BATON ROUGE SSO PROGRAM

2002 CONSENT DECREE

2006 ANNUAL REPORT

January 27, 2007

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Department of Public Works

City of Baton Rouge
Parish of East Baton Rouge

Post Office Box 1471
Baton Rouge, Louisiana
70821

January 27, 2007

CERTIFIED – RETURN RECEIPT REQUESTED

Chief,
Water Enforcement Branch (6EN-W)
Compliance Assurance and Enforcement Division
U.S. Environmental Protection Agency, Region VI
1445 Ross Avenue
Dallas, Texas 75202-2733

Re: City of Baton Rouge and Parish of East Baton Rouge
Consent Decree-Civil Action No. 01-978-B-M3
Annual Report - **Period Ending December 31, 2006**

Gentlemen:

Pursuant to Paragraph 52 of the Consent Decree, the City of Baton Rouge and Parish of East Baton Rouge hereby submits the Annual Report covering activities for the year ending December 31, 2006. This report addresses the following items:

- Remedial Measures Action Plan (RMAP)
- Treatment Facility Assessment
- Environmental Results Monitoring (ERM)
- Interim Relief Measures Activities
- Outreach and Public Awareness Program
- Plan Modification Needs
- Stipulated Penalties

These items are described in Sections XII, XIII, XIV, XVI, XV and XXI of the Consent Decree.

I certify that the information contained in or accompanying this document is true, accurate and complete. As to identified portions of this document for which I cannot personally verify their

truth and accuracy, I certify as the official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification, that this is true, accurate and complete.

Sincerely,

Peter T. Newkirk
Director of Public Works

Cc: Honorable Melvin L. "Kip" Holden, Mayor-President
Mr. Walter Monsour, Chief Administrative Officer
Mr. Bruce Hammatt, LDEQ
Chief, Environmental Enforcement Section, US DOJ
Ms. Mona Tates, US EPA Region 6
Mr. Carlos Zequeira, (6RC-EA)
Ms. Gladys Gooden-Jackson, EPA (6EN-WC)
Mr. Bruce Hammatt, LDEQ
Ms. Peggy Hatch, LDEQ
Mr. Harold Leggett, LDEQ
Mr. Wade Shows, Parish Attorney's Office
Mr. Bryan Harmon
Mr. Mark LeBlanc
Mr. Richard Wright
Mr. Walter Jenkins
Mr. David Ratcliff
Ms. Seema Alim, PhD, CH2MHILL

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Baton Rouge Consent Decree
2006 Annual Report

This Annual Report covering the period from January 1, 2006 to December 31, 2006 is submitted in accordance with Paragraph 52 of the Consent Decree. The report addresses all items identified in Consent Decree Exhibit I regarding the Annual Report format and content.

I Remedial Measures Action Plan (RMAP)

The City/Parish identified a comprehensive remedial action plan for the collection system during consent decree negotiations, identified as Alternative 1 (the original SSO Plan) in the Consent Decree. Shortly thereafter, a VE study was commissioned to explore cost-saving alternatives, and the VE study identified seven options of the original SSO Plan for further considerations. Three of those options (3, 4 and 7) were considered equivalent low-cost options. Through a series of Metro Council and public meetings, Option 7, the Composite Plan, was selected.

The First RMAP, submitted on January 10, 2001, consists of the projects common to the three lowest cost VE options. Table 1 list the projects in the First RMAP and identifies the status of each project based on the original schedule. The Second RMAP, submitted on November 19, 2002, consists of the projects required to complete the selected overall remedial action plan, Option 7. Table 2 lists the projects in the Second RMAP and identifies the status of each project based on the original schedule. As the planning and design activities for the RMAPs have progressed, it was apparent that modifications to the projects and schedule were necessary. On December 3, 2004, proposed RMAP modifications were submitted for review and approval in the form of Table 3 and Table 4.

Predicting a proposed budget over run has mandated that the City/Parish reconsider the Option 7 selection, of the original SSO Plan. A written request with proposed Second RMAP modifications for review and approval were submitted on July 29, 2005, as shown in Appendix A. The City/Parish conducted a telephone conference with EPA and LDEQ on August 1, 2005 for a program status presentation. That presentation included the requested revision to the Second Remedial Action Plan (RMAP2). The requested modification represents a material change in the currently approved Second Remedial Action Plan and the requested revision to the RMAP2 should not extend the final compliance date beyond the existing January 1, 2015 deadline. However, delays in final approval, changes in the Program Manager, and complications and shortages associated with the aftermath of Hurricanes Katrina and Rita may result in a future documented request for a justified time extension. A second written request with the proposed RMAP2 modification was resubmitted on December 12, 2006. The City/Parish with the assistance of the New Program Manager shall establish a revised Second Remedial Action Plan including the RMAP2, project list and construction schedule.
The Consent Decree RMAP milestone dates are as follows:

	Consent Decree Date	Actual Date
Start construction of 1st RMAP remedial measures	January 15, 2001	January 10, 2001
Submit 2nd RMAP schedule	December 1, 2002	November 20, 2002
Complete construction of 1st RMAP remedial measures	May 4, 2007	
Complete construction of 33% of total RMAP	July 1, 2007	
Complete construction of 66% of total RMAP	July 1, 2011	
Complete construction of 100% of the total RMAP	January 1, 2015	

The City/Parish was not in compliance with Section XII Collection System Remedial Program during this reporting period. Due to a slow first, third and fourth quarter, CCTV did not reach more than 100% of its goal; it reached 69% of the annual goal. In order to insure the annual goals for the year 2007 are met, we have increased the number of television inspection crews being used on our annual physical inspection contract. There were no problems encountered in the Collection System Remedial Program during this reporting period and non-compliance is not anticipated during the next reporting period.

Table 1
First RMAP Project Status (original)

Project Description		Design Status	Construction				
			Start Date		Completion Date		Percent Complete
			Sched.	Actual	Sched.	Actual	
N-01	Choctaw Basin Return System[1]	0%	01/01/03		10/19/04		
N-02	PS 49/52 Area Upgrades	100%	03/10/03		06/25/04		
N-04	PS 47 Area Upgrades	0%	04/07/03		07/23/04		
N-05	PS 24 Area Upgrades	100%	02/09/04		05/27/05		
N-06	PS 43 Area Upgrades[3]	25%	10/22/01		11/08/02		
N-07	PS 39/55 Area Upgrades	5%	04/07/03		07/23/04		
N-09	PS 44/46 Area Upgrades	100%	02/09/04	12/01/03	05/27/05		5%
N-10	PS 240 Area Upgrades	95%	11/12/01		02/28/03		
N-11	PS 65 Area Upgrades	20%	11/12/01		02/28/03		
N-12	North Sewer Rehab Projects[2]	0%	01/21/02		11/07/03		
N-13	North Choctaw Basin System	0%	03/18/02		01/02/04		
N-99	Further Investigations (North Area)[2]	100%	N/A	N/A	N/A	N/A	N/A
C-03	PS 2 Area Rehabilitation	100%	11/21/01	03/04/02	02/28/03	09/28/02	100%
S-01B	SWWTP-Influent Pump Station	100%	10/16/00	01/10/01	08/02/02	04/14/03	100%
S-08	Industriplex Area Upgrades	95%	03/20/01		07/08/02		
S-11	PS 40 Area Upgrades	100%	11/12/01	08/06/03	02/28/03	12/22/03	100%
S-14	Kleinpeter Area Upgrades	0%	02/15/02		03/06/03		
S-16	PS 136 Area Upgrades	95%	04/09/01		01/24/03		
S-99	Further Investigations (South Area)	100%	10/01/01	07/5/02	09/26/03	05/22/03	100%

[1] Project deleted
[2] Project separated into smaller scopes/projects (Project number & description may be changed or re-used)
[3] Project combined with others (Project number & description may be changed or re-used)
[4] Project description may have changed
[5] New Project

Table 2
Second RMAP Project Status (original)

Project Description		Design Status	Construction				
			Start Date		Completion Date		Percent Complete
			Sched.	Actual	Sched.	Actual	
BFU1	Ballasted Flocculation Unit for N-08	0%	03/02/04		06/15/05		
BFU2	Ballasted Flocculation Unit for N-03	0%	04/12/05		01/27/07		
BFU3	Ballasted Flocculation Unit for C-02	0%	03/25/08		01/09/10		
BFU4	Ballasted Flocculation Unit for SWWTP	0%	03/01/05		06/14/06		
N-03	North Park Area Upgrades	0%	04/12/05		01/27/07		
N-08	PS 45 Area Upgrades	0%	01/16/04		04/30/05		
C-01	PS 59 Area Upgrades	0%	03/27/07		01/10/09		
C-02	PS 23/PS 60 Area Upgrades	0%	03/25/08		01/09/10		
C-04	PS 4 Area Upgrades	0%	01/14/11		04/28/12		
C-05	PS 5 Area Upgrades	0%	12/23/09		01/06/11		
C-06	PS 15/PS 48 Area Upgrades	0%	01/16/12		04/30/13		
C-07	PS 1 Area Upgrades	0%	01/13/09		04/28/10		
S-01A	PS 58 Area Upgrades	0%	01/15/08		04/29/09		
S-02	East Highland Road Area Upgrades	0%	01/13/09		04/28/10		
S-03	PS 58 Area Upgrades #1[1]	0%	12/23/09		01/06/11		
S-04	PS 66 Area Upgrades	0%	12/22/10		01/05/12		
S-05	PS 58 Area Upgrades #2[1]	0%	01/16/12		04/30/13		
S-06	PS 31 Area Upgrades	0%	01/15/10		04/30/11		
S-07	PS 944 Area Upgrades	0%	12/20/07		01/02/09		
S-09	Gardere/GSRI Area Upgrades	0%	12/20/07		01/02/09		
S-10	Tiger Bend/Antioch Area Upgrades	0%	01/17/11		05/01/12		
S-12	PS 177 Area Upgrades	0%	12/19/08		01/02/10		
S-13	PS 170/PS274 Area Upgrades	0%	12/19/08		01/02/10		
S-15	Hoo Shoo Too & Jefferson Hwy Area Upgrades	0%	12/20/07		01/02/09		
S-17	South Siegen Area Upgrades	0%	01/15/08		04/29/09		
S-18	PS 40 Area Upgrades	0%	01/15/08		04/29/09		
S-19	PS 53 Area Upgrades[4]	0%	01/14/09		04/29/10		
S-20	PS 56 Area Upgrades[4]	0%	01/13/09		04/28/10		
S-21	BPS 100 Area Upgrades	0%	01/16/12		04/30/13		
S-22	BPS 508 Area Upgrades	0%	01/15/13		04/30/14		
S-23	PS 120 Area Upgrades[4]	0%	01/14/11		04/28/12		
S-24	PS 50 Area Upgrades #2[4]	0%	01/14/11		04/28/12		
S-25	PS 236 Area Upgrades	0%	01/15/10		04/30/11		
T-01	SWWTP Tunnel Pump Station	5%	05/10/04		08/17/06		
T-02	CWWTP Tunnel Pump Station	5%	05/10/04		02/16/06		
T-03	Tunnel - CWWTP to PS 2	5%	11/10/04		08/09/06		
T-04	Tunnel - SWWTP to Highland	5%	11/11/04		11/16/06		
T-05	Bluebonnet Tunnel Highland - South of I-10	0%	05/10/05		11/27/07		
T-06	Brightside/Perkins/Ben Hur Tunnel	0%	05/09/07		07/22/09		
T-07	Southeast Baton Rouge Minor Tunnels	0%	11/10/06		02/18/10		

Table 2 (continued)
Second RMAP Project Status (original)

Project Description		Design Status	Construction				
			Start Date		Completion Date		Percent Complete
			Sched.	Actual	Sched.	Actual	
T-08	Old Hammond Highway Minor Tunnels[1,3]	0%	05/11/09		06/20/11		
T-09	Tunnels South of Old Hammond to Bluebonnet[1,3]	0%	05/10/05		12/30/08		
T-10	Tunnels North of PS 2, Central Service Area[1,3]	0%	02/08/08		05/20/11		
T-11	Perkins Road Tunnel, Pecue to Bluebonnet[1,3]	0%	11/09/05		03/19/08		
T-12	Highland Road Tunnel West of Gardere[1,3]	0%	05/10/05		02/19/08		
T-13	Pecue Lane Tunnel[1,3]	0%	05/09/06		10/21/08		
T-14	Sherwood Forest Boulevard Tunnel[1,3]	0%	08/11/08		03/08/11		
T-15	Tunnels South of PS 2 in Central Area[1,3]	0%	05/09/07		04/08/09		
T-16	Tunnel Tie-ins (Phases 1, 2, & 3)[1,3]	0%	05/26/08		02/21/13		
T-17	Highland Road East Tunnels[1,3]	0%	11/09/05		12/30/09		
T-18	Pump Station Demolition (Phases 1 & 2)[1,3]	0%	03/26/12		07/16/14		

[1] Project deleted
[2] Project separated into smaller scopes/projects (Project number & description may be changed or re-used)
[3] Project combined with others (Project number & description may be changed or re-used)
[4] Project description may have changed
[5] New Project

Table 3
First RMAP Project Status (proposed revision)

Project Description		Design Status	Construction				
			Start Date		Completion Date		Percent Complete
			Sched.	Actual	Sched.	Actual	
N-02	PS 49/52 Area Upgrades	100%	04/16/04	05/24/04	04/12/05		77%
N-05	PS 24 Area Upgrades	100%	04/12/04	05/17/04	04/14/05		79%
N-09	PS 44/46 Area Upgrades	100%	02/09/04	12/01/03	05/27/05	04/12/06	100%
N-10	PS 240 Area Upgrades	100%	05/24/04	08/30/04	05/26/05	10/31/05	100%
N-11	PS 65 Area Upgrades	50%	03/28/05		03/30/06		
N-12	North Area Lateral Rehabilitation	95%	09/17/04		03/15/06		
N-14	Betlingrath Rehabilitation	100%	12/09/03	12/09/03	12/07/04	12/30/04	100%
N-15	Frenchtown Road Rehabilitation	100%	04/23/04	05/24/04	04/25/05	07/08/05	100%
N-23	North Area Comp. Rehabilitation	100%	08/10/04	08/30/04	08/09/05	04/17/06	100%
N-31	PS 45 Area Rehabilitation	100%	05/09/00	05/09/00	01/23/01	01/23/01	100%
N-99	Further Investigations (North Area)	100%	N/A	N/A	N/A	N/A	N/A
C-03	PS 2 Area Rehabilitation	100%	11/21/01	03/04/02	02/28/03	09/28/02	100%
S-01B	SWWTP-Influent Pump Station	100%	10/16/00	01/10/01	08/02/02	04/14/03	100%
S-08	Industriplex Area Upgrades	95%	06/16/04		12/11/05		
S-11	PS 40 Area Upgrades	100%	11/12/01	08/06/03	02/28/03	12/22/03	100%
S-14	Kleinpeter Area Upgrades	95%	03/15/05		12/14/05		
S-16	PS 136 Area Upgrades	95%	05/20/04		11/14/05		
S-99	Further Investigations (South Area)	100%	10/01/01	07/5/02	09/26/03	05/22/03	100%

