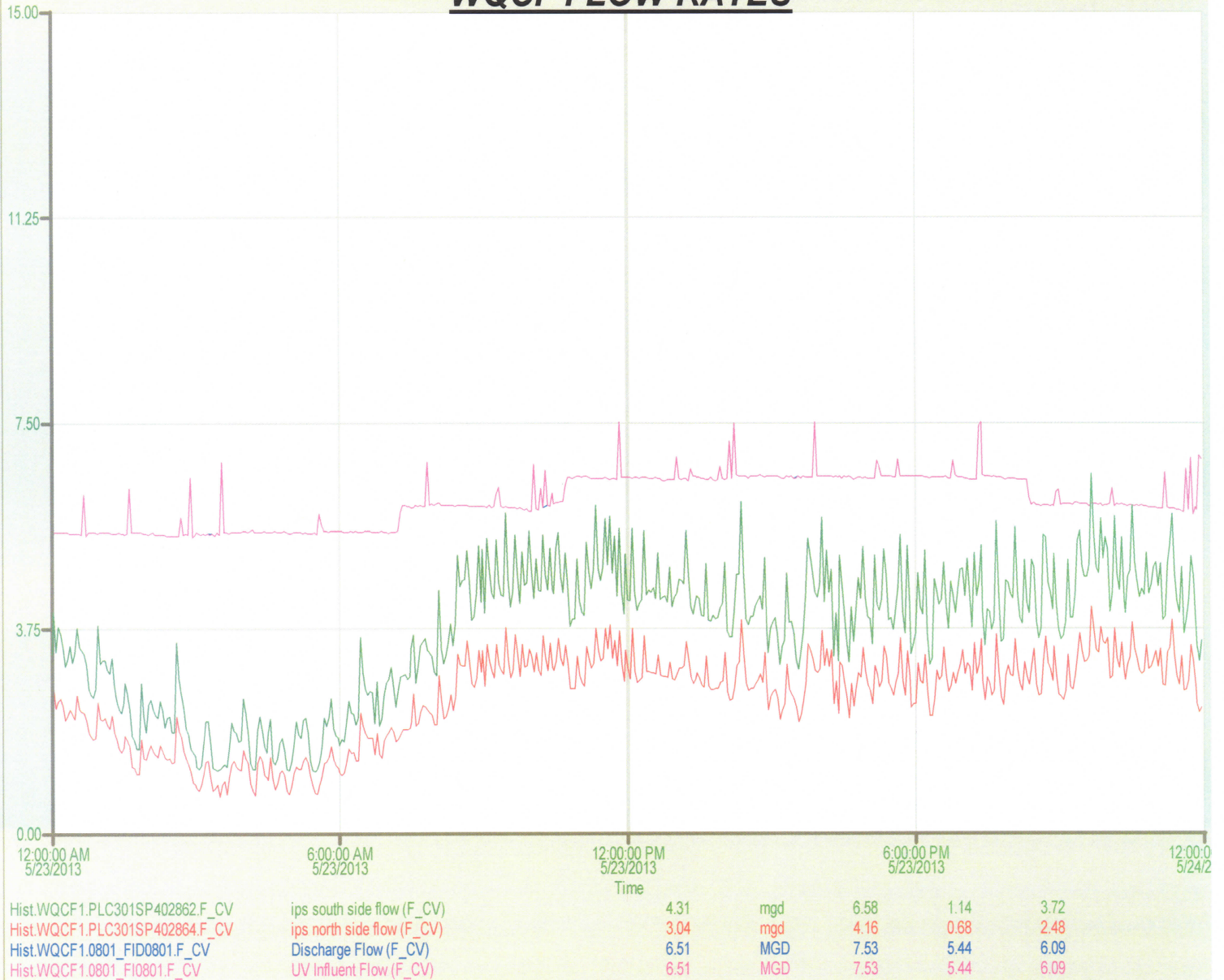
24 Hour

7 Day

14 Day

30 Day

Custom Time

Scroll
Time**WQCF FLOW RATES**

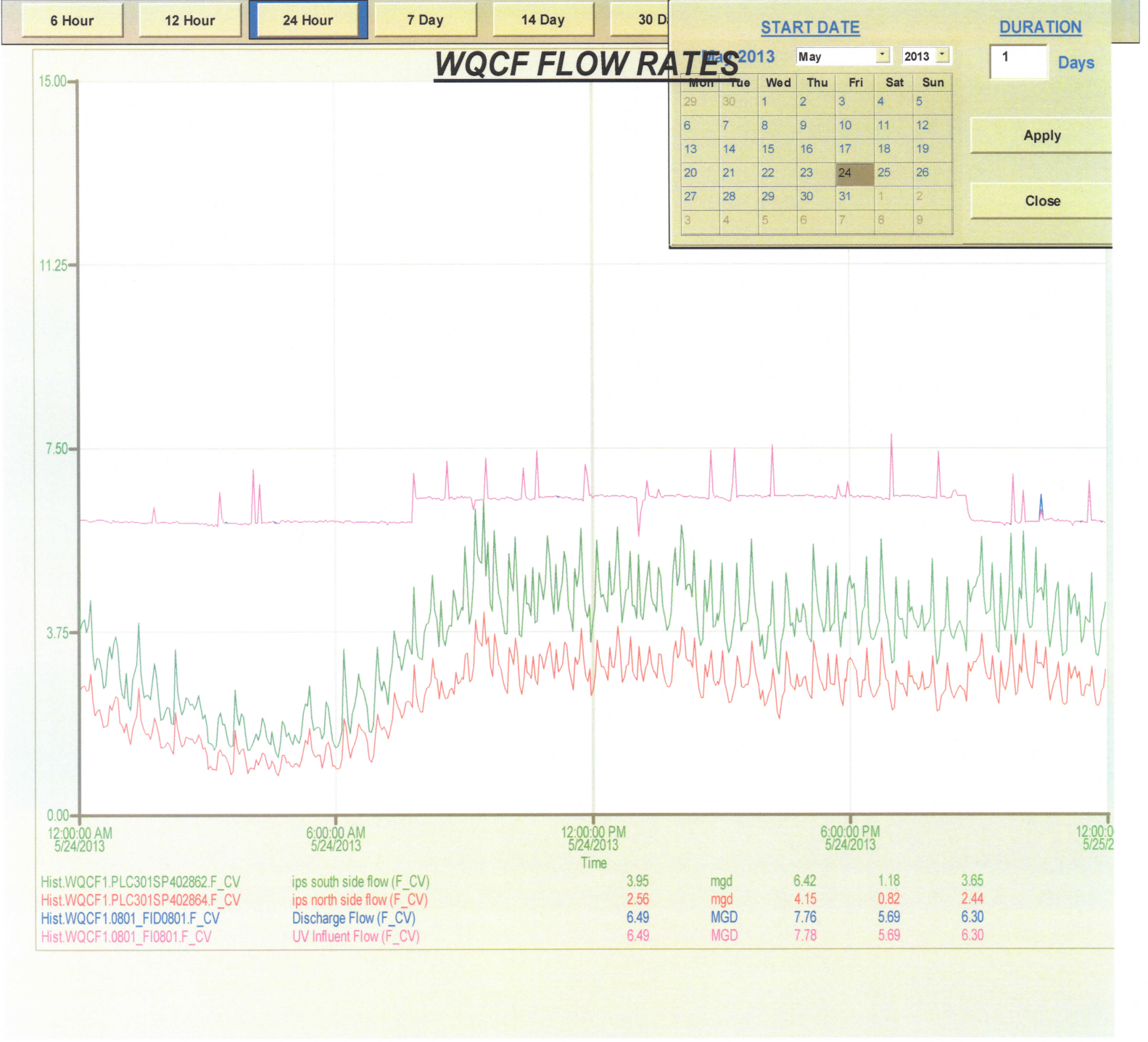
This graph provides a representation of influent flow fluctuation throughout a typical day. Sum flows shown by Green Pen + Red Pen to calculate total flow at a particular time of day.

Green Pen = Flow Into South Treatment Plant (not south trunk sewer flow)

Red Pen = Flow Into North Treatment Plant (not north trunk sewer flow)

Ignore **Purple Pen**

Ignore **Blue Pen**



This graph provides a representation of influent flow fluctuation throughout a typical day. Sum flows shown by Green Pen + Red Pen to calculate total flow at a particular time of day.

Green Pen = Flow Into South Treatment Plant (not south trunk sewer flow)

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Ignore **Purple Pen**

Ignore **Blue Pen**

6 Hour

12 Hour

24 Hour

7 Day

14 Day

30 Day

Custom Time

Scroll
Time**WQCF FLOW RATES**

Hist.WQCF1.PLC301SP402862.F_CV	ips south side flow (F_CV)	6.23	mgd	6.87	1.14	3.67
Hist.WQCF1.PLC301SP402864.F_CV	ips north side flow (F_CV)	3.98	mgd	4.50	0.51	2.45
Hist.WQCF1.0801_FID0801.F_CV	Discharge Flow (F_CV)	4.94	MGD	6.97	3.42	4.75
Hist.WQCF1.0801_FI0801.F_CV	UV Influent Flow (F_CV)	4.94	MGD	6.97	3.42	4.75

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Ignore **Purple Pen**

Ignore **Blue Pen**

6 Hour

12 Hour

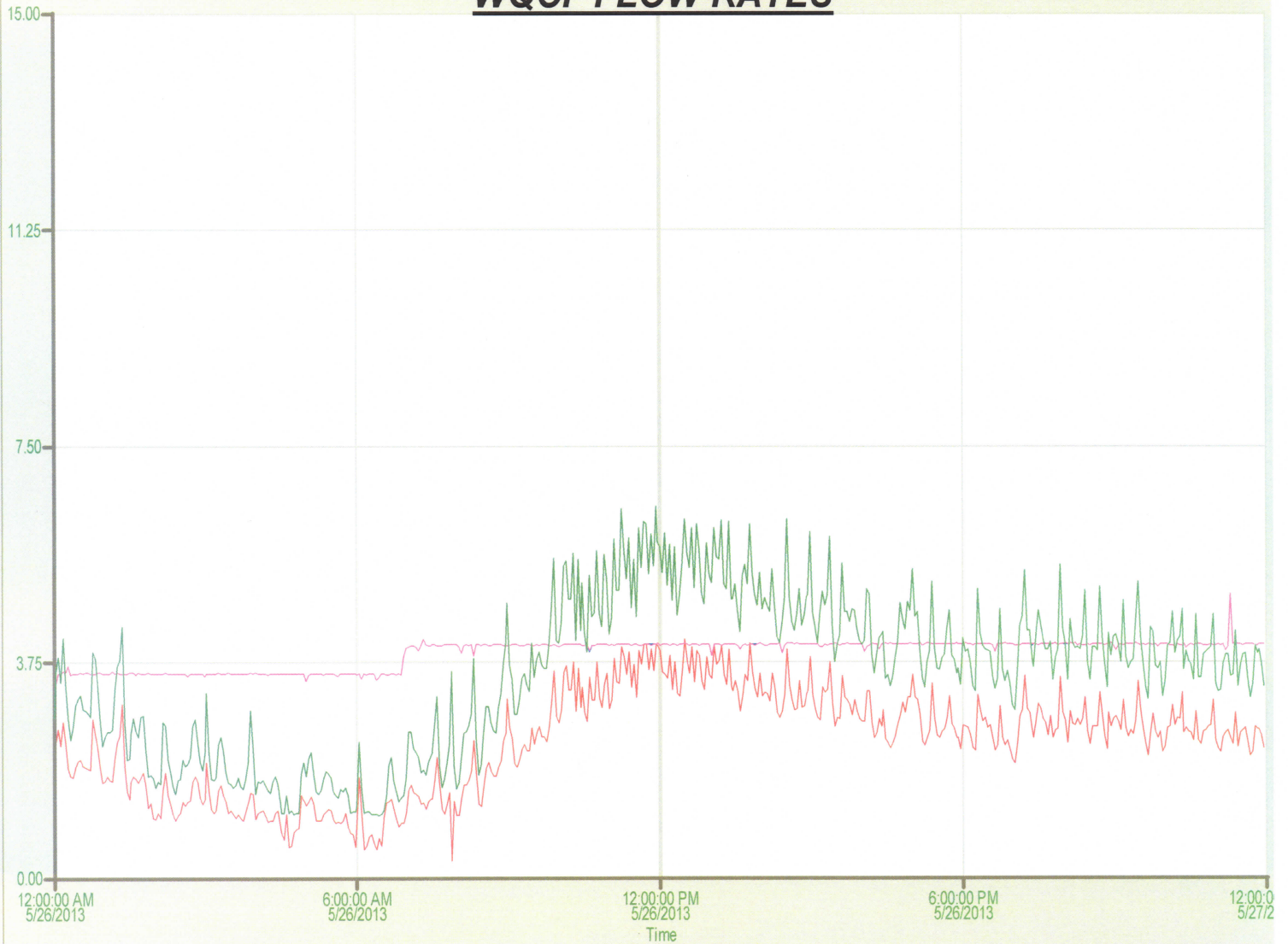
24 Hour

7 Day

14 Day

30 Day

Custom Time

Scroll
Time**WQCF FLOW RATES**

Hist.WQCF1.PLC301SP402862.F_CV	ips south side flow (F_CV)	5.75	mgd	6.47	1.10	3.56
Hist.WQCF1.PLC301SP402864.F_CV	ips north side flow (F_CV)	3.95	mgd	4.15	0.30	2.37
Hist.WQCF1.0801_FID0801.F_CV	Discharge Flow (F_CV)	4.05	MGD	4.94	3.36	3.91
Hist.WQCF1.0801_FI0801.F_CV	UV Influent Flow (F_CV)	4.05	MGD	4.94	3.36	3.91

This graph provides a representation of influent flow fluctuation throughout a typical day. Sum flows shown by Green Pen + Red Pen to calculate total flow at a particular time of day.

Green Pen = Flow Into South Treatment Plant (not south trunk sewer flow)

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Ignore **Purple Pen**

Ignore **Blue Pen**

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW				S. PLANT GRIT FLOW				TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)		Max (GPM)	Min (GPM)	Total (MG)		Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Apr-2012	0.00	0.00	0.000		258.00	0.00	0.055		10.51	1.37	6.08	0.75	0.40	0.491
2-Apr-2012	0.00	0.00	0.000		141.00	0.00	0.063		9.56	1.45	6.24	1.06	0.47	0.541
3-Apr-2012	0.00	0.00	0.000		124.00	0.00	0.064		9.38	1.46	5.93	0.48	0.48	0.480
4-Apr-2012	0.00	0.00	0.000		135.00	0.00	0.064		10.38	1.40	6.24	0.48	0.48	0.480
5-Apr-2012	0.00	0.00	0.000		237.00	0.00	0.057		8.99	1.30	5.80	0.48	0.48	0.480
6-Apr-2012	0.00	0.00	0.000		109.00	0.00	0.054		10.14	1.25	5.87	1.69	0.48	0.784
7-Apr-2012	0.00	0.00	0.000		111.00	0.00	0.054		11.38	1.70	6.16	0.88	0.68	0.769
8-Apr-2012	0.00	0.00	0.000		97.00	0.00	0.048		10.54	1.29	5.86	0.71	0.50	0.598
9-Apr-2012	0.00	0.00	0.000		268.00	0.00	0.040		10.32	1.46	6.26	0.58	0.48	0.518
10-Apr-2012	0.00	0.00	0.000		233.00	0.00	0.034		14.77	-0.15	-145.62	0.77	0.44	0.513
11-Apr-2012	0.00	0.00	0.000		455.00	0.00	0.062		9.43	1.43	6.18	1.58	0.45	0.514
12-Apr-2012	0.00	0.00	0.000		238.00	0.00	0.046		10.58	2.61	6.38	0.65	0.41	0.483
13-Apr-2012	0.00	0.00	0.000		141.00	0.00	0.049		9.31	2.46	6.16	4.69	0.41	0.542
14-Apr-2012	0.00	0.00	0.000		261.00	0.00	0.061		10.48	1.33	6.28	0.57	0.48	0.517
15-Apr-2012	0.00	0.00	0.000		122.00	0.00	0.060		10.51	1.03	6.29	0.56	0.46	0.505
16-Apr-2012	0.00	0.00	0.000		119.00	0.00	0.059		9.21	1.75	6.01	0.62	0.44	0.507
17-Apr-2012	0.00	0.00	0.000		118.00	0.00	0.060		12.86	3.59	6.35	0.60	0.44	0.494
18-Apr-2012	0.00	0.00	0.000		234.00	0.00	0.040		10.45	1.31	6.16	0.59	0.41	0.497
19-Apr-2012	0.00	0.00	0.000		243.00	0.00	0.033		10.57	1.32	5.98	0.57	0.41	0.459
20-Apr-2012	0.00	0.00	0.000		127.00	0.00	0.058		9.84	1.59	6.01	0.56	0.40	0.446
21-Apr-2012	0.00	0.00	0.000		119.00	0.00	0.059		12.25	1.54	6.20	0.50	0.39	0.427
22-Apr-2012	0.00	0.00	0.000		115.00	0.00	0.044		11.19	1.32	6.37	0.51	0.38	0.423
23-Apr-2012	0.00	0.00	0.000		228.00	0.00	0.024		10.03	1.40	6.21	0.48	0.39	0.420
24-Apr-2012	0.00	0.00	0.000		219.00	0.00	0.022		10.15	1.45	6.01	0.55	0.40	0.435
25-Apr-2012	0.00	0.00	0.000		214.00	0.00	0.040		9.81	1.46	5.81	0.67	0.45	0.498
26-Apr-2012	0.00	0.00	0.000		135.00	0.00	0.067		11.57	1.33	6.06	0.62	0.44	0.505
27-Apr-2012	0.00	0.00	0.000		127.00	0.00	0.064		9.74	1.88	6.03	19.98	0.48	1.355
28-Apr-2012	0.00	0.00	0.000		130.00	0.00	0.061		11.13	1.40	6.11	1.23	0.45	0.578
29-Apr-2012	0.00	0.00	0.000		129.00	0.00	0.067		10.29	1.29	6.13	0.78	0.50	0.585
30-Apr-2012	0.00	0.00	0.000		129.00	0.00	0.068		9.45	1.34	6.03	0.65	0.52	0.569
1-May-2012	0.00	0.00	0.000		125.00	0.00	0.064		9.93	1.83	6.44	0.71	0.49	0.548
AVERAGE	0.000	0.000	0.000		175.516	0.000	0.053		10.477	1.523	1.227	1.469	0.455	0.547
MAX	0.000	0.000	0.000		455.000	0.000	0.068		14.773	3.586	6.444	19.980	0.680	1.355
MIN	0.000	0.000	0.000		97.000	0.000	0.022		8.986	-0.147	-145.620	0.480	0.380	0.420
TOTAL			0.000				1.642				38.035			16.962

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-May-2012	0.00	0.00	0.000	125.00	0.00	0.064	9.93	1.83	6.44	0.71	0.49	0.548
2-May-2012	0.00	0.00	0.000	128.00	0.00	0.066	11.04	1.54	5.89	0.81	0.51	0.607
3-May-2012	0.00	0.00	0.000	248.00	0.00	0.045	10.33	1.67	6.03	0.78	0.51	0.585
4-May-2012	0.00	0.00	0.000	241.00	0.00	0.049	9.66	1.45	5.92	0.57	0.57	0.570
5-May-2012	0.00	0.00	0.000	115.00	0.00	0.048	10.43	1.49	6.20	0.57	0.57	0.570
6-May-2012	0.00	0.00	0.000	97.00	0.00	0.047	10.90	2.18	6.35	0.57	0.57	0.570
7-May-2012	0.00	0.00	0.000	93.00	0.00	0.048	11.50	1.33	6.07	0.57	0.57	0.570
8-May-2012	0.00	0.00	0.000	91.00	0.00	0.046	11.12	1.63	6.04	0.57	0.57	0.570
9-May-2012	0.00	0.00	0.000	206.00	0.00	0.040	9.95	1.39	5.91	0.57	0.57	0.570
10-May-2012	0.00	0.00	0.000	96.00	0.00	0.044	9.90	1.37	5.93	0.57	0.57	0.570
11-May-2012	0.00	0.00	0.000	240.00	0.00	0.031	14.87	-0.15	5.70	0.57	0.57	0.570
12-May-2012	0.00	0.00	0.000	236.00	0.00	0.053	10.10	1.41	6.25	0.57	0.57	0.570
13-May-2012	0.00	0.00	0.000	106.00	0.00	0.052	10.61	1.34	6.35	2.01	0.57	0.983
14-May-2012	0.00	0.00	0.000	108.00	0.00	0.053	10.20	1.61	6.04	1.25	0.89	1.048
15-May-2012	0.00	0.00	0.000	113.00	0.00	0.049	10.30	1.55	6.25	1.25	0.58	0.846
16-May-2012	0.00	0.00	0.000	256.00	0.00	-0.460	10.41	1.60	-60.73	0.79	0.51	0.634
17-May-2012	0.00	0.00	0.000	66.00	0.00	0.551	3.65	4.08	#VALUE!	0.57	0.57	0.570
18-May-2012	0.00	0.00	0.000	264.00	0.00	0.067	10.39	1.79	#VALUE!	0.85	0.41	0.464
19-May-2012	0.00	0.00	0.000	127.00	0.00	0.061	10.40	2.00	#VALUE!	0.46	0.36	0.401
20-May-2012	0.00	0.00	0.000	114.00	0.00	0.055	10.52	1.55	#VALUE!	4.16	0.35	0.477
21-May-2012	0.00	0.00	0.000	128.00	0.00	0.054	10.40	1.58	#VALUE!	0.62	0.34	0.410
22-May-2012	0.00	0.00	0.000	130.00	0.00	0.056	9.99	2.19	#VALUE!	0.61	0.35	0.407
23-May-2012	0.00	0.00	0.000	121.00	0.00	0.055	9.99	2.07	#VALUE!	0.43	0.35	0.384
24-May-2012	0.00	0.00	0.000	186.00	0.00	0.053	9.86	2.17	#VALUE!	0.44	0.34	0.373
25-May-2012	0.00	0.00	0.000	117.00	0.00	0.054	8.85	1.68	#VALUE!	0.57	0.33	0.395
26-May-2012	0.00	0.00	0.000	109.00	0.00	0.051	10.03	1.48	#VALUE!	0.53	0.38	0.446
27-May-2012	0.00	0.00	0.000	189.00	0.00	0.051	10.58	1.42	#VALUE!	0.56	0.40	0.466
28-May-2012	0.00	0.00	0.000	220.00	0.00	0.043	11.13	1.44	#VALUE!	0.62	0.40	0.493
29-May-2012	0.00	0.00	0.000	114.00	0.00	0.061	10.28	1.62	#VALUE!	0.61	0.41	0.486
30-May-2012	0.00	0.00	0.000	114.00	0.00	0.059	10.19	1.52	#VALUE!	0.62	0.44	0.516
31-May-2012	0.00	0.00	0.000	112.00	0.00	0.057	10.33	2.12	#VALUE!	0.85	0.45	0.530
AVERAGE	0.000	0.000	0.000	148.710	0.000	0.052	10.253	1.675	#VALUE!	0.814	0.486	0.555
MAX	0.000	0.000	0.000	264.000	0.000	0.551	14.866	4.078	#VALUE!	4.160	0.890	1.048
MIN	0.000	0.000	0.000	66.000	0.000	-0.460	3.655	-0.154	#VALUE!	0.430	0.330	0.373
TOTAL			0.000			1.604			#VALUE!			17.198

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Jun-2012	0.00	0.00	0.000	116.00	0.00	0.058	10.23	1.79	#VALUE!	0.77	0.45	0.546
2-Jun-2012	0.00	0.00	0.000	114.00	0.00	0.057	10.51	1.42	#VALUE!	0.67	0.45	0.521
3-Jun-2012	0.00	0.00	0.000	111.00	0.00	0.051	10.17	1.40	#VALUE!	0.81	0.45	0.568
4-Jun-2012	0.00	0.00	0.000	113.00	0.00	0.060	9.34	1.41	#VALUE!	0.68	0.49	0.578
5-Jun-2012	0.00	0.00	0.000	118.00	0.00	0.059	11.08	1.62	#VALUE!	0.71	0.49	0.571
6-Jun-2012	0.00	0.00	0.000	113.00	0.00	0.058	9.97	1.66	#VALUE!	1.17	0.50	0.591
7-Jun-2012	0.00	0.00	0.000	116.00	0.00	0.062	9.94	1.87	5.92	1.14	0.52	0.635
8-Jun-2012	0.00	0.00	0.000	113.00	0.00	0.059	10.83	1.61	5.96	0.87	0.50	0.591
9-Jun-2012	0.00	0.00	0.000	114.00	0.00	0.057	10.44	1.70	6.04	0.67	0.45	0.539
10-Jun-2012	0.00	0.00	0.000	120.00	0.00	0.058	10.68	1.58	6.05	0.73	0.46	0.568
11-Jun-2012	0.00	0.00	0.000	248.00	0.00	0.054	10.55	1.60	6.04	0.73	0.47	0.569
12-Jun-2012	0.00	0.00	0.000	118.00	0.00	0.057	10.06	1.95	5.96	2.17	0.48	0.590
13-Jun-2012	0.00	0.00	0.000	127.00	0.00	0.056	9.85	1.53	5.93	0.66	0.46	0.528
14-Jun-2012	0.00	0.00	0.000	121.00	0.00	0.056	10.49	1.66	5.86	0.55	0.34	0.431
15-Jun-2012	0.00	0.00	0.000	252.00	0.00	0.055	9.63	1.75	5.91	0.46	0.34	0.378
16-Jun-2012	0.00	0.00	0.000	126.00	0.00	0.057	11.50	1.59	5.87	0.65	0.37	0.445
17-Jun-2012	0.00	0.00	0.000	119.00	0.00	0.055	11.01	0.36	5.98	0.58	0.38	0.435
18-Jun-2012	0.00	0.00	0.000	119.00	0.00	0.052	10.32	1.51	6.37	11.68	1.06	0.816
19-Jun-2012	0.00	0.00	0.000	261.00	0.00	0.050	9.92	1.65	6.57	1.06	1.06	1.060
20-Jun-2012	0.00	0.00	0.000	142.00	0.00	0.073	9.66	1.61	6.45	1.06	1.06	1.060
21-Jun-2012	0.00	0.00	0.000	252.00	0.00	0.065	9.77	1.79	6.35	1.06	1.06	1.060
22-Jun-2012	0.00	0.00	0.000	114.00	0.00	0.059	10.43	1.54	6.23	1.06	1.06	1.060
23-Jun-2012	0.00	0.00	0.000	236.00	0.00	0.059	10.75	1.44	6.23	1.06	1.06	1.060
24-Jun-2012	0.00	0.00	0.000	118.00	0.00	0.054	14.47	1.38	6.52	1.06	1.06	1.060
25-Jun-2012	0.00	0.00	0.000	119.00	0.00	0.054	10.21	1.72	6.23	1.06	1.06	1.060
26-Jun-2012	0.00	0.00	0.000	113.00	0.00	0.056	10.72	1.71	6.31	1.06	1.06	1.060
27-Jun-2012	0.00	0.00	0.000	127.00	0.00	0.062	10.70	1.69	6.23	2.15	0.37	0.484
28-Jun-2012	0.00	0.00	0.000	116.00	0.00	0.058	10.13	1.65	6.14	0.53	0.53	0.530
29-Jun-2012	0.00	0.00	0.000	127.00	0.00	0.058	9.92	1.52	6.20	0.53	0.53	0.530
30-Jun-2012	0.00	0.00	0.000	115.00	0.00	0.058	10.52	1.57	6.59	0.53	0.53	0.530
1-Jul-2012	0.00	0.00	0.000	243.00	0.00	0.056	10.68	1.86	6.55	0.53	0.53	0.530
AVERAGE	0.000	0.000	0.000	143.903	0.000	0.057	10.468	1.586	#VALUE!	1.240	0.611	0.677
MAX	0.000	0.000	0.000	261.000	0.000	0.073	14.471	1.952	#VALUE!	11.680	1.060	1.060
MIN	0.000	0.000	0.000	111.000	0.000	0.050	9.338	0.359	#VALUE!	0.460	0.340	0.378
TOTAL			0.000			1.781			#VALUE!			20.984

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Jul-2012	0.00	0.00	0.000	243.00	0.00	0.056	10.68	1.86	6.55	0.53	0.53	0.530
2-Jul-2012	0.00	0.00	0.000	106.00	0.00	0.054	10.29	1.73	6.30	0.53	0.53	0.530
3-Jul-2012	0.00	0.00	0.000	107.00	0.00	0.054	10.16	1.59	6.15	0.53	0.53	0.530
4-Jul-2012	0.00	0.00	0.000	94.00	0.00	0.050	9.98	1.73	6.29	0.76	0.43	0.537
5-Jul-2012	0.00	0.00	0.000	94.00	0.00	0.040	10.06	1.51	6.24	0.44	0.30	0.369
6-Jul-2012	0.00	0.00	0.000	91.00	0.00	0.042	10.44	1.79	6.09	0.35	0.28	0.305
7-Jul-2012	0.00	0.00	0.000	220.00	0.00	0.042	11.65	1.57	6.21	0.35	0.27	0.305
8-Jul-2012	0.00	0.00	0.000	251.00	0.00	0.053	10.87	0.83	6.25	0.37	0.29	0.326
9-Jul-2012	0.00	0.00	0.000	123.00	0.00	0.056	10.24	1.85	6.26	0.74	0.31	0.378
10-Jul-2012	0.00	0.00	0.000	254.00	0.00	0.045	10.08	1.88	6.20	0.44	0.32	0.366
11-Jul-2012	0.00	0.00	0.000	219.00	0.00	0.070	10.10	2.18	6.12	0.54	0.31	0.428
12-Jul-2012	0.00	0.00	0.000	256.00	0.00	0.061	10.77	1.90	6.21	0.54	0.53	0.536
13-Jul-2012	0.00	0.00	0.000	114.00	0.00	0.056	9.79	1.89	6.17	0.54	0.53	0.538
14-Jul-2012	0.00	0.00	0.000	119.00	0.00	0.053	10.67	1.76	6.25	0.54	0.53	0.538
15-Jul-2012	0.00	0.00	0.000	113.00	0.00	0.048	10.78	1.45	6.29	0.54	0.53	0.538
16-Jul-2012	0.00	0.00	0.000	238.00	0.00	0.048	9.94	1.95	6.29	0.54	0.53	0.539
17-Jul-2012	0.00	0.00	0.000	145.00	0.00	0.063	9.28	1.65	6.12	0.54	0.53	0.539
18-Jul-2012	0.00	0.00	0.000	227.00	0.00	0.052	9.29	1.90	6.36	0.54	0.53	0.539
19-Jul-2012	0.00	0.00	0.000	123.00	0.00	0.056	10.56	1.90	6.21	0.54	0.53	0.538
20-Jul-2012	0.00	0.00	0.000	123.00	0.00	0.057	10.27	1.57	6.32	0.54	0.53	0.538
21-Jul-2012	0.00	0.00	0.000	229.00	0.00	0.049	10.79	1.48	6.25	0.54	0.53	0.537
22-Jul-2012	0.00	0.00	0.000	126.00	0.00	0.054	10.51	0.87	6.33	0.54	0.53	0.537
23-Jul-2012	0.00	0.00	0.000	109.00	0.00	0.051	10.68	1.77	6.43	0.69	0.49	0.558
24-Jul-2012	0.00	0.00	0.000	247.00	0.00	0.043	11.46	1.39	6.58	0.51	0.36	0.426
25-Jul-2012	0.00	0.00	0.000	218.00	0.00	0.048	11.40	1.31	6.63	0.66	0.31	0.461
26-Jul-2012	0.00	0.00	0.000	121.00	0.00	0.055	9.53	1.76	6.56	0.62	0.62	0.620
27-Jul-2012	0.00	0.00	0.000	119.00	0.00	0.046	14.07	-0.30	6.38	20.60	0.00	0.633
28-Jul-2012	0.00	0.00	0.000	241.00	0.00	0.042	10.88	1.50	6.48	1.75	0.58	0.831
29-Jul-2012	0.00	0.00	0.000	239.00	0.00	0.062	10.58	1.24	6.47	1.90	0.63	1.027
30-Jul-2012	0.00	0.00	0.000	132.00	0.00	0.064	11.06	1.61	6.49	1.78	1.77	1.780
31-Jul-2012	0.00	0.00	0.000	135.00	0.00	0.064	9.72	1.89	6.52	1.78	1.77	1.780
AVERAGE	0.000	0.000	0.000	166.968	0.000	0.053	10.535	1.581	6.323	1.349	0.531	0.601
MAX	0.000	0.000	0.000	256.000	0.000	0.070	14.074	2.177	6.632	20.600	1.770	1.780
MIN	0.000	0.000	0.000	91.000	0.000	0.040	9.276	-0.298	6.095	0.350	0.000	0.305
TOTAL			0.000			1.633			196.000			18.637

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Aug-2012	0.00	0.00	0.000	127.00	0.00	0.065	9.88	2.26	6.68	1.78	1.77	1.780
2-Aug-2012	0.00	0.00	0.000	131.00	0.00	0.063	9.99	1.65	6.42	1.78	1.77	1.780
3-Aug-2012	0.00	0.00	0.000	125.00	0.00	0.062	9.59	2.04	6.57	1.78	1.77	1.780
4-Aug-2012	0.00	0.00	0.000	127.00	0.00	0.064	10.45	1.38	6.65	1.78	1.77	1.780
5-Aug-2012	0.00	0.00	0.000	148.00	0.00	0.065	11.36	1.82	6.82	1.78	0.44	1.039
6-Aug-2012	0.00	0.00	0.000	126.00	0.00	0.065	9.74	0.37	6.85	0.55	0.35	0.411
7-Aug-2012	0.00	0.00	0.000	144.00	0.00	0.065	12.32	2.16	7.22	0.68	0.29	0.437
8-Aug-2012	0.00	0.00	0.000	128.00	0.00	0.065	11.17	1.90	6.90	0.71	0.39	0.506
9-Aug-2012	0.00	0.00	0.000	126.00	0.00	0.066	10.08	2.13	7.10	0.51	0.35	0.439
10-Aug-2012	0.00	0.00	0.000	122.00	0.00	0.060	12.65	-0.32	6.42	0.39	0.39	0.390
11-Aug-2012	0.00	0.00	0.000	137.00	0.00	0.057	11.14	2.05	6.40	0.39	0.39	0.390
12-Aug-2012	0.00	0.00	0.000	114.00	0.00	0.053	11.90	0.81	6.51	0.62	0.32	0.385
13-Aug-2012	0.00	0.00	0.000	124.00	0.00	0.055	10.30	1.92	6.38	0.46	0.29	0.350
14-Aug-2012	0.00	0.00	0.000	114.00	0.00	0.055	10.00	1.90	6.33	0.50	0.30	0.360
15-Aug-2012	0.00	0.00	0.000	223.00	0.00	0.056	10.39	1.42	6.18	0.37	0.36	0.363
16-Aug-2012	0.00	0.00	0.000	114.00	0.00	0.055	9.56	1.56	6.59	0.37	0.36	0.364
17-Aug-2012	0.00	0.00	0.000	118.00	0.00	0.051	9.67	1.51	6.13	0.82	0.36	0.414
18-Aug-2012	0.00	0.00	0.000	218.00	0.00	0.044	10.87	1.54	6.22	0.42	0.32	0.365
19-Aug-2012	0.00	0.00	0.000	117.00	0.00	0.053	11.15	-0.19	6.56	0.84	0.30	0.331
20-Aug-2012	0.00	0.00	0.000	108.00	0.00	0.055	11.55	1.38	7.19	5.98	0.28	0.373
21-Aug-2012	0.00	0.00	0.000	120.00	0.00	0.055	10.40	2.30	7.02	0.41	0.41	0.410
22-Aug-2012	0.00	0.00	0.000	108.00	0.00	0.055	10.48	1.67	6.27	0.41	0.41	0.410
23-Aug-2012	0.00	0.00	0.000	127.00	0.00	0.054	11.41	1.48	6.43	0.41	0.41	0.410
24-Aug-2012	0.00	0.00	0.000	108.00	0.00	0.054	10.02	1.43	5.95	0.41	0.41	0.410
25-Aug-2012	0.00	0.00	0.000	108.00	0.00	0.054	10.63	1.39	6.30	0.41	0.41	0.410
26-Aug-2012	0.00	0.00	0.000	108.00	0.00	0.054	11.14	1.17	6.50	0.41	0.41	0.410
27-Aug-2012	0.00	0.00	0.000	102.00	0.00	0.054	10.35	1.74	6.32	0.41	0.41	0.410
28-Aug-2012	0.00	0.00	0.000	118.00	0.00	0.059	10.27	1.44	6.07	0.41	0.41	0.410
29-Aug-2012	0.00	0.00	0.000	179.00	0.00	0.059	10.32	1.51	6.30	0.41	0.41	0.410
30-Aug-2012	0.00	0.00	0.000	248.00	0.00	0.051	10.25	1.78	6.44	0.41	0.41	0.410
31-Aug-2012	0.00	0.00	0.000	121.00	0.00	0.058	9.88	1.65	6.43	0.41	0.41	0.410
AVERAGE	0.000	0.000	0.000	133.484	0.000	0.057	10.610	1.511	6.520	0.872	0.551	0.598
MAX	0.000	0.000	0.000	248.000	0.000	0.066	12.650	2.296	7.216	5.980	1.770	1.780
MIN	0.000	0.000	0.000	102.000	0.000	0.044	9.557	-0.321	5.952	0.370	0.280	0.331
TOTAL			0.000			1.778			202.122			18.547

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Sep-2012	0.00	0.00	0.000	526.00	0.00	0.059	11.05	1.52	6.89	1.42	0.41	0.591
2-Sep-2012	0.00	0.00	0.000	122.00	0.00	0.053	10.63	1.50	6.11	0.58	0.41	0.490
3-Sep-2012	0.00	0.00	0.000	114.00	0.00	0.051	11.68	-0.25	6.69	0.63	0.36	0.405
4-Sep-2012	0.00	0.00	0.000	271.00	0.00	0.031	10.48	1.38	6.25	1.52	0.29	0.336
5-Sep-2012	0.00	0.00	0.000	113.00	0.00	0.057	11.04	1.34	6.36	0.44	0.28	0.320
6-Sep-2012	0.00	0.00	0.000	239.00	0.00	0.052	10.20	1.53	6.04	0.43	0.32	0.373
7-Sep-2012	0.00	0.00	0.000	112.00	0.00	0.060	9.16	1.51	6.07	1.13	0.34	0.421
8-Sep-2012	0.00	0.00	0.000	116.00	0.00	0.060	10.87	1.65	6.18	0.46	0.36	0.391
9-Sep-2012	0.00	0.00	0.000	225.00	0.00	0.056	12.26	1.38	6.53	0.47	0.35	0.400
10-Sep-2012	0.00	0.00	0.000	112.00	0.00	0.058	10.02	1.65	6.36	0.43	0.37	0.388
11-Sep-2012	0.00	0.00	0.000	124.00	0.00	0.059	9.95	2.21	6.28	0.62	0.36	0.413
12-Sep-2012	0.00	0.00	0.000	111.00	0.00	0.059	10.25	1.80	5.88	0.55	0.41	0.462
13-Sep-2012	0.00	0.00	0.000	110.00	0.00	0.055	10.32	1.76	6.20	2.98	0.43	0.658
14-Sep-2012	0.00	0.00	0.000	102.00	0.00	0.054	9.59	1.81	6.35	1.02	0.53	0.754
15-Sep-2012	0.00	0.00	0.000	212.00	0.00	0.052	11.92	1.58	6.65	1.11	0.68	0.897
16-Sep-2012	0.00	0.00	0.000	112.00	0.00	0.058	11.25	1.62	7.17	19.98	0.21	1.594
17-Sep-2012	0.00	0.00	0.000	113.00	0.00	0.059	10.30	2.05	6.83	0.71	0.45	0.552
18-Sep-2012	0.00	0.00	0.000	112.00	0.00	0.058	10.18	1.66	6.85	0.74	0.48	0.584
19-Sep-2012	0.00	0.00	0.000	111.00	0.00	0.059	10.10	1.84	6.72	0.88	0.53	0.645
20-Sep-2012	0.00	0.00	0.000	110.00	0.00	0.058	10.87	1.65	6.82	1.02	0.58	0.747
21-Sep-2012	0.00	0.00	0.000	113.00	0.00	0.058	10.26	1.66	6.70	1.21	0.71	0.933
22-Sep-2012	0.00	0.00	0.000	115.00	0.00	0.059	11.37	1.77	6.91	1.74	0.78	1.104
23-Sep-2012	0.00	0.00	0.000	116.00	0.00	0.058	11.34	1.03	7.12	1.55	0.85	1.135
24-Sep-2012	0.00	0.00	0.000	118.00	0.00	0.059	11.08	1.72	6.82	1.15	0.70	0.897
25-Sep-2012	0.00	0.00	0.000	110.00	0.00	0.059	9.93	1.54	6.97	1.25	0.69	0.956
26-Sep-2012	0.00	0.00	0.000	114.00	0.00	0.056	10.22	1.71	6.72	1.22	0.75	0.934
27-Sep-2012	0.00	0.00	0.000	118.00	0.00	0.057	10.91	1.82	6.82	1.38	0.70	0.940
28-Sep-2012	0.00	0.00	0.000	109.00	0.00	0.058	9.64	1.62	6.66	1.10	0.67	0.872
29-Sep-2012	0.00	0.00	0.000	117.00	0.00	0.058	11.50	2.19	6.78	1.18	0.66	0.873
30-Sep-2012	0.00	0.00	0.000	113.00	0.00	0.056	11.35	0.97	6.60	1.06	0.64	0.820
1-Oct-2012	0.00	0.00	0.000	113.00	0.00	0.055	10.40	1.31	6.25	1.13	0.65	0.820
AVERAGE	0.000	0.000	0.000	142.677	0.000	0.056	10.649	1.565	6.567	1.648	0.515	0.700
MAX	0.000	0.000	0.000	526.000	0.000	0.060	12.256	2.211	7.168	19.980	0.850	1.594
MIN	0.000	0.000	0.000	102.000	0.000	0.031	9.161	-0.248	5.884	0.430	0.210	0.320
TOTAL			0.000			1.741			203.574			21.705

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Oct-2012	0.00	0.00	0.000	113.00	0.00	0.055	10.40	1.31	6.25	1.13	0.65	0.820
2-Oct-2012	0.00	0.00	0.000	121.00	0.00	0.058	8.99	1.24	6.25	1.01	0.62	0.774
3-Oct-2012	0.00	0.00	0.000	111.00	0.00	0.058	9.66	1.23	6.37	1.05	0.55	0.740
4-Oct-2012	0.00	0.00	0.000	110.00	0.00	0.059	8.54	1.68	6.75	1.02	0.60	0.738
5-Oct-2012	0.00	0.00	0.000	114.00	0.00	0.059	8.74	1.81	6.50	0.99	0.61	0.733
6-Oct-2012	0.00	0.00	0.000	217.00	0.00	0.052	10.56	1.36	6.67	1.16	0.62	0.786
7-Oct-2012	0.00	0.00	0.000	183.00	0.00	0.048	10.73	1.02	6.93	1.07	0.62	0.785
8-Oct-2012	0.00	0.00	0.000	117.00	0.00	0.062	9.46	2.20	6.42	1.03	0.64	0.766
9-Oct-2012	0.00	0.00	0.000	117.00	0.00	0.061	9.57	1.35	5.88	1.05	0.62	0.752
10-Oct-2012	0.00	0.00	0.000	116.00	0.00	0.061	9.57	1.46	5.95	1.05	0.62	0.752
11-Oct-2012	0.00	0.00	0.000	116.00	0.00	0.061	9.67	1.47	6.16	1.05	0.62	0.752
12-Oct-2012	0.00	0.00	0.000	119.00	0.00	0.061	8.91	1.40	6.37	0.56	0.28	0.409
13-Oct-2012	0.00	0.00	0.000	116.00	0.00	0.062	10.31	1.63	6.71	0.49	0.32	0.390
14-Oct-2012	0.00	0.00	0.000	121.00	0.00	0.062	10.49	1.59	6.84	0.52	0.43	0.493
15-Oct-2012	0.00	0.00	0.000	131.00	0.00	0.062	9.08	2.12	6.28	1.20	0.52	0.678
16-Oct-2012	0.00	0.00	0.000	248.00	0.00	0.057	9.34	1.49	6.06	0.72	0.49	0.553
17-Oct-2012	0.00	0.00	0.000	140.00	0.00	0.061	9.48	1.82	6.19	0.80	0.42	0.562
18-Oct-2012	0.00	0.00	0.000	114.00	0.00	0.056	9.11	1.20	6.38	0.76	0.48	0.559
19-Oct-2012	0.00	0.00	0.000	104.00	0.00	0.050	8.98	1.53	6.64	0.60	0.45	0.515
20-Oct-2012	0.00	0.00	0.000	125.00	0.00	0.058	10.38	1.56	6.92	0.64	0.45	0.519
21-Oct-2012	0.00	0.00	0.000	200.00	0.00	0.052	10.85	1.58	7.12	0.64	0.48	0.555
22-Oct-2012	0.00	0.00	0.000	106.00	0.00	0.052	9.69	1.58	6.92	19.12	0.44	0.592
23-Oct-2012	0.00	0.00	0.000	111.00	0.00	0.053	10.01	1.63	6.91	0.90	0.41	0.534
24-Oct-2012	0.00	0.00	0.000	109.00	0.00	0.055	9.54	1.65	6.62	0.55	0.42	0.472
25-Oct-2012	0.00	0.00	0.000	116.00	0.00	0.056	9.64	1.67	6.59	0.54	0.39	0.443
26-Oct-2012	0.00	0.00	0.000	106.00	0.00	0.055	8.86	1.75	6.56	0.54	0.39	0.443
27-Oct-2012	0.00	0.00	0.000	231.00	0.00	0.055	10.49	1.62	6.89	0.48	0.38	0.425
28-Oct-2012	0.00	0.00	0.000	109.00	0.00	0.057	10.32	1.57	7.08	0.50	0.38	0.427
29-Oct-2012	0.00	0.00	0.000	112.00	0.00	0.054	9.43	2.08	6.56	0.69	0.38	0.475
30-Oct-2012	0.00	0.00	0.000	250.00	0.00	0.058	10.18	2.08	6.69	0.49	0.36	0.415
31-Oct-2012	0.00	0.00	0.000	246.00	0.00	0.047	9.32	1.95	6.38	6.06	0.35	0.461
AVERAGE	0.000	0.000	0.000	140.290	0.000	0.057	9.688	1.601	6.544	0.41	0.30	0.322
MAX	0.000	0.000	0.000	250.000	0.000	0.062	10.851	2.203	7.116	1.16	0.650	0.769
MIN	0.000	0.000	0.000	104.000	0.000	0.047	8.543	1.022	5.885	0.410	0.280	0.322
TOTAL			0.000			1.758			202.872			23.828

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Nov-2012	0.00	0.00	0.000	116.00	0.00	0.062	9.66	1.45	6.69	2.21	0.29	0.646
2-Nov-2012	0.00	0.00	0.000	120.00	0.00	0.061	9.47	1.83	6.47	0.44	0.28	0.328
3-Nov-2012	0.00	0.00	0.000	164.00	0.00	0.057	11.09	1.48	6.84	0.38	0.28	0.329
4-Nov-2012	0.00	0.00	0.000	114.00	0.00	0.059	10.96	1.31	7.32	0.38	0.29	0.343
5-Nov-2012	0.00	0.00	0.000	112.00	0.00	0.057	10.10	1.76	6.73	6.00	0.31	0.387
6-Nov-2012	0.00	0.00	0.000	107.00	0.00	0.049	9.60	1.44	6.95	2.65	0.31	0.992
7-Nov-2012	0.00	0.00	0.000	245.00	0.00	0.059	9.86	2.14	7.45	0.61	0.32	0.368
8-Nov-2012	0.00	0.00	0.000	121.00	0.00	0.065	10.11	2.00	7.28	4.29	0.32	0.411
9-Nov-2012	0.00	0.00	0.000	130.00	0.00	0.065	9.49	2.18	7.07	1.49	0.31	0.375
10-Nov-2012	0.00	0.00	0.000	121.00	0.00	0.065	11.42	2.00	7.45	0.41	0.29	0.346
11-Nov-2012	0.00	0.00	0.000	127.00	0.00	0.064	10.56	1.59	7.06	0.40	0.31	0.335
12-Nov-2012	0.00	0.00	0.000	123.00	0.00	0.058	11.10	1.92	7.14	0.38	0.29	0.325
13-Nov-2012	0.00	0.00	0.000	242.00	0.00	0.019	9.28	1.41	6.48	0.36	0.27	0.310
14-Nov-2012	0.00	0.00	0.000	176.00	0.00	0.049	9.54	1.69	6.73	1.07	0.27	0.318
15-Nov-2012	0.00	0.00	0.000	242.00	0.00	0.053	10.01	1.67	6.69	0.50	0.27	0.303
16-Nov-2012	0.00	0.00	0.000	99.00	0.00	0.050	9.18	1.63	6.60	0.69	0.26	0.312
17-Nov-2012	0.00	0.00	0.000	242.00	0.00	0.054	10.81	1.69	6.95	1.27	0.28	0.368
18-Nov-2012	0.00	0.00	0.000	219.00	0.00	0.049	10.20	1.86	7.11	0.88	0.28	0.343
19-Nov-2012	0.00	0.00	0.000	117.00	0.00	0.057	8.90	2.22	6.30	0.38	0.29	0.334
20-Nov-2012	0.00	0.00	0.000	116.00	0.00	0.058	9.82	1.39	6.30	0.41	0.30	0.352
21-Nov-2012	0.00	0.00	0.000	112.00	0.00	0.058	9.43	1.57	6.19	0.45	0.32	0.381
22-Nov-2012	0.00	0.00	0.000	220.00	0.00	0.052	11.45	1.47	6.47	1.43	0.35	0.612
23-Nov-2012	0.00	0.00	0.000	241.00	0.00	0.055	10.03	1.62	5.86	0.43	0.33	0.373
24-Nov-2012	0.00	0.00	0.000	118.00	0.00	0.057	10.61	1.50	6.19	0.48	0.32	0.385
25-Nov-2012	0.00	0.00	0.000	116.00	0.00	0.057	10.78	1.42	6.52	0.46	0.33	0.390
26-Nov-2012	0.00	0.00	0.000	214.00	0.00	0.055	9.53	1.48	6.07	0.55	0.34	0.392
27-Nov-2012	0.00	0.00	0.000	233.00	0.00	0.050	9.13	1.51	6.14	0.48	0.33	0.396
28-Nov-2012	0.00	0.00	0.000	101.00	0.00	0.051	9.74	1.67	6.00	0.55	0.36	0.437
29-Nov-2012	0.00	0.00	0.000	105.00	0.00	0.050	9.53	1.47	5.86	0.49	0.36	0.409
30-Nov-2012	0.00	0.00	0.000	213.00	0.00	0.048	11.10	1.63	6.91	19.98	0.35	0.595
1-Dec-2012	0.00	0.00	0.000	111.00	0.00	0.041	10.33	1.63	6.47	0.45	0.33	0.381
AVERAGE	0.000	0.000	0.000	156.032	0.000	0.054	10.091	1.665	6.655	1.644	0.308	0.406
MAX	0.000	0.000	0.000	245.000	0.000	0.065	11.445	2.220	7.452	19.980	0.360	0.992
MIN	0.000	0.000	0.000	99.000	0.000	0.019	8.901	1.306	5.861	0.360	0.260	0.303
TOTAL			0.000			1.683			206.309			12.576

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Dec-2012	0.00	0.00	0.000	111.00	0.00	0.041	10.33	1.63	6.47	0.45	0.33	0.381
2-Dec-2012	0.00	0.00	0.000	225.00	0.00	0.046	11.34	1.40	7.47	0.57	0.33	0.408
3-Dec-2012	0.00	0.00	0.000	130.00	0.00	0.063	9.50	1.19	6.36	0.46	0.34	0.389
4-Dec-2012	0.00	0.00	0.000	127.00	0.00	0.063	9.31	1.71	5.95	0.66	0.32	0.378
5-Dec-2012	0.00	0.00	0.000	129.00	0.00	0.064	9.98	1.64	6.66	0.49	0.30	0.365
6-Dec-2012	0.00	0.00	0.000	219.00	0.00	0.056	9.18	1.64	6.28	4.63	0.30	0.421
7-Dec-2012	0.00	0.00	0.000	230.00	0.00	0.050	8.70	2.11	6.12	3.18	0.28	0.423
8-Dec-2012	0.00	0.00	0.000	237.00	0.00	0.043	10.74	1.54	6.31	1.91	0.29	0.456
9-Dec-2012	0.00	0.00	0.000	137.00	0.00	0.041	10.49	1.61	6.51	1.73	0.33	0.486
10-Dec-2012	0.00	0.00	0.000	246.00	0.00	0.058	9.66	1.85	6.12	1.03	0.29	0.434
11-Dec-2012	0.00	0.00	0.000	228.00	0.00	0.055	9.41	1.65	6.31	0.99	0.28	0.400
12-Dec-2012	0.00	0.00	0.000	104.00	0.00	0.051	9.91	1.67	6.61	0.44	0.31	0.360
13-Dec-2012	0.00	0.00	0.000	233.00	0.00	0.042	9.78	1.70	6.52	0.69	0.30	0.363
14-Dec-2012	0.00	0.00	0.000	110.00	0.00	0.055	8.90	1.73	6.38	0.53	0.30	0.327
15-Dec-2012	0.00	0.00	0.000	234.00	0.00	0.049	10.41	1.54	6.56	0.62	0.28	0.344
16-Dec-2012	0.00	0.00	0.000	252.00	0.00	0.038	10.22	1.63	6.87	0.39	0.28	0.332
17-Dec-2012	0.00	0.00	0.000	107.00	0.00	0.053	9.66	1.79	6.55	7.20	0.13	0.408
18-Dec-2012	0.00	0.00	0.000	215.00	0.00	0.050	9.53	1.55	6.45	0.91	0.31	0.419
19-Dec-2012	0.00	0.00	0.000	253.00	0.00	0.042	9.47	1.38	6.52	0.41	0.31	0.356
20-Dec-2012	0.00	0.00	0.000	237.00	0.00	0.055	9.30	1.70	6.33	0.42	0.30	0.355
21-Dec-2012	0.00	0.00	0.000	117.00	0.00	0.056	10.29	1.86	6.38	0.42	0.31	0.364
22-Dec-2012	0.00	0.00	0.000	120.00	0.00	0.055	9.49	1.55	6.81	0.71	0.33	0.387
23-Dec-2012	0.00	0.00	0.000	108.00	0.00	0.047	11.98	1.51	7.49	1.77	0.34	0.425
24-Dec-2012	0.00	0.00	0.000	219.00	0.00	0.043	11.43	1.62	6.81	0.50	0.34	0.410
25-Dec-2012	0.00	0.00	0.000	224.00	0.00	0.050	10.50	1.60	6.34	0.46	0.32	0.381
26-Dec-2012	0.00	0.00	0.000	118.00	0.00	0.058	10.55	2.11	6.53	0.46	0.32	0.378
27-Dec-2012	0.00	0.00	0.000	256.00	0.00	0.056	9.42	1.93	6.30	0.81	0.34	0.441
28-Dec-2012	0.00	0.00	0.000	128.00	0.00	0.058	9.44	1.63	6.04	0.46	0.31	0.390
29-Dec-2012	0.00	0.00	0.000	228.00	0.00	0.058	10.34	1.60	6.32	0.92	0.44	0.512
30-Dec-2012	0.00	0.00	0.000	219.00	0.00	0.047	10.34	1.65	6.30	0.53	0.35	0.435
31-Dec-2012	0.00	0.00	0.000	215.00	0.00	0.059	10.92	1.71	6.22	0.53	0.37	0.441
AVERAGE	0.000	0.000	0.000	184.387	0.000	0.052	10.016	1.660	6.481	1.138	0.312	0.399
MAX	0.000	0.000	0.000	256.000	0.000	0.064	11.982	2.114	7.487	7.200	0.440	0.512
MIN	0.000	0.000	0.000	104.000	0.000	0.038	8.702	1.188	5.948	0.390	0.130	0.327
TOTAL			0.000			1.602			200.911			12.367