Table 4
Second RMAP Project Status (proposed revision)

Project Description		Design Status	Construction				
			Start Date		Completion Date		Percent Complete
			Sched.	Actual	Sched.	Actual	
NBFU	Ballasted Flocculation Unit for N-08	0%	07/24/05		07/24/08		
CBFU	Ballasted Flocculation Unit for C-02	0%	05/30/07		12/03/08		
SBFU	Ballasted Flocculation Unit for SWWTP	0%	12/17/05		12/22/07		
N-01	Choctaw Area Pump Station	0%	12/07/05		06/04/07		
N-03	North Park Area Upgrades	0%	08/27/06		11/04/08		
N-04	PS 47 Area Upgrades	0%	06/09/07		06/09/08		
N-07	PS 39/55 Area Upgrades	5%	03/05/06		03/05/07		
N-08	PS 45 Area Upgrades	0%	05/11/07		11/04/08		
N-13	North Choctaw Area Upgrades	0%	08/22/05		08/27/07		
N-16	Annual Rehabilitation Contract #1	100%	01/19/04	01/19/04	12/30/06	12/31/06	100%
N-17	Annual Rehabilitation Contract #2	100%	07/10/04	07/16/04	12/31/07		33%
N-18	Annual Rehabilitation Contract #3	100%	10/09/04	09/27/04	12/31/07		33%
N-19	Annual Rehabilitation Contract #4	100%	01/03/05	01/26/05	12/31/07		33%
N-20	North Area Influent Forcemain	0%	08/02/06		08/06/08		
N-21	North Area Influent Pump Station	0%	02/10/07		08/06/08		
C-01	PS 59 Area Upgrades	0%	08/01/07		02/05/09		
C-02	PS 23/PS 60 Area Upgrades	0%	11/29/07		06/05/09		
C-04	PS 4 Area Upgrades	0%	06/28/11		06/26/12		
C-05	PS 5 Area Upgrades	0%	06/29/10		03/31/11		
C-06	PS 15/PS 48 Area Upgrades	0%	06/26/12		06/25/13		
C-07	PS 1 Area Upgrades	0%	06/30/09		07/02/10		
S-01A	PS 58 Area Upgrades #1	0%	01/24/08		01/25/09		
S-02	East Highland Road Area Upgrades	0%	11/25/08		11/27/09		
S-03	PS 58 Area Upgrades #2	0%	06/01/10		06/02/11		
S-04	PS 66 Area Upgrades	0%	11/30/10		11/30/11		
S-05	South Choctaw Area Upgrades #2	0%	11/15/05		11/20/07		
S-06	PS 31 Area Upgrades	0%	12/01/09		12/03/10		
S-07	PS 944 Area Upgrades	0%	05/27/08		05/29/09		
S-09	Gardere/GSRI Area Upgrades	0%	05/27/08		05/29/09		
S-10	Tiger Bend/Antioch Area Upgrades	0%	05/31/11		05/29/12		
S-12	PS 177 Area Upgrades	0%	05/26/09		05/28/10		
S-13	PS 170/PS274 Area Upgrades	0%	05/26/09		05/28/10		
S-15	Hoo Shoo Too & Jefferson Hwy Area Upgrades	0%	03/24/09		12/23/09		
S-17	South Siegen Area Upgrades	0%	04/01/08		04/03/09		
S-18	PS 40 Area Upgrades	0%	05/27/08		05/29/09		
S-19	PS 53 Area Upgrades	0%	05/26/09		05/28/10		
S-20	PS 56 Area Upgrades	0%	05/26/09		05/28/10		
S-21	BPS 100 Area Upgrades	0%	03/27/12		03/26/16		
S-22	BPS 508 Area Upgrades	0%	09/11/12		09/10/12		
S-23	PS 120 Area Upgrades	0%	05/31/11		05/29/12		
S-24	PS 50 Area Upgrades #2	0%	05/29/07		05/30/08		
S-25	PS 236 Area Upgrades	0%	05/18/10		11/10/11		
T-01	SWWTP Tunnel Pump Station	5%	05/18/05		05/13/07		

Table 4 (continued)
Second RMAP Project Status (proposed revision)

Project Description		Design Status	Construction				
			Start Date		Completion Date		Percent Complete
			Sched.	Actual	Sched.	Actual	
T-02	CWWTP Tunnel Pump Station	5%	05/18/05		08/14/06		
T-03	Central Service Area Trunk Tunnels	5%	06/22/05		01/11/10		
T-04	South Service Area Trunk Tunnels	5%	06/23/05		12/30/10		
T-05	Bluebonnet/Airline Tunnels	0%	10/26/06		03/26/11		
T-06	Airline Extension Tunnels	0%	12/12/07		12/12/10		
T-07	Old Hammond Tunnels	0%	06/12/07		06/20/12		

In accordance with Paragraph 35 of the Consent Decree, the City/Parish shall spend at least $3 million per year for sewer repairs, sewer rehabilitation, and other capital needs related to reduction of Infiltration and Inflow ("I & I") into the North, Central, and South Plant Collection Systems. The following table identifies the funds expended during 2006 to meet this requirement.

Table 5
Infiltration & Inflow Reduction Activities

PROJECT	DESCRIPTION	2006 % COMPLET	ACTUAL % COMPLETE	CONSTRUCTION COST/BID	EXPENDITURES 2006
05-CDR-RBL2	Annual Lining Project (Yr. 2)	100%	100%	$1,000,000.00	$998,374.00
03-CDR-06	Annual Manhole Rehab. Project (Yr. 3)	100%	100%	$770,000.00	$423,776.00
05-CDR-PI	Physical Inspection for Evaluation of Portions of the Existing Sanitary Sewers	100%	100%	$1,000,000.00	$995,519.20
04-CDR-07	Annual Parishwide Sewer Collection System Rehabilitation By Point Repair	100%	100%	$1,000,000.00	$749,029.94
TOTAL EXPENDITURES IN 2006				**$3,770,000.00**	**$3,166,699.14**

II Treatment Facility Assessment

The Treatment Facility Assessment was submitted March 26, 2002. In the Treatment Facility Assessment, all process units and conveyance elements were determined to have capacity for current and projected design flows at all three WWTPs. Also, all WWTPs have the ability to meet their permit effluent limits. Based on these findings, no WWTP facility improvements or expansion are required. The Treatment Facility Assessment also indicated that the monthly Operators Process Control meetings currently led by Dr. John J. Sansalone of LSU are having a beneficial impact on plant performance.

The City/Parish submitted a Municipal Water Pollution Prevention (MWPP) Environmental Audit Reports on May 22, 2006, August 8, 2006 and October 31, 2006 (see Appendix B). This report contains an evaluation and rating for influent loadings, plant performance, overflows & bypasses, treatment plant age, sludge disposal, new development in collection system, and operator certification training for the North, South and Central Wastewater Treatment Plants. The MWPP audit rated the treatment plants on the above factors for the year following the entry into the Consent Decree. The actions that will be taken to maintain compliance and prevent effluent violations are presented in a MWPP Resolution, which was submitted along with the audit. Some of those actions include implementation of aggressive process control strategies recommended by Louisiana State University Civil & Environmental Engineering Department and managing a project to reduce the high concentration of hydrogen sulfide at the treatment plants.

III Environmental Results Monitoring (ERM)

The objective of the ERM program is to measure the environmental impacts of the SSO Program by monitoring sewage indicating pollutants in major receiving waters prior to and following completion of remedial measures within each drainage basin. The four sampling locations, identified in Figure 1, include all major tributaries in East Baton Rouge Parish, which enter the Amite River System – and eventually Lake Ponchatrain.

The Phase I Baseline Monitoring was completed during the 2004 reporting period. The Phase II Results Monitoring will began 6 months following completion of all remedial measures within a specified drainage area contributing to an identified sampling location.

IV Interim Relief Measures Activities

Paragraph 39 of the Consent Decree provides interim effluent limits of 75% removal of BOD and TSS (based on 30-day average removal rates), until completion of all RMAP construction projects, as an interim relief to the 85% removal requirement of the three WWTP NPDES permits. During 2006 the North and Central WWTPs have been in compliance with the 75% interim effluent limits for removal of both TSS and BOD the entire twelve month period. In fact, the Central WWTP, and the North WWTP, met the permit limit of 85% removal for both TSS and BOD, thirty two out of forty eight times during the year, as illustrated by Table 6.

The South WWTP has been in compliance with the 75% interim effluent limit for TSS all year. However, it did not meet the 75% interim effluent limit for BOD for 3 months of the year. The South WWTP is experiencing operational difficulties related to primary basin #4, #5 & #6, and bar screens E101, E102, & E103 being out of service.

Construction project, replacing the digester covers on digesters No. 3 and No. 4 at South WWTP was bid on December 5, 2006, construction shall begin in the first quarter of 2007(See Appendix C.)

Table 6
Monthly Average Percent Removal

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
North Plant-LA0036439												
BOD	76	77	77	85	80	82	84	83	85	84	75	77
TSS	84	89	87	94	88	92	94	92	90	92	89	85
Central Plant-LA0036421												
BOD	80	79	82	86	87	90	88	87	88	88	82	82
TSS	90	89	91	92	91	93	93	92	91	92	90	88
South Plant-LA0036412												
BOD	78	83	86	81	75	75	79	75	74	75	74	66
TSS	88	89	92	90	90	92	91	87	85	88	87	84

V Outreach and Public Awareness Program

During this reporting period, the City/Parish has continued its Outreach and Public Awareness Program in the same format and methods as used in past reporting periods. During the City/Parish budgeting process this year, the Mayor-President presented information about the Sanitary Sewer Overflow Program (SSO) and the Consent Decree. As of December 31, 2006, the City/Parish has appropriated $711.2 million for sewer capital improvements. Of this amount, $199.4 million will fund the first phases of the SSO Capital Improvements Program.

During this reporting period, the City/Parish has continued a series of workshops/seminars in the same format and methods as used in past reporting periods.

During this reporting period City/Parish continued its Sewer Tie-in Program, which enables the homeowner to abandon their old septic tank at a fixed price. The City/Parish, through negotiations with several plumbing contractors, developed an agreement between the homeowners and contractors to wave all City/Parish permit fees in order to keep the septic tank abandonment fees to a minimum. In order to assist low income homeowners, the City/Parish, with funding from of a Community Development Block Grant (CDBG), pays for the septic tank abandonment fees after the homeowner has met the program guidelines. The information handed out at the public meeting (see attachment) was placed on the program website for public access. The information presented in this section demonstrates that the City/Parish has been in compliance with Section XV Outreach and Public Awareness Program during the reporting period.

	Activity	Date / Status
1.	Provide Program informational brochures on SSO Plan	**July 2001**
2.	Neighborhood meetings in various Metropolitan Council Districts	**On going**
3.	Meet with Mayor and the Metropolitan Council members on program status	**On going**
4.	Develop information program on the Consent Decree and the Sewer Improvement Program	**On going**
5.	Post Consent Decree and overflow information on City-Parish website	**June 2002**
6.	Public appearances by DPW Director	**On going**
7.	Provide SCIP and SSO CAP information in the Mayor-President's Budget Message	**Nov 2004**
8.	Sewer Tie-In Program	**On going**
9.	Provide fact sheet about the SEPs on City-Parish website	**Dec 2002**
10.	Consent Decree copies made available	**ongoing**
11.	SRF Loan Program	**On going**

VI Plan Modification Needs

The City/Parish has not identified any deficiencies in the Cross Connection Elimination Plan or the Preventive Maintenance Program. However the Remedial Measures Action Plan (RMAP) was revised and submitted for approval on July 29, 2005. The Remedial Measures Action Plan was revised to provide for revisions to the Second RMAP (RMAP2). Due to budgetary constraints encountered in the selection of option 7, the City/Parish has revised the RMAP2 to implement a much more aggressive and comprehensive sewer rehabilitation program to reduce inflow and infiltration. These changes will not affect the final Consent Decree RMAP complete construction date of January 1, 2015.

VII Stipulated Penalties

Table 7 presents a summary of submittal and construction milestone dates subject to stipulated penalties in accordance with Section XXI of the consent decree. As of December 31, 2006 the City/Parish has not missed any submittal or construction milestone deadlines, and therefore is not subject to any stipulated penalties due to milestone dates.

Non-compliance items, which are subject to stipulated penalties in accordance with Section XXI of the consent decree, are identified in each consent decree quarterly report. A summary of non-compliance items and associated stipulated penalties reported in quarterly reports for the year 2006 are presented in Table 8.

Table 7
Summary of Stipulated Penalties for Submittal/Construction Milestones

Stipulated Penalties		Deadline	Completion	Total Owed*	Total Paid*
Past Stipulated Penalties		15-Apr-02	12-Apr-02	$216,000	$216,000
Failure to Submit Timely Reports					
Quarterly Reports	16th Report	30-Apr-06	24-Apr-06		
	17th Report	30-Jun-06	28-Jul-06		
	18th Report	30-Sept-06	25-Oct-06		
	19th Report	31-Dec-06	26-Jan-07		
Annual Reports	2006 Report	31-Jan-07	27-Jan-07		
Collection System PMP Plan		30-Mar-01	29-Mar-01		
Treatment Facility Assessment Report		30-Mar-02	26-Mar-02		
SEP Completion Report		15-Sep-04	10-Sep-04		
Failure to Submit Timely and Complete 2nd RMAP		1-Dec-02	20-Nov-02		
Failure to Meet RMAP and Construction Milestones					
Start of Construction		15-Jan-01	10-Jan-01		
1st RMAP Construction Complete		4-May-07			
1st & 2nd RMAP at 33%		1-July -07			
1st & 2nd RMAP at 66%		1-July -11			
2nd RMAP Design Completion		3-June-13			
Completion of all Construction		1-Jan-15			
Failure to Meet SEP Milestone Dates					
Donwood/Oak Manor Project	(start construction)	14-Mar-03	21-Feb-03		
	(end construction)	14-Mar-04	04-Sept-03		
Pleasant Hills/Green Acres Project	(start construction)	14-Jun-03	27-Jun-03		
	(end construction)	14-Jun-04	30-Jul-04		
Sharon Hills/Cedar Glen/Pleasant Hills Project	(start construction)	14-Mar-03	27-Jun-03		
	(end construction)	14-Aug-04	30-Jul-04		
Stumberg Lane Project	(start construction)	14-Mar-03	28-Mar-03		
	(end construction)	14-Mar-04	15-Sept-03		
	Total			**$216,000**	**$216,000**

Table 8
Summary of Stipulated Penalties for Non-Compliance Items

Stipulated Penalties	# of Occurrences	Per Occurrence	Total
Failure to Seal/Eliminate New Cross Connections			
Unauthorized Discharges			
Less Than 1 million gallons and Non-Compliance	1	$5,000	$5,000
Less Than 1 million gallons and Compliance (Post-remedial)	N/A	N/A	
1 million gallons or more	6	$5,000	$30,000
Non-compliant Discharges			
Daily Maximum Limits			
Weekly Average Limits	3	$1,000	$3,000
Monthly (30-day Average) Limits	16	$2,500	$40,000
		Total	$78,000

Office of the Mayor-President

City of Baton Rouge
Parish of East Baton Rouge

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Baton Rouge, Louisiana 70821

225/389-3100
Fax 225/389-5203

MELVIN L. "KIP" HOLDEN
Mayor-President

July 29, 2005

Michael Michaud, Chief
Water Enforcement Branch (6EN-W)
Compliance Assurance and Enforcement Division
U.S. Environmental Protection Agency - Region 6
1445 Ross Avenue Suite 1200
Dallas, TX 75202-2733

Harold Leggett, Assistant Secretary
Office of Environmental Compliance
Department of Environmental Quality
P.O. Box 4312
Baton Rouge, LA 70821-4312

Re: Baton Rouge City/Parish Consent Decree
Civil Action No. 01-978-B-M3
Request for Modification to Consent Decree
Agency Interest Nos. [AI#4841, AI#4842, AI#4843]

Attention: Mona Tate

Dear Mr. Michaud, Ms. Tate and Mr. Leggett:

The City of Baton Rouge/Parish of East Baton Rouge ("City/Parish") hereby requests a modification to the 2001 Consent Decree pursuant to the procedures of Section XXXIV of the Consent Decree. The requested modification represents a material change in the currently approved Second Remedial Action Plan (RMAP2); however, the requested revision to the RMAP2 will not extend the final compliance date beyond the existing January 1, 2015 deadline. The City/Parish believes that the modification proposed herein will achieve the purposes of the Consent Decree in a more permanent, reliable, and less risky manner than the current Second RMAP. The primary features of the Revised Second RMAP are:

- Implementation of a much more aggressive and comprehensive sewer rehabilitation program to reduce inflow and infiltration

- Elimination of the deep tunnels (as the need will be eliminated by comprehensive inflow and infiltration control and other system upgrades)

- Revision to the pipe and pump station upgrades (although portions of this will parallel efforts already in the existing Second RMAP);

- Improvements to the South WWTP consisting of a new head works, new influent pump station, flow equalization, conversion to an activated sludge process and elimination of chlorine currently used for disinfection and installation of UV disinfection.

The specific proposed modifications to both the existing Consent Decree and to the Second RMAP are attached.

The City/Parish commissioned Camp Dresser & McKee Inc. ("CDM") to conduct a formal reassessment of the Consent Decree compliance program. A copy of the CDM Report is attached in support of this modification request. This evaluation concludes that the City/Parish should shift its primary emphasis away from the current plan which relies primarily on conveyance and storage through the use of a tunnel system. The newly proposed plan emphasizes comprehensive sewer system rehabilitation and infiltration and inflow (I/I) reduction combined with focused facility improvements as needed to increase wet-weather pumping and treatment capacity.

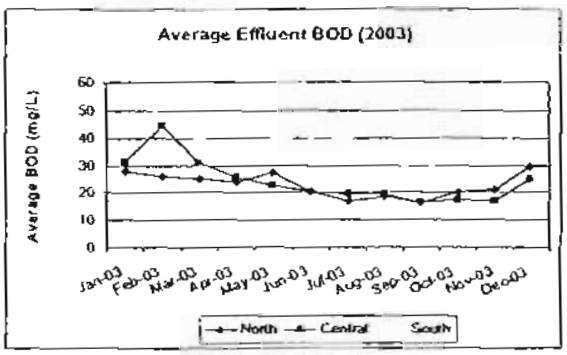
A comprehensive rehabilitation approach has been demonstrated in other programs as the best means of accomplishing substantial I/I reduction during both wet weather and dry weather because it eliminates the vast majority of I/I sources, including those on private property when needed. A comprehensive approach has been shown to remove between 50 and 85 percent of I/I peaks and volume. Based on the CDM evaluation, application of this comprehensive approach in priority areas of the City/Parish system will have substantial benefits in terms of I/I reduction and improved local system performance. The City/Parish rehabilitation program will include a comprehensive sewer system evaluation survey (SSES) in areas selected as those offering the best opportunity to reduce I/I and control sanitary sewer overflows (SSOs) based on flow monitoring information, capacity modeling, and historical operations and maintenance records. Within the priority areas, comprehensive rehabilitation will include the lining or repair of pipe, manholes, and service laterals that do not meet I/I control standards. The rehabilitation strategy will be closely coordinated with other needed facility improvements to achieve results as quickly as possible in priority areas with a history of chronic, repeated SSOs.

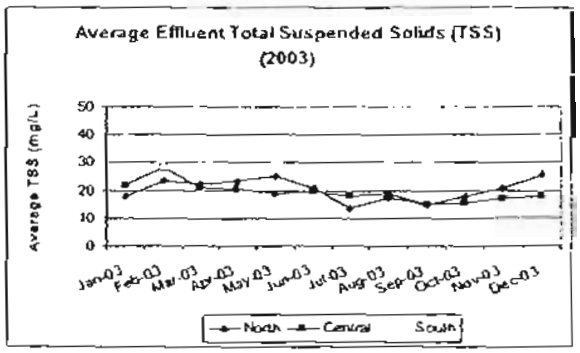
We believe that this increased focus on infrastructure rehabilitation will provide us with many benefits in terms of I/I reduction as well as reduced system operations and maintenance costs and improved structural integrity. This proposal will result in "fixing" the system to prevent

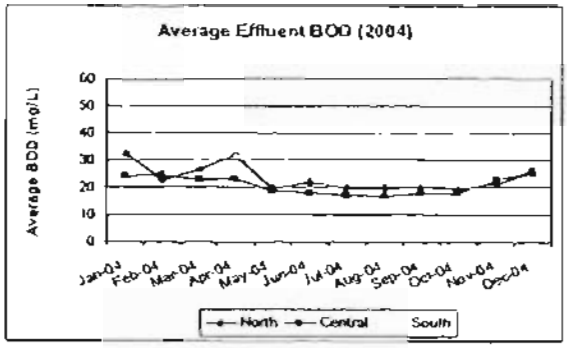
overflows rather than constructing tunnels to store and transport the excess wastewater generated from an overly leaky system.

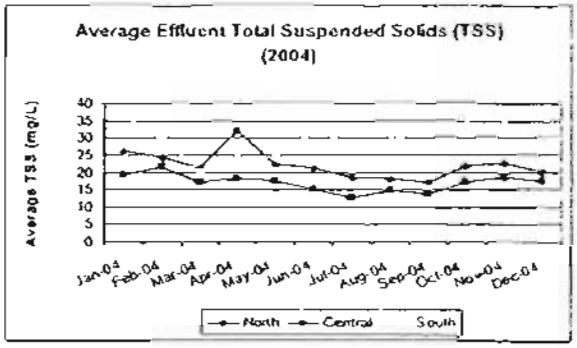
From our current analysis, the proposed alternative plan will cost approximately $500 million, which includes approximately $200 million of sewer rehabilitation, approximately $232 million in pump station, force main upgrades, and other gravity sewer system projects, and approximately $68 million in treatment plant improvements, in addition to the approximately $63 million in improvements that have already been completed or begun by the City/Parish. The details of the proposed modifications may be found in the attachments provided with this letter.

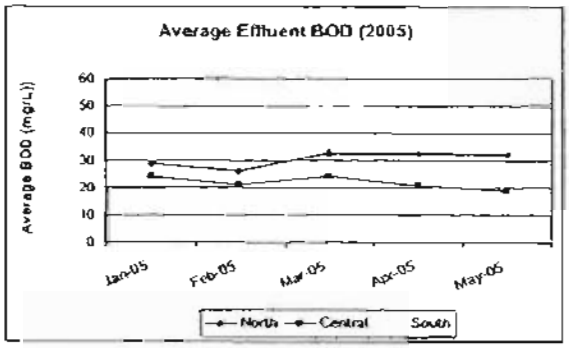
One area of proposed modification associated with the wastewater improvements at the South wastewater treatment plant (WWTP) is the need for temporary interim limits to facilitate the conversion of the plant to an Activated Sludge Process. In addition to the interim limits for the South WWTP already contained in the current Consent Decree, we are hereby requesting additional interim limits of 45 mg/l of BOD_5 and 45 mg/l of TSS as monthly average limits for the South WWTP and 60 mg/l of BOD_5 and TSS as weekly average limits. The proposed Revised Second RMAP improvement plan not only focuses on the elimination of SSOs, but also on achieving NPDES/LPDES Permit compliance at all three wastewater treatment plants. The charts below show the BOD_5 and TSS effluent concentrations at the North, Central and South WWTPs for the years 2003 through May of 2005:

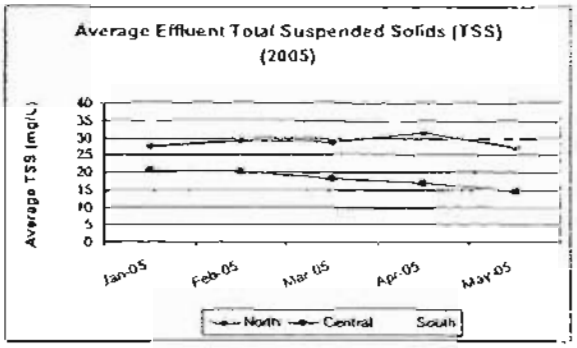












As seen, the North and Central WWTPs show a trend toward compliance and, with the exception of few minor exceedances, those plants are operating satisfactorily. It is projected that these plants will be able to remain in compliance after the implementation of the remedial measures in the proposed Revised Second RMAP as well. However, as is evident from the charts above, the South WWTP is struggling to maintain compliance with the monthly average BOD_5 and TSS limits. Although there have been fewer issues with the weekly average limits (as noted on quarterly reports), during conversion of the plant the weekly limits for BOD_5 and TSS will be difficult to meet. The draft plan and schedule allows design and subsequent construction on the improvements to the South WWTP to begin immediately. With the comprehensive sewer system upgrades proposed, the peak flows to the South WWTP will increase as system deficiencies are currently precluding all flows from reaching the plant. Flows to the North and Central WWTPs are projected to remain within the design capacities of these plants with minor system operational improvements.

The proposed plan entails upgrading the South WWTP to an activated sludge facility and abandoning the trickling filters. Also, this new plan covers upgrading the total treatment capacity from 125 mgd to 200 mgd. Construction of an activated sludge process has numerous advantages including: 1) effluent quality is better than 30 mg/l of BOD_5 and TSS; 2) improves

ability to consistently meet NPDES/LPDES permit limits; 3) enables elimination of primary effluent pump stations; 4) enables abandonment of chlorination facilities for disinfection and allows use of ultraviolet light (UV) for disinfection; 5) helps to control odors; 6) helps with aesthetic concerns in fast developing section of town; 7) eliminates current problems with snails; and 8) allows smoother delivery of flow to plant.

Interim limits are requested because the process of upgrading the plant requires abandoning half of the existing trickling filter plant during construction. The City/Parish will do everything within its means to expedite this part of the work. Taking into consideration the limitation imposed on us by Public Bid Laws and our limited control over the construction contractor, we respectfully request that the Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LDEQ) allow the interim limits proposed above to be in place for the time period commencing on the date or entry of a Modified Consent Decree through the date 30 days following completion of shakedown of the new activated sludge facility.

We are appreciative of the close cooperation we have received from both the EPA and LDEQ in allowing us the time and opportunity to conduct this reevaluation and to prepare this alternative proposal. We are hopeful that both agencies will be able to review and approve this request well before the 120 day deadline provided in Section XXXIV. We will make available all personnel who may be needed to respond to any questions you may have concerning this proposal. As you know, we currently have a meeting scheduled in Dallas on September 1, 2005 to review the proposal. If you have any questions or comments prior to that time, please direct them to Mr. William Daniel and we will respond as quickly as possible. Thank you again for your consideration.

Sincerely,

Melvin L. "Kip" Holden
Mayor-President

MLH/sb
attachments

cc: Mr. Walter Monsour, Chief Administrative Officer
Mr. William B. Daniel, IV, Interim Director of Public Works
Mr. Jim Thompson
Ms. Irys Allgood
Mr. Jeff Broussard
Mr. Bryan Harmon
Mr. Mark LeBlanc
Mr. Charles Faultry (EPA Region 6)
Ms. Vivian Hare (EPA Region 6)
Mr. Carlos Zequeira (EPA Region 6)
Ms. Gloria Vaughn (EPA Region 6)
Mr. Harold Leggett (LDEQ)
Ms. Peggy Hatch (LDEQ)
Mr. Ted Broyles (LDEQ)
Mr. Michael Donnellan (DOJ)
Mr. Justin Haydel (CDM)

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Executive Summary

ES.1 History and Background

On March 14, 2001, the City of Baton Rouge/Parish of East Baton Rouge (City/Parish) entered into a Consent Decree with the Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LDEQ). The Consent Decree outlines a scheduled program of system improvements to address historical overflows and by-passes that have occurred within the collection system and violations of effluent discharge limits at the three wastewater treatment plants (WWTP). The Consent Decree provided alternatives for system correction and required completion of construction and full operation by specific dates for three of the alternatives.

Prior to December 2002 the City/Parish elected to select Alternative 7, which provided for construction of deep underground tunnels, removal of numerous pump stations by connection to the tunnel system, installation of Ballasted Flocculation for peak wet weather treatment at the treatment plants, limited sewer rehabilitation, and construction of tunnel pump stations. In 2005, representatives of the City/Parish spoke with EPA about amending the Consent Decree to include a more aggressive approach to sanitary sewer overflow (SSO) abatement – namely comprehensive sewer rehabilitation as an alternative to the deep tunnel system. EPA agreed not to impose fine-related deadlines in the current Consent Decree to allow the City/Parish 90-days (beginning May 1, 2005) to verify and develop the comprehensive sewer rehabilitation option.