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Jan-2013	0.00	0.00	0.000	235.00	0.00	0.058	10.06	1.70	5.90	0.51	0.35	0.409
2-Jan-2013	0.00	0.00	0.000	110.00	0.00	0.050	10.57	1.69	6.25	2.47	0.34	0.680
3-Jan-2013	0.00	0.00	0.000	225.00	0.00	0.051	9.80	1.88	6.08	0.45	0.30	0.370
4-Jan-2013	0.00	0.00	0.000	224.00	0.00	0.054	9.09	1.66	6.06	0.54	0.34	0.404
5-Jan-2013	0.00	0.00	0.000	217.00	0.00	0.055	10.13	1.56	6.36	8.33	0.35	0.590
6-Jan-2013	0.00	0.00	0.000	228.00	0.00	0.053	11.33	1.35	6.94	0.59	0.31	0.358
7-Jan-2013	0.00	0.00	0.000	234.00	0.00	0.052	9.34	1.72	6.30	0.52	0.36	0.415
8-Jan-2013	0.00	0.00	0.000	230.00	0.00	0.047	8.66	1.77	6.47	0.49	0.34	0.402
9-Jan-2013	0.00	0.00	0.000	232.00	0.00	0.037	10.04	1.65	6.13	10.09	0.31	0.428
10-Jan-2013	0.00	0.00	0.000	108.00	0.00	0.054	8.94	1.60	6.11	0.37	0.29	0.322
11-Jan-2013	0.00	0.00	0.000	116.00	0.00	0.054	9.16	1.73	6.04	0.39	0.29	0.322
12-Jan-2013	0.00	0.00	0.000	112.00	0.00	0.057	10.10	1.64	6.22	0.48	0.30	0.359
13-Jan-2013	0.00	0.00	0.000	109.00	0.00	0.057	10.47	1.34	6.41	0.42	0.29	0.339
14-Jan-2013	0.00	0.00	0.000	114.00	0.00	0.053	9.08	1.66	6.07	0.89	0.30	0.417
15-Jan-2013	0.00	0.00	0.000	214.00	0.00	0.054	9.65	1.69	6.08	0.53	0.42	0.461
16-Jan-2013	0.00	0.00	0.000	249.00	0.00	0.051	11.72	1.66	6.04	0.52	0.39	0.453
17-Jan-2013	0.00	0.00	0.000	217.00	0.00	0.044	9.30	1.60	6.03	0.54	0.41	0.467
18-Jan-2013	0.00	0.00	0.000	116.00	0.00	0.058	9.40	1.59	5.91	0.54	0.41	0.469
19-Jan-2013	0.00	0.00	0.000	221.00	0.00	0.055	10.43	1.25	6.19	0.66	0.40	0.508
20-Jan-2013	0.00	0.00	0.000	234.00	0.00	0.058	11.39	1.22	6.13	0.66	0.43	0.559
21-Jan-2013	0.00	0.00	0.000	116.00	0.00	0.058	10.01	1.34	6.69	0.87	0.43	0.532
22-Jan-2013	0.00	0.00	0.000	168.00	0.00	0.056	9.14	2.10	6.37	0.77	0.44	0.477
23-Jan-2013	0.00	0.00	0.000	112.00	0.00	0.057	9.06	1.48	5.95	0.53	0.38	0.417
24-Jan-2013	0.00	0.00	0.000	123.00	0.00	0.059	9.59	1.49	5.93	0.51	0.36	0.405
25-Jan-2013	0.00	0.00	0.000	122.00	0.00	0.059	9.39	1.65	5.97	0.50	0.36	0.430
26-Jan-2013	0.00	0.00	0.000	219.00	0.00	0.051	9.84	1.30	6.12	0.54	0.38	0.452
27-Jan-2013	0.00	0.00	0.000	236.00	0.00	0.059	10.70	0.74	6.55	0.54	0.37	0.817
28-Jan-2013	0.00	0.00	0.000	113.00	0.00	0.054	9.59	1.34	5.99	19.69	0.35	0.426
29-Jan-2013	0.00	0.00	0.000	109.00	0.00	0.056	9.48	1.39	5.98	0.51	0.35	0.426
30-Jan-2013	0.00	0.00	0.000	109.00	0.00	0.056	8.89	1.71	5.87	0.56	0.40	0.454
31-Jan-2013	0.00	0.00	0.000	213.00	0.00	0.056	8.31	1.32	5.63	0.67	0.40	0.503
AVERAGE	0.000	0.000	0.000	173.710	0.000	0.054	9.763	1.544	6.154	0.64	0.42	0.502
MAX	0.000	0.000	0.000	249.000	0.000	0.059	11.718	2.103	6.939	1.796	0.362	0.456
MIN	0.000	0.000	0.000	108.000	0.000	0.037	8.313	0.744	5.631	0.370	0.290	0.322
TOTAL			0.000			1.673			190.763			14.147

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Feb-2013	0.00	0.00	0.000	213.00	0.00	0.059	8.86	1.54	5.99	0.64	0.39	0.489
2-Feb-2013	0.00	0.00	0.000	113.00	0.00	0.052	10.34	1.42	6.01	0.60	0.39	0.484
3-Feb-2013	0.00	0.00	0.000	226.00	0.00	0.047	10.07	1.17	6.09	0.66	0.40	0.466
4-Feb-2013	0.00	0.00	0.000	100.00	0.00	0.052	12.73	3.11	6.51	0.56	0.38	0.460
5-Feb-2013	0.00	0.00	0.000	98.00	0.00	0.021	9.22	1.56	5.76	0.63	0.40	0.445
6-Feb-2013	0.00	0.00	0.000	262.00	0.00	0.032	9.08	1.42	5.96	0.60	0.36	0.423
7-Feb-2013	0.00	0.00	0.000	236.00	0.00	0.055	9.25	1.43	6.01	0.47	0.37	0.409
8-Feb-2013	0.00	0.00	0.000	258.00	0.00	0.052	9.79	1.49	5.84	0.51	0.36	0.416
9-Feb-2013	0.00	0.00	0.000	230.00	0.00	0.050	10.70	1.40	6.17	17.88	0.42	0.551
10-Feb-2013	0.00	0.00	0.000	104.00	0.00	0.051	10.18	1.49	6.25	0.51	0.37	0.435
11-Feb-2013	0.00	0.00	0.000	99.00	0.00	0.047	9.12	1.68	6.20	0.48	0.30	0.377
12-Feb-2013	0.00	0.00	0.000	223.00	0.00	0.050	9.39	1.64	5.93	0.50	0.30	0.357
13-Feb-2013	0.00	0.00	0.000	107.00	0.00	0.052	9.32	1.44	5.81	0.44	0.34	0.390
14-Feb-2013	0.00	0.00	0.000	220.00	0.00	0.052	9.02	1.59	5.95	0.48	0.35	0.408
15-Feb-2013	0.00	0.00	0.000	108.00	0.00	0.053	9.09	1.66	5.95	0.53	0.37	0.443
16-Feb-2013	0.00	0.00	0.000	116.00	0.00	0.043	11.07	1.47	6.16	1.50	0.39	0.511
17-Feb-2013	0.00	0.00	0.000	240.00	0.00	0.041	9.81	1.43	6.04	0.53	0.36	0.427
18-Feb-2013	0.00	0.00	0.000	120.00	0.00	0.061	10.06	1.35	6.33	0.48	0.35	0.398
19-Feb-2013	0.00	0.00	0.000	129.00	0.00	0.061	9.40	1.37	6.19	0.56	0.36	0.396
20-Feb-2013	0.00	0.00	0.000	121.00	0.00	0.063	9.88	1.35	6.02	0.47	0.35	0.400
21-Feb-2013	0.00	0.00	0.000	205.00	0.00	0.061	8.36	1.44	5.80	0.52	0.35	0.417
22-Feb-2013	0.00	0.00	0.000	128.00	0.00	0.055	9.19	1.33	6.10	0.51	0.38	0.440
23-Feb-2013	0.00	0.00	0.000	232.00	0.00	0.048	10.83	1.44	6.16	0.71	0.37	0.481
24-Feb-2013	0.00	0.00	0.000	116.00	0.00	0.056	9.99	1.31	6.20	0.55	0.36	0.409
25-Feb-2013	0.00	0.00	0.000	114.00	0.00	0.057	9.82	1.36	6.14	0.51	0.34	0.412
26-Feb-2013	0.00	0.00	0.000	112.00	0.00	0.057	9.30	1.41	5.97	0.56	0.33	0.401
27-Feb-2013	0.00	0.00	0.000	134.00	0.00	0.058	9.03	1.42	5.77	1.20	0.32	0.423
28-Feb-2013	0.00	0.00	0.000	215.00	0.00	0.055	9.33	1.38	6.31	0.51	0.33	0.388
1-Mar-2013	0.00	0.00	0.000	221.00	0.00	0.054	8.82	1.88	5.99	0.52	0.35	0.408
2-Mar-2013	0.00	0.00	0.000	214.00	0.00	0.050	10.29	1.33	6.10	19.98	0.33	0.647
3-Mar-2013	0.00	0.00	0.000	162.00	0.00	0.065	9.94	1.16	6.34	0.42	0.31	0.348
AVERAGE	0.000	0.000	0.000	166.968	0.000	0.052	9.719	1.499	6.066	1.775	0.357	0.434
MAX	0.000	0.000	0.000	262.000	0.000	0.065	12.735	3.112	6.509	19.980	0.420	0.647
MIN	0.000	0.000	0.000	98.000	0.000	0.021	8.360	1.164	5.764	0.420	0.300	0.348
TOTAL			0.000			1.613			188.045			13.460

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW			S. PLANT GRIT FLOW			TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)
1-Mar-2013	0.00	0.00	0.000	221.00	0.00	0.054	8.82	1.88	5.99	0.52	0.35	0.408
2-Mar-2013	0.00	0.00	0.000	214.00	0.00	0.050	10.29	1.33	6.10	19.98	0.33	0.647
3-Mar-2013	0.00	0.00	0.000	162.00	0.00	0.065	9.94	1.16	6.34	0.42	0.31	0.348
4-Mar-2013	0.00	0.00	0.000	143.00	0.00	0.074	9.22	1.40	6.04	0.34	0.34	0.340
5-Mar-2013	0.00	0.00	0.000	251.00	0.00	0.064	9.73	1.68	6.04	0.34	0.34	0.340
6-Mar-2013	0.00	0.00	0.000	109.00	0.00	0.051	9.14	1.55	5.95	0.34	0.34	0.340
7-Mar-2013	0.00	0.00	0.000	242.00	0.00	0.049	8.75	1.39	5.69	0.34	0.34	0.340
8-Mar-2013	0.00	0.00	0.000	241.00	0.00	0.043	8.76	1.38	6.05	0.34	0.34	0.340
9-Mar-2013	0.00	0.00	0.000	106.00	0.00	0.050	9.30	1.38	6.17	0.98	0.34	0.454
10-Mar-2013	0.00	0.00	0.000	109.00	0.00	0.050	9.76	1.53	6.15	0.48	0.28	0.361
11-Mar-2013	0.00	0.00	0.000	107.00	0.00	0.052	9.47	1.40	6.17	0.46	0.30	0.360
12-Mar-2013	0.00	0.00	0.000	107.00	0.00	0.044	9.36	1.68	6.16	4.06	0.28	0.436
13-Mar-2013	0.00	0.00	0.000	257.00	0.00	0.037	9.03	1.63	6.15	0.68	0.32	0.412
14-Mar-2013	0.00	0.00	0.000	107.00	0.00	0.054	9.68	1.45	5.94	0.41	0.30	0.349
15-Mar-2013	0.00	0.00	0.000	116.00	0.00	0.057	9.27	1.46	5.85	0.51	0.32	0.384
16-Mar-2013	0.00	0.00	0.000	125.00	0.00	0.060	11.00	1.42	6.08	0.52	0.36	0.424
17-Mar-2013	0.00	0.00	0.000	124.00	0.00	0.060	9.85	1.12	6.03	0.45	0.35	0.390
18-Mar-2013	0.00	0.00	0.000	117.00	0.00	0.062	9.72	1.18	6.23	0.56	0.35	0.414
19-Mar-2013	0.00	0.00	0.000	124.00	0.00	0.055	10.17	1.33	5.87	0.46	0.33	0.380
20-Mar-2013	0.00	0.00	0.000	215.00	0.00	0.045	9.54	1.36	5.87	0.42	0.31	0.362
21-Mar-2013	0.00	0.00	0.000	230.00	0.00	0.053	9.96	1.34	5.76	0.58	0.30	0.361
22-Mar-2013	0.00	0.00	0.000	230.00	0.00	0.054	9.45	1.39	5.72	0.40	0.29	0.333
23-Mar-2013	0.00	0.00	0.000	231.00	0.00	0.053	10.48	1.30	6.03	0.42	0.27	0.317
24-Mar-2013	0.00	0.00	0.000	109.00	0.00	0.051	9.70	1.17	5.86	0.40	0.27	0.325
25-Mar-2013	0.00	0.00	0.000	185.00	0.00	0.051	9.63	1.22	6.03	0.38	0.27	0.320
26-Mar-2013	0.00	0.00	0.000	113.00	0.00	0.057	9.14	1.58	5.74	0.41	0.29	0.330
27-Mar-2013	0.00	0.00	0.000	110.00	0.00	0.053	9.29	1.34	6.00	0.44	0.27	0.314
28-Mar-2013	0.00	0.00	0.000	122.00	0.00	0.055	9.50	1.33	6.03	0.38	0.26	0.302
29-Mar-2013	0.00	0.00	0.000	114.00	0.00	0.058	9.87	1.49	5.93	0.39	0.25	0.291
30-Mar-2013	0.00	0.00	0.000	113.00	0.00	0.059	10.28	1.40	6.04	0.36	0.26	0.297
31-Mar-2013	0.00	0.00	0.000	112.00	0.00	0.056	14.13	1.72	7.59	19.94	0.28	0.734
AVERAGE	0.000	0.000	0.000	156.968	0.000	0.054	9.749	1.420	6.052	1.829	0.308	0.379
MAX	0.000	0.000	0.000	257.000	0.000	0.074	14.128	1.883	7.595	19.980	0.360	0.734
MIN	0.000	0.000	0.000	106.000	0.000	0.037	8.753	1.118	5.689	0.340	0.250	0.291
TOTAL			0.000			1.677			187.615			11.753

City of Manteca - WQCF Monthly Report

Day	SOUTH PLANT RECYCLE FLOW				S. PLANT GRIT FLOW				TOTAL PLANT FLOW INSTANTANEOUS			FINAL EFFLUENT TURBIDITY		
	Max (GPM)	Min (GPM)	Total (MG)	Max (GPM)	Min (GPM)	Total (MG)	Max (MGD)	Min (MGD)	Total (MG)	Max (NTU)	Min (NTU)	Average (NTU)		
1-Apr-2013	0.00	0.00	0.000	241.00	0.00	0.050	10.29	1.81	6.72	0.31	0.25	0.276		
2-Apr-2013	0.00	0.00	0.000	234.00	0.00	0.042	9.01	1.36	5.99	0.35	0.26	0.296		
3-Apr-2013	0.00	0.00	0.000	133.00	0.00	0.058	9.41	1.65	6.17	0.99	0.26	0.373		
4-Apr-2013	0.00	0.00	0.000	238.00	0.00	0.056	12.99	1.72	6.73	0.47	0.32	0.378		
5-Apr-2013	0.00	0.00	0.000	228.00	0.00	0.055	10.08	1.87	6.54	0.40	0.30	0.341		
6-Apr-2013	0.00	0.00	0.000	116.00	0.00	0.058	10.87	1.78	6.42	0.48	0.31	0.350		
7-Apr-2013	0.00	0.00	0.000	112.00	0.00	0.052	10.20	1.80	6.56	2.04	0.26	0.564		
8-Apr-2013	0.00	0.00	0.000	222.00	0.00	0.050	9.66	1.51	6.28	0.41	0.25	0.310		
9-Apr-2013	0.00	0.00	0.000	114.00	0.00	0.059	9.82	1.37	6.05	0.40	0.27	0.322		
10-Apr-2013	0.00	0.00	0.000	234.00	0.00	0.060	10.03	1.66	6.17	0.44	0.27	0.331		
11-Apr-2013	0.00	0.00	0.000	116.00	0.00	0.057	9.94	1.68	5.97	0.38	0.28	0.322		
12-Apr-2013	0.00	0.00	0.000	243.00	0.00	0.050	12.16	1.44	6.24	0.49	0.29	0.358		
13-Apr-2013	0.00	0.00	0.000	108.00	0.00	0.055	12.56	3.23	7.94	0.47	0.36	0.404		
14-Apr-2013	0.00	0.00	0.000	230.00	0.00	0.055	12.42	3.21	8.09	0.53	0.30	0.397		
15-Apr-2013	0.00	0.00	0.000	116.00	0.00	0.056	10.60	3.39	7.19	1.17	0.48	0.525		
16-Apr-2013	0.00	0.00	0.000	231.00	0.00	0.052	10.80	3.23	7.33	0.50	0.49	0.499		
17-Apr-2013	0.00	0.00	0.000	114.00	0.00	0.057	9.77	1.35	6.09	0.50	0.49	0.499		
18-Apr-2013	0.00	0.00	0.000	109.00	0.00	0.057	9.85	1.45	6.02	0.50	0.49	0.499		
19-Apr-2013	0.00	0.00	0.000	110.00	0.00	0.055	9.31	1.32	6.10	0.50	0.49	0.498		
20-Apr-2013	0.00	0.00	0.000	210.00	0.00	0.052	10.49	1.39	6.12	0.86	0.49	0.558		
21-Apr-2013	0.00	0.00	0.000	106.00	0.00	0.055	10.40	1.45	6.38	0.56	0.34	0.453		
22-Apr-2013	0.00	0.00	0.000	104.00	0.00	0.054	9.83	1.70	6.47	0.52	0.31	0.393		
23-Apr-2013	0.00	0.00	0.000	103.00	0.00	0.052	10.13	1.92	6.55	0.40	0.32	0.371		
24-Apr-2013	0.00	0.00	0.000	223.00	0.00	0.055	10.33	1.74	6.60	0.39	0.32	0.342		
25-Apr-2013	0.00	0.00	0.000	236.00	0.00	0.056	10.34	2.09	6.57	0.35	0.29	0.311		
26-Apr-2013	0.00	0.00	0.000	122.00	0.00	0.060	9.11	1.78	6.46	0.37	0.29	0.311		
27-Apr-2013	0.00	0.00	0.000	229.00	0.00	0.053	10.81	1.92	6.59	0.34	0.34	0.340		
28-Apr-2013	0.00	0.00	0.000	239.00	0.00	0.045	11.07	1.28	6.24	0.34	0.34	0.340		
29-Apr-2013	0.00	0.00	0.000	246.00	0.00	0.050	10.37	0.75	6.77	0.34	0.34	0.340		
30-Apr-2013	0.00	0.00	0.000	241.00	0.00	0.051	9.70	1.72	6.33	0.34	0.34	0.340		
1-May-2013	0.00	0.00	0.000	115.00	0.00	0.058	9.83	1.75	6.48	0.34	0.34	0.340		
AVERAGE	0.000	0.000	0.000	174.935	0.000	0.054	10.393	1.817	6.521	0.532	0.338	0.387		
MAX	0.000	0.000	0.000	246.000	0.000	0.060	12.993	3.393	8.088	2.040	0.490	0.564		
MIN	0.000	0.000	0.000	103.000	0.000	0.042	9.008	0.753	5.973	0.310	0.250	0.276		
TOTAL			0.000			1.672			202.154			11.982		

SECTION 01060

SAFETY AND HEALTH

PART 1 GENERAL

1.1 GENERAL

A. RAW WASTEWATER.

Portions of the wastewater quality control facility, including the wet well and trunk sewers, are exposed to raw wastewater. Other portions of the facility are exposed to wastewaters of varying degrees of treatment. The Contractor certifies that he is experienced and qualified to anticipate and meet the safety and health requirements of this project.

Workmen involved in the removal, renovation, or installation of equipment within the treatment plant may be exposed to disease-producing organisms. The Contractor shall require his personnel to observe proper hygienic and safety precautions.

Solvents, gasoline, and other hazardous material enter the plant with incoming sewage, and, therefore, certain areas are hazardous to open flame, sparks, or unventilated occupancy. The Contractor shall take measures to assure his personnel observe proper safety precautions when working in these areas.

B. WET WELL PERMITTED CONFINED SPACE.

The wet side of the Influent Pump Station including the wet well and influent room is a permitted confined space and shall be treated as such. Elevated levels of hydrogen sulfide gas have been encountered in the Influent Pump Station. An odalog graph of hydrogen sulfide gas concentrations taken within the influent room of the Influent Pump Station is attached to this specification section. The odalog data record was located approximately 2 feet above the grating next to the entrance of the north truck sewer. Measurements were taken from May 10 to May 18, 2012 and represent hydrogen sulfide gas concentrations for those days only. The Contractor should expect hydrogen sulfide gas concentrations to vary. Additional dangers in the influent room include, but may not be limited to, falling debris, unstable walking surfaces, entrapment hazards, and engulfment hazards.

- C. Other confined spaces, both permitted and not permitted, may be located at the Facility. The Contractor shall conduct construction operations within the requirements of CalOSHA regulations for all confined spaces.

1.2 SAFETY AND HEALTH REGULATIONS

The Contractor shall comply with Safety and Health Regulations for Construction, as promulgated by Federal Regulations. The Contractor shall comply with Federal and State of California Occupational Safety and Health Act, as amended.

END OF SECTION

SECTION 02140
BYPASS PUMPING

PART 1 GENERAL

1.1 DESCRIPTION

Provide a bypass pumping system that will pump the entire City's wastewater flow from the north and south trunk sewer manholes into the wet well of the Influent Pump Station; bypassing the influent room. Discharge location shall be as shown on Sheet C3 such that the wastewater flow will go through the City's bar screens.

1.2 SUBMITTALS

- A. The Contractor shall prepare and submit to the Owner, the following submittals:
1. Bypass pumping plan with a backup plan. Backup plan shall be based on the scenario of a pump failure and a power failure.
 2. Engineering calculations and data on pumps verifying they are adequate to perform.
 3. Engineering calculations for bulkhead system.

1.3 PUMPING SYSTEM

- A. The Contractor shall select pumps and piping adequate to pump the wastewater influent from the north and south trunk sewers to the Influent Pump Station Wet Well. Contractor shall provide engineering calculations.
- B. Calculations shall be based on information provided in Section 01020.
- C. Do not create an overflow or spill occurrence. Section 01020 provides information on sewer system elevations.
- D. The Contractor shall have backup systems and design a fail-safe pumping system.
- E. The Contractor shall have an operator experienced with pumping systems onsite 24/7 until the bulkheads have been removed and the bypass pumping terminated.
- F. Power for pumping system shall be provided by the Contractor

1.4 WASTEWATER DISCHARGE

- A. The Contractor shall discharge wastewater into the wet well, upstream of the bar screens. The discharge piping shall extend to the bottom of the wet well.
- B. When considering by-pass pumping note that the south plant grit and recycle flows do not contain solids larger than 3/8" and therefore can be pumped to the south plant grit tanks instead of the IPS wet well.

1.5 BULKHEADS

- A. The Contractor shall install bulkheads within the trunk sewers or trunk sewer manholes that will prevent wastewater from entering the Influent Room during work below the grating level.
- B. Bulkheads shall be designed by an engineer to withstand static water levels and wave action.

- C. The Contractor shall remove bulkheads and repair damage to trunk sewer pipe/manhole and liner system.

1.6 SOLIDS HANDLING

- A. Solids contained in the bypass wastewater discharge upstream of the City's bar screen will be screened by the bar screens and disposed of by the City.
- B. Approximate total solids removed by the bar screens is 500 lbs per day. Contractor shall remove and properly dispose of accumulated solids in the trunk sewer before the bulkheads are removed.
- C. Contractor shall be responsible for disposing of solids in conformance with all federal, state, and local waste disposal regulations. All debris disposal from the job site shall be through the City of Manteca Solids Waste Division and paid for by the Contractor.
- D. All wastewater entering the Wet Well is screened to 3/8 inch. The City's screening system includes two bar screens, conveyors, a grinder/compactor, and a trash bin. The City disposes of all solids removed by their solids removal system. It is anticipated that the Contractor will use the City's solids screening system to accomplish screening.

1.7 ENVIRONMENTAL REGULATIONS AND VIOLATIONS

- A. **Indemnification clause** to protect City and consultants from spill.
- B. **Language that Contractor shall pay all fines** assessed to City for spill.
- C. **Will contractor pay fines for process violations??**

PART 2 MATERIALS: Not Used.

PART 3 EXECUTION

3.1 SHUTDOWN OF NORTH AND SOUTH TRUNK SYSTEM

- A. See Section 01020 for information on shutdown of the City's north and south trunk sewers.

END OF SECTION

SECTION 02201
TRENCHING, PIPE EMBEDMENT, AND TRENCH BACKFILL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope:
1. Clearing, grubbing and site preparation.
 2. Removal and disposal of debris.
 3. Handling, storage, transportation and disposal of excavated material.
 4. Sheeting, shoring, bracing and protection Work.
 5. Pumping and dewatering trenches.
 6. Backfilling.
 7. Pipe embedment.
 8. Potholing of existing utilities at treatment facility site.
 9. Appurtenant Work.

1.02 QUALITY ASSURANCE

- A. Labor Code 6705 – Protection of Workers in Excavations:
As required by Section 6705 of the California Labor Code and in addition thereto, whenever work under the Contract involves the excavation of any trench or trenches 5 feet or more in depth, the Contractor shall submit for acceptance by the Owner or by a registered civil or structural engineer, employed by the Owner, to whom authority to accept has been delegated, in advance of excavation, a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for work protection from the hazard of caving ground during the excavation, of such trench or trenches. If such plan varies from the shoring system standards established by the Construction Safety Orders of the Division of Industrial Safety, the plan shall be prepared by a registered civil or structural engineer employed by the Contractor, and all costs therefore shall be included in the price named in the Contract for completion of the Work as set forth in the Contract Documents. Nothing in this Section shall be deemed to allow the use of a shoring, sloping, or other protective system less effective than that required by the Construction Safety Orders. Nothing in this Section shall be construed to impose tort liability on the Owner, or any of their officers, agents, representatives, or employees.
- B. Requirements of Regulatory Agencies:
1. Comply with all requirements of local, county and state agencies.

1.03 JOB CONDITIONS

- A. Protection:
1. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling.
 2. Do not remove trees from outside excavation or fill areas unless authorized by the Engineer; protect from permanent damage by construction activities in accordance with Section 01050.
 3. Protect Work from erosion or other similar types of damage until the Project has been completed.
- B. Weather:

1. Do not backfill during freezing weather or during periods of heavy rainfall when soil moisture conditions will not permit achieving required compaction.
2. Do not use frozen materials, snow, or ice in any backfill.

1.04 SUBMITTALS

- A. Gradation Curves:
 1. Pipe embedment.
- B. Dewatering:
 1. Proposed equipment.
 2. Well or sump location, size, and details of construction.
 3. Size and layout of discharge headers.
- C. Potholing Report:
 1. Do not prepare any shop drawings for, or make final order for, or design any pipe materials for any particular section of pipeline until all utilities in that section of pipeline have been exposed, and until such time as no interferences are found between said existing utilities and the proposed pipeline alignment. If interferences are found in any particular section of pipeline, do not prepare any shop drawings for, or make final order for, or design any pipe materials for that particular section of pipeline until the pipeline alignment has been modified by the Engineer to eliminate all such interferences.
 2. The number and location of the potholes to be made shall be determined by the Contractor in advance and submitted in writing to the Engineer. If such conflicts are discovered, they shall be immediately reported to the Engineer by the Contractor.
 3. Submit report to Engineer with potholing results for the Grease Receiving Station Utilities:
 - a. Utility location in Plan.
 - b. Material type.
 - c. Material size (diameter)
 - d. Utility depth, IE.
 4. Submit potholing report to Engineer at least 2 weeks in advance of desired work by Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Classification of Excavated Materials:
 1. None.
 2. Remove and handle excavated materials regardless of its type, character, composition, condition, or depth.
 3. No blasting allowed due to proximity of essential treatment plant facilities.
- B. Topsoil:
 1. Native material removed and stockpiled before excavation.
 2. Free from trash, debris and surface vegetation.

- C. Pipe Embedment:
 1. Sand: Clean sand with not more than 25 percent retained on No. 4 sieve and not more than

- 7 percent passing No. 200 sieve and effective size 0.10-0.30 mm.
2. Bedding:
 - a. 4 inches minimum in bottom of trench excavation.
 - b. Bedding material continuous around pipe, extend to minimum 6 inches above top of pipe., or as indicated on drawings.
 - c. Compact bedding material to 90% relative compaction.
 - d. Gradation requirements:

1) Percent Passing 3/8" sieve	90-100
2) Percent Passing No 4 sieve	55-100
3) Percent Passing No 200 sieve	1-4
 - e. Bedding material shall be clean material, free of organic matter and clay; with a chloride content of <300 ppm.
- D. Trench Backfill: (above pipe embedment)
1. Compacted backfill:
 - a. Job excavated material:
 - 1) Approved select fill.
 - 2) Finely divided, free of debris organic material, and stones larger than 1-1/2 inches in greatest dimension.
 - 3) Liquid limit <40.
 - 4) Plasticity Index <20.
 - 5) Passing No. 200 sieve <50% by weight.
 2. Cover:
 - a. Free of brush, debris, and roots.
 - b. May contain rubble and detritus from rock excavation, stones and boulders if well separated and arranged to not interfere with backfill settlement.
 - c. In upper 18 inches no rock or excavated detritus except with specific approval of Engineer.
 - d. No stones larger than three (3) inches in greatest dimension within three (3) feet of top of pipe.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Field verify the location of all underground utilities, pipelines and structures. **Special attention is directed to existing pipes and electrical conduits on site, which must remain in service throughout construction.**
 1. Clear sites to be occupied by permanent construction of logs, trees, roots, brush, tree trimmings, and other objectionable material and debris.
 2. Grub stumps.
 3. Clean and strip subgrade for fills and embankments of surface vegetation, sod, and organic topsoil.
 4. Remove waste materials from site and dispose weekly.
 5. No burning onsite is allowed.