The City/Parish subsequently hired Camp Dresser & McKee Inc. (CDM) to provide engineering services to evaluate the existing sewer system model and develop a plan which would address the causes of the rainfall dependent inflow and infiltration (RDII) and resulting system overflows. The result of the analysis is the development of a Revised Second Remedial Measures Action Plan (RMAP2). The proposed Revised RMAP2 identifies the combination of system improvements needed to control wet weather overflows during the simulated planning condition, sewer rehabilitation to reduce RDII, system conveyance upgrades to address capacity problems, and improvements at the South WWTP to achieve permit compliance during both wet and dry weather conditions.

The Consent Decree requires the RMAP2 to provide specific information related to system improvements to reduce overflows and comply with the requirements of the Consent Decree. Specifically, the Consent Decree states the following.

> "In the Second RMAP, the City/Parish shall provide a detailed description of the selected remedial measure and shall specify a schedule for beginning and completing construction of each element of the selected remedial measure not addressed in the First RMAP. The Second RMAP shall also set forth a process for evaluating and providing the personnel and training that will be required to successfully implement the selected

remedial measure. The Second RMAP shall also provide an estimate of the cost of the selected remedial measure and a detailed description of how the City/Parish will fund the remedial measure to be implemented."

The revised RMAP2 is provided as **Appendix B** to this report and is summarized in this section. Each of the required elements is addressed in this report.

ES.2 Analysis of Existing System

The City/Parish operates three wastewater treatment plants and most of the collection systems draining to these treatment plants.

ES.2.1 Wastewater Treatment

The wastewater treatment plants are permitted as secondary treatment facilities and all three plants generally includes preliminary treatment including screening and grit removal, primary clarification, biological treatment through trickling filters, secondary clarification, and disinfection through use of chlorine.

The treatment plants discharge directly into the Mississippi River or to its tributary. The discharge limits require an average monthly limit of 30 milligrams per liter (mg/l) for 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) and a weekly maximum average of 45 mg/l for both of these parameters. The plants have fecal coliform discharge limits of 200 colonies per 1000 milliliters (ml) average and 400 colonies per 1000 ml peak. Because the treatment plants provide disinfection by chlorination and removal of chlorine prior to discharge through the use of sulfur dioxide, the plants also have specific total chlorine residual (TRC) limitations, which vary between the plants.

The North and Central WWTPs generally operate within the discharge permit limitations. The South WWTP has not achieved consistent permit compliance and experiences extreme influent flow peaks during wet weather events.

ES.2.2 Collection and Conveyance Systems

The City/Parish collection system is divided into three major service areas: North, Central and South. The Central system is primarily a gravity network. The South and North systems have both a gravity network and a pressure transmission network. The system includes over 400 pump stations and approximately 1,880 miles of force main and gravity sewer serving approximately 270 square miles.

The collection system is mostly 8-inch pipe which comprises approximately 85% of the gravity system. Most neighborhoods are served exclusively by a network of 8-inch sewers. The areas drain, or are pumped, to larger diameter sewers which ultimately flow to one of the main trunk lines leading to the plants.

ES.3 Model Analysis and Verification

In order to develop an alternative sewer system management plan, CDM collected existing system information from the City/Parish, including the existing *HydroWorks*

models collectively covering the entire City/Parish collection system, flow monitoring and rainfall data collected at various sites between 1996 and 2003, and GIS files showing the delineations of model sewer basins and the collection system. The model contains approximately 1,282,000 linear feet of gravity sewer, 3,822 manholes listed as nodes within the model, and 1,142,000 linear feet of force main. The models also include data for 296 pump stations.

Based on the modeled storm event, there are capacity deficiencies severe enough to create overflows at 387 locations in the system. Because the model is a representation of the system which has been executed using an evenly distributed, stationary rainfall, it is important to recognize that the model is capable of indicating deficiencies and bottlenecks rather than predicting the actual locations and volumes of overflows. Overflows in the model are used as an indicator of capacity deficiency rather than a means of identifying specific overflow locations.

Overflows that occur in gravity lines upstream of pump stations generally indicate insufficient capacity at the pump station. Based on the model results, an estimated one hundred local pump stations lack sufficient capacity to drain the neighborhoods they serve. The remaining overflows indicate capacity deficiencies due to undersized gravity sewers.

ES.4 Proposed Solution

The City/Parish wishes to develop a solution that focuses on fixing major portions of the existing infrastructure rather than building additional new facilities. This remedial action plan first looks at reducing system inflows by rehabilitating and upgrading local sewers. The plan then identifies wastewater collection and transmission system improvements that will convey future base wastewater flows and wet-weather flows without surcharging or overflows for the design storm event. Increased sewer and pumping capacity will be required to accommodate some level of RDII during wet - weather as well as dry-weather flow associated with growth. Finally, the plan addresses treatment plant modifications to assure all the flow in the system is treated according to Louisiana Pollution Discharge Elimination System (LPDES) permit requirements. The recommended improvements have been divided into three improvement categories as defined below.

ES.4.1 Category 1: Comprehensive Sewer Rehabilitation and Pump Station Upgrades

ES.4.1.1 Comprehensive Sewer Rehabilitation

A comprehensive rehabilitation approach consists of rehabilitation of sewer basins that do not meet infiltration and inflow (I/I) control standards. The recommended approach for the City/Parish to take in areas where RDII reduction is targeted is to begin with comprehensive rehabilitation of the public sewer system, including the service laterals up to the property line. Comprehensive sewer rehabilitation methods including lining, pipe bursting, and pipe replacement or relief sewers. Point repairs may also be required for lines that are generally in compliance with I/I control

standards and for which only a specific location requires repair to repair structural defects.

The sewer rehabilitation strategy developed for the North, Central and South treatment plant basins assumes all areas where RDII currently exceeds 10 percent of the rainfall volume will receive comprehensive rehabilitation. The rehabilitation in each of the basins with R-values in excess of 0.10 is considered part of the Category 1 improvements.

The first basins to be scheduled for rehabilitation are generally those with the highest existing R-values. Several basins in the North area have the highest R-values; however, the Central area has numerous basins with moderate to high R-values indicating the sewer lines in this area are generally in worse condition than other areas of the City's system. A greater portion recommended for comprehensive rehabilitation. The South system is generally in significantly better condition than the other systems; hence a lower percentage of the system requires rehabilitation.

In areas where this approach does not achieve the desired level of RDII reduction or in areas where there are known significant sources of RDII on private property from system investigations, additional rehabilitation of the remaining service laterals on private property is recommended. The City/Parish currently has a sewer ordinance in place that provides the authority to require customers to remove sources of extraneous flow from the sanitary sewer system and to fine customers who fail to do so. The State of Louisiana Constitution contains a public purpose doctrine that requires public money to only be spent for a public purpose; however, the Constitution contains exemptions to the public purpose doctrine when it can be demonstrated that the public funding would be used for the purpose of assisting needy residents. Additionally, the City/Parish could use funding that was not considered to be public (i.e. "insurance") to rehabilitate private laterals. The City/Parish could also use funds that would be contributed in fines toward Supplemental Environmental Projects (SEPs). Special legislation that would allow the use of public funds for the repairs of private service laterals could also be sought.

ES.4.1.2 Pump Station Modifications

Forty-three pump stations in the North CSD area, three pump stations in the Central CSD area, and 41 pump stations in the South CSD/STN area could not overcome the system head required to allow the pump stations to pump into the system. It is difficult to assess the improvements required to allow all the pumps stations to operate; therefore, detailed field investigation of each pump station is required prior to determining the specific improvements required for each pump station. Improvements may require minor adjustments, or may require pump, motor or impeller replacement.

ES.4.2 Category 2: Transmission and Conveyance System Improvements

The model indicates overflows will occur even with sewer system rehabilitation if additional capacity improvements are not made. Capacity upgrades to the

City/Parish existing pump stations or the construction of new pump stations will be required to convey wet-weather flows and to prevent overflows upstream of the pump station. Most pump station capacity improvements identified by the model require less than 12 MGD, with a large percentage of pump stations requiring upgrade of less than 1 MGD. In the South service area, the model indicates several pump stations require significant capacity increases. A more detailed listing of the pump station and pipelines requiring capacity increases are provided in the Revised Second Remedial Action Plan as provided in Appendix B. The Category 2 improvements are identified by service area below.

North CSD/STN Area: minor capacity upgrades are required at 16 pump stations. The capacity increases required are generally less than 2 MGD. Pump Station 241 requires an increase of 12.5 MGD, which is the largest increase in the service area. Pipeline capacity improvements include replacement of approximately 37,000 linear feet (LF) of replacement gravity sewer, installation of approximately 84,000 LF of new parallel gravity sewer, approximately 51,000 LF of replacement force main, and 2,700 LF of parallel force main.

Central CSD Area: Capacity upgrades are required at three pump stations, with the Pump Station 2 requiring approximately 17 MGD of additional capacity. Pipeline capacity improvements include replacement of approximately 22,000 LF of replacement gravity sewer and installation of approximately 38,000 LF of new parallel gravity sewer. Based upon model results, no new force main based upon capacity needs is required in this service area.

South CSD/STN Area: Capacity upgrades are required at 35 pump stations, with the largest upgrades required at Pump Station 57, Pump Station 58, and Pump Station 514. It is assumed this will require construction of a new pump station or significant increase to the existing pump station wet well and pump/pipe systems. Pipeline capacity improvements include replacement of approximately 126,000 LF of replacement gravity sewer, installation of approximately 174,000 LF of new parallel gravity sewer, approximately 26,000 LF of replacement force main, and 7,000 LF of parallel force main.

ES.4.3 Wastewater Treatment and Flow Equalization

The peak flows predicted by the model for the North WWTP and Central WWTP are slightly less than the plants' current treatment capacities. The flows predicted for the South WWTP are significantly above the capacity of the plant and cannot be managed through pump station and flow control. Based upon the predicted increase in flow to the South WWTP and the historical performance of the treatment plant, the following improvements to the treatment plant are recommended.

- *New Headworks and Flow Equalization Basin* – Peak flows to the treatment plant from the South CSD and the South STN will be 273 MGD. If the South WWTP is upgraded to a peak capacity of 200 MGD, a 19 million gallon (MG) flow equalization facility is required. The construction of a new headworks facility with screening, grit removal facilities and influent pumping in the vicinity of the

required 19 MG equalization basin is required. With a new headworks facility, the two poorly functioning headworks facilities at the South WWTP can be eliminated.

- *Upgrade the South WWTP to a 200 MGD Activated Sludge WWTP* – Abandon the trickling filters and construct facilities for a new activated sludge process.

ES.5 Construction Sequence and Schedule

A project schedule has been developed that reflected the design, bidding, construction, and start-up of the projects included in Categories 1, 2 and 3. As required by the Consent Decree, the schedule reflects a completely operational system by January 2015, with milestones noted for completion of individual projects. The construction projects included in the schedule allow the City/Parish to comply with the requirements of the Consent Decree for reduction of SSO within the collection area and for the discharge from the wastewater treatment plants to be within permit limits. The schedule for each category of improvements is provided below.

Category	*Start Construction*	*Complete Construction*	*Fully Operational*
1: Comprehensive Sewer Rehabilitation and Pump Station Upgrade			
Comprehensive Sewer Rehabilitation	March 2006	August 2013	March 2014
Pump Station Upgrades	October 2006	September 2008	December 2008
2: Conveyance/Transmission System	October 2010	July 2014	November 2014
3: Wastewater Treatment/Flow Equalization			
Headworks and Flow Equalization	May 2007	May 2010	September 2010
Pipe to from Flow Equalization to South WWTP	August 2008	August, 2009	September 2011
South WWTP Improvements	May 2007	April 2010	September 2011
Pipeline to Mississippi River	April 2008	August 2009	December 2009

ES.6 Program Costs

The cost estimate for the recommended improvements includes administration, design, contingency, bidding, and construction costs and includes an allowance for normal inflation. The costs do not include land acquisition required for easements or land for new facilities. The opinion of probable construction cost for each of the categories of improvements is discussed below. Additional cost information is provided in Appendix E. The program costs are shown below.

Program Category of Improvements	*Total*
Category 1: Collection System Basin Rehabilitation SSO Collection System	$199.1 million
Category 2: Transmission/Conveyance System Improvements Pump Station & Transmission	$233.7 million
Category 3: Treatment Plant and Flow Equalization WWTP & Flow Equalization Basin	$68.0 million
Total Program Cost	***$500.8 million***

ES.6.1 Category 1: Comprehensive Sewer Basin Rehabilitation and Pump Station Upgrades

The projects have been separated to generate bid packages valued at between $4 million and $6 million. This cost includes manhole and public-side lateral rehabilitation. An additional cost of $900 per service lateral is included for any private side lateral rehabilitation required to reduce the basin R-values. The preliminary opinion of probable construction cost for the comprehensive sewer rehabilitation in Category 1 is $170 million to rehabilitate approximately 350 miles of sewer. The rehabilitation costs are based upon a unit price ranging between $80 and $90 per linear foot of pipe rehabilitated and $5 to $10 per foot of pipe for engineering and field work.

Eighty-seven pump stations were identified in the model as requiring an increase in head, likely due to pumping against another pump station in the conveyance system. These improvements are divided into seven construction contracts valued between $3 and $6 million per project for a preliminary opinion of probable construction cost of $29.2 million. The cost for pump station evaluation and mechanical improvements was estimated as 30 percent of the cost for a new pump station.

The total preliminary opinion of probable construction cost for Category 1 improvements is approximately $200 million.

ES.6.2 Category 2: Pump Station and Transmission/Conveyance System Improvements

These improvements are generally split into pipe line projects and pump station projects. The pipeline project contracts are split into construction projects generally valued between $3 million and $12 million. The pump station capacity increases are generally significant enough to warrant new pump stations or increases in wet well capacity and are considered complex construction projects. Several of these pump station construction contracts will be over $20 million each. The unit cost of the installed pipe ranges from $5.50 to $20 per inch diameter per foot. The price variation is due to depth of installation and material for pipe. The total Category 2 preliminary opinion of probable construction cost is $232 million.