3.02 EXISTING UTILITIES

- A. The Contractor shall excavate and locate (pothole) existing pipelines, conduits and facilities within two feet of a proposed excavations.
- B. The known existing buried utilities and pipelines are shown on the Drawings in their approximate location. The Contractor shall exercise care in avoiding damage to all utilities and will be held responsible for repair if damaged. There is no guarantee that all utilities or obstructions are shown, or that locations indicated are accurate. Utilities are piping, conduits, wire, cable, ducts, maintenance holes, pull boxes and the like, located at the project site and adjoining construction locations.
- C. Clearly paint the location of all affected utility underground pipes, conduits and other utilities on the pavement or identify the location with suitable markers if not on pavement. In addition to the location of metallic pipes and conduits, non-metallic pipe, ducts and conduits shall also be similarly located using surface indicators, and detection tape if present and shall then be similarly marked.
- D. After the utility survey is completed, commence “potholing” to determine the actual location and elevation of all utilities where crossings, interferences, or connections to new pipelines or other facilities are shown on the Drawings, marked by the utility companies, or indicated by surface signs. **Prior to the preparation of piping shop drawings, or the excavating for any new pipelines or structures, the Contractor shall locate and uncover these existing utilities to a point 1 foot below the utility.** Submit a report identifying each underground utility and its depth and location. Any variation in the actual elevations and the indicated elevations shall be brought to the Resident Engineer’s attention.
- E. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workmen or damage to electrical ducts or conduits. Similar precautions shall be exercised around gas lines and telephone cables.
- F. Backfill after completing potholing. In existing pavement, pave with 1 inch of cold mix asphalt concrete.
- G. Contractor may be requested to submit a method to correct the interferences. The Engineer will provide the selected method for correcting said interferences to the Contractor. **If the Contractor does not expose all required utilities prior to shop drawing preparation, he shall not be entitled to additional compensation for work necessary to avoid interferences, nor for repair to damaged utilities.**
- H. Any necessary relocations of utilities, whether shown on the Drawings or not, shall be coordinated with the affected utility. The Contractor shall perform the relocation only if instructed to do so in writing from the utility and the Resident Engineer. The Contractor shall also protect any utilities encountered in the work.
- I. Shutdowns: Planned utility service shutdowns shall be accomplished during period of minimum use. In some cases this may require night or weekend work. Such work shall be at no additional cost to the District. Program work so that service will be restored in the minimum possible time, and shall cooperate with the utility companies in reducing shutdowns of utility systems to a minimum.
1. Disconnections: No utility shall be disconnected without prior written approval from the utility owner. When it is necessary to disconnect a utility, the Contractor shall give the utility owner not less than 72 hours notice when requesting written approval. The Contractor shall program his work so that service will be restored in the minimum possible time.

- J. Overhead Facilities: Overhead lines exist in the project area and must be flagged and protected by the Contractor from damage. These overhead utilities are not shown on the Drawings. Extreme caution shall be used when working in the vicinity of overhead utilities so as to prevent injury to workmen or damage to the utilities. The Contractor shall be required to comply with the applicable provisions of the California Construction Safety Orders when working anywhere on this project.

3.03 OBSERVATION OF STAINED OR ODOROUS SOIL

- A. Contractor shall notify Engineer and immediately stop work in an area if soil, debris, water or other substances at an area of the Site (“Affected Area”) are observed, uncovered, or otherwise discovered because the soil, concrete or debris is discolored, oily or exhibits an odor. Promptly confirm this oral notice in writing. The District will consider such conditions and determine a course of action. The Contractor shall continue to work in areas not affected and shall resume work in the Affected Area only after being notified by the Engineer.

3.04 PERFORMANCE - GENERAL

- A. General:
 - 1. Perform Work in a safe and proper manner with appropriate precautions against hazard.
 - 2. Provide adequate working space and clearances for Work performed within excavations and for installation and removal of concrete forms.
 - 3. Clean subgrades of loose material before concrete is placed thereon.
 - 5. Preservation of trees:
 - a. Do not remove trees outside fill or excavated areas, except as authorized by Engineer.
 - b. Protect trees left standing from permanent damage by construction operation.
 - c. Trim standing trees as directed by Engineer.
 - 6. Except as otherwise authorized, indicated, or specified, replace all material excavated below the bottom of concrete walls, footings, slabs on grade and foundations with concrete placed at the same time and monolithic with the concrete above.
 - 7. Remove soft soil materials, loose materials, wood, debris and deleterious substances encountered within excavated areas.
- B. Blasting: Not permitted.
- C. Topsoil:
 - 1. Remove and stockpile sufficient topsoil to surface to a minimum depth of 4 inches fill, embankment and other areas where the original topsoil will be removed or damaged.
 - 2. At the completion of other Work in each area, place and grade topsoil to Engineer's satisfaction.
- D. Dewatering:
 - 1. Contractor shall remove all sediment from water pumped or otherwise removed from trenches before disposing of it in a natural stream or water course (flowing or not).
 - 2. All dewatering activities to be in accordance with local codes and regulations.
 - 3. Provide and maintain adequate dewatering equipment to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the Work.
 - 4. Keep each excavation dry during subgrade preparation and continually thereafter until the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
 - 7. Dewater excavations which extend to or below groundwater by lowering and keeping the

groundwater level beneath such excavation at least 12 inches below the bottom of the excavation.

8. Divert surface water or otherwise prevent it from entering trenches to the extent practical without damaging adjacent property.
9. Contractor is responsible for the condition of any pipe or conduit he uses for drainage; all drainage pipes shall be left clean and free of sediment.
10. Obtain all required local and State permits required to discharge water pumped from the excavations.
11. Provide stable excavation slopes, walls and bottom.
12. Filter native soil and prevent loss of ground from dispersion and erosion
13. Prevent soil piping and groundwater boring through the excavation bottom
14. Prevent damaging settlement to nearby structures, utilities, and pipelines
15. Dewatering to be installed and removed in accordance with governing agency
16. Allow for controlled release of groundwater to its static level in a manner that prevents disturbance of the bottom soils and prevents flotation or movement of structures, pipelines or utilities

E. Sheeting, Shoring and Bracing:

1. The Contractor shall obtain an excavation permit from COSHA for any excavations over 5 feet. The trench width shall not be more than 2 feet wider than the outside diameter of the pipeline or less than the OSHA requirements.
3. Provide proper and substantial sheeting, shoring and bracing, as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities.
4. Design and build sheeting, shoring and bracing to withstand all loads that might be caused by earth movement or pressure, and to be rigid, maintaining shape and position under all circumstances.
5. Submit sheet pile cut-off wall design calculations, stamped by a California registered professional engineer.
6. Do not pull trench sheeting before backfilling.
7. All sheeting, shoring and bracing in accordance with OSHA and UBC requirements.
8. All sheet pile cut-off walls to be removed at the end of the Project.

F. Stabilization:

1. Thoroughly compact and consolidate subgrades for trench bottoms so they remain firm, dense and intact during required construction activities.
2. Remove all mud and muck during excavation.
3. Reinforce subgrades with crushed rock or gravel if they become mucky during construction activities, as directed by Engineer.
4. Finished elevation of stabilized subgrades are to be at or below subgrade elevations indicated on Drawings.
5. Scarify subgrade to a depth of 6 to 8 inches and prior to subgrade compaction.

G. Trench Excavation:

1. Do not open more trench in advance of pipe laying than is necessary to expedite the Work; not more than the shorter of 400 feet or one (1) block length.
2. Except where tunneling is indicated on the Drawings, specified, or permitted by Engineer, excavate trenches by open cut from the surface.
3. Alignment, grade and minimum cover:

- a. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the Drawings.
- b. Comply with pipe specification sections regarding vertical and horizontal alignment and maximum joint deflection.
- c. Where grades or elevations are not fixed on the Drawings, excavate trenches to provide a minimum depth of backfill cover over top of the pipe:
 - 1) 36 inches for water piping.
 - 2) 36 inches in other locations.
 - 3) Increase depth as required at vertical curves and for clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades.
 - 4) Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation, or to future lower surface elevations where indicated on Drawings.
- 4. Maintain excavation spoils on uphill side of trench and provide erosion containment measures on downhill side.
- 5. Limiting trench widths:
 - a. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and placement of embedment.
 - b. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than one (1) foot above the top of the pipe.
 - c. Stipulated minimum clearances are minimum clear distances, not minimum average distances.
 - d. Maximum trench width six (6) inches above the top of the installed pipe: Pipe O.D. plus 24 inches, or as otherwise indicated on drawings..
 - e. Minimum permissible clearances between installed pipe and trench wall:

<u>Pipe Size</u>	<u>Minimum Clearance</u>
<8 inches	8 inches
8 inches and Larger	12 inches

- 6. If the width of the lower portion of the trench exceeds the maximum permitted, provide pipe of adequate strength, special pipe embedment, or arch concrete encasement as required by loading conditions and as determined by Engineer.
- 7. Mechanical excavation:
 - a. Do not use where its operation would damage trees, buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas.
 - b. Use mechanical equipment of a type, design, and construction and operated so that:
 - 1) Rough trench bottom elevation can be controlled.
 - 2) Uniform trench widths and vertical sidewalls are obtained from one (1) foot above the top of the installed pipe to the bottom of the trench.
 - 3) Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls.
 - c. Do not undercut trench sidewalls.
- 8. Excavation below pipe subgrade:
 - a. Except as otherwise required, excavate trenches below the underside of pipes as indicated on Drawings, according to pipe and soil type, to provide for installation of embedment pipe foundation material.
 - b. Where in earth, trench bottoms for six (6) inches and smaller pipe may be excavated below pipe subgrade and embedment provided or the trench may be graded to provide uniform

and continuous support (between bell holes or end joints) of the installed pipe, Contractor's option.

- c. Pipe may not be laid directly on trench bottom.
9. Artificial foundation in trenches:
 - a. Whenever so directed by Engineer, excavate to such depth below a grade as Engineer directs and bring the trench bottom to grade with such material as Engineer may direct.
 - b. Provide timber, concrete, or other foundations made necessary by unstable soil as directed by Engineer.
 - c. District shall compensate Contractor for artificial foundations in accordance with the Contract provisions for extra Work, except as provided for in the Contract unit prices.
 10. Bell holes:
 - a. Excavate to provide adequate clearance for tools and methods of pipe installation.
 - b. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined.
- H. Pipe Embedment:
1. Embed pipes above and below the bottom of pipe as indicated on Drawings and as specified.
 2. Spread and surface grade embedment to provide continuous and uniform support beneath pipe at all points between bell holes or pipe joints.
 3. Slightly disturbing finished subgrade surface during withdrawal of slings and lifting tackle is permissible.
 4. After grading, aligning and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent operations.
 5. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent lateral displacement.
 6. Granular:
 - a. Maximum uncompacted thickness of layers: Six (6) inches.
 - b. Compact by slicing with shovel or vibrating.
 7. Compacted embedment:
 - a. Maximum uncompacted thickness of layers: eight (8) inches.
 - b. Compact to 90 percent maximum density as determined by ASTM D1557.
 - c. For Class C embedment, compact to top of pipe.
 8. Jetting and ponding not permitted.
- I. Trench Backfill:
1. Compacted backfill:
 - a. Provide for the full depth of trench above embedment at all locations.
 - b. Where the trench for one (1) pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench.
 - c. Finish the top portion beneath established sodded areas with 12 inches minimum, topsoil corresponding to, or better than, underlying adjacent sodded areas.
 - d. Suitable job excavated material, or graded gravel, Contractor's option.
 - e. Job excavated materials:
 - 1) Place in eight (8)-inch maximum uncompacted thickness, uniform layers.
 - 2) Increased layer thickness may be permitted for non-cohesive material if Contractor demonstrates to Engineer's satisfaction that specified compacted density will be achieved.

- 3) Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe.
 - 4) Roadways and under structures: Compact to 95 percent of maximum density at optimum moisture content per ASTM D1557 or to 70 percent relative density per ASTM D4253 and D4254 when appropriate.
 - 5) Other locations, compact to 90 percent of maximum density at optimum moisture content per ASTM D1557 or to 70 percent of relative density per ASTM D4253 and D4254.
- f. Graded gravel:
- 1) Deposit in uniform layers of 12 inches maximum uncompacted thickness.
 - 2) Compact with suitable vibrating roller or platform vibrator to not less than 70 percent relative density per ASTM D4253 and D4254.
2. Water settled backfill: Not allowed.
 3. Finish the top portion of backfill with at least 12 inches of topsoil corresponding to, or better than, that underlying adjoining areas.
- J. Drainage Maintenance:
1. Do not backfill trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid.
 2. Backfill so that water does not accumulate in unfilled or partially filled trenches.
 3. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours.
 4. Do not obstruct surface drainage any longer than necessary.
- K. Protection of Trench Backfill:
1. Where trenches are constructed in ditches or other water courses, protect backfill from erosion.
 2. Install ditch checks where the ditch grade exceeds one (1) percent.
 3. Minimum depth: Two (2) feet below the original ditch or water course bottom for the full bottom width.
 4. Minimum width: 18 inches into the side slopes.
 5. Minimum thickness: 12 inches.
- L. Disposal of Excess Excavated Materials:
1. Except as otherwise permitted, dispose of excess excavated materials away from the site of the Work as directed by Engineer and areas designated by the District.
 2. Distribute excess earth from excavations located in unimproved property directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly each way:
 - a. Carefully finish material thus wasted with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point.
 - b. Do not waste excess excavated material in the above manner where the trench line crosses or is within a railroad, public road, or highway right-of-way.
 - c. Distribute and level to thicknesses noted on the Drawings.
- M. Final Grading and Topsoil Replacement:
1. After completion of all other outside Work and after backfilling is completed and settled, bring to grade at the indicated elevations, slopes and contours, all areas of the site to be graded.

2. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand Work.
3. Grade all surfaces for effective drainage.
4. Provide a one (1) percent minimum slope except as otherwise required.
5. Place topsoil at locations and to limits indicated on Drawings.
6. Grade and surface to Engineer's satisfaction.

3.05 FIELD QUALITY CONTROL

- A. District will pay for all laboratory and field tests to determine compliance of in-place and backfill materials and compaction with the Specifications. Contractor to coordinate field sampling schedule with Resident Inspector to provide the specified number of tests.
- B. Pipe Embedment and Backfill:
 1. Two initial gradation tests for each type of material plus one (1) additional test for each 500 cubic yards of each material.
 2. Two modified Proctor compaction tests, ASTM D1557, or two (2) relative density tests, ASTM D4253 and D4254, as appropriate, for each type of embedment on backfill material proposed, except granular embedment material.
 3. Minimum of one (1) in-place compaction test, *ASTM D2922*, for every two (2)-foot depth of backfill per 100-foot interval will be required.
 4. Contractor shall, when requested, excavate to the required depth so density tests may be taken and bring such excavations to required density after testing at no additional cost to the District.
- C. Retests of failed compaction shall be performed by the District, but shall be paid for by the Contractor.

3.06 SCHEDULES

- A. Pipeline Embedment:
 1. Class A arch encasement: Where indicated on Drawings and as required by improper trenching or unexpected trench conditions as determined by Engineer.
 2. Class B bedding:
 - a. All pipe and buried fiberglass duct.

END OF SECTION

SECTION 03002 CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Cast-in-place concrete and grout.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. American Concrete Institute (ACI):
 - a. 116R, Cement and Concrete Terminology.
 - b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 - c. 212.3R, Chemical Admixtures for Concrete.
 - d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - e. 304.2R, Placing Concrete by Pumping Methods.
 - f. 305R, Hot Weather Concreting.
 - g. 306R, Cold Weather Concreting.
 - h. 318, Building Code Requirements for Structural Concrete.
 - i. 347R, Recommended Practice for Concrete Formwork.
 2. American Society for Testing and Materials (ASTM):
 - a. A82, Standard Specification Steel Wire, Plain, for Concrete Reinforcement.
 - b. A185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - c. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (Including Supplementary Requirements S1).
 - d. A775, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - f. C33, Standard Specification for Concrete Aggregates.
 - g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - h. C94, Standard Specification for Ready-Mixed Concrete.
 - i. C138, Standard Method of Test for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
 - j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
 - k. C150, Standard Specification for Portland Cement.
 - l. C157, Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
 - m. C171, Standard Specification for Sheet Materials for Curing Concrete.
 - n. C172, Standard Practice for Sampling Freshly Mixed Concrete.
 - o. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - p. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - q. C260, Standard Specification for Air Entraining Admixtures for Concrete.
 - r. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
 - s. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

- t. C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - u. C494, Standard Specification for Chemical Admixtures for Concrete.
 - v. C496, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - w. C567, Standard Test Method for Unit Weight of Structural Lightweight Concrete.
 - x. C595, Standard Specification for Blended Hydraulic Cements.
 - y. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - z. D1056, Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber.
 - aa. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - bb. E329, Standard Specification for Agencies Engages in the Testing and/or Inspection of Materials Used in Construction.
3. Federal Specification (FS):
 - a. CEGS 03300, Vegetable Fiber.
 4. Corps of Engineers: Specification CRD-C572 Polyvinyl Waterstops.
- B. Quality Control:
1. Concrete testing agency.
 - a. Contractor to employ and pay for services of a testing laboratory to:
 - 1) Perform materials evaluation.
 - 2) Design concrete mixes.
 - b. Concrete testing agency to meet requirements of ASTM E329.
 2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
 - a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
 3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 - a. Do not use revised concrete mixes until submitted to and approved by Engineer.
 4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.
- C. Qualifications:
1. Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).
 2. Formwork, shoring and reshoring for slabs and beams except where cast on ground to be designed by a professional engineer currently registered in the states where the project is located.

1.3 DEFINITIONS

- A. Per ACI 116R except as modified herein:
1. Concrete fill: Non-structural concrete.
 2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
 3. Exposed concrete: Exposed to view after construction is complete.
 4. Indicated: Indicated by Contract Documents.
 5. Lean concrete: Concrete with low cement content.
 6. Nonexposed concrete: Not exposed to view after construction is complete.
 7. Required: Required by Contract Documents.
 8. Specified strength: Specified compressive strength at 28 days.
 9. Submitted: Submitted to Engineer.

1.4 SUBMITTALS

- A. Shop Drawings:
1. See Section 01340.
 2. Concrete mix designs proposed for use. Concrete mix design submittal to include the following information:
 - a. Sieve analysis and source of fine and coarse aggregates.
 - b. Test for aggregate organic impurities.
 - c. Test for deleterious aggregate per ASTM C289.
 - d. Proportioning of all materials.
 - e. Type of cement with mill certificate for cement.
 - f. Type of fly ash with certificate of conformance to specification requirements.
 - g. Slump.
 - h. Air content.
 - i. Brand, type, ASTM designation, and quantity of each admixture proposed for use.
 - j. 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
 - k. Shrinkage test results.
 - l. Standard deviation value for concrete production facility.
 - m. Contractor's proposed pour sequence. Provide 1/8 IN = 1 FT - 0 IN minimum scaled drawings indicating:
 - 1) Location of all construction joints.
 - 2) Location and type of waterstops.
 - 3) Any proposed deviations from Contract Drawings must be clearly indicated.
 - 4) Reproductions of Contract Drawings are acceptable for this purpose.
 3. Manufacturer and type of joint filler, joint sealant, curing agent and chemical floor hardener.
 4. Manufacturer and type of bonding and patching mortar and bonding adhesive used at construction joints.
 5. Manufacturer and type of nonshrink grout and the cure/seal compound required for the nonshrink grout.
 6. Reinforcing steel: Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
 - a. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
 - b. Obtain approval of shop drawings by Engineer before fabrication.
 - c. Mill certificates.
 7. Strength test results of in place concrete including slump, air content and concrete temperature.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage of Material:
1. Cement and fly ash:
 - a. Store in moistureproof, weathertight enclosures.
 - b. Do not use if caked or lumpy.
 2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use bottom 6 IN of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
 3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.
 - c. Completely mix solutions and suspensions prior to use.
 4. Reinforcing steel:

- a. Support and store all rebars above ground.
- B. Delivery:
- 1. Concrete:
 - a. Prepare a delivery ticket for each load for ready-mixed concrete.
 - b. Truck operator shall hand ticket to Engineer at the time of delivery.
 - c. Ticket to show:
 - 1) Mix identification mark.
 - 2) Quantity delivered.
 - 3) Amount of each material in batch.
 - 4) Outdoor temp in the shade.
 - 5) Time at which cement was added.
 - 6) Numerical sequence of the delivery.
 - 7) Amount of water added.
 - 2. Reinforcing steel: Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
 - a. Mark numbers to match shop drawing mark number.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
- 1. Nonshrink grout:
 - a. Sika "SikaGrout 212."
 - b. Gifford Hill "Supreme Grout."
 - c. Master Builders "Masterflow 713."
 - 2. Epoxy grout:
 - a. Master Builders "Brutem MPG."
 - b. Euclid Chemical Company, "High Strength Grout."
 - c. Fosroc, "Conbextra EPHF".
 - 3. Expansion joint fillers:
 - a. Permaglaze Co.
 - b. Rubatex Corp.
 - c. Williams Products, Inc.
 - 4. Waterstops, PVC:
 - a. Greenstreak Plastic Products, Inc.
 - b. W.R. Meadows, Inc.
 - c. Burke Company.
 - 5. Form coating:
 - a. Richmond "Rich Cote."
 - b. Industrial Lubricants "Nox-Crete Form Coating."
 - c. Protex "Pro-Cote."
 - 6. Prefabricated forms:
 - a. Simplex "Industrial Steel Frame Forms."
 - b. Symons "Steel Ply."
 - c. Universal "Uniform."
 - 7. Chemical Floor Hardeners.
 - a. L & M Construction Chemicals, Inc.
 - b. Euclid Chemicals Inc.
 - c. Dayton Superior.
 - 8. Bonding agents:
 - a. Euclid Chemical Co.
 - b. Master Builders Inc.
 - c. L&M construction Chemicals Inc.

2.2 MATERIALS

- A. Portland Cement: Conform to ASTM C150 Type IP(MS), II, or V, Low Alkali (LA).
- B. Fly Ash:
 - 1. ASTM C618, Class F or Class C.
 - 2. Nonstaining.
 - a. Hardened concrete containing fly ash to be uniform light gray color. Specifier: May use 6 percent loss on ignition for non-air-entrained concrete.
 - 3. Maximum loss on ignition: 4 percent.
 - 4. Compatible with other concrete ingredients.
 - 5. Obtain proposed fly ash from a source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
- C. Admixtures:
 - 1. Air entraining admixtures: ASTM C260.
 - 2. Water reducing, retarding, and accelerating admixtures:
 - a. ASTM C494 Type A through E.
 - b. Conform to provisions of ACI 212.3R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
 - 3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
 - a. 0.10 all concrete.
 - 4. Do not use calcium chloride.
 - 5. Pozzolanic admixtures: ASTM C618.
 - 6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
- D. Water: Potable, clean, free of oils, acids and organic matter.
- E. Aggregates:
 - 1. Normal weight concrete: ASTM C33, except as modified below.
 - 2. Fine aggregate: Clean natural sand.
 - a. No manufactured or artificial sand.
 - 3. Coarse aggregate: Crushed rock, natural gravel, or other inert granular material.
 - a. Maximum amount of clay or shale particles: 1 percent.
 - 4. Gradation of coarse aggregate:
 - a. Lean concrete and concrete topping: Size #7.
 - b. All other concrete: Size #57 or #67.
- F. Concrete Grout:
 - 1. Nonshrink grout:
 - a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
 - b. Grout to produce a positive but controlled expansion.
 - c. Mass expansion not to be created by gas liberation.
 - d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
 - 2. Epoxy grout:
 - a. 3-component epoxy resin system.
 - 1) Two liquid epoxy components.
 - 2) One inert aggregate filler component.
 - b. Each component packaged separately for mixing at jobsite.
- G. Reinforcing Steel:
 - 1. Reinforcing bars: ASTM A615, Grade 60, epoxy coated.
 - 2. Welded wire fabric: ASTM A185.

- a. Minimum yield strength: 60,000 psi.
 - 3. Column spirals: ASTM A82.
- H. Forms:
- 1. Prefabricated or job built.
 - 2. Wood forms:
 - a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
 - b. Built-in-place or prefabricated type panel.
 - c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.
 - d. When approved, plywood may be reused.
 - 3. Metal forms:
 - a. Metal forms excluding aluminum may be used.
 - b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
 - 4. Chamfer strips: Clear white pine, surface against concrete planed.
 - 5. Form ties: Removable end, permanently embedded body type with cones on outer ends not requiring auxiliary spreaders.
 - a. Cone diameter: 3/4 IN minimum to 1 IN maximum.
 - b. Embedded portion 1 IN minimum back from concrete face.
 - c. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.
 - d. Provide ties with built-in waterstops at all walls that will be in contact with process liquid during plant operation.
 - 6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.
- I. Waterstops:
- 1. Plastic: Corp of Engineers Specification CRD-C572.
 - 2. Serrated with center bulb.
 - 3. Thickness: 3/8 IN.
 - 4. Length (general use): 6 IN unless indicated otherwise.
 - 5. Expansion joints:
 - a. Length: 9 IN.
 - b. Center bulb: 1 IN OD x 1/2 IN ID.
 - 6. Provide hog rings or grommets spaced at maximum 12 IN OC along the length of the water stop.
 - 7. Provide factory made waterstop fabrications at all changes of direction, intersections and transitions leaving only straight butt splices for the field.
- J. Chairs, Runners, Bolsters, Spacers, and Hangers:
- 1. Stainless steel, epoxy coated, or plastic coated metal.
 - a. Plastic coated: Rebar support tips in contact with the forms only.
- K. Chemical Floor Sealer, Hardener, Densifier:
- 1. Colorless, no VOC, odorless chemical solution containing alkaline siliconates.
 - 2. Will not support bacteria growth.
 - 3. 10-year manufacturers warranty.
 - 4. Similar to L&M construction Chemicals Inc. "Seal Hard".
- L. Membrane Curing Compound: ASTM C309, Type I-D.
- 1. Resin based, dissipates upon exposure to UV light.
 - 2. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
 - 3. Curing compounds used in water treatment plant construction to be nontoxic and taste and odor free.

- M. Expansion Joint Filler:
1. In contact with water or sewage:
 - a. Closed cell neoprene.
 - b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
 2. Exterior driveways, curbs and sidewalks:
 - a. Asphalt expansion joint filler.
 - b. ASTM D994.
 3. Other use:
 - a. Fiber expansion joint filler.
 - b. ASTM D1751.

- N. Materials.
1. Bonding agent:
 - a. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
 - b. Euclid Chemical Co. "Flex-Con".
 - c. Master Builders Inc. "Acryl-Set".
 - d. L&M construction Chemicals "Everbond".
 - e. Thoro System Products "Acryl 60".

2.3 CONCRETE MIXES

- A. General:
1. All concrete to be ready mixed concrete conforming to ASTM C94.
 2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
 3. All concrete to be normal weight concrete.

- B. Strength:
1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE =====	WEIGHT =====	SPECIFIED STRENGTH* =====
All general use Concrete	Normal weight	4000 psi
Precast Concrete	Normal weight	5000 psi

*Minimum 28-day compressive strength.

- C. Air Entrainment: Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

MAX AGGREGATE SIZE =====	TOTAL AIR CONTENT PERCENT =====
1 IN or 3/4 IN	5 to 7
1/2 IN	5-1/2 to 8
3/8 pea gravel	5 to 7 (lean concrete and topping only)

1. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.
- D. Slump: 4 IN maximum, 1 IN minimum.
1. Measured at point of discharge of the concrete into the concrete construction member.
 2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
 3. Pumped concrete:
 - a. Provide additional water at batch plant to allow for slump loss due to pumping.

- b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
- 4. Determine slump per ASTM C143.
- E. Selection of Proportions:
 - 1. General - Proportion ingredients to:
 - a. Produce proper workability, durability, strength, and other required properties.
 - b. Prevent segregation and collection of excessive free water on surface.
 - 2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	MINIMUM CEMENT, LB/CY			MAXIMUM WATER CEMENT RATIO BY WEIGHT
	MAXIMUM AGGREGATE SIZE, IN			
	1/2 or 3/8	3/4	1	
4000	611	611	611	0.45
5000	---	686	665	0.40

- 3. Substitution of fly ash:
 - a. Maximum of 25 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
- 4. Sand cement grout:
 - a. Three parts sand.
 - b. One part portland cement.
 - c. Entrained air: Six percent plus or minus one percent.
 - d. Sufficient water for required workability.
 - e. Minimum 28-day compressive strength: 3,000 psi.
- 5. Submit mix design data as required by this specification section.
- 6. Normal weight concrete: Proportion mixture to provide desired characteristics using one of methods described below:
 - a. Method 1 (Trial Mix): Per ACI 318, Chapter 5, except as modified herein.
 - 1) Air content within range specified above.
 - 2) Record and report temperature of trial mixes.
 - 3) Proportion trial mixes per ACI 211.1.
 - b. Method 2 (Field Experience): Per ACI 318, Chapter 5, except as modified herein:
 - 1) Field test records must be acceptable to Engineer to use this method.
 - 2) Test records shall represent materials, proportions and conditions similar to those specified.
- 7. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in paragraph 5.3.1 of ACI 318.
- 8. Clarifier concrete topping:
 - a. 3/8 IN pea gravel for aggregate.
- F. Allowable 21-day shrinkage for lab mixed trail batches: 0.040 percent per ASTM C157 as modified by SEAOC.

PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

- A. General:
 - 1. Contractor is responsible for design and erection of formwork.
 - 2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.