ES.6.3 Category 3: Flow Equalization and Wastewater Treatment Improvements

Category 3 costs include costs associated with treatment plant improvements and flow equalization. No treatment plant improvements are required at the North WWTP or Central WWTP. Process modifications are required at the South WWTP to comply with Consent Decree requirements and to ensure long-term compliance with all Clean Water Act requirements. The cost of the Category 3 improvements includes construction of a new headworks/flow equalization facility and upgrade of the South WWTP to an activated sludge facility/peak flow treatment facility. The preliminary opinion of probable construction cost for Category 3 is $68 million.

ES.7 Operation and Maintenance

Implementation of the revised RMAP2 program will have a number of implications related to operations and maintenance (O&M) costs to the City/Parish. To evaluate these impacts, CDM obtained the detailed City/Parish line item wastewater budget and used this budget to determine how operation and maintenance costs would be expected to change upon implementation of the improvements program.

ES.7.1 Collection System O&M Costs

A significant portion of the sewer system has average groundwater infiltration rates of 3,000 gallons per foot per year or greater. It was assumed that comprehensive rehabilitation would remove 80 percent of this groundwater infiltration.

Operation and maintenance savings will be achieved as a result of the comprehensive rehabilitation program. A comprehensive program will result in decreased overflows and stoppage responses as well as a decrease in the frequency of cleaning needed for the rehabilitated pipes. At the completion of the RMAP2 comprehensive rehabilitation program, it is anticipated that the City/Parish costs for emergency point repairs of structural failures will be decreased from its current $2,000,000 annual cost to approximately $1,100,000 (a $900,000 savings) given that much of the oldest sewers will be included in the rehabilitation program. In addition, it is anticipated that the responsive (emergency) maintenance costs will be reduced by approximately $460,000 based on a reduced cleaning frequency that will be required in the rehabilitated areas.

ES.7.2 Pumping O&M Costs

System pumping costs are approximately $0.06 per 1000 gallons of wastewater pumped to the treatment plant. Infiltration reduction from comprehensive rehabilitation is projected to reduce pumping costs in the system by approximately $275,000 annually. Design improvements can be made to the pump stations during the upgrades that will have an overall benefit in terms of reduced power usage and therefore result in potential energy savings. Energy savings can be realized by proper pump selection and operation of pumps near their best efficiency point.

ES.7.3 Wastewater Treatment Plant O&M Costs

Based on the City/Parish budget, treatment plant power and chemical costs average approximately $0.18 per 1000 gallons treated. The average daily dry-weather influent flow to the treatment plant will be reduced with the implementation of the rehabilitation program. The groundwater infiltration to the system will be significantly reduced, thereby reducing flow to the South WWTP. An annual savings in treatment costs of approximately $890,000 per year is expected with implementation of the recommended program.

The system modifications at the treatment plant will add approximately $500,000 in annual power cost. There will be a decrease in power costs of $400,000 due to the elimination of the two primary effluent pump stations. There is a projected savings of approximately $400,000 in chlorine, sulfur dioxide, and NaOH costs associated with the disinfection system that will no longer be incurred. The two old maintenance

intensive headworks will be eliminated. The total projected savings due to process and equipment modification at the South WWTP is an additional $700,000.

The net decrease in wastewater treatment plant O&M cost is expected to be approximately $1.6 million once the RMAP2 program is complete.

ES.7.4 Total O&M Savings

Based on this analysis, CDM estimates the following changes in the annual City/Parish operation and maintenance costs as a result of implementing the revised RMAP2 program:

Wastewater Treatment Plant O&M:	$1.6 million savings
Pumping O&M:	$0.3 million savings
Collection System O&M:	$1.3 million savings
TOTAL O&M:	**$3.2 million savings**

Section 1
Introduction

1.1 Project History

On March 14, 2001, the City of Baton Rouge/Parish of East Baton Rouge (City/Parish) entered into a Consent Decree with the Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LDEQ). The Consent Decree outlines a scheduled program of system improvements to correct historical overflows and by-passes that have occurred within the collection system and violations of effluent discharge limits at the three wastewater treatment plants (WWTP). The Consent Decree provided alternatives for system correction and required completion of construction and full operation by specific dates for three of the alternatives.

Prior to December 2002 the City/Parish elected (by vote of City Council) to select Alternative 7, which provided for construction of deep underground tunnels, removal of numerous pump stations by connection to the tunnel system, and construction of tunnel pump stations. This alternative included an annual expenditure of $3 million in collection system rehabilitation. The City/Parish moved forward with several aspects of this alternative, including the selection of design consultants for the tunnels and tunnel pump stations.

In April 2005, representatives of the City/Parish spoke with EPA about amending the Consent Decree to include a more aggressive approach to sanitary sewer overflow (SSO) abatement – namely comprehensive sewer rehabilitation as an alternative to the deep tunnel system. In late April, 2005, EPA agreed not to impose fine-related deadlines in the current Consent Decree to allow the City/Parish 90-days (beginning May 1, 2005) to verify and develop the comprehensive sewer rehabilitation option more fully. The previously selected alternative did not address the root of the problem by providing only limited rehabilitation of the collection system, which is the source of inflow and infiltration (I/I) into the system. The tunnel and pump station system would not correct the problems within the system.

1.2 Purpose and Objective

The City/Parish subsequently hired Camp Dresser & McKee Inc. (CDM) to provide engineering services to evaluate the existing sewer system model and develop a plan

which would address the causes of the rainfall dependent inflow and infiltration (RDII) and resulting system overflows. This report defines a specific plan for rehabilitation of Baton Rouge's collection system so that it will operate without overflow during the design modeled storm event. The primary focus of this plan is to address the cause of RDII and to develop economical corrections to eliminate overflows and treatment plant permit violations. The result of CDM's analysis is the development of a Revised Second Remedial Measures Action Plan (RMAP2) as defined in the Consent Decree. The RMAP2 is the second phase of improvements to be undertaken by the City/Parish. The first RMAP

(RMAP1) improvements, as outlined in the Consent Decree, are underway and anticipated to be completed on schedule.

The proposed Revised RMAP2 focuses on repair and upgrade of existing facilities while minimizing construction of additional infrastructure. The plan identifies the combination of system improvements needed to control wet weather overflows during the simulated planning condition, and it includes a combination of sewer rehabilitation to reduce RDII, system conveyance upgrades to address capacity problems, and improvements at the South WWTP to achieve permit compliance during both wet and dry weather conditions.

This report also provides a schedule for completion of specific collection system and wastewater treatment plant improvement projects and for implementation of a collection system rehabilitation program. The schedule for implementation is based on meeting Consent Decree requirements that the work be completed by January 1, 2015. Annual spending requirements are provided to assure that the City/Parish understands the rate and funding implications of the recommended program.

The final work product includes a proposed (red-lined) modified Consent Decree (**Appendix A**) revised Remedial Measures Action Plan 2 (RMAP2)(**Appendix B**) and all other proposed Consent Decree modifications for LDEQ and EPA review and approval.

1.3 Project Approach

To accomplish the stated objective, an updated hydraulic analysis has been conducted on the City/Parish sanitary sewer collection system. This analysis consisted of four major tasks as described below.

Task 1 - Verification of System Flows
The main purpose of this task was to make sure the flow input is representative of wet weather conditions and the estimates are adequately documented for review. The subtasks associated with this task were as follows:

a. Obtain and review historical flow monitoring and rainfall data.

b. Confirm flow analyses to determine simulated rainfall dependent infiltration and inflow rates.

c. Review and revise sub-basin delineations and flow assignment. Basins were consolidated as needed to obtain an accurate input scheme.

d. Verify the modeled system by comparing predicted flow outputs to known conditions throughout the system.

Task 2 - Local System Improvement Plan
As part of this task, a plan for making local system improvements needed to address current and predicted future capacity issues was developed. The plan specifies the combination of sewer rehabilitation, gravity sewer improvements, and pump station and force main improvements needed to mitigate overflows in the local basins. The subtasks included:

a. Review flow conditions and identified bottlenecks and areas where excessive flows are generated. Reviewed flow monitoring data, where available.

b. Prepare sewer rehabilitation plan, if appropriate, for basin. Determine likely flow reduction that can be achieved.

c. Determine conveyance and pump station improvements needed to meet system capacity requirements with assumed I/I reduction levels.

d. Compile improvement projects and prepare construction cost estimates.

Sewer overflows are generally caused by insufficient conveyance capacity in gravity sewers or pumping facilities. Maintenance problems including debris blockage, collapsed pipes and mechanical failure do not factor into this analysis. The local system improvement plan identifies projects needed to provide sufficient capacity to convey sub-system flows to the trunk sewer system. These local projects focus on rehabilitation of existing sewers in areas where high RDII is expected based on available information. However, gravity sewer and pump station improvements were included where additional capacity is needed to meet planning conditions.

Task 3 - Regional Conveyance and Treatment
In many areas, there is insufficient trunk sewer capacity to convey the local basin flows to the existing treatment plants. This task determined the conveyance and treatment needs to provide treatment for the flows generated in each local basin. The subtasks included:

a. Identify trunk system bottlenecks and deficiencies.

b. Develop key conveyance projects including consideration of diversions between wastewater treatment plant service areas if these would be beneficial.

c. Determine treatment and/or equalization requirements at each plant based on overall collection system improvements.

Work in this task also determined treatment plant modifications needed to treat or equalize peak wet weather flows.

Task 4 - Implementation Plan
In Tasks 2 and 3, system modeling was used to determine the projects required to achieve the level of service desired by the City/Parish. Task 4 set a construction

sequence and investment schedule to implement the improvements by 2015 as required by the Consent Decree. Subtasks of Task 4 include the following:

a. Determine necessary sequence of construction to prevent overloading of individual facilities.

b. Prepare planning level cost estimates for all recommended improvements in the plan.

c. Determine a construction schedule that meets the financial objectives of the City/Parish.

d. Prepare documentation and exhibits for use in EPA negotiations and assist the City/Parish in presenting the plan to EPA.

1.4 Report Structure

The primary purpose of this project is to identify the alternative plan and provide a proposed Revised RMAP2 along with supporting information needed by the City/Parish to implement the Revised RMAP2 plan. This data includes the design and construction cost, construction sequence, implementation schedule and cash flow requirements. The execution and results of these tasks are discussed in the remaining sections of this report as follows.

Executive Summary – A summary of the information contained in Sections 1 through 5 is provided as an overview of the report. This section outlines the existing conditions and recommended program. Details regarding the program development can be found in the report sections.

Section 1: Introduction – This section includes a summary of the Consent Decree history and a description of the purpose of the model verification and development of the Revised Second Remedial Action Plan.

Section 2: System Description and Data – This section includes a description of the existing treatment and collection/conveyance system as well as modeling input information and system flow monitoring data. Wastewater flow assumptions, design storm and model verification are discussed.

Section 3: Existing System Assessment – This section provides a discussion of the existing model limitations, analysis of system improvements including sewer system rehabilitation approaches, and discussion of wet weather management alternatives.

Section 4: Improvement Plan – In this section, the improvement plan for the collection and conveyance system is developed based on model results for each of the major wastewater treatment plant service areas. Recommended improvements for wastewater treatment and wet weather management are also presented.

Section 5: Implementation Plan – This section includes development of an implementation schedule based upon construction constraints as well as financing ability of the City/Parish. The estimated program costs including construction, design and implementation for the recommended improvements is presented along with the changes in operations and maintenance costs. A cash flow analysis based upon the estimated costs and implementation schedule is presented.

Section 2
System Description and Data

The City of Baton Rouge/Parish of East Baton Rouge (City/Parish) operates three wastewater treatment plants (WWTP) and most of the collection systems draining to these treatment plants. The portions of the collection system not owned by the City/Parish are privately owned and operated by suburban communities. There are no hydraulic connections between each of these service areas. The North and South WWTP service areas contain both gravity conveyance systems as well as pressure transmission networks. The Central WWTP service area contains a primarily gravity collection system.

2.1 Wastewater Treatment

The City/Parish owns and operates the North WWTP, Central WWTP, and South WWTP. The delineation of the service area and location of the wastewater treatment plants are located as shown in Figure 2-1. The design average daily flow and peak hourly flow capacity in million gallons per day (MGD) for each plant is listed in Table 2-1.

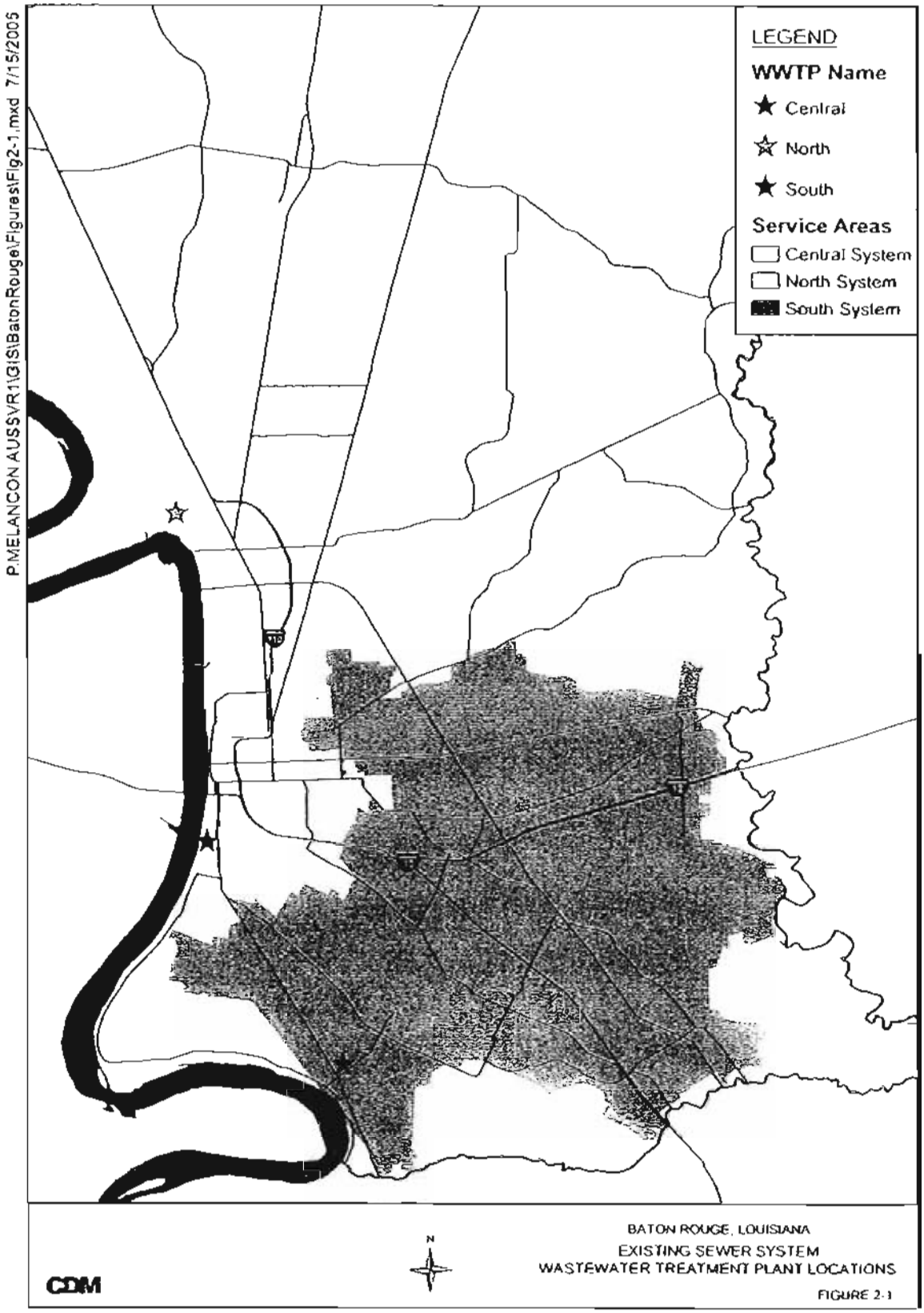
Table 2-1
Treatment Plant Flow Information