- a. Allowable tolerances: As recommended in ACI 347R.
3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
 - a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
 - b. Do not place floor drains through beams.
- B. Openings: Provide openings in formwork to accommodate work of other trades.
 1. Accurately place and securely support items built into forms.
- C. Chamfer Strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
- D. Reinforcement:
 1. Position, support and secure reinforcement against displacement.
 2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
 3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
 4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
 5. Extend reinforcement to within 2 IN of concrete perimeter edges.
 - a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
 6. Unless otherwise indicated, provide minimum concrete cover as follows:
 - a. Concrete deposited against earth: 3 IN.
 - b. Formed surfaces exposed to weather or in contact with earth: 2 IN for reinforcing bars #6 or larger; 1-1/2 IN for reinforcing bars less than #6.
 - c. Formed surfaces exposed to or located above any liquid: 2 IN.
 - d. Interior surfaces: 1-1/2 IN for beams, girders and columns; 3/4 IN or bar diameter, whichever is greater, for slabs, walls and joists.
 7. Do not weld reinforcing bars.
- E. Construction, Expansion, and Contraction Joints:
 1. Provide at locations indicated.
 2. Locate wall vertical construction joints at 30 FT maximum centers and wall horizontal construction joints at 10 FT maximum centers.
 3. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
 4. Install construction joints perpendicular to the planes of their surfaces.
 5. At least 48 HRS shall elapse between placing of adjoining concrete construction.
 6. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
 7. Before new concrete is placed, coat all construction joints with an approved bonding agent used and applied in accordance with manufacturer's instructions.
- F. Embedments:
 1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
 2. Use setting diagrams, templates and instructions for locating and setting.
 3. Secure waterstops in correct position using hog rings or grommets spaced along the length of the waterstop and wire tie to adjacent reinforcing steel.
- G. Preparation:
 1. Clean and adjust forms prior to concrete placement.
 2. Tighten forms to prevent mortar leakage.
 3. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.
- H. Placing Concrete:
 1. Place concrete in compliance with ACI 304R and 304.2R.
 2. Place in a continuous operation within planned joints or sections.

3. Begin placement when work of other trades affecting concrete is completed.
4. Place concrete by methods which prevent aggregate segregation.
5. Do not allow concrete to free fall more than 4 FT.
6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.

I. Consolidation:

1. Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.

J. Protection:

1. Protect concrete from physical damage or reduced strength due to weather extremes.
2. In cold weather comply with ACI 306R except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
 - b. Minimum concrete temperature at the time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
=====	=====
Below 30 DegF	70 DegF
Between 30-45 DegF	60 DegF
Above 45 DegF	50 DegF

- c. Do not place heated concrete that is warmer than 80 DegF.
 - d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.
 - e. Do not allow concrete to cool suddenly.
3. In hot weather comply with ACI 305R except as modified herein.
 - a. At air temperature of 90 DegF and above, keep concrete as cool as possible during placement and curing.
 - b. Do not allow concrete temperature to exceed 90 DegF at placement.
 - c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
 - d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.

K. Curing:

1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
4. Provide curing for minimum of 7 days.
5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
6. In hot weather follow curing procedures outlined in ACI 305R.
7. In cold weather follow curing procedures outlined in ACI 306R.
8. If forms are removed before 7 days have elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.
9. Curing vertical surfaces with a curing compound: Cover vertical surfaces with a minimum of two coats of the curing compound.
 - a. Allow the preceding coat to completely dry prior to applying the next coat.
 - b. Apply the first coat of curing compound immediately after form removal.
 - c. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - d. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.

- L. Form Removal:
 - 1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
 - 2. Where no reshoring is planned, leave forms and shoring used to support concrete until it has reached its specified 28-day compressive strength.
 - 3. Where reshoring is planned, supporting formwork may be removed when concrete has sufficient strength to safely support its own weight and loads placed thereon.
 - a. While reshoring is underway, no superimposed loads shall be permitted on the new construction.
 - b. Place reshores as soon as practicable after stripping operations are complete but in no case later than the end of working day on which stripping occurs.
 - c. Tighten reshores to carry their required loads.
 - d. Leave reshores in place until concrete being supported has reached its specified 28-day compressive strength.

3.2 CONCRETE FINISHES

- A. Tolerances:
 - 1. Class A: 1/8 IN in 10 FT.
 - 2. Class B: 1/4 IN in 10 FT.
- B. Surfaces Exposed to View:
 - 1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
 - a. To be covered with a coating or covering material applied directly to concrete.
 - b. Scheduled for grout cleaned finish.
 - 2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
 - 3. Fill tie holes with nonshrink grout.
- C. Surfaces Not Exposed to View:
 - 1. Patch voids, air pockets and honeycomb areas with sand cement grout.
 - 2. Fill tie holes with nonshrink grout.
- D. Grout Cleaned Finish:
 - 1. Mix a part portland cement and 1-1/2 parts fine sand with sufficient bonding agent/water mixture to produce a grout with the consistency of thick paint.
 - a. White portland cement shall be substituted for gray portland cement to produce a color that matches color of surrounding concrete as determined by trial patch for areas not to be painted.
 - 2. Wet surface of concrete to prevent absorption of water by grout and uniformly apply grout with brushes or spray gun.
 - 3. Immediately scrub the surface with a cork float or stone to coat and fill air bubbles and holes.
 - 4. While grout is still plastic, remove all excess grout by working surface with rubber float, sack or other approved means.
 - 5. After the surface whitens from drying, rub vigorously with clean burlap.
 - 6. Keep final finish damp for a minimum of 36 HRS after final rubbing.
- E. Slab Float Finish:
 - 1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
 - 2. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
 - 3. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
 - 4. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
 - 5. Refloat slab immediately to a uniform sandy texture.

- F. Troweled Finish:
 - 1. Float finish surface.
 - 2. Next power trowel, and finally hand trowel.
 - 3. Produce a smooth surface which is relatively free of defects with first hand troweling.
 - 4. Perform additional trowelings by hand after surface has hardened sufficiently.
 - 5. Final trowel when a ringing sound is produced as trowel is moved over surface.
 - 6. Thoroughly consolidate surface by hand troweling.
 - 7. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
 - 8. On surfaces intended to support floor coverings remove any defects of sufficient magnitude that would show through floor covering by grinding.
- G. Broom Finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom across surface.
- H. Apply chemical floor sealer, hardener, densifier to all permanently exposed interior concrete non-vertical surfaces.
 - 1. Apply in accordance with manufacturer's instructions.

3.3 GROUT

- A. Preparation:
 - 1. Nonshrinking nonmetallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 HRS prior to grouting.
 - 2. Rock anchors:
 - a. Clean rock anchors of all loose material.
 - b. Orient hook or bends in anchor bars to clear anchor bolts, reinforcements, and other embedments to be installed later.
 - 3. Epoxy grout: Apply only to clean, dry, sound surface.
- B. Application:
 - 1. Nonshrink grout:
 - a. Mix in a mechanical mixer.
 - b. Use no more water than necessary to produce flowable grout.
 - c. Place in accordance with manufacturer's instructions.
 - d. Completely fill all spaces and cavities below the bottom of baseplates.
 - e. Provide forms where baseplates and bedplates do not confine grout.
 - f. Where exposed to view, finish grout edges smooth.
 - g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
 - h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
 - i. Wet cure grout for 7 days, minimum.
 - 2. Epoxy grout:
 - a. Mix and place in accordance with manufacturer's instructions.
 - b. Completely fill all cavities and spaces around dowels and anchors without voids.
 - c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

3.4 FIELD QUALITY CONTROL

- A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
 - 1. Contractor to cooperate with Owner in obtaining and testing samples.
- B. Tests During Construction:
 - 1. Strength test - procedure:
 - a. Three cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and C31.
 - b. Cylinders will be tested per ASTM C39:

- 1) One at 7 days.
 - 2) Two at 28 days.
 2. Strength test - frequency:
 - a. Not less than one test each day concrete placed.
 - b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
 - c. Not less than one test for each type of concrete poured.
 - d. Not less than one test for each concrete structure exceeding 2 CY volume.
 3. Slump test: Per ASTM C143.
 - a. Determined for each strength test sample.
 - b. Additional slump tests may be taken.
 4. Air content: Per ASTM C231, C173, and C138.
 - a. Determined for each strength test sample.
 5. Temperature: Determined for each strength test sample.
- C. Evaluation of Tests:
1. Strength test results: Average of 28-day strength of two cylinders from each sample.
 - a. If one cylinder manifests evidence of improper sampling, molding, handling, curing or testings, strength of remaining cylinder will be test result.
 - b. If both cylinders show any of above defects, test will be discarded.
- D. Acceptance of Concrete:
1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
 - a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
 - b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
 2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
 - a. Perform additional tests and/or corrective measures at no additional cost to Owner.

3.5 SCHEDULES

- A. Form Types:
1. Surfaces exposed to view:
 - a. Prefabricated or job-built wood forms.
 - b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
 - c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
 - d. Construct forms sufficiently tight to prevent leakage of mortar.
 2. Surfaces normally submerged or not normally exposed to view:
 - a. Wood or steel forms sufficiently tight to prevent leakage of mortar.
 3. Other types of forms may be used:
 - a. For surfaces not restricted to plywood or lined forms.
 - b. As backing for form lining.
- B. Grout:
1. Nonshrink grout: General use.
 2. Epoxy grout:
 - a. Grouting of dowels and anchor bolts into existing concrete.
 - b. Other uses indicated on Drawings.
 3. Sand cement grout:
 - a. Repair of surfaces not exposed to view as specified in 3.02 C.
- C. Concrete:
1. Precast concrete: Where indicated on Drawings.
 2. Normal weight concrete: All concrete.

D. Concrete Finishes:

1. Grout cleaned finish: Where indicated on Drawings.
2. Slab finishes:
 - a. Use following finishes as applicable, unless otherwise indicated:
 - 1) Floated finish: Surfaces intended to receive roofing, concrete topping, concrete fill and waterproofing.
 - 2) Troweled finish: Interior floor slabs, exposed roof slabs and base slabs of structures, equipment bases, and column bases.
 - 3) Broom finish: Sidewalks, docks, concrete stairs, and ramps.

END OF SECTION

SECTION 05501

ANCHOR BOLTS AND EXPANSION ANCHORS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope:
 - 1. Equipment anchor bolts
 - 2. Structural anchor bolts
 - 3. Expansion anchors
 - 4. Epoxy set anchor bolts

- B. Additional Requirements Specified Elsewhere:
 - 1. Shop Drawings, Product Data and Samples: Section 01340
 - 2. Product Requirements: Section 01600

1.02 SUBMITTALS

- A. Product Data: Sufficient to verify compliance with Specifications

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver anchor bolts and templates in time to permit setting when structural concrete is placed

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bolts:
 - 1. Stainless steel: IFI-104, Grade 316

- B. Nuts:
 - 1. Same material as bolts
 - 2. Self-locking: Prevailing torque, IFI-100, grade A

- C. Washers:
 - 1. Same material as bolts
 - 2. Flat: ANSI B27.2
 - 3. Locking: Spring type ANSI B27.1

- D. Sleeves:
 - 1. Pipe: ASTM A120
 - 2. Bearing plates: ASTM A36
 - 3. Hot dip galvanize after fabrication

- E. Expansion Anchors:
 - 1. In hardened concrete and grouted masonry
 - a. Type "A": Wedge type, FS FF-S-325, Group II, Type 4, Class 1
 - b. Type "B": Self-drilling, FS FF-S-325, Group III, Type 1, flush type
 - c. Type "C": Non-drilling, internally threaded, FS FF-S-325, Group VIII, Type 1 Drop in
 - d. Type "D": Non-drilling, externally threaded, FS FF-S-325, Group VIII, Type 2
 - 2. In hollow and solid masonry
 - a. Type "E": Lag shield, FS FF-S-325, Group II, Type 1, Class 1
 - b. Type "F": Split sleeve, FS FF-S-325, Group II, Type 3, Class 3

2.02 FABRICATION AND MANUFACTURE

- A. Anchor Bolts:
 - 1. 3/4 inch minimum, except as indicated on the Drawings
 - 2. Type:
 - a. General use: L-shaped hook type
 - b. Where indicated on Drawings or specified:
 - 1) Straight bolt with square head
 - 2) Straight bolt with square plate welded to bolt and nut welded to plate and bolt
 - 3) Through-bolt with sleeve and square plate assembly
 - 4) Coupled bolt with sleeve welded to square plate and bolt
 - 3. Material:
 - a. General use: Stainless steel
 - b. Submerged service: Stainless steel
 - c. Where indicated on Drawings: Stainless steel
- B. Expansion Anchors:
 - 1. 3/4-inch maximum unless otherwise indicated on Drawings
 - 2. Do not use cinch anchors
 - 3. Length: As required for proper embedment
 - 4. Material:
 - a. General use: Stainless steel
 - b. Submerged service: Stainless steel
 - c. Where indicated on Drawings: Stainless steel
- C. Epoxy Set Anchors:
 - 1. FS FF-S-325
 - 2. In hardened concrete and where specifically noted on plans:
 - a. Parabond capsule anchors
 - b. Stainless steel studs, nuts and washers
 - c. Approved manufacturers:
 - 1) Molly Fastener Group by Emhart
 - 2) Hilti, Inc.
 - 3) Or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that holes for anchor bolts in forms and templates match applicable equipment Shop Drawings

3.02 INSTALLATION

- A. Anchor Bolts:
 - 1. Where installed in cast-in-place concrete, install a nut on the concrete side of the form or supporting template
 - 2. Provide 3 nuts for each anchor bolt for which a lock nut is indicated, 2 for others
 - 3. Sleeved anchor bolts:
 - a. Centered in pipe sleeve
 - b. Sleeve ID: Approximately 2 1/2 times bolt OD
 - c. Sleeve length: Approximately 8 times bolt OD
 - d. Bearing plate minimum thickness: 1/2 times bolt OD
 - 4. Through bolts:
 - a. Sleeved with bearing plates
 - b. Bearing plates welded to bolt and plate welded to sleeve
 - c. Dimensions: As specified for sleeved anchor bolts
- B. Expansion Anchors:
 - 1. Install in conformity with the manufacturer's instructions
 - 2. Minimum embedment: 4 bolt diameter or manufacturer's instructions, whichever is greater
 - 3. Minimum distance between expansion anchor centerline and any edge or exterior corner of concrete: 4 1/2 bolt hole diameter
- C. Epoxy Set Anchors:
 - 1. Install as per manufacturer's recommendation
 - 2. Minimum hole depth: As per manufacturer's recommendation but not less than 6-5/8 inches
 - 3. Diameter of drilled holes: As per ANSI B94.12

3.03 SCHEDULE

- A. Expansion Anchors:
 - 1. In hardened concrete and grouted masonry: Type "A," "B," "C," or "D," Contractor's option, unless type is indicated on Drawings
 - 2. In hollow and solid masonry: Type "E," or "F," Contractor's option, unless type is indicated on Drawings
 - 3. Epoxy set anchors were adhesion or epoxy anchor bolts specifically noted on Drawings

END OF SECTION

SECTION 05999

MISCELLANEOUS METAL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope:
 - 1. Items fabricated from metal shapes, plates, sheets, rods, bars, or castings.
 - 2. Checkered floor plate.
 - 3. Railings, galvanized.
 - 4. Grating and grating treads, galvanized.
 - 5. Edge angles.
 - 6. Stairs, galvanized.
 - 7. Nosings cast in stair steps.
 - 8. Metal specialties as specified herein.
 - 9. Ladders, galvanized.
 - 10. And all other miscellaneous metals shown on drawings.

- B. Additional Requirements Specified Elsewhere:
 - 1. Shop Drawings, Product Data and Samples: Section 01340.
 - 2. Product Requirements: Section 01600.
 - 3. Anchor Bolts and Expansion Anchors: Section 05501.

1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Handrail, steps, and ladders shall comply with all applicable provisions of OSHA.

- B. Reference Standards:
 - 1. AISC "Steel Construction Manual".
 - 2. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
 - 3. ASTM A1: Carbon Steel Tee Rails.
 - 4. ASTM A36: Structural Steel.
 - 5. ASTM A366: Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
 - 6. ASTM A569: Steel, Carbon (0.15 Max, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
 - 7. ASTM A325: High Strength Bolts for Structural Joints.
 - 8. ASTM A307: Carbon Steel Externally Threaded Standard Fasteners.
 - 9. IFI-100:
 - 10. ASTM A490: Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
 - 11. FS WW-F-461: Floor Plate, Steel, Rolled.
 - 12. ASTM A500: Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 13. ASTM A501: Hot-Formed Welded and Seamless, Carbon Steel Structural Tubing.
 - 14. FS RR-G-661: Grating, Metal, Bar Type (Floor, Except for Naval Vessels).

15. ASTM A48: Gray Iron Castings.
16. ASTM A167: Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
17. ASTM B36: Brass Plate, Strip and Rolled Bar.
18. ASTM B61: Steamer Valve Bronze Castings.
19. ASTM B140: Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar and Shape .
20. ASTM B97: Copper-Silicon-Alloy Plate, Strip and Rolled Bar for General Purposes.
21. ANSI A202.1: Metal Bar Grating Manual for Steel and Aluminum Gratings and Stair Treads.
22. ASTM A120: Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless for Ordinary Uses.

C. Tolerances:

1. Structural steel:
 - a. All members level, plumb and aligned within 1:500.
 - b. Top elevation of roof and floor members within 1/16 inch of that indicated on Drawings.
 - c. Girt faces and other supporting members in vertical planes within 1/8 inch.

1.03 SUBMITTALS

A. Shop Drawings and Product Data:

1. Product Data describing each manufactured metal specialty.
2. Shop Drawings describing each fabricated item.
3. Erection Drawings for structural steel.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Store on Blocking So That No Metal Touches the Ground and Water Cannot Collect Thereon.
- B. Protected From Bending Under Its Own Weight or Superimposed Loads.

1.05 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Guardrail, steps and ladders shall comply with all applicable provisions of OSHA.
- B. Compliance with the requirements specified herein may necessitate modification to the manufacturer's standard materials or equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel:

1. Plates and shapes: ASTM A36.
2. Sheets: ASTM A366 or A569, zinc coated.
3. Pipe: ASTM A120.
4. Bolts:
 - a. High strength: ASTM A325.

- b. Unfinished: ASTM A307.
 - c. Self-locking nuts: Prevailing torque type; IFI-100, Grade A.
 - d. Flat washers: ANSI B27.2.
 - e. Lock washers: Spring type, ANSI B27.1.
 - f. Beveled washers: Table 1 of Specifications for Structural Joints Using ASTM A325 or A490 Bolts, AISC Steel Construction Manual.
5. Welds:
- a. Part 5 Specifications and Codes, AISC Steel Construction Manual.
 - b. AWS D1.1-77 American Welding Society.
 - c. Welding Electrodes: AWS 5.20 E70TX.
6. Checkered plate: FS QQ-F-461.
7. Structural tubing: ASTM A500 or A501.
8. Railings, hand and guard:
- a. Structural Steel Shapes and Plates: ASTM A36.
 - b. Steel Bars and Bar-size Shapes: ASTM A36.
 - c. Steel Tubing: ASTM A500, Grade B (Fy = 46,000 psi) (317MPa).
 - d. Gray Iron Castings: ASTM A48, Class 30.
 - e. Malleable Iron Castings: ASTM A47, Grade as selected.
 - f. Steel Pipe: ATM A53, type as selected, Grade A standard weight (Schedule 40).
 - g. Paint:
 - 1) Metal Primer: VOC compliant.
 - a) Interior steel: Tnemec 10-99W (white).
 - b) Exterior steel (exposed): Tnemec-Zinc 90-97.
 - 2) Galvanizing repair paint: High zinc dust content; MIL-P-21035 (Ships).
- B. Cast Iron: ASTM A48, Class 25 or better.
- C. Stainless Steel: 18-8:
- 1. Plates: ASTM A167.
 - 2. Bolts: IFI-104, Grade 303 or 305.
- D. Aluminum:
- 1. Sheet and plate: ASTM B209, alloy 6061-T6.
 - 2. Rolled sections: ASTM B308, alloy 6061-T6.
 - 3. Rod and bar: ASTM B211, alloy 6061-T6 or 2017-T4.
 - 4. Extrusions: ASTM B221, alloy 6063-T5 or T6.
 - 5. Pipe: ASTM B429, alloy 6061-T6 or 6063-T6.
 - 6. Rivets: ASTM B316, alloy 6061-T6.
 - 7. Bolts: IFI-104, Grade 24T4.
 - 8. Castings: ASTM B26 or B85.
 - 9. Checkered plate: Alcoa C102.
- E. Specialty and Accessory Items:
- 1. Chain: FS RR-C-271, Type I, Grade C, Class 5, Style 2, galvanized; welded steel, twist-link style, short link pattern.
 - 2. Guardrail-setting cement: ASTM C595 hydraulic quick setting cement, factory prepared with accelerator.
 - 3. Bird screen: 2 mesh, brass or copper wire cloth, minimum wire diameter 0.063 inch.

4. Body solder: Flux-core wire, ASTM B32, Alloy Grade 20B.
 5. Grating saddle clips and flange block:
 - a. ANSI A202.1.
 - b. Steel grating: Galvanized steel clips.
 - c. Aluminum grating: galvanized steel clips.
 - d. Clip fasteners: Nelson stud type bolts, 1/4-inch minimum, galvanized or corrosion resistant alloy.
- F. Safety Nosings:
1. Safety stair nosings, 3 inches wide, 1/4-inch thick single component type with anchor set into concrete. Aluminum base of 6063-T5 extruded aluminum with anti-slip filler containing 65 percent grain aluminum oxide (AL₂O₃)/silicon carbide (sic) abrasive. Nosings shall be designed for outdoor use, heavy pedestrian traffic. Manufactured by company specializing in fabrication of safety nosings, Manufactured by Wooster Products, Balco Inc., or equal.
 2. Provide safety stair nosings at all concrete stairs and steel pain stairs.
- G. Shop Coatings:
1. Rust inhibitive shop primer for steel: Tnemec "77 Chem-Prime", Carboline, or approved equal.
 2. Zinc rich primer: Tnemec "92 Tnemec- Zinc", Carboline, or approved equal.
 3. Coal tar paint: Tnemec "450 Heavy Tnemecol", Carboline, or approved equal.
 4. Galvanizing: Hot-dip process:
 - a. ASTM A123 – Standard Spec for Zinc (Hot Dip) Coatings on Iron and Steel Products.
 - b. ASTM A385 – Standard Practice for Providing High Quality Zinc Coatings (Hot Dip).
 - c. ASTM A384 – Practice for Guarding Against Warp and Distortion During Hot Dip Galvanizing.
 5. Bolt galvanizing:
 - a. Zinc: ASTM A164, Type GS.
 - b. Cadmium: ASTM A165, Type NS.
 6. Aluminum:
 - a. Standard mill finish.
 - b. Clear anodize.
- H. Metal Framing Strut:
1. As shown on Pipe Support Details.
 2. Non-submerged locations: Stainless steel or FRP.
 3. Submerged locations: Stainless steel.
 4. Provide accessory fittings, clamps, spring screws, etc. as required.
 5. Tyco, AlSCO, or equal.

2.02 FABRICATION AND MANUFACTURE

- A. General:
1. In accordance with dimensions, arrangement, sizes and weights or thicknesses indicated on the Drawings or specified.
 2. All members free of winds, warps, local deformations or unauthorized bends.
 3. Holes and other provisions for field connection accurate and shop checked for proper fit. Holes shall be neatly drilled or punched. Torch cut hole are not acceptable.
 4. Mark each piece according to the erection Drawing.

5. Provide all field connection materials.
- B. Connections:
 1. General:
 - a. As indicated on the Drawings.
 - b. Where welding is permitted or required:
 - 1) Butt and miter welds continuous.
 - 2) Exposed welds ground smooth.
 - 3) Intermittent welds:
 - a) 2 inches minimum effective length.
 - b) 6 inches minimum spacing.
 2. Structural:
 - a. If not indicated on the Drawings, as defined in Part 4 "Connections" of the AISC Manual Ninth Edition.
 - b. Shop connections may be bolted, welded, or riveted.
 - c. Bolted connections for girts with slotted or oversized holes for adjustment.
 3. All others: If not indicated on the Drawings, unfinished bolts with self locking nuts or lock washers.
- C. Shop Coating:
 1. Preparation:
 - a. All surfaces to be at the proper temperature, dry, and free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter, and other objectionable substances.
 - b. Scrape, chip and brush welds as required to remove all spatter.
 - c. Dull sharp corners of cut or sheared edges with at least one pass of a power grinder.
 2. Galvanizing: Hot dipped after fabrication.
 3. Castings: Hot dip in asphalt varnish or coat with coal tar paint, 6 mils minimum.
 4. Steel:
 - a. Unless otherwise indicated or specified, coat with rust inhibitive primer, 1 1/2 mils minimum.
 - b. Apply after fabrication.
 - c. Coat as soon after cleaning as practicable.
 - d. Apply in a heated structure if outside air temperature is below 50 Degrees F.
 - e. Do not move or handle until coating is dry and hard.
 5. Aluminum: Coat all surfaces to come in contact with concrete, cement, mortar, or dissimilar metals with coal tar paint, 6 mils minimum.
 6. Other surfaces: Do not shop coat galvanized steel, stainless steel, or bronze.
- D. Checkered Floor Plate:
 1. As indicated on Drawings.
 2. If not indicated on Drawings: Aluminum.
 3. Provided with lifting hole if not bolted or welded in place.
 4. Shop straighten warped or bent plates to lie perfectly flat.
 5. Supporting steel members hot-dip galvanized after fabrication.
- E. Hand and Guard Railings:
 1. Galvanized, hot dipped after fabrication.
 2. All railings provided of the same type and design, except as otherwise specified or indicated on Drawings.

3. Steel:
 - a. 1-1/2-inch standard weight steel pipe.

4. Connections:
 - a. Welded railing:
 - 1) Make connection angles, offsets or other changes in alignment in pipe railings with prefabricated railing cells and welding connectors, R.B. Wagner, Julius Blum.
 - b. Prefabricated railing: As recommended by railing manufacturer.

5. Fabrication:
 - a. Smooth with all projecting joints and sharp corners ground smooth.
 - b. Make welded joints flush.
 - c. Neatly cope members and continuously weld or connect mechanically at all junctions.
 - d. Dress weld fillets to uniform radius, remove excess metal and grind smooth.
 - e. Removable guardrail sections to have two (2) posts each.

6. Sleeves:
 - a. Fixed posts:
 - 1) Standard weight steel pipe.
 - 2) 6-inch minimum, or larger as required to provide 1/4-inch minimum clearance around post.
 - b. Removable posts:
 - 1) Outer sleeve: Standard weight black steel pipe.
 - 2) Inner sleeve: Schedule 40 PVC pipe.

7. Safety chain:
 - a. Provide where indicated on Drawings.
 - b. 1/4-inch chain, length as required by opening.
 - c. Fastened to one post with cadmium plated or stainless steel eyebolt.
 - d. Fastened to other post by a 2-1/2-inch heavy duty cadmium plated harness strap engaging a similar eyebolt.

8. Toe boards:
 - a. All railings to have minimum 1/4-inch by 4-inch toe boards.
 - b. Plates to have slotted holes to allow for alignment and avoid warpage after installation.

- F. Grating and Grating Treads:
 1. Galvanized.
 2. Depth of bearing bars as indicated on Drawings.
 3. If not indicated on Drawings: Galvanized steel grating, and galvanized stair treads.
 4. Laid out with openings centered on a joint between sections.
 5. 3/16-inch toe plates around openings extending the full depth and 4 inches above top of grating.
 6. Weld toeplates to each bearing bar.
 7. 3/16-inch thick, full depth bands at ends of bearing bars in grating floor sections.
 8. Weld bands to first, last and every fourth intermediate bearing bar.
 9. Cut cross bars flush with outside face of side bars.
 10. Cutting:
 - a. All cuts: Sawed or sheared.
 - b. Clean and smooth without fins, beads or other projections.
 11. Fabricate in easily handled panels equally spaced or area covered.
 12. Maximum weight of each panel: 40 lbs. Submit panel weights with panel layout drawing.

13. Align cross bars and edge bars of adjacent panels.
14. Maximum clearance between panels: 1-1/4 inches.
15. Make all bearing bars parallel.
16. Make all grating flat with no tendency to rock.
17. Tolerance:
 - a. Length: 3/16-inch.
 - b. Width: 1/8-inch.
 - c. Maximum difference on opposite diagonals: 1/4-inch.
 - d. Bearing bar spacing: 1/32-inch.
 - e. Band and toeplate vertical and horizontal alignment: 1/8-inch.
18. Grating:
 - a. Pressure locked - swaging process.
 - b. Bearing bars: 3/16-inch thick minimum at 1-3/16-inch centers maximum.
19. Hot-dip galvanize after fabrication steel frames to be cast in concrete.
20. Stair treads:
 - a. With carrier plates and abrasive nosing.
 - b. Fastened to stringers with galvanized bolts.
 - c. Galvanized similar to grating style.
21. Aluminum nosing: Non-slip nose tread.

G. Steel Stairs:

1. Erect true to line and slope.
2. Support rigidly and brace and tighten against movement.
3. Install treads level and to perfect alignment and spacing.
4. Attach handrails rigidly and to perfect alignment:
 - a. Rigid with no noticeable sway or deflection under ordinary foot traffic.
 - b. If necessary, provide additional supports and bracing to prevent noticeable movement.
5. Provide steel pans for concrete filled stairs at treatment building and maintenance/SCADA building, where shown on plans.

H. Door Frames: Not Applicable

I. Castings:

1. Manhole covers:
 - a. Cast iron frame and lid, Neenah R-1769A, Deeter Foundry, McKinley Iron Works, or approved equal.
 - b. 24-inch clear opening, or as required on Drawings.

J. Galvanized Ladders:

1. Provide in locations shown on contract plans.
2. Vertical dimensions as required and measured in field.
3. Galvanize after fabrication.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Field Measurements: Verify existing conditions by taking field measurements as required.
- B. Before Assembly, Thoroughly Clean All Parts Which Will Be In Contact With Each Other.

3.02 ERECTION AND INSTALLATION

- A. General:
 - 1. Assemble all parts accurately as indicated on the Drawings.
 - 2. Set baseplates level and grout in place.
- B. Connections:
 - 1. General:
 - a. As indicated on the Drawings.
 - b. Where welding is permitted or required:
 - 1) Butt and miter welds continuous.
 - 2) Exposed welds ground smooth.
 - 3) Intermittent welds:
 - a) Minimum effective length: 2 inches.
 - b) Max spacing: 6 inches.
 - c. No field welding to package factory water treatment plant permitted.
 - d. Light drifting is permitted to draw parts together.
 - e. No drifting to match unfair holes.
 - f. Enlarge holes, if necessary, by reaming with twist drills.
 - g. No burning to enlarge holes.
 - 2. Structural steel:
 - a. High strength bolts:
 - 1) Turn-of-nut tightening as described in "Specifications for Structural Joints Using ASTM A325 or A490 Bolts" in the AISC manual.
 - 2) Use beveled washers when the bearing faces of bolted parts have a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis.
 - b. No field welding of structural steel, except as indicated on the Drawings:
 - 1) By certified welders.
- C. Aluminum Stairs:
 - 1. Erect true to line and slope.
 - 2. Support rigidly and brace and tighten against movement.
 - 3. Install treads level and to perfect alignment and spacing.
 - 4. Attach handrails rigidly and to perfect alignment:
 - a. Rigid with no noticeable sway or deflection under ordinary foot traffic.
 - b. If necessary, provide additional supports and bracing to prevent noticeable movement.
- D. Handrails and Guard Rails:
 - 1. Install with posts plumb and longitudinal members parallel to each other and to floor or slope of stairs.
 - 2. All members in a section or in true alignment in the same vertical plane.
 - 3. Provide wall brackets where indicated or required, anchored with stainless steel bolts and expansion anchors.
 - 4. Rigidly attach fixed handrail posts to supporting structure:

- a. Attach to concrete structure by setting in sleeves, except as otherwise indicated.
 - b. Rigidly support sleeves in accurate alignment in forms.
 - c. Position vertically so sleeve is held below the finished concrete surface.
 - d. Measure the location of each sleeve before fabricating handrail.
 - e. Wedge post in accurate alignment and fill annular space with handrail set in cement.
 - f. Finish top surface of cement smooth and sloping away from post.
 - g. Where indicated, attach to structure with flanges and other special attachments or anchorages.
5. Set removable sections in double sleeves:
- a. Set inner sleeve in outer sleeve as specified for fixed posts.
 - b. Take special care that inner sleeves are accurately spaced and plumb so handrail sections will stand in proper alignment and will be removable without binding.
6. Field connections: Locking mechanical splice fittings, R. B. Wagner, Julius Blum and Co., or equal.
7. Slip joints for expansion and contraction:
- a. Provide at 30-foot maximum intervals.
 - b. Gap: Between 1/8 inch and 3/8 inch.
8. Post spacing:
- a. Steel: 5 feet maximum.
- E. Grating:
- 1. Do not damage during installation.
 - 2. General areas:
 - a. Securely anchor in place.
 - b. Fasten with saddle clips or flange blocks in accordance with ANSI A202.1.
- F. Door Frames: Anchor steel clip angles to concrete floors with 1/2-inch bolts and expansion anchors, except as otherwise indicated.
- G. Guardrail and Lattice: Tube steel of sizes indicated.

3.03 FIELD QUALITY CONTROL

- A. Structural Steel Connections:
- 1. Provide a platform or other means of access for inspection of each field connection.
 - 2. Leave in place until inspected by Engineer.
- B. Guardrail:
- 1. Check final alignment with a tightly drawn reference wire.
 - 2. Max misalignment allowed: 1/8 inch.
 - 3. Replace bent, damaged or deformed railings.

END OF SECTION

SECTION 06601

FIBERGLASS REINFORCED PLASTIC (FRP) GRATING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The CONTRACTOR shall properly install, and fabricate where necessary, all FRP products required to produce a complete, operable, and serviceable installation as shown on the Drawings and as specified herein in accordance with the requirements of the Contract Documents.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. ASTM D635 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
 2. ASTM D638 Test Method for Tensile Properties of Plastic.
 3. ASTM D695 Test Method for Compressive Strength of Rigid Plastics.
 4. ASTM D732 Shear Strength of Plastics by Punch Tool.
 5. ASTM D790: Test Methods for Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 6. ASTM E84 Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. The CONTRACTOR shall furnish shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section.
- B. The CONTRACTOR shall furnish manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.
- C. The CONTRACTOR shall submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.
- D. The CONTRACTOR shall submit sample pieces of each item specified herein for

SECTION 09800
CONCRETE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. CONTRACTOR shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the application of a repair mortar and a protective lining on the non-immersed concrete surfaces. All structures are located at the Wastewater Quality Control Facility located in Manteca, California.
- B. Abrasive blast the concrete surfaces to remove 2 inches of concrete and apply a concrete resurfacer. After the application of the resurfacer, the structure will require the application of a protective lining. The final quantity of area and the cost involved, based on the unit price listed in the Schedule of Prices, shall be based on the areas determined by the INSPECTOR's inspection. This Work shall include all precleaning, surface preparation, dehumidification, coating application on concrete surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, in accordance with the requirements of the Contract Documents.
- C. All coatings, solvents, equipment and procedures necessary to complete the Work specified shall be suitable for wastewater treatment plant and marine environments and shall comply with San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 4601. Materials shall be delivered unopened to the jobsite in their original containers bearing the manufacturer's label, completely identifying the contents, date of manufacture, volatile organic compounds (VOCs), and listing directions for their proper use. Products that do not conform to SJVAPCD Rule 4601 shall not be allowed on site.
- D. The coating system schedules in Part 3 EXECUTION of this Specification summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. The requirements of the following sections and divisions apply to the Work of this Section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 01410 Submittals

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. All Work specified herein shall conform to or exceed the applicable requirements of the referenced portions of the following publications to the extent that the provisions thereof are not in conflict with other provisions of these Specifications. The CONTRACTOR shall comply with the applicable editions of the following codes, regulations and standards.

B. American Society for Testing and Materials International (ASTM):

1. D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
2. D1653 Standard Method for Water Vapor Transmission of Organic Coating Films
3. D2240 Standard Test Method for Rubber Property – Durometer Hardness
4. D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Tabor Abrasor
5. D4258 Standard Practice for Surface Cleaning Concrete for Coating
6. D4259 Standard Practice for Abrading Concrete
7. D4262 Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
8. D4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
9. D4414 Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gauges
10. D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
11. D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
12. D5402 Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs

C. California Code of Regulations (CCR), Title 8 Industrial Relations

1. Section 1532.1 Containment, Disposal, and Safety Requirements for Lead
2. Section 1637 Scaffolds – General Requirements
3. Section 1670 Personal Fall Arrest Systems, Personal Fall Restraint Systems and Positioning Devices
4. Section 1676 Job-Made Ladders

- 5. Section 5157 Permit Required Confined Space
- D. Code of Federal Regulations (CFR), Title 29 Labor
 - 1. Section 1910.94 Ventilation
- E. International Concrete Repair Institute (ICRI)
 - 1. 310.2 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
- F. National Association of Corrosion Engineers International (NACE)
 - 1. SP0188 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
 - 2. RP0287 Field Measurements of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape
- G. San Joaquin Valley Air Pollution Control District (SJVAPCD)
 - 1. Rule 4601 Architectural Coatings – VOC Limits
- H. Steel Structures Painting Council, the Society for Protective Coatings (SSPC)
 - 1. Guide 6 Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
 - 2. Guide 7 Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
 - 3. Guide 15 Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates
 - 4. PA 1 Shop, Field, and Maintenance Painting of Steel
 - 5. PA 2 Measurement of Dry Film Thickness with Magnetic Gauges
 - 6. QP 1 Qualification Procedure 1 for Field Coating
 - 7. QP 3 Qualification Procedure 3 for Shop Painting
 - 8. SP1 Solvent Cleaning
 - 9. SP2 Hand Tool Cleaning
 - 10. SP3 Power Tool Cleaning
 - 11. SP7 Brush Off Blast Cleaning
 - 12. SP10 Near White Blast Cleaning

13. SP11	Power Tool Cleaning to Bare Metal
14. SP12	Surface Preparation and Cleaning of Metals by Water Jetting Prior to Recoating
15. SP13	Surface Preparation of Concrete
16. VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
17. VIS 3	Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
18. Vol. 1	Good Painting Practice

1.4 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit the following in accordance with the requirements in Section 01410 Submittals. The CONTRACTOR shall submit the following prior to mobilizing to the project site:
1. Copy of an active State of California C 33 Contractor's license as required for the application of coatings.
 2. Provide 5 references which show that the CONTRACTOR has previous successful experience with each specified or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the CONTRACTOR applied the protective coating.
 3. Provide a written letter from the manufacturer stating that the coating CONTRACTOR's supervisor and each applicator performing Work on the project has been trained and approved by the manufacturer to apply the selected coating system. The manufacturer shall state whether or not it has verified that the CONTRACTOR is going to use the proper mixing, coating application, heating, and environmental control equipment for the specified coating products.
 4. The CONTRACTOR shall provide SSPC QP 1 Certification or up to 5 projects in the last 5 years.
- B. Complete data on each type and kind of paint, primer and materials shall be submitted for review. Acceptance shall be received from the DISTRICT before the paint is delivered to the jobsite. This procedure shall be followed whether or not the paint that the CONTRACTOR proposes to use is named in the Contract Documents. Submitted data shall show where and for what uses each paint product is proposed with cross-reference made to sections of these Specifications. Paint material submittals shall include the following:
1. Material safety data sheets for all products used at the jobsite including paints, primers, mortars, thinners, solvents and cleaners.
 2. Product Data Sheets for all primers, surface fillers, and coating products with the following information:

- a. Surface preparation requirements for immersion service
 - b. Minimum and maximum wet and dry film thickness per coat
 - c. Minimum and maximum cure, induction, and pot life times
 - d. Temperature and humidity requirements during and after application
 - e. Proper storage and shelf life at various temperatures
 - f. EPA Method 24 results to verify compliance with SJVAPCD Rule 4601 for VOC's
 - g. Tensile, elongation, moisture vapor transmission rate, and abrasion testing results.
- C. Manufacturer's product data sheet for each abrasive material to be used with the following:
1. Technical data sheet for each product used, including statements on the suitability of the material for the intended use.
 2. State and country of origin.
 3. Material safety data sheet for each product, if applicable.
 4. Size/mesh and percentage by weight of each component.
- D. Samples: During the coating application, the CONTRACTOR shall submit a coating sample, one each for each coating system, on 6-inch by 6-inch concrete samples. Each sample shall be abrasive blasted and completely coated over its entire surface with the complete coating system including primers.
- E. Coating Manufacturer's Information: For each coating system to be used the CONTRACTOR shall submit the following information at least 30 days prior to application:
1. Coating manufacturer's technical application instructions for application, heating materials, mixing, spray tip sizes, and hose pressures.
 2. Provide written certification that the coating CONTRACTOR's supervisor and each applicator performing Work on the project have been trained and approved by the manufacturer to apply the selected coating system. The manufacturer shall state whether or not it has verified that the CONTRACTOR is going to use the proper mixing, coating application, heating, and environmental control equipment for the specified coating products.

1.5 INSPECTOR AND CONTRACTOR COORDINATION

- A. INSPECTOR shall be defined as a NACE Certified Level 3 Coatings Inspector retained by the DISTRICT on a full time basis during the coating operations. The CONTRACTOR shall give the DISTRICT's Coatings Inspector a minimum of 5 days advance notice of the start of any field surface preparation work for coating application work.
- B. All such work shall be performed only in the presence of the INSPECTOR, unless INSPECTOR has granted prior approval in writing to perform such work in his/her absence.
- C. Inspection by INSPECTOR, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.
- D. The CONTRACTOR shall hold all surface preparation and coating application operations until INSPECTOR approves the following inspection points: completion of blasting prior to coating; primer application; coating application and testing of cured coating.
- E. Scaffolding shall be erected and moved to locations where requested by INSPECTOR to facilitate inspection. Additional illumination shall be provided to cover all areas to be inspected.

1.6 MANUFACTURER'S REPRESENTATIVE

- A. The CONTRACTOR shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support for three (3) separate days to resolve field questions attributable to or associated with the manufacturer's products furnished under this Contract or the application thereof. The manufacturer's technical representative shall be onsite before the application of their specified product and during testing specified in 3.9 of this specification, at no additional cost to the DISTRICT.

1.7 WARRANTY INSPECTION

- A. The CONTRACTOR and coating manufacturers shall warrant the coating system applications against defects and workmanship after final acceptance of the Work for a period of 5 years. The CONTRACTOR shall perform all Work and supply all equipment and materials associated with the repair of failures identified in the warranty inspection at no cost to the DISTRICT.
- B. A warranty inspection may be conducted prior to expiration of the 5 year warranty period after final acceptance of all coating work. The CONTRACTOR and a representative of the coating material manufacturer shall attend this inspection at no cost to the DISTRICT. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the DISTRICT. The DISTRICT may by written notice to the CONTRACTOR, reschedule the warranty inspection, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the CONTRACTOR is not relieved of its responsibilities under the Contract Documents.
- C. A total of five (5) inspections will be required at locations chosen by the DISTRICT and can include any or all surfaces. The DISTRICT will be responsible for dewatering and providing access, and for performing the inspection and testing. The inspection will include thorough

visual inspection to identify pin holes, bubbles, blisters, delaminations or other product or installation defects. The DISTRICT, at its sole discretion, may choose to perform bond strength testing per ASTM D4541. The CONTRACTOR shall conduct repairs to coated surfaces per the manufacturer's recommendations and the repaired surfaces shall be subject to inspection by the DISTRICT.

1.8 SAFETY AND HEALTH REQUIREMENTS

- A. In accordance with the requirements CCR Title 8 Section 5157, the CONTRACTOR shall provide and require the use of personal protective and lifesaving equipment for all persons working in confined spaces.
- B. Head and face protection and respiratory devices shall include protective helmets conforming to the requirements of ANSI Z 89.1-2009 which shall be worn by all persons at all times while in the vicinity of the work when coatings are being applied. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices meeting the requirements of ANSI Z 87.1-2010 and a respirator with appropriate filter.
- C. Where ventilation is used to control potential exposures to workers, as set forth in Code of Federal Regulations Title 29 Section 1910.94 of the OSHA Regulations for Construction, ventilation shall be adequate to reduce the concentration of the air contaminant to the degree that a hazard to the worker does not exist. Methods of ventilation shall meet the requirements set forth in ANSI Z9.2-2006.
- D. Temporary ladders and scaffolding shall conform to the applicable requirements of CCR Title 8 Section 1676 and Section 1637. The CONTRACTOR shall submit scaffolding plans to the DISTRICT for review.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Definitions: The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.
- B. General: Coating materials shall be sealed in new containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.
- C. The CONTRACTOR shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.
- D. Compatibility: In any coating system, only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats.

- E. Colors: All colors and shades of colors of all coats of paint shall be as selected or specified by the DISTRICT.
- F. Protective Coating Materials: Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the CONTRACTOR shall provide the DISTRICT with the names of not less than 5 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.
- G. Substitute or "Or-Equal" Submittals: Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed and accepted by the ENGINEER. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or-equal" material that said material meets the specified requirements and is equivalent or better than the listed materials in the following properties:
 - 1. Minimum and Maximum Cure Times
 - 2. Moisture Vapor Transmission Rate per ASTM D1653 Method B at 60 mils minimum
 - 3. Abrasion Resistance per ASTM D4060 using a CS17 Wheel
 - 4. Minimum and Maximum Recoat Times
 - 5. Solids content by volume
 - 6. Dry film thickness per coat
 - 7. Compatibility with other coatings
 - 8. Suitability for the intended service
 - 9. Resistance to chemical attack
 - 10. Temperature limitations in service and during application
- H. The cost of all testing and analysis of the proposed substitute materials that may be required by the DISTRICT shall be paid by the CONTRACTOR. If the proposed substitution requires changes in the Contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 INDUSTRIAL COATING SYSTEMS MATERIALS

- A. Material Sources: Each of the following manufacturers is capable of supplying many of the industrial coating materials specified herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials shall be shown to satisfy the material descriptions and to equal or exceed the properties of the listed materials as required in the paragraph entitled "Substitute or `Or-Equal' Submittals" herein.

1. Carboline Coatings Company
2. International Protective Coatings
3. PPG Amercoat
4. Raven Lining Systems
5. Sherwin Williams
6. Tnemec Company

2.3 CONCRETE RESURFACER

- A. Resurfacer for concrete walls or structures following the abrasive blasting shall be high early strength, epoxy-modified mortar with aggregates capable of producing a dry rough finished surface. The material shall be a two or three-component aggregate-filled mortar to be applied on vertical walls and capable of being top coated within 16 hours of surface preparation. Approved products include the following:
1. Five Star Structural Concrete V/O as manufactured by Five Star Products, Inc.,
 2. Sikatop 123 Plus or SikaRepair 224 as manufactured by Sika Corporation
 3. Carboguard 510 as manufactured by Carboline Company
 4. or approved equal.

2.4 CONCRETE REPAIR MORTAR

- A. Repair mortar shall be a pneumatically or hand-placed cementitious, silica fume, fiber-reinforced, high strength shrinkage-compensated portland cement mortar. Approved products include the following:
1. SikaRepair 224 as manufactured by Sika Corporation
 2. Five Star Structural Concrete V/O as manufactured by Five Star Products, Inc.,
 3. Or approved equal

2.5 CONCRETE LINERS

1. Description
 - a. Liner shall be Arrow-Lock Sheet Liner with a thickness of 65 mils, and ¼-inch long extensions spaced 2 inches apart, as manufactured by Ameron Protective Lining Products, Brea, California.
 - b. Primer for use prior to application of intermediate layer shall be Arrow-Lock Primer No. 5101 as supplied by Ameron Protective Lining Products, Brea, California.

- c. Mastic for intermediate layer shall be Arrow-Lock Mastic, No. 9912 at 2:1 epoxy gel mastic as supplied by Ameron Protective Lining Products, Brea, California.
2. Application/Installation
- a. All specified materials shall be installed in strict accordance with the manufacturer's application or installation instructions.
 - b. NOTE: If external ground water is present, de-watering procedures must be continued for a minimum of 24 hours after final installation of mastic, Arrow-Lock and welding strips.
3. Physical Properties
- a. Tensile specimens shall be prepared and tested in accordance with ASTM D412 using Die B. Weight change specimens shall be 1-inch (25-mm) by 3-inch (75-mm) samples. Specimens for testing of initial physical properties may be taken from liner plate sheet and welding strip at any time prior to final acceptance of the work.
 - b. All plastic liner sheets, including ¼-inch long locking extensions, all joint, corner and welding strips shall be free of cracks, cleavages or other defects adversely affecting the protective characteristics of the material. The engineer may authorize the repair of such defects by approved methods.
 - c. All plastic liner sheets, including locking extensions, all joint, corner and welding strips shall be free of cracks, cleavages or other defects adversely affecting the protective characteristics of the material. The engineer may authorize the repair of such defects by approved methods.
 - d. The PVC lining shall have good impact resistance, shall be flexible and shall have an elongation sufficient to bridge up to 1/4" (6mm) settling cracks, which may occur in the concrete or in joints after installation without damage to the lining.
 - e. The lining shall be repairable at any time during the life of the rehabilitated structure.

PART 3 - EXECUTION

3.1 STORAGE, MIXING, AND THINNING OF MATERIALS

- A. After each component of the coating system has been thoroughly heated, the CONTRACTOR shall perform a paint/pump ratio test on the first day of spraying and at least once a day thereafter in the presence of the DISTRICT's Coatings Inspector. The CONTRACTOR shall set up two see-through containers with preprinted volumetric marks used for the paint/pump ratio test on a flat surface. The hose valve for each component shall be opened simultaneously and each component flow rate shall be allowed to stabilize by pouring the discharging materials into separate disposable containers. After the flow is stabilized, the hoses shall be transferred to the pre-printed volumetric containers and the valves shall be shut off after one of the containers has been filled to 32 or 48 fluid ounces, depending on the mixing ratio recommended by the manufacturer. If the volumetric quantity of coating in the containers does not match the manufacturer's recommendation, the CONTRACTOR shall reduce or increase the pressure and

temperature until it meets the specified mixing ratio. No spraying shall be performed until the ratio test result has been accepted by the INSPECTOR.

- B. **Manufacturer's Recommendations:** Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed. The CONTRACTOR shall supply the DISTRICT with copies of each manufacturer's instructions.
- C. Thinning of paint shall be in accordance with the manufacturer's published instructions, especially as to the amount and kind of thinner used, and accepted by the ENGINEER. The CONTRACTOR shall perform all thinning in the presence of INSPECTOR.
- D. All protective coating materials shall be used within the manufacturer's recommended shelf life. Materials exceeding the storage life recommended by the manufacturer shall be removed from the jobsite.
- E. **Storage and Mixing:** Coating materials shall be protected from exposure to temperatures greater than or less than the manufacturer's recommendations and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together. Flammable materials shall be stored in accordance with state and local codes.

3.2 PREPARATION FOR COATING

- A. All surfaces to receive protective coatings shall be prepared as specified prior to application of said coatings. The CONTRACTOR shall examine all surfaces to be coated, and shall correct all surface defects prior to application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application.
- B. Surface preparation shall be accepted by the INSPECTOR prior to application of the repair mortar and coating.
- C. The CONTRACTOR shall remove and dispose of all debris from abrasive blasting and other surface preparation prior to coating.
- D. **Protection of Surfaces Not to Be Coated:** Surfaces which are not to receive protective coatings shall be protected, using drop clothes and other protective measures as necessary, during surface preparation, cleaning, and coating operations.
- E. All hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations.
- F. Care shall be exercised not to damage adjacent piping, railing, or other work during blast cleaning operations. Coating shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

- G. For all field painting located on the DISTRICT's property, the CONTRACTOR shall provide and use a temporary enclosed booth system to prevent overspray and contain emissions as required by local air quality regulations. Any damage incurred by the DISTRICT or its employees due to paint, solvent or sandblasting materials shall be repaired by the CONTRACTOR to the satisfaction of the INSPECTOR.
- H. Protection of Painted Surfaces: Cleaning and coating shall be so programmed that dust and other contaminants from the cleaning process shall not fall on wet, newly-coated surfaces.

3.3 ENVIRONMENTAL REQUIREMENTS

- A. No coating work shall be performed under the following conditions:
 - 1. Surface or ambient temperatures exceed the manufacturer's recommended maximum or minimum allowable.
 - 2. Dust or smoke laden atmosphere.
 - 3. Damp or humid conditions, where the relative humidity is above the manufacturer's maximum allowable.
 - 4. Substrate and ambient temperatures are less than 5 degrees F above the dewpoint and are decreasing. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce, Weather Bureau psychrometric tables. Elcometer 319 Dew Point meter or equal may also be used.
 - 5. Ambient temperature that is expected to drop below 50 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.
- B. The CONTRACTOR shall provide and use dehumidification and temperature control equipment during the course of the Work. The CONTRACTOR shall be expected to maintain the established production schedule despite these potentially adverse conditions by providing all labor, equipment and materials necessary to maintain a controlled environment in the area where Work is to be performed. The substrate and atmospheric conditions within the controlled environment, with respect to temperature and relative humidity, shall be maintained within the limits established by the manufacturer of the selected coating system to ensure proper application and curing of the coating. If the conditions are not in the specified ranges stated by the manufacturer, the CONTRACTOR shall use the following:
 - 1. Humidity Control – Desiccant or Direct Expansion Refrigeration dehumidification shall be used to control the environment in the space 24 hours a day during blast cleaning, coating application and coating cure. Equipment shall conform to the following requirements:
 - 2. Equipment – Desiccant dehumidifiers shall be a solid desiccant design having a single rotary desiccant wheel capable of fully automatic continuous operation. No liquid, granular, or loose lithium chloride drying systems will be accepted. The use of direct expansion (DX) refrigeration type dehumidifiers with reheat may be considered if the expected ambient temperature shall remain above 60 degrees F. Heating the space changes relative humidity only and does not change the dew point temperature. Heat alone, therefore, is not a substitute for dehumidification, unless substrate temperature is high enough to meet the

dew point differential. The dehumidification system may consist of a combination of desiccant and refrigerant equipment.

3. Air Changes – Equipment shall be provided that maintains an air change rate for maintaining a required spread of 17 degrees F between inside surface temperature and inside space dew point temperature with a maximum relative humidity of 45% in the space. There shall be 1 to 4 air changes per hour, depending on the air volume of the space to be controlled, to hold the desired degree of cleanliness of the surface.
4. Temperature Control – Auxiliary cooling or insulation may be necessary to maintain the surface temperature at an acceptable level for the coating manufacturer's application parameters. This auxiliary equipment shall be approved for use by the supplier of the dehumidification equipment and shall meet the following requirements:
 - a. Refrigerant type systems shall be installed in the process air supply duct between, and/or blended with, the dehumidifier as close to the work space as possible.
 - b. Only electric, indirect fired combustion, or steam coil auxiliary heaters shall be used. No direct-fired space heaters shall be allowed during the blasting, coating, or curing phases.
 - c. The space to be controlled shall be sealed off as well as possible, allowing air to escape the work space away from the point where the dehumidified air is being introduced. If it is necessary to filter the air escaping the space, the filtration system shall be designed so that it does not interfere with the dehumidification equipment's ability to control the dew point and relative humidity of the work space.

C. Overspray and Dust Control Protection.

1. All spray application of coatings or blast cleaning at the project site which is performed outside of a totally enclosed booth shall be kept to a minimum. Alternative application methods (brushing, rolling, etc) or off-hour work shall be considered and may be required to minimize potential overspray damage.
2. When spray painting and/or blast cleaning are required, the CONTRACTOR shall submit a work plan for review by the ENGINEER in advance outlining specific areas where the work will take place including a schedule and preventative measures being utilized to eliminate the possibility of overspray damage to facilities and vehicles and dust control.
3. Under no circumstances shall fugitive dusts or coating particulates be permitted to leave the immediate work area.
4. For work within the site, the CONTRACTOR shall provide and install signs at Plant entrances, work areas, and roadways to direct traffic as needed to alternate parking areas to prevent overspray damage to vehicles. Parking areas immediately downwind or otherwise in high-risk areas shall be delineated to prevent vehicles from parking in these areas.
5. Any damage incurred by the DISTRICT or its employees due to paint, solvent or sandblasting materials from blasting or coating operations shall be promptly repaired by the CONTRACTOR to the satisfaction of the DISTRICT and its employees at no additional contract cost to the DISTRICT.

3.4 SURFACE PREPARATION OF DAMAGED CONCRETE

A. Surface preparation shall be as follows:

1. All loose, brown carbonated, deteriorated, or unsound concrete shall be removed in the immediate vicinity of the damaged documented areas to provide a termination point that is tightly adhered to the surfaces of the structure.
2. The depth of concrete to be removed shall be measured by pre-drilling holes 0.5 inch deep, 10 feet by 10 feet apart, before any surface preparation occurs. The removal of sufficient concrete shall be measured by comparing the surrounding concrete to the predrilled holes. Concrete surfaces shall be prepared per SSPC SP13 abrasive blasting to remove the top 2 inch of existing concrete and to produce a surface roughness equivalent to that of ICRI 310.2 Concrete Surface Profile 5. If grease or other contaminants remain on the surface, the CONTRACTOR shall scrub the surfaces with a mixture of trisodium phosphate detergent and water until the surfaces are acceptable to the INSPECTOR.
3. Install a 1/8-inch wide by 3/8-inch deep groove in the concrete near all coating termination points as shown in the Drawings. Dust, debris, and other contaminants shall be removed prior to primer application.
4. At the discretion of the Inspector, the Contractor shall test the concrete surfaces for soluble salts with the use of Chlor*Test CSN as manufactured by Chlor*Rid International or approved equivalent. The surfaces shall be tested and shall have a concentration less than 5 micrograms per square centimeter ($\mu\text{g}/\text{cm}^2$) of chlorides, sulfates, or nitrates. A test shall be conducted for every 200 square feet (ft^2) of surface area to be coated at locations determined by the Inspector.
5. If the soluble salt test indicates chloride, sulfate, or nitrate concentrations greater than those outlined in these Specifications, the Contractor shall use Chlor*Rid, as manufactured by Chlor*Rid International, in the water source during Low Pressure Water Cleaning at 1,500 psi to remove the salts from the substrate and allow it to dry for a minimum of 8 hours. The treated areas shall be reblasted and tested after the surfaces have been cleaned. A substrate's surface preparation will be accepted once the soluble salt concentration is below the amounts outlined in these Specifications.
6. In accordance with ASTM D4262, test to determine the pH of the concrete surface after the surface has been thoroughly blasted and cleaned. If the pH is outside the range recommended by the coating manufacturer, then the surface must be neutralized by removing concrete until a surface pH of 7 or greater is obtained prior to any coating application. One pH test shall be performed every 200 square feet, or less, and at locations determined by the Inspector.
7. The Contractor shall test for capillary moisture in accordance with ASTM D4263. Moisture tests shall be taken every 200 square feet or less and at locations determined by the Inspector. If capillary moisture is present, the coating manufacturer shall be consulted to determine primer requirements and special coating application criteria.
8. Resurfacing of Concrete: The Contractor shall use a concrete resurfacer to rebuild the existing concrete for up to 1 inch in depth following abrasive blasting. The existing concrete shall be resurfaced with a high early strength, epoxy-modified cement resurfacer,

as specified, prior to the installation of the epoxy primer. The resurfaced concrete shall be finished with a masonry brush with 4-inch long Tampico fibers, completely cured, and dried according to the manufacturer's recommendations.