Treatment Plant	*Design Average Daily Flow*[1] *(MGD)*	*Design 1-hour Peak Flow (MGD)*	*Actual Average Dry Weather Influent Flow (MGD)*
North	54	130	15-20
Central	32	65	7-10
South	54	120	32-35

[1] Per Louisiana Pollution Discharge Elimination System (LPDES) Permit

The wastewater treatment plants are permitted as secondary treatment facilities. All three discharge directly into the Mississippi River or to its tributary. The discharge limits require an average monthly limit of 30 milligrams per liter (mg/l) for 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) and a weekly maximum average of 45 mg/l for both of these parameters. The plants have fecal coliform discharge limits of 200 colonies per 1000 milliliters (ml) average and 400 colonies per 1000 ml peak. Because the treatment plants provide disinfection by chlorination and removal of chlorine prior to discharge through the use of sulfur dioxide, the plants also have specific total chlorine residual (TRC) limitations, which vary between the plants.

The treatment process for all three plants generally includes preliminary treatment including screening and grit removal, primary clarification, biological treatment through trickling filters, secondary clarification, and disinfection through use of chlorine. The North and Central WWTPs generally operate within the discharge permit limitations. The South WWTP has not achieved consistent permit compliance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LEGEND
WWTP Name
Central
North
South
Service Areas
Central System
North System
South System
N
BATON ROUGE, LOUISIANA
EXISTING SEWER SYSTEM
WASTEWATER TREATMENT PLANT LOCATIONS
CDM
FIGURE 2-1

and experiences extreme influent flow peaks during wet weather events. Corrective action for this treatment plant is discussed in more detail in Section 4.4.

2.2 Collection System

The City/Parish collection system consists of local gravity collection sewers, gravity interceptors, force mains and over 400 pump stations. There are approximately 1,880 miles of force main and gravity sewer within the sewer system. The total area served by the tributary collection systems is approximately 270 square miles. **Table 2-2** summarizes the length of gravity pipe within the collection system by pipe diameter. Pipe sizes with less than 500 feet of pipe were not included in this table.

Table 2-2
Summary of Gravity Sewer Pipe Length

Pipe Diameter (in.)	*Length (ft)*	*Pipe Diameter (in.)*	*Length (ft)*
4	600	24	78,000
6	57,900	27	4,500
8	7,375,800	30	48,900
9	700	33	3,800
10	349,500	36	72,500
12	231,100	42	21,300
15	153,600	48	21,400
18	127,000	>48	37,600
21	17,000		
Total Length of Pipe in Collection System (ft)			***8,601,200***

The City/Parish collection system is divided into three major service areas: North, Central and South. Each of these services area has a dedicated treatment plant. The Central system is primarily a gravity network. The South and North systems have both a gravity network and a pressure transmission network. It should be noted that there are short stretches of gravity sewers in both the North and South pressure networks.

The collection system is mostly 8-inch pipe which comprises approximately 85% of the gravity system. A map of the collection system is shown in **Figure 2-2**. Neighborhoods are served exclusively by a network of 8-inch sewers and drain, or are pumped, to larger diameter sewers which ultimately flow to one of the main trunk lines leading to the plants. A 54-inch gravity sewer and a 54-inch pressure sewer enter the North WWTP. Influent to the Central WWTP is pumped from three pump stations (PS59, PS1, and Louisiana State University (LSU)). LSU and PS1 join at the gate and become a single pipe just upstream of the Central WWTP headworks. The South WWTP is currently fed by a 72-inch gravity sewer and a 48-inch pressure sewer. A new force main that carries flow to the South WWTP has been constructed from

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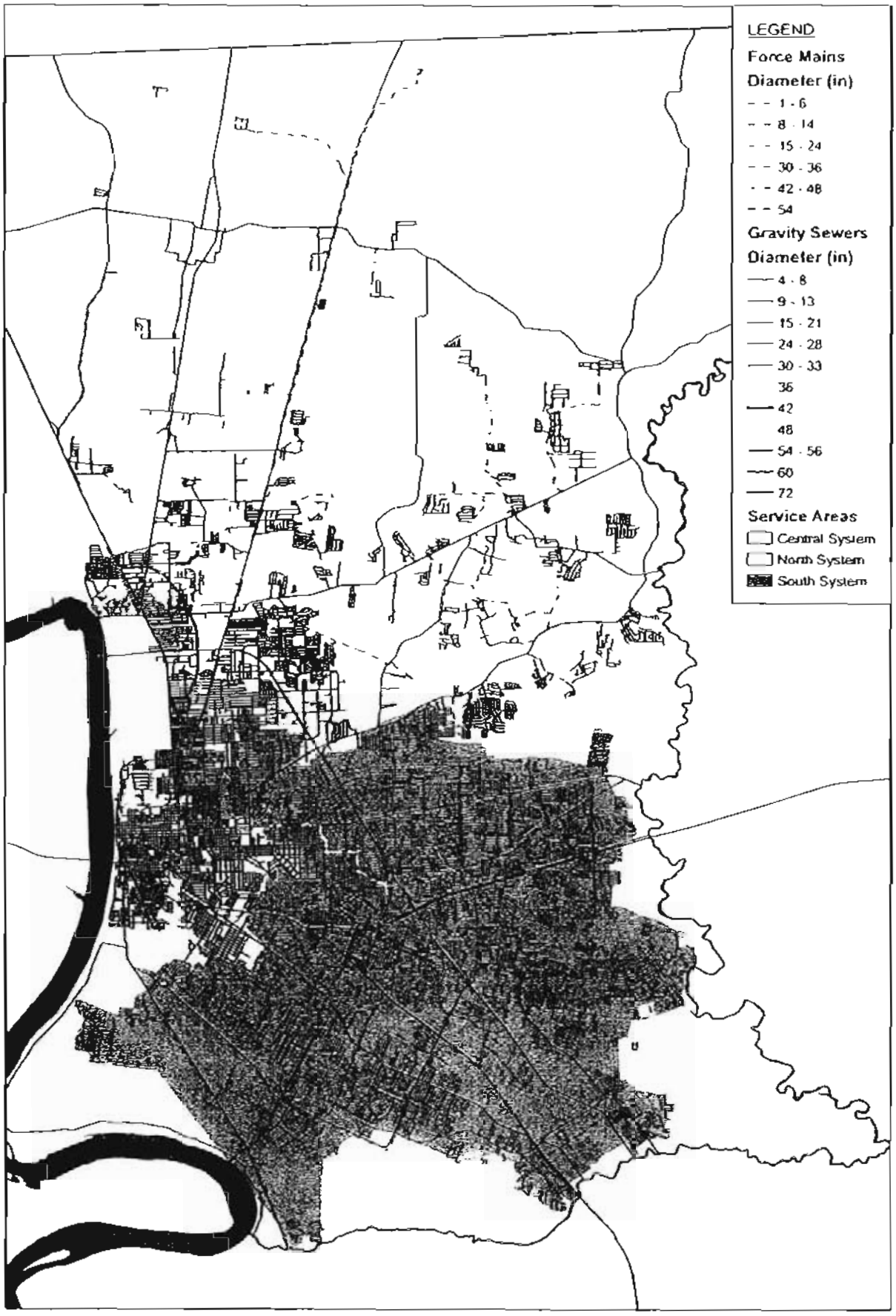


CDM

N

BATON ROUGE, LOUISIANA

EXISTING SEWER SYSTEM

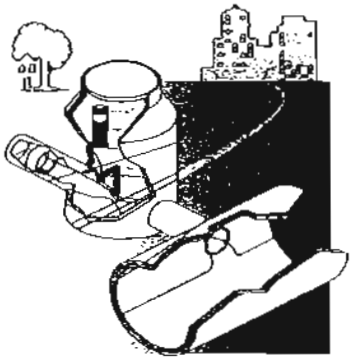
FIGURE 2-2

Nicholson to Gardere and serves the new developments along Burbank and Bluebonnet.

2.3 Hydraulic Model

In order to develop an alternative sewer system management plan, CDM collected existing system information from the City/Parish. The data provided included:

- Four *HydroWorks* models collectively covering the entire City/Parish collection system. The hydraulic model for each system generally contains the gravity sewers greater than 8-inches in diameter and major pump stations and forces mains.



- Flow monitoring and rainfall data collected at various sites between 1996 and 2003.
- GIS files showing the delineations of model sewer basins.
- GIS files showing the entire collection system with sewer sizes.

The reliability of the available data was assessed using the model. The data was reviewed and evaluated for use in the development of an overflow elimination plan. The *HydroWorks* model was delivered as four networks. These networks were labeled as follows:

- North – North pressure and gravity system network
- SSTN - South pressure system network
- SCSD - South gravity system network
- CCSD - Central system network

The models represent approximately 459 miles of sanitary sewer and force main, or approximately 24 percent of the overall collection system. The models also include data for 296 pump stations. Smaller pumping stations are generally not included in the system model. Network data and wastewater flow assumptions are summarized below.

2.3.1 Network Data

The model "networks" identified above consist of the layout or configuration of system elements including pipes, manholes, pumps, force mains, valves and outfalls. The physical system in the model network also contains surface hydrology data and some dry weather flow data (population and base flow). The physical data describing the geometry of the network is also associated with the network. This data includes sewer and manhole diameters, sewer invert elevations and pump performance curves. For each manhole, the network data also defines how the model simulates

flooding, i.e., the action the model takes when the hydraulic grade line exceeds the rim elevation of the manhole when the manhole is likely to overflow.

The model contains approximately 1,282,000 linear feet of gravity sewer, 3,822 manholes listed as nodes within the model, and 1,142,000 linear feet of force main. Table 2-3 summarizes some of the network information contained within the developed model.

Table 2-3
Modeled Network Information

System	Gravity Pipe (feet)	Manholes	Force Main (feet)	Pump Stations
North	427,418	1,325	615,279	104
CCSD	179,829	457	20,239	14
SCSD/SSTN	674,798	2,040	506,099	178
Total	*1,282,045*	*3,822*	*1,141,617*	*296*

2.3.2 Flow Input and Data Groups

Additional model input is contained in data groups. Several data groups were present in the model provided by the City/Parish. These included wastewater flow, base flow, rainfall and real time control (RTC) groups. There were also level and inflow groups included in the model; however, these were determined to be irrelevant for evaluation of sanitary sewer overflows (SSOs) under design storm conditions because, for the City/Parish model, these groups supply operating data for specific historical events.

For purposes of flow monitoring and model development, the collection system was separated into sewer basins. These basins are small units in which the pipes converge to a point. Data is input into the collection system model by basins. Data related to a particular event or controlled by specific dates simulate a particular circumstance and are not necessary for evaluating sanitary sewer overflows.

Wastewater Flow Data Group

The wastewater flow data group defines the amount and variation of wastewater flow. Since flows are assigned to each basin on a per capita basis, a basin population is required. The per capita flows in the wastewater flow group range from 35 to 90 gallons per capita per day (gpcpd).

The model contains 1,175 sewer basins with wastewater flow assignments. An additional 313 basins have wastewater flow assigned but no service area. For these basins, the flow and population assigned in the existing appear to represent the commercial and industrial wastewater flow. This flow is converted to population equivalents (PE) by dividing by 100 gpcpd. Based on the data in the model,

commercial and industrial flow is represented by a PE of 63,843 with a flow of 6.38 MGD. The total population represented in the model is 431,627, with a residential population of 367,784 and a commercial/industrial PE of 63,843. The 2000 U. S. Census puts the City/Parish population at 412,447. The difference is likely due to areas not served by sewers or not represented as population, such as the entire LSU campus. The flow assignments in the model appear to represent 2001 conditions. Current year (2005) flows are slightly less than those simulated in the model. Based on information provided to CDM by the City/Parish, the North and Central service areas would not see future increases in wastewater flows due to growth. The South service area is predicted to sustain continued growth, thus necessitating more capacity improvements in this area than required in the North and Central service areas.

Baseflow Data Group

Baseflow input is part of the network input and is a constant flow input assigned to individual manholes in the network. In collection system modeling, baseflow typically is used to represent groundwater infiltration into the system. It appears that baseflow has also been used to represent other system inflows such as the contribution from LSU. The system model includes baseflow inputs at 1,151 locations ranging from 0.00023 to 0.5 MGD. The total of all base flow input in the model is 24.85 MGD, which appears to represent groundwater infiltration throughout the service area as well as a few selected point inflows.

Rainfall Data Group

The rainfall input to the model is used to simulate the process of rainfall dependent infiltration and inflow (RDII). RDII is the rain water that leaks into the sanitary sewer system and is the cause of nearly all sewer overflows in the modeled system.

The rainfall group in the model provided by the City/Parish contains a single rainfall event dated September 5, 1977. This storm begins at 10 AM and concludes at 10 PM (22:00). The hourly rainfall input nearly matches the rainfall recorded at the Baton Rouge Metropolitan Airport on that date. This storm has been used as the design storm for developing previous remedial action plans. The rainfall data group input consists of 4.41 inches of rainfall over the 12-hour period. A multiplier of 0.89 was been applied to the hourly rainfall, presumably to convert the point rainfall to an equivalent rainfall depth over a large area. The rainfall information is discussed further in **Section 2.4**. This rainfall data is summarized in **Table 2-4**. The model networks reference up to 20 different rainfall patterns, with this rainfall event the only one provided. This event was verified by statistical analysis of historical data and is used for evaluation of the sanitary sewer system.