9. After curing, and prior to coating, the resurfaced concrete shall be lightly abrasive blast cleaned to produce a surface roughness equivalent to that of ICRI 310.2 Concrete Surface Profile 3.

3.5 REINFORCING STEEL REPAIR

- A. If reinforcing steel is exposed and determined to be in adequate condition by the Engineer, the CONTRACTOR shall remove concrete from around the reinforcing steel so there is a ½-inch gap around the circumference of the reinforcing bars, and coat reinforcing steel with Sika Aramotec 110, or equal, prior to rebuilding the concrete or applying other coating system components.
- B. If the reinforcing steel has more than 50 % of the cross sectional area lost along its exposed length, the reinforcing steel shall be replaced and spliced to sound, adjacent reinforcing steel. The CONTRACTOR shall remove enough of the concrete around the circumference of the reinforcing bar to accommodate the splices and/or coupler installation and to allow for bonding between the reinforcing steel and the new cementitious mortar material. Removals shall allow for a ½-inch gap around the circumference of the reinforcing steel or coupler.

3.6 WORKMANSHIP

- A. Each coat of material shall be subject to the inspection and acceptance of the INSPECTOR before the next successive coating is applied. Defective work of any kind shall be deemed sufficient cause for completely stripping, preparing, and recoating the entire surface involved. Sufficient time shall be allowed between coats to assure proper drying for optimum bonding of the subsequent coats as recommended by the manufacturer for the existing ambient conditions. Excessive time beyond the manufacturer's recommended recoat window shall be avoided. When maximum recommended drying times are exceeded, surfaces shall be abraded for subsequent coats as recommended by the manufacturer.
- B. All work shall be done in a professional manner with high quality workmanship leaving the finished surfaces free from runs, drops, ridges, waves, holidays, laps, brush marks, variations in color, texture and finish. No visual holes, bubbles, or blisters shall be allowed to be exposed to wastewater.
- C. Upon completion of the painting, the CONTRACTOR shall remove all rubbish and shall remove spattered paint from hardware, floors, equipment and any other surfaces upon which it is not intended.
- D. Skilled craftsmen and experienced supervision shall be used on all work.
- E. Clean drop cloths shall be used. All damage to surfaces resulting from the work hereunder shall be cleaned, repaired, and refinished to their original condition.
- F. All coatings shall be applied under dry and dust-free conditions as indicated in the Environmental Requirements Section 3.3 of this Specification. Coating shall be done in a

workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to ensure that they have been thoroughly cleaned and that they receive an adequate thickness of coating material. Particular care shall be used to ensure that the specified coverage is secured on the edges and corners of all surfaces.

3.7 SURFACES NOT TO BE COATED

- A. The following surfaces shall not be protective coated hereunder unless shown or specified herein, or elsewhere in the Contract Documents. The following surfaces shall be masked off by the CONTRACTOR prior to coating work being performed on adjacent surfaces requiring coating:
1. Maintenance hole frames and covers
 2. Sliding and gear surfaces of telescoping valves
 3. Threaded portions of gate stems
 4. Machined surfaces of gate slides, frames and guides
 5. Any roller-type chains not completely enclosed in drive housings
 6. Pump inlets and outlets
 7. Internal pipe seals, joints, and gaskets
 8. Butterfly valves, check valves, gaskets and slide gates
- B. Drop cloths and other coverings shall be so placed at all times to protect asphalt, concrete, exterior steel and other surfaces from spatter and drippings.
- C. Valve gaskets or seals, flanges, drains, or manhole seats, which are not to be painted, shall be masked off prior to lining work.

3.8 APPLICATION OF PRIMER AND MASTICS

- A. Materials and supplies provided shall be the standard products of the manufacturer. Materials within a coating system shall be the products of a single manufacturer.
- B. The application of protective coatings to steel substrates shall be in accordance with "Paint Specification No. 1, (SSPC_-PA_-1)", Steel Structures Painting Council.
- C. Before the start of the coating application each day, the CONTRACTOR shall set up a 10-foot by 10-foot polyethylene sheet or cardboard on the ground for the purpose of performing a test patch. The CONTRACTOR, in the presence of the INSPECTOR, shall spray on the polyethylene sheet or cardboard and shall not have any discoloration, bubbles, or pinholes in the coating and the spray gun shall not clog. The spray gun shall produce an even fan spray and the coating shall be of a consistent color. Once these performance characteristics are achieved, the coating application may proceed.

- D. No lining shall be applied under conditions which, in the opinion of the INSPECTOR, could jeopardize the appearance or quality of the finish in any way. It is necessary for the CONTRACTOR to provide a working area which meets the manufacturer's recommended and specified environmental conditions.
- E. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The CONTRACTOR shall schedule such inspection with the INSPECTOR in advance.
- F. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and procedures included in this Section, whichever has the most stringent requirements.
- G. The CONTRACTOR shall verify the wet film thickness with a notched gauge in conformance with ASTM D4414. Wet film thickness readings shall be recorded a minimum of every 100 square feet.
- H. Special attention shall be given to edges, angles, corners, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.
- I. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
- J. Finish coats, including touch-up and damage repair coats shall be overlapped 6 inches onto existing coatings and shall be applied in a manner which will present a uniform texture and color matched appearance.
- K. The Contractor shall employ backrolling, troweling, mist coats, or coating at night to minimize holidays, blisters, and bubbles.

3.9 ARROW-LOCK LINING INSTALLATION

A. General

1. Installation of the lining, including preheating of sheets in cold weather and the welding of all joints, shall be done in accordance with the recommendations of the liner manufacturer.
2. Coverage of the lining shall not be less than the minimum shown on the plans.
3. The lining is normally installed with the locking extensions running vertically in the structure.
4. All cut, torn and seriously abraded areas in the lining shall be patched according to manufacturer's instructions.
5. Hot joint compounds, such as coal tar, shall not be poured or applied to the lining until all welding has been completed.
6. The contractor shall take all necessary measures to prevent damage to installed lining from equipment and materials used in or taken through the work.

B. Priming

1. Mix Arrow-Lock Mastic Primer No. 5101 according to directions on the label.
2. Brush, roller, or spray system (optional) to apply good wet coat to exposed concrete, achieving thorough coverage.
3. Let primer cure until it becomes tacky (approximately 30 minutes) before applying mastic. Drying times may vary due to humidity or cooler temperatures.
4. Apply primer to resurface concrete and backside of PVC liner at a rate of 200 square feet per gallon.

C. Mastic Application

1. Arrow-Lock Mastic No. 9912 is a 2:1 epoxy gel for filling voids and bonding to properly prepared concrete substrates.
2. DO NOT apply mastic at ambient temperatures below 45°F (7°C) or above 100°F (38°C).
3. Mixing
 - a. Mix Mastic Component A and Component B in a 5 gallon pail using an air or electric powered mixer until the components are a uniform color. Pot life is approximately 15 minutes if mastic is left in the container.
 - b. DO NOT over mix, as this will shorten the pot life.
 - c. In cool climates, store mastic and primer at approximately 77°F (25°C) to facilitate mixing and application.
4. Application
 - a. Abrade the leading edge of the existing PVC Liner with 60 grit sandpaper and solvent clean per SSPC SP1 the tightly adhered and embedded PVC liner and allow surface to dry.
 - b. Use small un-notched trowel or other suitable tool to apply mastic to concrete substrate in a uniform minimum thickness of 3/8-inch.
 - c. Small voids may be filled with mastic; larger voids require filling with an appropriate concrete repair material.
 - d. Carefully watch mastic setting time (approximately 15 minutes) to avoid hardening before the liner is applied to the mastic-coated surface.
 - e. Mastic coverage is approximately 4 sq. ft. per gallon at a 3/8-inch applied thickness.
 - f. If there is evidence of external groundwater infiltration, de-watering procedures are required for a minimum 24 hours after the final installation of the mastic, Arrow-Lock, and weld strips.

D. Arrow-Lock Sheet Lining Application

1. Install Arrow-Lock with sheet on non-horizontal surfaces with the ribs oriented vertically to allow run off of any moisture that may accumulate behind the lining.
2. Measure and cut sheets to size before mixing and applying mastic to the concrete surface.
3. Place one edge of Arrow-Lock sheet into position and roll the Arrow ribs into the mastic.
4. Properly align sheets with respect to each other as required by the type of joint to be produced.
5. NOTE: It may be necessary to heat the lining to allow the sheet to turn corners.
6. Use a hard rubber roller to embed the ¼-inch long ribs full depth into the mastic layer.
7. Clean the surface of an installed sheet with a soft cloth.
8. Do not contaminate a weld area with mastic.
9. Continue process until all surfaces have been covered.

E. Hot Air Welding of Liner Joints

1. Three joint types are recommended (refer to Ameron Protective Lining Division Drawing No. PLD-AL-010)
 - a. Type AL-1 (1-inch maximum joint gap)
 - b. Type AL-2 (1/2-inch maximum joint gap)
 - c. Type AL-3 (1/4-inch maximum joint gap)
2. Solvent clean areas to be covered with a weld strip per SSPC SP1. Remove cured mastic with a scraper.
3. Use a hot air gun to fuse the weld strip over the gap between adjacent sheets.
4. Follow the manufacturer's recommendations for setting the heat gun exit air temperature, and the instructions for fusing and applying the weld strip seal over the joint gap.

F. Inspection and Repair

1. Visually inspect all areas of the lining and joints for cracks, tears, punctures, and delamination. Repair punctures and holes in the lining by fuse-welding on weld strips directly over the damaged area.
2. All welds shall be physically tested by a non-destructive probing method using a blunt instrument such as a putty knife.
3. All repairs shall use methods approved by the manufacturer.

3.10 INSPECTION AND TESTING DURING AND AFTER APPLICATION

- A. All inspection and testing shall be subject to confirmation by the DISTRICT's Coatings Inspector.
- B. The CONTRACTOR shall provide anchor profile measurements, blast hose pressures, type/percent mixture of the abrasive, and shall check the compressor air cleanliness.
- C. The CONTRACTOR shall provide a written record of the quantity of coating material applied and the quantity of surface area covered, a description of the location of the area coated, each coating product batch number, dew point temperature, surface temperature, ambient temperature, relative humidity, and names of applicators on a daily basis. The CONTRACTOR shall record the pressures and temperatures at which the coating material is being heated and delivered to the spray gun.
- D. The CONTRACTOR shall provide wet film and dry film thickness readings, and results of the holiday testing, and shall note any discrepancies with the coating specifications. All test results shall be documented in daily inspection reports. These reports shall be submitted to the ENGINEER not less than one business day following the completion of testing.
- E. Inspection Devices: The CONTRACTOR shall furnish, until final acceptance of such coatings, inspection devices in good working condition and calibrated by the manufacturer prior to testing until the final acceptance of such coatings.
- F. Holiday Testing: The CONTRACTOR shall holiday test all spray applied-coated ferrous and non-ferrous surfaces, and surfaces exposed to submerged and severe service environments in the presence of the INSPECTOR. After the specified coating has set hard to the touch, the CONTRACTOR shall test the coated steel surfaces for pinholes and holidays using a high voltage spark tester according to NACE SP0188. The CONTRACTOR shall test the coated concrete surfaces for pinholes and holidays using a high voltage spark tester according to ASTM D4787. Areas which contain visual pinholes and sparking holidays shall be marked, repaired or recoated, and retested in accordance with the coating manufacturer's printed instructions. The electrode movement over the coating surface shall be continuous and shall proceed in a systematic manner, which ensures 100% coverage of the coated surfaces.
 - 1. Coatings with Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils, a pulse-type holiday detector shall be used. Holiday testing shall be conducted with a new 12-inch or 18-inch wide wire brush electrode attached to the unit. A silicon rubber electrode shall not be allowed. The unit shall be adjusted to operate between 18,000 and 22,000 Volts. Approved products include the following:
 - a. Tinker & Rasor Model AP-W,
 - b. D.E. Stearns Co. Model 14/20,
 - c. Elcometer D236-30KV
 - d. or equal
- G. Film Thickness Testing: The dry film coating thickness shall be measured in accordance with the SSPC PA 2 using a magnetic-type dry film thickness gage. The instruments shall have the

capability of measuring 50% over the specified coating thickness and shall produce an actual reading and shall not be estimated. No measurements shall be made until at least 8 hours after application of the coating. The following instruments are acceptable:

1. Concrete

- a. Wet – Notched gauge per ASTM D4414, or approved equal
- b. Dry – PosiTector 200 or equal.

H. Adhesion Testing – Adhesion testing on the concrete shall be performed every 400 square feet of coated concrete surfaces. The coating adhesion to the concrete substrates shall be tested using a Type II or Type V instrument per ASTM D4541 on each coupon and shall be witnessed by the INSPECTOR. Elcometer 106, Defelsko Positector AT, or equal, shall be used to perform the test. The procedure is as follows:

1. The new lining material shall be abraded and wiped with solvent per SSPC SP1 prior to applying the adhesive on the dolly.
2. A minimum of one new 20 mm diameter dolly shall be affixed to the coated surface for every 400 square feet. Each testing location shall be identified and recorded by the INSPECTOR.
3. After the dolly is affixed to the new lining but prior to conducting the pull-off test, the INSPECTOR shall score around the dolly without disturbing the dolly or bond within the test area. The scoring shall penetrate through the newly applied coating, and abrade the substrate.
4. The adhesive used to attach the dollies to the liner shall be rapid setting with a tensile strength in excess of the coating material and permitted to cure in accordance with the manufacturer's recommendations. Failure of the dolly adhesive shall require re-testing.
5. The concrete adhesion pulls shall exceed 200 psi with failure at the concrete. Adhesion pulls between 150 psi and 200 psi shall be acceptable if the dolly contains 50% concrete. An additional pull test will be required for results less than 150 psi for concrete as stated below.
6. The INSPECTOR shall record the type of adhesive used, the length of time the adhesive was allowed to cure, and the type of failure observed on the dolly.
7. If more than 50% of the adhesion tests on the concrete do not meet the adhesion requirements, an additional test shall be conducted within 12 inches of the lowest measurement. If the additional dolly does not meet the adhesion requirements, an additional location shall be tested on a different surface. The adhesion values of the retests and passing results shall be recorded and shall average a minimum of 175 psi for concrete, or as otherwise approved by DISTRICT. If the adhesion tests fail to meet the adhesion requirements, the coating shall be removed and replaced at the CONTRACTOR's expense.
8. The CONTRACTOR shall repair the coating and damaged concrete at the locations of the adhesion tests per the manufacturer's recommendations. The testing dollies shall be retained by the INSPECTOR at the conclusion of the testing.

3.11 CURING OF COATINGS

- A. The coating shall not exhibit bubbling, tackiness, or softness after the coating has exceeded the manufacturer's recommended cure time.
- B. If necessary, the INSPECTOR shall conduct a Solvent Rub Test in accordance with ASTM D5402 after 24 hours of curing. The test area shall be evaluated for appearance, hardness, or any color transfer to the cloth. If there is no change to the coating after the test, it shall be considered cured.
- C. If necessary, the INSPECTOR shall conduct Shore D Durometer Hardness Testing per ASTM D2240. In order to consider the coating cured and properly mixed, it shall meet the manufacturer's recommended Shore D Durometer requirement for the specified product.
- D. The CONTRACTOR shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the highest requirement, prior to placing the completed coating system into service.
- E. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

3.12 COLORS

- A. The CONTRACTOR shall prepare and submit color chip samples for all items that require color selection by the DISTRICT. No color selection shall be made until after samples of all paints have been submitted to the DISTRICT, and the DISTRICT has prepared a color scheme using the submitted colors.

3.13 COATING SYSTEM A – PVC LINING SYSTEM

- A. The following PVC lining product, or equal, shall line concrete as indicated in the drawings:

Product Name	Arrow Lock
Minimum Surface Profile	ICRI 310.2 CSP 5
Prime Coat DFT	Arrow Lock 5101 at 200 sq. ft. per gallon
Mastic DFT	Arrow Lock 9912 at 3/8-inch thick (4 sq. ft. per gallon)
PVC Liner	Arrow Lock Sheet Liner at 65 mils
Total System DFT	100 to 110 mils

3.14 COATING SYSTEM B – CONCRETE RESURFACER

- A. The following epoxy modified cement mortar, or equal, shall be used to build up the existing concrete surfaces of the Influent Pump Station from Elevation -0.5 ft. up to Elevation +25.0 ft., including the ceiling to their original surface, after it has been abrasive blasted and tested for surface contaminants.

Product Name	Five Star Structural Concrete V/O, Sikatop 123 Plus, Carboguard 510, or approved equal
Surface Preparation	SSPC SP13 Abrasive Blast to remove top 2 inches of original surface and achieve a ICRI 310.2 CSP 5
Application Method	Per Manufacturer's Recommendations
Total System DFT	2 inch

3.15 COATING SYSTEM D – CONCRETE REPAIR MORTAR FOR SPALLS/REBAR

- A. One of the following concrete repair mortars shall also be used to repair cracks/spalls around the structure:

Product Name	Sika Armatec 110 and SikaRepair 224 or Five Star Structural Concrete V/O
Surface Preparation	SP3 on exposed reinforcing steel
Corrosion Inhibitor	2 coats at 20 mils
Repair Mortar	As needed to restore to original surface.
Application Method	Per Manufacturer's Recommendations

-END OF SECTION-

acceptance by the ENGINEER as to quality and color. Sample pieces shall be manufactured by the method to be used in the WORK.

1.04 QUALITY ASSURANCE

- A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.
- B. The installing Contractor shall assure that all field dimensions are taken accurately and communicated to the FRP Fabricator and that all the Manufacturer's instructions and recommendations are followed.
- C. Manufacturer shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship. The warranty of all fiberglass products shall be extended for a period of 10 years against failure due to corrosion.
- D. Manufacturer shall be certified to the ISO 9001-2000 standard.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Products shall be delivered, stored and handled per the manufacturer's recommendations. Deliver products individually crated for protection from damage in cardboard containers, clearly marked with project information and shipping information. Include a copy of the installation instructions with the product delivery.
- B. All materials shall be carefully handled to prevent abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All FRP shall be corrosion resistant using resins resistant to continuous contact with the following:
 - 1. Ferric Chloride (40%).
 - 2. Mannich Polymer.
 - 3. Emulsion Polymer.
 - 4. Municipal Wastewater.
 - 5. Sulfuric Acid (10%)

- B. All FRP materials shall be manufactured with vinyl ester resins.
- C. All FRP products shall also be suitable for outdoor installation and be ultraviolet (UV) resistant. Pultruded grating and structural shapes shall be constructed of strand roving, transverse mat, and a synthetic veil. Fabrication shall include UV light inhibitors.
- D. All pultruded grating and structural shapes shall be flame retardant per ASTM E-84 Class 1 Flame Spread of less than 25.
- E. After fabrication of FRP, all cuts, holes, and abrasion shall be sealed with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the Contractor in accordance with the manufacturer's instructions.
- F. All related hardware shall be Type 316 or 316L stainless steel unless noted otherwise on the Drawings.

2.02 GRATING

- A. Grating and plate shall be suitable for outdoor installation, UV resistant and able to provide load requirements for walkway applications.
- B. Load/Deflection: Grating shall meet manufacturer's published safe recommended loadings with deflection not to exceed the following:
 - 1. Uniform distributed load of 50 pounds per square foot over a 66" span with a maximum deflection of 0.13".
- C. Depth: 2" deep load bars with a tolerance of plus or minus 1/32".
- D. Mesh Configuration: 2" load bar spacing, 6" tie bar spacing on centers.
- E. Grating shall be assembled using a locking cross-rod design that makes a permanent connection between the cross-rod and bearing bar.
- F. Grating shall be flush construction, having no seams or cracks.
- G. Maximum weight of any single panel shall be 50 lbs.
- H. Grating shall be provided with a grit bonded and baked to the top surface of the finished grating product.
- I. The FRP color shall be gray or yellow.
- J. Engineering properties per foot of grating width:
 - 1. Cross sectional area – 3.2 in²
 - 2. Moment of inertia – 1.68 in⁴
 - 3. Section modulus of top – 1.96 in³

4. Section modulus of bottom – 1.47 in³
- K. Manufacturer and Grating Model:
1. Fibergrate Composite Structures, Inc., Safe-T-Span, T5020.
 2. Or approved equal.

PART 3 - EXECUTION

3.01 FABRICATION

- A. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.
- B. Each grating section shall be readily removable, except where indicated on the Drawings. Provide openings and holes where shown on the Drawings. Grating supports shall be provided at openings in the grating by Contractor where necessary to meet load/deflection requirements specified herein. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.

3.02 INSTALLATION

- A. Install FRP products in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified.
- B. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's installation instructions.
- C. Field cutting of FRP products shall not be allowed unless authorized by the Engineer. All cut or sanded surfaces shall be sealed with resin prior to installation.

3.03 PROTECTION OF INSTALLED PRODUCTS

- A. Protect products from damage by subsequent construction activities until final inspection.
- B. If FRP materials are not to be installed immediately, then store to prevent twisting, bending, breaking, or damage of any kind. Keep material covered to prevent unnecessary exposure to UV.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope:
 - 1 Flashing and sheet metal work for moisture protection
 - 2 Miscellaneous sheet metal work
- B. Additional Requirements Specified Elsewhere:
 - 1 Shop Drawings, Product Data and Samples: Section 01340
 - 2 Materials and Equipment: Section 01600

1.02 SUBMITTALS

- A. Submit Complete Specifications, Data, and Catalog Cuts on Drawings Covering All Items to be Provided

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver Flashing Members to be Built Into Masonry, or Concrete at the Proper Time for Incorporation into the Work
- B. Protect Materials from Damage During Shipment, Site Storage, and Installation
- C. Store in Clean, Dry Storage Areas

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sheet Metal:
 - 1 Galvanized steel: ASTM A366 or A569, zinc-coated
 - 2 Aluminum: ASTM B204, alloy 3003-H14, mill finish
 - 3 Stainless steel: 18-8, ASTM A167, Type 302 or 304, AISI 2D finish
 - 4 Lead-coated copper: ASTM B101, Type 1, Class A
 - 5 Lead: FS QQ-L-201, Grade B
- B. Accessories:
 - 1 Extruded aluminum: ASTM B221, alloy 6053 or 6063
 - 2 Solder, ASTM B32, alloy grade 50A (50-50)
 - 3 Solder flux:
 - a. Stainless steel: Zinc chloride type, FS O-F-506, Type II

- b. Other metals: Acid type, FS O-F-506, Type I, Form A
- 4. Fasteners:
 - a. Lead-coated copper: Copper nails, other fasteners bronze
 - b. Galvanized steel: Galvanized or cadmium-plated steel
 - c. Lead: Galvanized or cadmium-plated steel
 - d. Aluminum: Aluminum
 - e. Stainless steel: Stainless steel
- 5. Bird screen: 2-mesh, brass or copper wire cloth, minimum wire diam 0.063 inch
- 6. Asphalt roof coating: FS SS-A-694, Type I
- 7. Plastic cement: FS SS-C-153, Type I
- 8. Coal tar paint: Koppers "Bitumastic Super Service Black," Porter "Tarmastic 103," Tnemec "450 Heavy Tnemecol," or equal
- 9. Acrylic sealant: Pecora "Unicrylic," Tnemco "Mono," or equal

2.02 FABRICATION AND MANUFACTURE

A. Flashing:

- 1. Through wall flashing: Stainless steel, 32 ga, dead soft, fully annealed, ribbed; Architectural Steel "Rib-Bond," Cheney "3-Way Sawtooth Flashing," Revere-Keystone "Interlocking Type," or equal
- 2. Cap flashing: Stainless steel, 26 ga; or lead-coated copper, 16 ounce
- 3. Counterflashing: Stainless steel, 26 ga; or lead-coated copper, 16 ounce; Architectural Steel, Cheney, Revere, or equal; with 4-inch wall flat and hook dam for masonry wall installation
- 4. Reglets: Stainless steel, 26-gauge or lead-coated copper, 16 ounce; designed to retain counterflashing by snap action or friction fit; Architectural Steel "Friction Reglet," Cheney "Type A," Revere-Keystone "Simplex," or equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

- 1. Install sheet metal as indicated on Drawings and as specified herein and in related Work sections
- 2. Avoid marring or improper bending of sheet metal
- 3. Prevent contact with corrosive or staining materials
- 4. Replace damaged sections
- 5. Install only undamaged sections
- 6. Aluminum in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint
- 7. All exposed or contacting flashing shall be of the same material

B. Joints:

- 1. Closed watertight, except where slip joints are specifically required
- 2. Watertight joints:
 - a. Mechanically interlock
 - b. Joints in aluminum or between aluminum and other metals: Acrylic sealant

- c. Other metal joints:
 - 1) Solder
 - 2) Wipe clean of flux
 - 3) Neutralize acid flux by washing with sodium bicarbonate solution
- C. Through Wall Flashing:
 - 1. Flashings under copings continuous
 - 2. Extend flashings over lintels and under sills 8 inches past each jamb and turn ends up 1/4 inch
 - 3. Form wall flashing with receivers for counterflashings where required
 - 4. Overlap and interlock joints in wall flashing and receivers for counterflashing
 - 5. Flashing which requires multiple bends may be single-bend sections with vertical legs overlapped to drain to the outside face of the wall
- D. Counter Flashing:
 - 1. Provide to overlap membrane base flashing, to fit into reglets or receivers, and as indicated on Drawings
 - 2. Maximum section length: 10 feet
 - 3. Overlap sections 3 inches and form a slip joint
 - 4. Do not interlock slip joints
 - 5. Offset end joints from underlying joints between reglet or receiver sections
 - 6. Make corner joints watertight
- E. Miscellaneous Metal Flashing:
 - 1. Provide for vents, sleeves and similar projections through roof
 - 2. Extend 8 inches minimum above roof, except as indicated on Drawings
- F. Conductor Heads:
 - 1. Extend downspout thimble 2 inches below conductor head soffit, sized to fit, and 1/8 inch less than downspout
 - 2. Rivet and solder thimble flanges to conductor head bottom
 - 3. Secure to scupper with single corner seams
 - 4. Nail to wall with overflow opening
- G. Gutters and Downspouts:
 - 1. Provided by metal building system supplier, reference Section 13121
- H. Cap Flashing:
 - 1. Provide at roof ventilators, skylights, and where indicated on Drawings
 - 2. Maximum section length: 10 feet
 - 3. Overlap sections 3 inches and form a slip joint
 - 4. Do not interlock slip joint
 - 5. Make corner joints watertight
 - 6. Install after membrane base flashing is completed
 - 7. Anchor as indicated on Drawings
- I. Pitch Dams: Provide at gravel stops, vents, sleeves, pans elsewhere as indicated on Drawings, and specified in related Work sections
- J. Flashing Pans: Provide for columns, equipment supports, and similar members bearing on roofs

- K. Hoods: Provide counterflashing hoods for conduits and pipes, except vents that pass through the roof; for columns equipment supports and similar members that bear on the roof; and as indicated on Drawings

- L. Miscellaneous Metal Flashing:
 - 1. Provide for vents, sleeves, and similar projections through roof
 - 2. Extend 8 inches minimum above roof, except as indicated on Drawings

END OF SECTION

SECTION 07720

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof Curbs
 - 2. Gravity ventilators.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
 - 1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes or location of existing fixtures and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, those equal to manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use.
- D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.
- E. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.
- F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
- G. Steel Tube: ASTM A 500, round tube, baked-enamel finished.
- H. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
- I. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.3 MISCELLANEOUS MATERIALS

- A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C 920, silicone or polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
- G. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF CURBS

- A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
 - 1. Acceptable Manufacturers:
 - a. Colony Custom Curbs.
 - b. Commodity Products Company, Inc.
 - c. Conn-Fab Sales, Inc.
 - d. Curbs Plus Inc.
 - e. Custom Curb, Inc.
 - f. LM Curbs.
 - g. Loren Cook Company.
 - h. Metallic Products Corporation.
 - i. Pate Company (The).
 - j. Roof Products & Systems Corporation.
 - k. Roof Products, Inc.
 - l. Thaler Metal Industries Ltd.
 - m. ThyCurb; Div. of Thybar Corporation.
 - n. Uni-Curb, Inc.
 - o. Vent Products Company, Inc.
 - p. Or equal
 - 2. Load Requirements: Able to handle loads from fans and ventilators.

3. Material: Galvanized steel sheet, 0.079 inch or
4. Material: Stainless-steel sheet, 0.078 inch thick.
5. Liner: Same material as curb, of manufacturer's standard thickness and finish.
6. Factory install wood nailers at tops of curbs.
7. Factory insulate curbs with 1-1/2-inch thick, glass-fiber board insulation.
8. Fabricate units to minimum height of 12 inches, unless otherwise indicated.