Table 2-4
Rainfall Group Model Storm Event

Date & Time	Rainfall Intensity (in/hr)
09-05-1977 at 10:00	0.56
09-05-1977 at 11:00	0.12
09-05-1977 at 12:00	0.18
09-05-1977 at 13:00	0.75
09-05-1977 at 14:00	0.30
09-05-1977 at 15:00	0.59
09-05-1977 at 16:00	0.19
09-05-1977 at 17:00	0.77
09-05-1977 at 18:00	0.15
09-05-1977 at 19:00	0.45
09-05-1977 at 20:00	0.18
09-05-1977 at 21:00	0.16
TOTAL	4.41

Real Time Control (RTC) Group
RTCs simulate the logical controls that dictate the behavior of network elements beyond hydrologic and/or hydraulic conditions. RTC groups for the North, SCSD, and SSTN model networks were received. A standard modeling practice is to use RTC conditions unless they are controlled by specific dates.

Level Group
A "level" group was provided in the information received from the City/Parish for the model. Level groups are used to simulate a time varying hydraulic grade at point locations. They are commonly used to simulate tidal effects or other surface water influences. The level group provided simulates a constant hydraulic grade of 40.22 feet extending from midnight on December 26, 1997 through 4 days and 14 hours at the manhole where the SSTN network discharges to the South WWTP. The level group provided was configured to simulate a particular circumstance and is not necessary for evaluating sanitary sewer overflows.

Inflow Group
Inflow groups contain tabular profiles of flow versus time that are used to simulate point loads. "Inflow" group information was provided for the CCSD and the North networks. The inflow groups for the CCSD and North network contained point loads configured to a particular date or circumstance and they are not necessary for evaluating sanitary sewer overflows.

The wastewater flow data input is summarized below.

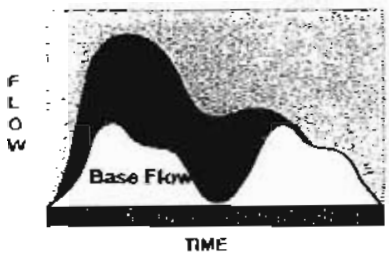
- Residential — 367,784 people at 35-90 gpcpd distributed among 1,175 input locations
- Commercial/Industrial — 6.38 MGD distributed among 313 load points
- Additional Groundwater — 24.85 MGD distributed among 1,151 load points

Infiltration

- Rainfall Dependent I/I — Input at 1,184 load points with an average R=0.061 over 90 square miles of sewered area

2.4 Flow Verification

Flow monitoring and rainfall records obtained for several permanent monitoring sites were evaluated to check the flow data contained in the model. The City/Parish has 16 permanent meters. Records were obtained which cover the period 1997 to 2003. A flow decomposition procedure was used to segregate the flows into base wastewater flow (BWF), groundwater infiltration (GWI) and RDII. The decomposition process first looks at dry days to determine the dry-weather flow pattern at the site. The dry-weather flow is divided into BWF and GWI based on the assumption that the lowest observed flows in the record are likely equivalent to the GWI components. Next, the dry-weather flow as determined above is subtracted from the monitoring records on rainy days. The remainder is the RDII hydrograph. The volume of RDII can be determined from the hydrograph allowing calculation of an R-value.



Many of the flow monitoring records were found to have large changes in flow depth at various times in the record. This could indicate a failure to maintain the flow monitoring site or a result of construction activity upstream or downstream of the site. Using portions of the records that appeared to be reliable, R-values were found to vary between 2 and 20 percent with most in the range of 4 to 6 percent. This is consistent with the R-values used in the model; however, a more in-depth follow-up investigation is recommended to verify the areas where R-values exceed 10 percent.

2.5 Model Modifications

Results of the previously developed model were accepted by the Environmental Protection Agency (EPA) for use by the City/Parish to develop the First Remedial Action Plan (RMAP1) and the original Second Remedial Action Plan (RMAP2). This study verified the model parameters based upon the information provided. Changes to the model made as a result of the verification include: addition of a diurnal variation for wastewater flow, correction of some pumping curves so that flow decreased with increasing pumping head and modification of selected pipes and manholes which contained questionable data. Other minor changes were made to improve model initialization requirements and to improve model run speed. None of these modifications affected the overall system representation. In all cases, the modified system made the model a more realistic representation of the network.

As is the case with most sewer system hydraulic models, RDII is simulated using a standard surface water hydrologic technique, or a rainfall run-off model. The observed behavior of an RDII hydrograph is very similar to a flood hydrograph. In *InfoWorks*, if a rainfall group is present, then the model attempts to simulate rainfall

dependent flow. The simulation uses runoff surfaces defined in the sub-catchment data. The model includes a total of 1,499 sub-catchments. Of these, 1,184 have basin areas defined. The remaining sub-catchments have been defined to provide commercial/industrial point flows from areas that overlap the other sub-catchments. The sub-catchments are shown in **Figure 2-3**.

The RDII process is simulated by generating runoff from a small portion of the sub-catchment. This can be observed by comparing the total sub-catchment area to the total runoff area. The runoff surfaces are defined to be 100 percent effective; therefore, the ratio of runoff area to sub-catchment areas is the percent of rainfall that is loaded into the sewer network. This proportion is known as the R-value of the sub-catchment. The R-value represents the fraction of rainfall that enters the sewer system.

It should be noted that several sub-catchments were configured to contain runoff surfaces defined to be less than 100 percent effective. These few runoff surfaces were modified to be 100 percent effective while their associated contributing area was simultaneously decreased so as to not alter the total contribution of RDII. These modifications were made to ease testing of rehabilitation alternatives and, because the overall RDII was balanced, do not alter model performance.

In the model provided by the City/Parish, runoff surfaces were provided for 1,184 sewer basins. The R-values for these basins ranged from 0.0047 to 0.68. The area weighted average is 0.061 and the median R is 0.053. R-values for a very tight/low leakage sewer system would be 0.01 or lower and for a leaky system are generally 0.04 or higher. A summary of select R-values is provided in **Appendix C**.

2.6 Design Storm Considerations

Historically, the source rainfall frequency data has been the National Weather Service document TP-40 published in 1961. Because the data records used to develop TP-40 ended over 50 years ago, the recent rainfall record in Baton Rouge was evaluated. A statistical analysis using techniques similar to TP-40 was performed on the Baton Rouge Metropolitan Airport rainfall records covering 1948 through 2003. In this analysis, the 2-year and 5-year frequency rainfalls were determined for various storm durations. Results of the analysis are summarized in **Table 2-5**.

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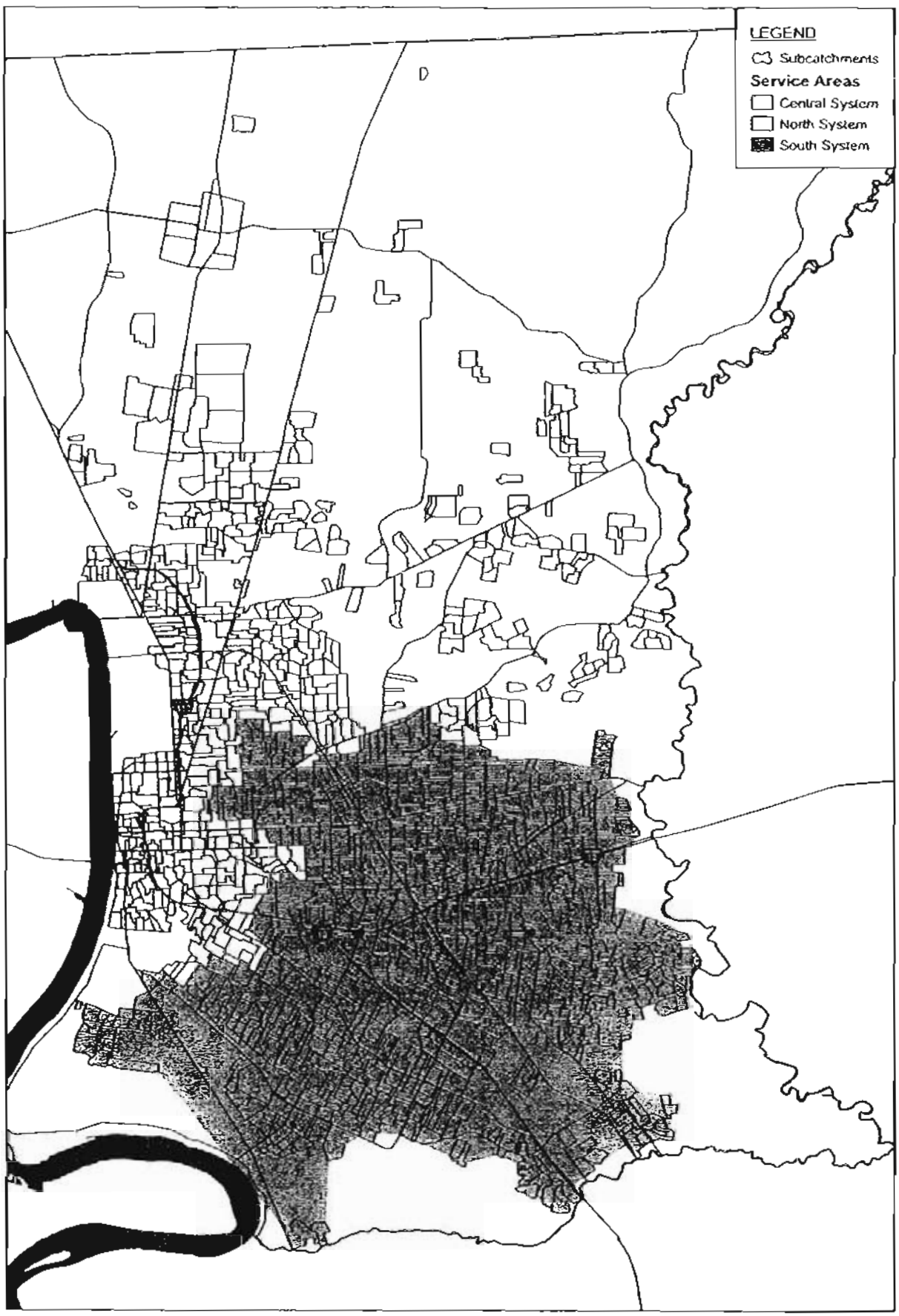


CDM

BATON ROUGE, LOUISIANA

System Subcatchments

Table 2-5
Rainfall Volumes Computed in the Current Study

Storm	Current Study Estimate (in.)
2-yr, 12-hour	4.02
2-yr, 24 hour	4.67
5-yr, 12 hour	5.62
5-yr, 24 hour	6.51

Section 3
Existing System Assessment

3.1 System Deficiencies

To be consistent with the previous modeling efforts, the existing system has been evaluated in *InfoWorks* using the 2-Year, 12-hour storm event. The *InfoWorks* system model represents about 15 percent of all gravity sewers and 24 percent of all pipes in the Baton Rouge collection system. The model includes virtually all system components that are 12 inches in diameter or larger.

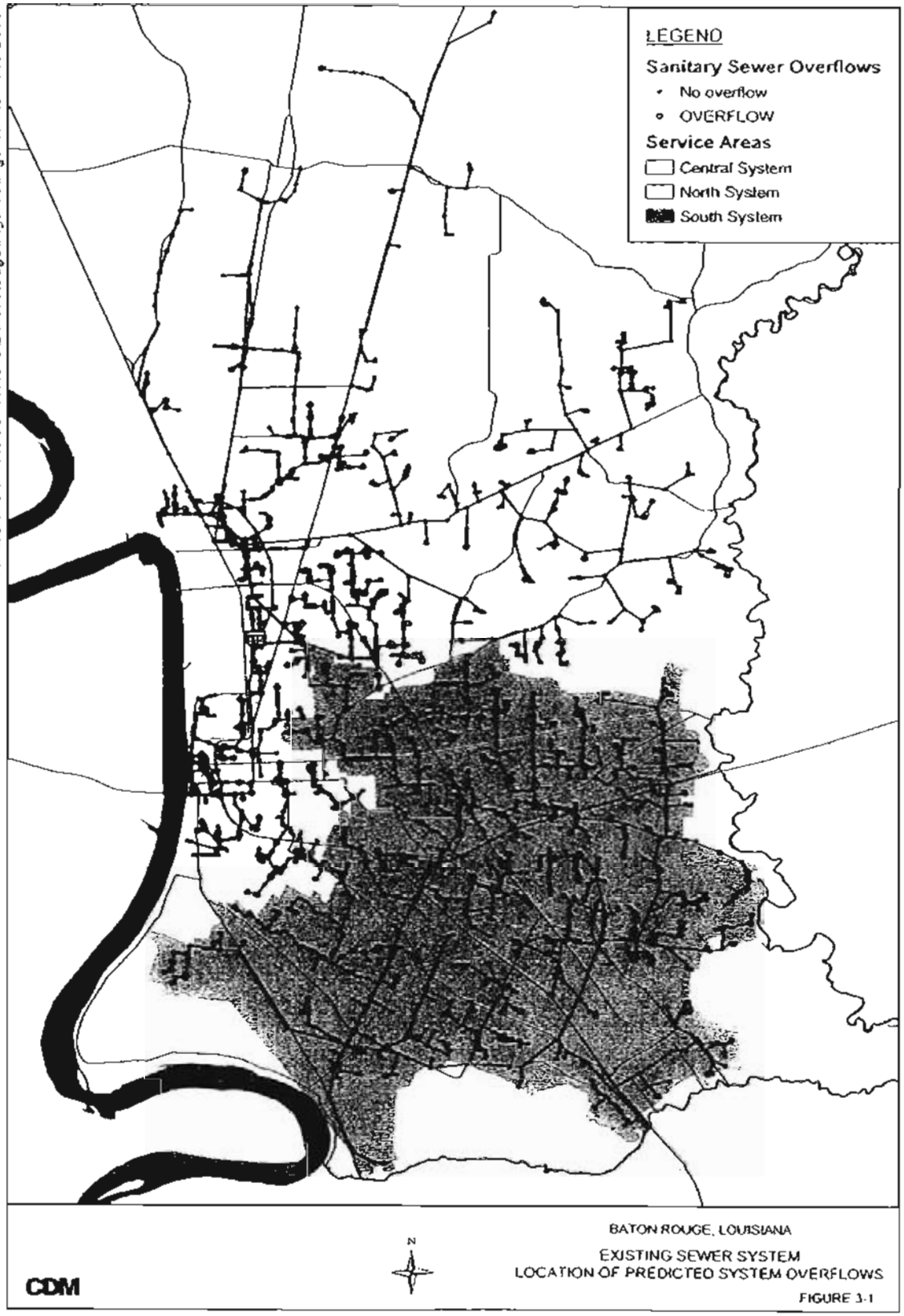
Nearly every neighborhood in Baton Rouge is served by a network of 8-inch sewers that drain to a pump station. Of the more than 400 pump stations in the Baton Rouge network, 296 are represented in the model. The primary gravity lines serving each local or neighborhood pump station are also included in the model. These local gravity lines account for much of the 54 miles of 8-inch sewer that have been included in the computer model.