2.5 GRAVITY VENTILATORS

A. Hooded Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:

1. Acceptable Manufacturers:
 - a. Active Ventilation Products.
 - b. Bristolite Skylights.
 - c. Commodity Products Company, Inc.
 - d. Loren Cook Company.
 - e. Metallic Products Corporation.
 - f. Solar Group (The).
 - g. Thaler Metal Industries Ltd.
 - h. ThyCurb; Div of Thybar Corporation.
 - i. Western Canwell.
 - j. Or equal
2. Provide integral frame with base flange, and weathertight cap.
3. Dimensions: 4' x 6' plus or minus, verify in field.
4. Style: Roll-formed hood panels.
5. Bird Screens: 1/2" stainless steel mesh, mounted in hood.
6. Insect Screens: Manufacturer's standard mesh with rewirable frame.
7. Construction: minimum 18 ga aluminum bolted to aluminum support structure.
8. Schedule:

Equip No.	Throat Area	CFM	Non-Ducted SP Loss
IH-1	48 x 60	9,600	0.044 IN WC

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 2. Verify dimensions of roof openings for roof accessories.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Equipment Support Installation:
 - 1. Set equipment support so top surface of equipment support is level.
- F. Preformed Flashing Installation:
 - 1. Secure to roof membrane according to flashing manufacturer's written instructions.
- G. Seal joints with elastomeric sealant as required by manufacturer of preformed flashing.

3.3 TOUCH UP

- H. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 painting Sections.
- I. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.3 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07900

SEALANTS AND CAULKING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: Provide caulking and sealing.
- B. Additional Requirements Specified Elsewhere:
 - 1. Shop Drawings, Product Data and Samples: Section 01340.
 - 2. Product Requirements: Section 01600.
- C. Definitions: The terms "caulking" and "sealing" are used on the Drawings and in the Specifications synonymously. Either or both terms indicate the materials specified herein.

1.02 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ANSI 116.1: Two Component Elastomeric Sealing Compounds for the Building Trade.
 - 2. FS TT-S-227: Sealing Compound, Rubber Base, Two Component for Caulking, Sealing and Glazing in Building Construction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Thiokol Sealant:
 - 1. Polysulfide rubber, 2 component, ANSI A116.1 and FS TT-S-227, bearing Thiokol Chemical "Treated and Approved Sealant" Label.
 - 2. Non-sag: Type I, Class B.
 - 3. Self-leveling: Type II, Class A.
- B. Urethane Sealant: Master Mechanics "Vulkem 116", Williams "Dynaseal," or equal.
- C. Acrylic Sealant: Pecora "Unicylic," Tremco "Mono," or equal.
- D. Silicone Sealant: Silicone rubber, neutral color; Dow Corning "780 Building Sealant," General Electric "Silicone Sealant 1300," or equal.
- E. Oil Base Compound: Not permitted.
- F. Primer: As recommended by sealant manufacturer.
- G. Back-up Material: Polyethylene foam; Dow "Ethafoam SB," Grace "Servicised 5401 Foam Filler," Haveg "Minicell Backer Rod," or equal.

2.02 MANUFACTURE

- A. Colors: Manufacturer's standard colors to best blend in with location.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Cleaning:
 - 1. Clean surfaces to receive sealant of all dust, grease, oil, or wax.
 - 2. Wipe surfaces with clean rag soaked in xylol or suitable solvent.
- B. Backup Material:
 - 1. Where required to control depth of sealant install backup material.
 - 2. When compressed 25 percent to 50 percent fills the joint space.
 - 3. Rolled or pressed into place avoiding lengthwise stretching.

3.02 INSTALLATION

- A. Install Sealants Before Painting.
- B. Install Sealants Only When the Air and Surface Temperatures are Above 50 Degrees F.
- C. Tool Each Joint to a Smooth, Even Finish, Flush with the Edges of the Sealing Recess.
- D. Keep Adjacent Surfaces Clean and Free of Overlapping Sealant.
- E. Apply to a Depth Equal to Joint Width, But Not Less Than 1/2 Inch.
- F. Remove Sealant and Reseal Joints at Which:
 - 1. Excess sealant is outside the joint and feathered onto surfaces.
 - 2. It is not possible to paint adjacent surfaces to a clean line.

3.03 SEALING SCHEDULE

- A. Non-sag Thiokol or Urethane:
 - 1. Locations where calking is shown on the Drawings or specified in other sections.
- B. Self-Leveling Thiokol:
 - 1. Horizontal joints in walks or drives.
 - 2. Horizontal joints in traffic bearing decks and slabs.
- C. Silicone:
 - 1. Where type not otherwise specified.

END OF SECTION

SECTION 10400

IDENTIFYING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included:
 - 1. Signs and Tags:
 - a. Safety, caution, danger and hazard signs.
 - b. Stamped metal tags for field equipment and instruments.
 - c. Tagging of valves, pumps, motors, conduit, instrumentation and process equipment.
 - 2. Pipeline marking tape to identify buried pipe:
 - a. All pressure lines.
 - b. All drain lines 4 inches or larger.
 - 3. Locating wire:
 - a. All non-metallic buried pipe.
 - 4. Color coding, labeling, stenciling, and tagging of all exposed process, water and air piping.
 - 5. Identification and tagging of electrical and instrumentation equipment.
 - 6. Wire numbering standards: See Division 16 specifications.

- B. Additional Requirements Specified Elsewhere:
 - 1. Shop Drawings, Product Data, and Samples: Section 01340.
 - 2. Quality Control: Section 01400.
 - 3. Product Requirements: Section 01600.
 - 4. Painting: Section 09900.
 - 5. Piping: Section 15060 – Piping Schedules

1.02 SUBMITTALS

- A. See Section 01340.

- B. Product Technical Data Including:
 - 1. Acknowledgment that products submitted meet requirements of standards referenced.
 - 2. Identification register listing all items to be identified, type of identification system to be used, lettering, location and color.
 - 3. Catalog information for all tagging systems.
 - 4. Updated, complete, identification register with non-conflicting numerical assignments submitted prior to project acceptance.

- C. Drawings and Data:
 - 1. Signs: Submit schedule of all signs, including data describing size, colors, materials, letter sizes, mounting and schedule of signage.
 - 2. Tape: Material, size, color, detectability.

1.03 JOB CONDITIONS

- A. Signs:
 - 1. Indoor installation; wall, bracket or pipe mount as directed by Engineer.
 - 2. Outdoor installation; wall mount, direct sunlight, locate as directed by Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Paint: As specified in Painting Section 09900.
- B. Metal Tags and Attachment Wire:
 - 1. Tags: Aluminum or stainless steel.
 - 2. Stamped-in identifying letters.
 - 3. Colors: Two colors, lettering on separate background color. Colors as selected by District.
 - 4. Size: 3 inch diameter, minimum, or larger as required.
 - 5. Wire: 32 mil, nylon coated, stainless steel, no substitution.
 - 6. Tag numbers in accordance with valve and equipment schedules in respective sections and numbering shown on P&ID's.
 - 7. WH Brady Company, Carlton Industries, or equal.
- C. Snap-on Markers: Plastic sleeves, Seton Name Plate "Setmark," WH Brady Company, Carlton Industries, or equal.
- D. Fiberglass Reinforced Plastic Signs:
 - 1. Approved manufacturers and catalog numbers:
 - a. W H Brady Co., Catalog S-10, #B-120, Carlton Industries, or equal.
 - 2. Material: Fiberglass reinforced plastic.
 - 3. Size:
 - a. Surface: As scheduled.
 - b. Thickness: 0.10 inch.
 - 4. Fabrication:
 - a. Rounded corners.
 - b. Drilled holes in corners with grommets.
 - 5. Legend: Preprinted and permanently embedded.
- E. Phenolic Nameplates:
 - 1. Approved manufacturers and catalog numbers:
 - a. W H Brady Co., Catalog S-10, #B-1, Carlton Industries, or equal.
 - 2. Materials: Phenolic.
 - 3. Size:
 - a. Surface: As required for text.
 - b. Thickness: 1/16 inch.
 - 4. Fabrication:
 - a. Three layers laminated.
 - b. Legend engraved through top lamination into center lamination.
 - c. Drilled holes with grommets for mounting.

2.02 SAFETY SIGNS

- A. General:
 - 1. Material: Fiberglass reinforced resin/glass.
 - 2. Construction:
 - a. Graphics laminated between resin glass shields.
 - b. Thickness: 1/16 inch.
 - c. Grommets corner holes.
 - 3. Abrasion and impact resistant.

2.03 PIPELINE AND ELECTRICAL CONDUIT MARKING TAPE

- A. Material: Mylar Encased Aluminum.
- B. Width: 2 inches.
- C. Color: Orange or Yellow.
- D. Printed Identification:
 - 1. Pressure lines: "Caution: Buried Water Line Below".
 - 2. Drain lines: "Caution: Buried Drain Line Below".
 - 3. Electrical: "Caution: Electrical Below".
- E. Capable of Being Located From Above Ground With Metal Locator.

2.04 LOCATING WIRE

- A. No. 10 AWG, Continuous, Solid Copper, with UF Coating.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Location of Identification:
 - 1. Lettering and flow direction arrows:
 - a. Near equipment served.
 - b. Adjacent to valves.
 - c. At each branch or tee.
 - d. At intervals of not more than 50 feet on straight runs, unless otherwise indicated by the Engineer.
 - 2. "Caution," "Danger," and identification signs located at direction of Engineer.
- B. Metal Tags:
 - 1. Provide tags in lieu of stenciling/lettering on pipe 5/8 inch or smaller outside diameter (including covering).
 - 2. Color code as specified.
 - 3. Attach with stainless wire and stainless crimps.
- C. Lettering:
 - 1. Self adhesive or snap-on style markers.
 - 2. Letter size as follows:

Outside Diameter of Pipe or Covering
 5/8 inch or smaller
 3/4 inch through 4 inches
 5 inches or larger

Minimum Height of Letters
 Metal tags – 1/4 inch
 3/4 inch
 2 inches

- D. Scheduled Color Coding:
 1. All 12 inch pipe and smaller.
 2. Bands where scheduled: 6 inches wide, at 5 foot intervals.
 3. Provide only bands of color on uninsulated stainless steel, CPVC, and PVC, elsewhere natural finish.

- E. Piping Not Scheduled:
 1. Paint to match wall or ceiling, unless otherwise directed by Engineer.
 2. Appropriately identify and place flow arrows
 3. Uninsulated stainless steel and PVC:
 - a. Natural finish.

- F. Pipeline Marking Tape:
 1. Install continuously above all buried pipe.
 2. Depth: 4 inches, 6 inches.

- G. Pipeline Locating Wire:
 1. Install continuously, tape to all non-metallic buried pipe.
 2. See details on plans for continuation at valve boxes.

- H. Piping Not Scheduled:
 1. Paint to match wall or ceiling, unless otherwise directed by Engineer.
 2. Appropriately identify and place flow arrows.
 3. Uninsulated stainless steel, CPVC and PVC:
 - a. Natural finish.

3.02 SCHEDULES

- A. Piping Color Schedule:

<u>Pipe</u>	<u>Color of Pipe</u>	<u>Lettering</u>
Odor Control	To match existing	Black

- D. Specially Paint the Following Items:

<u>Item</u>	<u>Color</u>
Factory Primed Equipment	to match existing
Exposed Galvanized Flashing	Light Gray
Anywhere steel comes into contact with aluminum	Factory color

- E. Danger Signs:
 1. Size: 10 inches wide by 7 inches high.

2. Standard OSHA header, "Danger," white letters on red background in upper half of sign.
3. Baked enamel on 0.063 inch aluminum.
4. Custom lettering, "Equipment Starts Automatically", black letters on white background, Quantity: 1.
5. Custom lettering, "No Smoking", quantity 3.
6. At exhaust fan

F. Pipeline Labeling Markers:

1. Label all process piping as listed below.
2. Peel and press self adhesive style labels.
3. White lettering on green background.
4. Size markers for pipe size per label manufacturer=s recommendations.
5. Secure each pipeline label marker with self adhesive flow arrow tape, one full wrap minimum at each end of label. White arrows on colored background, same color as pipeline label.
6. Legend:

<u>Label</u>	<u>Quantity</u>
Odor Control	1

G. Metal Tags:

1. Schedule:
 - a. Exhaust fan and motor

END OF SECTION

SECTION 15605
HVAC: EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Heating, ventilating, and cooling equipment.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. Air Movement and Control Association (AMCA):
 - a. 210, Laboratory Methods of Testing Fans for Rating Purposes.
 - b. AS401, Fans, Standard Classifications for Spark-Resistant Construction.
 2. Air Conditioning and Refrigeration Institute (ARI):
 - a. 410, Force-Circulation Air-Cooling and Air-Heating Coils.
 - b. 430, Central Station Air-Handling Units.
 3. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
 - a. Applications Handbook, Chapter on Sound and Vibration Control.
 4. National Electrical Manufacturers Association (NEMA).
 5. National Fire Protection Association (NFPA):
 - a. 90A, Installation of Air Conditioning and Ventilating Systems.
 6. National Roofing Contractor Association (NRCA).
 7. Underwriters Laboratories, Inc.(UL).
- B. Miscellaneous:
1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.
 2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

- A. Shop Drawings:
1. See Division 1.
 2. Fabrication and/or layout drawings.
 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Wiring diagrams.
 - d. Control diagrams.
 - e. Manufacturer's catalog cuts and technical data.
 - f. Corrosion-protection information.
 - g. Fan curves.
 - h. Sound data.
 - i. Vibration isolation.
 - j. Control description.
 - k. Performance data on all equipment.
 4. Certifications:
 - a. Provide certification of thickness of corrosion-protection coating.

- B. Operation and Maintenance Manuals:
 - 1. See Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Vibration isolation assemblies:
 - a. Mason.
 - b. Vibration Mounting and Controls Co.
 - 2. Corrosion-protective coatings:
 - a. Heresite and Chemical Co.; "Heresite."
 - b. Technical Coating Division of Southern Anodizing Co., Inc.; "Technicoat."
 - 3. Roof-mounted centrifugal exhaust fans:
 - a. Loren Cook.
 - b. Greenheck.
 - c. Penn Ventilator Co., Inc.
 - d. Or equal.

2.2 GENERAL

- A. All manufactured units shall be factory wired and assembled.
 - 1. Use fasteners made of same material as unit.
 - 2. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
 - a. Type: As per Table 42, Chapter 43, ASHRAE Applications Handbook.
- B. All manufactured units shall be constructed with corrosion-resistant materials or have corrosion-resistant coating.
 - 1. Type:
 - a. Corrosion-resistant materials:
 - 1) Aluminum.
 - 2) Stainless steel.
 - 3) FRP.
 - b. Corrosion-resistant coating:
 - 1) Phenolic-based coating:
 - 2) 3 mil minimum dry thickness, air-dried coating, for surfaces exposed to temperatures less than 150 DegF.
 - 3) 5 mil baked-on coating for heat transfer surfaces and surfaces exposed to temperatures greater than 150 DegF.
 - 4) Factory applied.

2.3 MANUFACTURED UNITS

- A. Roof-Mounted, Upblast Centrifugal Exhaust Fans:
 - 1. AMCA certified.
 - 2. Non-overloading horsepower capability.
 - 3. Materials:
 - a. Top cap: Spun aluminum.
 - b. Wheel and inlet shroud: Aluminum.
 - c. Baffle: Aluminum.
 - d. Base: One-piece aluminum.
 - e. Drive assembly supports: Steel.
 - f. Drive shaft: Solid stainless steel.
 - 4. Backward inclined blades.
 - 5. Tapered inlet shroud.
 - 6. Statically and dynamically balanced wheel.

7. Bearings:
 - a. Permanently sealed, flange type, ball-bearings.
 - b. Five-to-one load capability to actual load ratio.
 - c. 200,000 HR average life.
8. Weathertight compartment for motor and drives.
 - a. Separated from airstream.
9. Motor: See Section 11005.
 - a. Driver and driven sheaves:
 - 1) Keyed hub type.
 - 2) Drive sheaves: Fixed pitch diameter.
 - 3) Driver:
 - a) Shipped with variable pitch diameter sheave.
 - b) Fixed pitch diameter size based on approved test and balance reports.
 - 4) V-belt drives sized for 150-percent motor horsepower.
10. Vibration isolated drive assembly.
11. Accessories:
 - a. Prefabricated insulated aluminum roof curb.
 - b. Bird screen.
12. Size and capacity as scheduled.

Equip No.	Cook Model	CFM	ESP	HP	RPM
EF-1	ACRUB 330 R11B	10,560	1.0 IN WC	5	640

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with Section 11005.
- B. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

3.2 FIELD QUALITY CONTROL

- A. Comply with Section 15990.

END OF SECTION

SECTION 15890
DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Ductwork and accessories.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. American Architectural Manufacturer's Association (AAMA):
 - a. 605.2, Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
 2. Air Diffusion Council (ADC):
 - a. 1062, Test code for Grilles, Registers and Diffusers.
 3. Air Movement and Control Association (AMCA):
 - a. 210, Test Code for Air Moving Devices.
 - b. 500, Test Method for Louvers, Dampers, and Shutters.
 4. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - a. Handbook of Fundamentals, Chapter 33, Duct Design.
 - b. 52, Method of Testing Air Conditioning Devices Used in General Ventilation for Removing Particulate Matter.
 - c. 70, Method for Testing for Rating the Air Flow Performance of Outlets and Inlets.
 5. American Society for Testing and Materials (ASTM):
 - a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - b. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - c. B221, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 - d. D3299, Filament Wound Glass Fiber Reinforced Thermoset Resin.
 6. American Welding Society (AWS).
 7. National Fire Protection Association (NFPA):
 - a. 90A, Installation of Air Conditioning and Ventilating Systems.
 8. National Institute for Standards and Technology (NIST):
 - a. Voluntary Product Standard PS-15.
 9. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
 - a. Ducted Electrical Heat Guide for Air Handling Systems.
 - b. HVAC Duct Construction Standards - Metal and Flexible.
 10. Underwriters Laboratory, Inc (UL):
 - a. Building Materials Directory.
 - b. 555, Fire Damper and Ceiling Fire Damper.
- B. Qualifications:
1. Fabricator: Firms regularly engaged in the manufacture of the specific product, of type, size required, whose products have been in use in similar service for not less than 3 years.
 2. Installers: Firm with at least 5 years installation experience on products similar to that required for this Project.

- C. Shop Drawings:
 - 1. See Section 11005.
 - 2. Efficiency ratings per ASHRAE 52 for factory built and assembled filter units.
 - 3. Scaled ductwork drawings (1/4 IN equals 1 FT) showing duct and accessory layout and support.
- D. Operation and Maintenance Manuals:
 - 1. See Section 01340.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Fiberglass ductwork:
 - a. Peabody Spunstrand.
 - b. Ceilcote.
 - c. Or approved equal.
 - 2. Flexible duct connections:
 - a. Vent fabrics.
 - b. Duro-Dyne.
 - c. Or approved equal.
 - 3. Manual dampers:
 - a. Air Balance.
 - b. Ruskin.
 - c. American Warming.
 - d. Or approved equal.
 - 4. Duct sealers:
 - a. Chicago Mastic.
 - b. 3M Co.
 - c. Permatex.
 - d. Benjamin Foster.
 - e. Or approved equal.
 - f.

2.2 COMPONENTS

- A. FRP Duct and Fittings:
 - 1. Materials:
 - a. Resin:
 - 1) Halogenated polyester with 5 percent antimony trioxide.
 - 2) No fillers allowed except for fire retardance and UV protection.
 - 2. Fabrication:
 - a. Comply with NIST PS-15.
 - b. Surface mat liner:
 - 1) Resin-rich polyester liner with C-Veil glass on bore surface.
 - 2) Minimum thickness: 20 mils.
 - 3) 90 percent resin and 10 percent glass.
 - c. Structural layer:
 - 1) Filament wound glass and resin.
 - d. Exterior layer:
 - 1) Sufficient resin to ensure coverage of glass fibers.

- 2) Smooth surface free of sharp projections.
 - 3) Ultra violet inhibiting agent.
 - e. Liner or layers shall not contain siliceous sand or other granular fillers.
 - f. Minimum glass content: 50 percent.
 - g. Minimum wall thickness:
 - 1) 6 through 20 IN DIA: 0.125 IN.
 - 2) 21 through 36 IN DIA.: 0.187 IN.
 - 3) 37 IN DIA and larger: 0.250 IN.
 - 4) For rectangular ductwork:
 - a) Substitute longest side for diameter stated above.
 - b) Minimum wall thickness is as determined from a) above plus 0.0625 IN.
 - 3. Fittings from mitered sections:
 - a. Elbows:
 - 1) Centerline radius:
 - a) Standard: 1.5 times the duct diameter.
 - b) Short (where indicated on drawings): 1.0 times the duct diameter.
 - 2) 0 to 30 degrees: One miter/two gore.
 - 3) 31 to 60 degrees: Two miter/three gore.
 - 4) 61 to 90 degrees: Four miter/five gore
 - 5) 61 to 90 degrees short radius: Four miter/five gore.
 - 4. Flanged equipment connections:
 - a. Hand lay-up per NBS PS 15-69.
 - 5. Joints:
 - a. Same material as pipe.
 - b. Meet or exceed hoop tensile strength and axial strength requirements of the duct.
 - c. Butt and wrap.
 - 6. Minimum physical properties:
 - a. Thermal conductivity (K value): 1.7 BTU/HR/FT(2)/DegF/IN.
 - b. Specific Gravity: 1.4 to 1.9.
 - c. Thermal coefficient of expansion: 9 to 14 x 10⁻⁶ IN/INDegF.
 - d. Barcol hardness: 40 to 55.
 - e. Izod impact strength: 18 to 22 FT-LB/IN of notch
 - f. Heat distortion temp.: 210 to 310 DegF at 260 psi.
 - g. Compressive strength: 15,000 to 25,000 psi.
 - h. Tensile strength: 9,000 to 12,000 psi.
 - i. Flexural strength: 14,000 to 20,000 psi.
 - j. Flexural modulus: 700,000 to 900,000 psi.
 - k. Water absorption: 0.18 percent at 24 HRS ambient temperature.
 - l. Temperature limits: 250 DegF continuous.
- B. Supports and Hangers:
- 1. Materials:
 - a. Support angles: Stainless steel.
 - b. Hanger rods: Stainless steel.
 - c. Anchors: Stainless steel wedge type.
 - 2. Fabrication:
 - a. Trapeze type units where appropriate.
 - b. Wall supported units where required.
- C. Turning Vanes:
- 1. Materials: Same as duct.
 - 2. Fabrication:

- a. Fabricate double vane units.
 - b. Pressure drop through elbows: Maximum 20 percent of velocity pressure.
- D. Flexible Connections:
- 1. Materials: Hypalon, double coated closely woven glass fabric.
 - 2. Fabrication:
 - a. Withstand 10 IN water column, positive and negative pressure.
- E. Fiberglass Reinforced Plastic Dampers:
- 1. Motor and manually operated dampers:
 - a. Material: Continuous molded Series 625 vinyl ester resin.
 - b. Frame thickness: 0.125 IN minimum.
 - c. butterfly dampers.
 - d. Linkage: Face.
 - e. Axles: 3/4 IN DIA.
 - f. Bearings: Molded Synthetic.
 - g. Seals:
 - 1) Blade edge: Tetraglass.
 - 2) Jamb: Flexible compression type, stainless steel.
 - h. Dampers to be flange mounted.
- F. Grease Filter
- 1. Housing: FRP construction, rated at 15" WC positive pressure.
 - 2. 48-IN dia flanged FRP inlet and outlet. Filter size as specified.
 - 3. 1-IN PVC drain with CPVC ball valve.
 - 4. Access: Bolted and gasketed FRP side flange suitable for filter removal. Zero leakage at 15" WC positive pressure.
 - 5. Differential pressure connections: Two 0.5 IN PVC couplings with PPL connections and tubing.
 - 6. Differential pressure gage: Magnehelic Model 2010 or equal mounted on a FRP plate, 0" to 15" range.
 - 7. Grease filter 1 material: 1 IN of 315 stainless steel mesh pad.
 - 8. Grease filter 2 material: 1/4 IN mesh 316 birdscreen
 - 9. Provide two each grease filter 1 and grease filter 2.
 - 10. Fiberglass or 316 stainless steel filter internal guides. Width sized for one grease filter.
 - 11. Grease filter size: 72 in by 72 in, reinforced as required for specified positive pressure.
 - 12. Grease filter pressure drop: maximum clean pressure drop of 1.0 IN WC.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Section 11005.
- B. Fiberglass Ductwork:
 - 1. Install in accordance with manufacturer's recommendations.
 - 2. Wet field joints (mat and resin):
 - a. Minimum width: 4 IN.
 - b. Minimum thickness: Same as adjoining duct wall.
 - c. Resin: Same as duct.
 - d. Mat: Fiberglass.
 - e. Minimum wraps required:
 - 1) Ducts to 22 IN DIA: One.

- 2) Ducts 22 IN to 48 IN DIA: Two.
- 3) Ducts 48 IN to 60 IN DIA: Three.

C. Dampers:

1. Install where indicated on Drawings of sizes shown.

D. Roof-mounted Hoods:

1. Install where shown on Drawings.

E. Provide number and size of duct supports to comply with the latest edition of SMACNA and Uniform Mechanical Code Table 6-E.

1. Provide seismic bracing of ductwork to withstand Seismic forces in accordance with the latest edition of SMACNA "Seismic Restraint Manual".

END OF SECTION

SECTION 15990
HVAC SYSTEMS: AIR BALANCING AND TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Adjusting, balancing, and testing of ventilating including the following systems:
 - a. EF-1
 - b. Odor control duct from the Dewatering Building, and the discharge duct from existing odor control fan EF 16-1.
 - c. And as specified.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
1. Associated Air Balance Council (AABC):
 - a. National Standard for Total System Balance, Fourth Edition, 1982.
 2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - a. ASHRAE Handbook, Systems, chapter entitled "Testing, Adjusting, and Balancing."
 - b. ASHRAE Handbook, Applications, chapter entitled "Laboratories."
 3. National Environmental Balancing Bureau (NEBB):
 - a. Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
 4. Sheet Metal and Air Conditioning Contractors National Association, Inc (SMACNA):
 - a. HVAC Systems, Testing, Adjusting and Balancing.
- B. Qualifications:
1. Work of this Section to be accomplished by an independent testing and balancing firm certified by one of the following:
 - a. Associated Air Balance Council (AABC).
 - b. National Environmental Balancing Bureau (NEBB).
 - c. Other certification entity approved by Engineer.
 2. The independent firm shall not be the same firm as the firm installing the HVAC equipment, nor under contract to the firm installing the equipment.

1.3 SUBMITTALS

- A. Shop Drawings:
1. See Section 01340.
 2. Certifications:
 - a. Letter stating the name and qualifications of the firm proposed.
 - b. Evidence that relevant subcontractors have been notified of the requirement to coordinate balance and test elements in the work with the testing and balancing firm.
 3. Test reports:
 - a. Procedures and forms to be used in calibrating of test instruments, balancing systems, and recording and reporting test data.
 - b. Completed test reports and data forms upon completion of installation, balance and testing of HVAC systems.
 - 1) Insert recorded information on report forms required by specifications and approved for use on project.
 - 2) Additional written verification and other related information clearly identifying project, date and specifics of verification.

- 3) Utilize report forms similar to those shown in Section V of AABC Standard.
- 4) Provide forms typed and signed by the testing and balancing firm.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Secure approved shop drawings of specified systems equipment.
- B. Procedures and Forms:
 1. Submit procedures and forms to be used in calibration of test instruments, balancing systems, and recording and reporting test data.
 2. Obtain approval before beginning balancing and testing.
- C. Do not begin balancing and testing until systems are complete and in full working order.
 1. Place systems into full operation and continue their operation during each working day of balancing and testing.
- D. Provide qualified heating and ventilating Engineer(s) to supervise and perform balancing and testing.
- E. Review design Drawings, Specifications, approved shop drawings and other related items to become thoroughly acquainted with the design of HVAC systems.
- F. Check all installed systems against Contract Drawings, Specifications and shop drawings to see that system is installed as required.
 1. Report deficiencies to the Engineer.
 2. Report deficiencies to Contractor for remedial action including providing corrective measures required in the function of any part of system to complete balancing.
- G. Make necessary adjustments as required to balance the systems.
- H. Provide two weeks notice to Engineer to schedule witnessing of the test and balancing.
- I. Balance all new HVAC systems.

3.2 FIELD QUALITY CONTROL

- A. Balance and Test Air Systems:
 1. Engineer will be present at testing and balancing.
 2. Measure duct air flows using pitot tube traverse.
 3. Open all exhaust duct dampers in wet well/screen room to 100% open.
 4. Adjust dampers in FRP intake grilles in the Dewatering building to achieve 10,000 cfm from dewatering building, as measured in the 32" FRP header from the Dewatering building. Measure static pressure in 32" FRP header just outside of the Dewatering building.
 5. Measure air flow from discharge of existing odor control fan EF 16-1.
 6. Measure amps, fan speed, and suction and discharge pressure of EF 16-1.
 7. Measure static pressure loss across the grease filter with clean filter.
 8. Measure CFM into each exhaust grille in wet well/screen room.
 9. Report findings to Engineer on site. Engineer may direct testing and balance firm to adjust EF 16-1 fan speed and/or exhaust grille damper positions in wet well/screen room, and re-balance system.
 10. Obtain design CFM for EF-1. Adjust fan speed as required. Measure EF-1 amps and suction pressure at 32" FRP duct inside the dry well.
 11. Prepare and submit reports.

END OF SECTION