Overflows in Baton Rouge are caused by leaky sewers and leaky private laterals that result in either insufficient pumping capacity or insufficient gravity sewer capacity. Based on the modeled storm event, there are capacity deficiencies severe enough to create overflows at 387 locations in the system. Because the model is a representation of the system which has been executed using an evenly distributed, stationary rainfall, it is important to recognize that the model is capable of indicating deficiencies and bottlenecks rather than predicting the actual locations and volumes of overflows. Thus, overflows in the model are used as an indicator of capacity deficiency rather than a means of identifying specific overflows.

Figure 3-1 shows the locations where overflows occur in the model. As shown, the system deficiencies are distributed throughout the collection system. There are capacity shortfalls in every major drainage network, and they occur in the remote lines as well as along the trunk collector sewers.

Overflows that occur in gravity lines upstream of pump stations generally indicate insufficient capacity at the pump station. Based on the model results, an estimated one hundred local pump stations lack sufficient capacity to drain the neighborhoods they serve. The remaining overflows indicate capacity deficiencies due to undersized gravity sewers. Without significant reduction in inflow and infiltration, overflows associated with capacity deficiencies may increase in number as the pump stations are improved because the upgraded pump stations will transmit more flow to downstream gravity lines and treatment plants.

Due to the age and poor condition of the collection system throughout Baton Rouge, a plan to reduce overflows must be regional and comprehensive. A comprehensive plan must account for project scheduling, location, and impacts from system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LEGEND
Sanitary Sewer Overflows
No overflow
OVERFLOW
Service Areas
Central System
North System
South System
N
BATON ROUGE, LOUISIANA
EXISTING SEWER SYSTEM
LOCATION OF PREDICTED SYSTEM OVERFLOWS
CDM
FIGURE 3-1

improvements. The impacts include increased flow in portions of the conveyance system that result from pump station and pipeline capacity increases.

The City of Baton Rouge/Parish of East Baton Rouge (City/Parish) wishes to develop a solution that focuses on fixing major portions of the existing infrastructure while minimizing construction of additional new facilities or in-system storage. Therefore, the remedial action plan first looked at reducing system inflows by rehabilitating and upgrading local sewers. Then, the plan addressed remaining deficiencies by upgrading existing sewer pipes and pumping stations. Finally, the treatment plants were evaluated to assure all the flow in the system is treated according to Louisiana Pollution Discharge Elimination System (LPDES) permit requirements. The following sections discuss the various options available for developing required solutions to the system capacity problems.

3.2 Potential Solutions

A primary objective of this study is to identify wastewater collection and transmission system improvements that will remove rainfall dependent infiltration and inflow (RDII) and convey future base wastewater flows and wet-weather flows without surcharging or overflows for the design storm event. The combination of high RDII flows and increased base wastewater flows due to population growth have resulted in system surcharging and sanitary sewer overflows (SSOs) within the existing City/Parish system. High rates of RDII have been observed in many areas of the City/Parish system, and previous studies have characterized RDII as severe. Consequently, a comprehensive rehabilitation program aimed at reducing RDII and improving local system performance is a major component of the recommended improvement program. In addition, increased sewer and pumping capacity will be required to accommodate some level of RDII during wet weather as well as dry-weather flow associated with growth. Growth is projected to occur in the outer portions of the City/Parish system, particularly in the south service area.

The following sections discuss the full range of system improvements that have been considered and integrated into the recommended improvement program, including comprehensive sewer rehabilitation to reduce RDII, trunk sewer system and pump station upgrades, reduction of peak wet weather flows through flow equalization, and treatment of excess flows at the wastewater treatment plants (WWTPs). A general discussion of each of these improvement alternatives is presented herein.

3.2.1 Sewer Rehabilitation

Sewer rehabilitation is an effective means of reducing peak wet-weather flows that may cause sewer overflows. Three general sewer rehabilitation approaches that can be implemented within the City/Parish sewer system are:

- Comprehensive rehabilitation of all sewers and service laterals located both within the public right-of-way and on private property.
- Comprehensive rehabilitation of sewers located within public rights-of-way only.

- Repair of structural defects in pipes and manholes and removal of major identified inflow sources.

The first and second approaches encompass a "comprehensive rehabilitation" approach, with the only difference being the limits of rehabilitation. A comprehensive rehabilitation approach consists of rehabilitation of sewer areas that do not meet I/I control standards. The third approach is a structural rehabilitation approach, repairing only specific defects that are identified through sewer system evaluation survey (SSES) work, and is focused more on SSOs resulting from structural problems rather than RDII. This approach does not include laterals and thus is not typically an effective method of reducing RDII.

A more detailed discussion of both the comprehensive sewer rehabilitation and structural rehabilitation approaches follows.

3.2.1.1 Comprehensive Sewer Rehabilitation Techniques

Comprehensive sewer rehabilitation programs have proven effective in other municipal systems at eliminating a large percentage of RDII, and are effective at reducing both the volume of RDII and the peak flows of RDII into the system. This is evidenced by the case studies summarized in the recent American Society of Civil Engineers (ASCE) and Environmental Protection Agency (EPA) guidance manual titled *"Sanitary Sewer Overflow Solutions"* published in April 2004, comprehensive rehabilitation has resulted in reductions of infiltration and inflow from between 50 to 80 percent. While comprehensive rehabilitation is typically aimed at reducing peak RDII flows, rehabilitation can also reduce groundwater infiltration (GWI) flows by 85 to 90 percent. A reduction of GWI would be beneficial during dry weather conditions to reduce daily flows and operational costs of pumping stations and at the wastewater treatment plant. In addition to RDII and GWI reduction, design of a comprehensive rehabilitation program includes repairing structural defects and maintenance problems within the system.

A comprehensive sewer rehabilitation program consists of replacing, lining, or otherwise rehabilitating all pipe within the study area; however, this approach is cost effective because of the resulting reduction in RDII, extended system life, and other system benefits. This is particularly true in areas of the City/Parish system that have been identified as having high RDII rates based on a review of flow monitoring information and hydraulic modeling simulations.

There are several issues that must be addressed in a comprehensive rehabilitation program. For example, a comprehensive rehabilitation program including all sewer mains may not meet RDII reduction goals if a large percentage of RDII is entering through defective service laterals. Consequently, the need for private-side and public-side lateral rehabilitation must be considered as a component to this program.

Point repairs to address severe structural or maintenance problems (e.g., collapsed pipe and sags) are required prior to comprehensive sewer rehabilitation and will

differ depending on the sewer rehabilitation technique used. Rehabilitation of manholes within the system must also be considered.

Comprehensive sewer rehabilitation techniques include pipe bursting and lining. Each of these techniques is discussed below.

Pipe Bursting

Pipe bursting involves inserting a pneumatic, hydraulic, or mechanical wedge into the pipe. The wedge is then expanded in the existing pipe, fracturing the walls of the pipe and pushing the pieces into the surrounding soil. A new pipe is jacked into the place directly behind the wedge. The new pipe is either high density polyethylene (HDPE) with welded joints or short-jointed and thick-walled with in-wall joints (joints with no bells), which facilitates installation of the new pipe from an existing manhole access. With pipe bursting, the hydraulic wedge is guided by the existing pipe and therefore, the new pipe will follow the grade of the existing pipe.

Existing sewers that are free of sags or other hydraulic problems are the most appropriate for this technique. Pipe of the same or greater diameter than the existing pipe may be installed. Prior to pipe bursting, service laterals must be open excavated and disconnected in order to avoid destroying them with the hydraulic wedge. Depending on the type of pipe bursting technology used, there is the potential to harm adjacent utilities; therefore, care must be exercised in the selection of the type of equipment to be used when other utilities are located near the sewer.

Lining

CDM's broad definition of lining includes all rehabilitation techniques where a smaller diameter pipe is inserted, installed, or constructed inside of the existing sewer pipe. A wide variety of techniques fall within this category that are generally distinguished by the type of liner used. The variations in lining techniques include slip-lining, cured-in-place lining, and fold-and-form lining. These techniques offer the advantage of requiring little or no excavation for installation, and are therefore most suitable for pipes where aboveground obstructions exist or where very deep excavation would be required to replace the pipe. Lining also allows minimal disruption to traffic where sewer lines are located within public roads. Sewers must be cleaned and obstructions such as roots or protruding service connections must be removed prior to insertion of the liner. If all obstructions cannot be removed with conventional cleaning and cutting equipment, then excavation is necessary at those specific locations.

Slip-lining

Slip-lining involves inserting a pipe of a slightly smaller diameter into the existing pipe, usually from an excavated insertion pit. The liner pipe must be flexible and is commonly made of HDPE, fiberglass, or polyvinyl chloride (PVC). Liner pipe joints

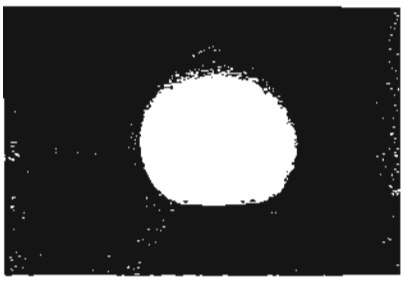
are heat-fused or gasketed, with heat-fused joints having the advantage of allowing the liner pipe to be closer in diameter to the existing pipe. The liner pipe is inserted by excavating an insertion pit at the center of the length of existing pipe. From this pit, the liner pipe may be inserted in both directions. The liner pipes are typically pulled through the sewer pipe with the assistance of a winch assembly that is installed in the adjacent manhole. Because pulling the liner pipe often causes it to elongate, the pipe must be allowed to contract to its original length before service connections and seals to manholes are made. Alternatively, the liner can be installed by pushing the liner pipe into the old pipe, using a sling or jacking assembly to avoid damage to the liner pipe.

CDM recommends that the void left between the existing pipe and the new pipe be filled with grout. If slip-lining is used without filling voids between the liner and the existing pipe with grout, less structural benefit is gained from the liner, and future loading increases to the pipe may result in failure. The annular space should be grouted in order to ensure the long-term strength of the newly lined pipe. The annular space should be at least two inches (50 mm) in order for grouting to be effective.

Once the slip-liner is in place, service connections must be made to the liner pipe. This must be performed by excavating each service connection, breaking through the outside pipe, and then making a connection to the slip-liner pipe by use of sidewall heat fusion or tapping saddles.

Cured-in-Place Lining

Cured-in-place lining (inversion lining) consists of a felt, fabric, or fiberglass lining that is impregnated with resin and becomes rigid through thermal activation (curing).



The liner typically is inserted in an inverted fashion into the existing pipe using water pressure. Once the liner is inserted, it is cured with the use of hot water or hot air that causes the liner to become rigid. The resulting liner is seamless and jointless. Service connections are made by excavation and the installation of a tapping saddle or equivalent watertight connection. Cured-in-place lining is a relatively quick method of rehabilitation and generally requires only 24 to 48 hours of bypass pumping of wastewater flows. Cured-in-place linings can be designed to handle structural loads, if necessary, where the existing pipe has structural defects or where additional loads are expected in the future.

Fold-and-Formed Pipe Lining

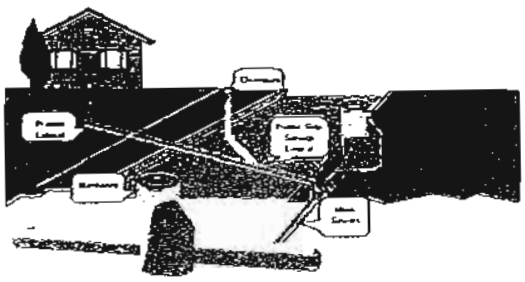
Fold-and-formed pipe lining is similar to slip-lining, except that the liner pipe is deformed in some manner to aid insertion into the existing pipe. Depending on the specific manufacturer, the liner pipe may be made of PVC or HDPE. One method of deforming the liner is to fold it into a "U" shape before insertion into the existing pipe. The pipe is then returned to its original circular shape using heated air or water, or using a rounded shaping device or mandrel. Ideally, there will be no void between

the existing pipe and the liner pipe after expansion of the liner pipe with the shaping device. For the "U" shape liner, the resulting pipe liner is seamless and jointless.

Most lining techniques have had very good reliability with proper installation. Slip-lining and cured-in-place lining techniques have been used extensively throughout the United States, and the fold-and-formed technique has been used throughout the country with success.

3.2.1.2 Private Lateral Rehabilitation

To achieve the desired RDII reduction as part of the City/Parish program, it is expected that rehabilitation and repairs will be required on private property in some areas. The recommended approach for the City/Parish to take in areas where RDII reduction is targeted is to begin with comprehensive rehabilitation of the public sewer system as described above, including the service laterals up to the property line. In areas where this approach does not achieve the desired level of RDII reduction or in areas where there are known significant sources of RDII on private property from system investigations, additional rehabilitation of the remaining service laterals on private property will need to be performed.



Rehabilitation of lateral sewers on private property may be accomplished using the same types of rehabilitation techniques as described previously. Trenchless techniques such as pipe-bursting are particularly applicable in areas where residents or businesses may have extensive landscaping or other surface conflicts that would make open cut excavation expensive or undesirable.

The City/Parish currently has a sewer ordinance in place that provides the authority to require customers to remove sources of extraneous flow from the sanitary sewer system and to maintain the private lateral. The ordinance creates a system for notice and an order by the City/Parish to trigger the repair. Customers who fail to do so can be subject to fine and property liens. The City/Parish has the authority to perform the repair where the private landowner fails to do so. The City/Parish is currently researching a number of approaches to assist private landowners and to streamline the program without having to use enforcement action, but such authority is available where needed. The City/Parish also has an assistance program for persons who cannot afford repairs. See http://www.brgov.com/dept/ocd/housing/sewerweb.htm.

Excerpts of the applicable portions of the City/Parish ordinance related to this issue follow:

> **Sec. 2:308. Duty of owner.**
> (a) It shall be the duty of all owners of improved premises which have been tied in and connected to the operating sanitary sewage system, as hereinabove provided, to maintain the service line on the premises or within a servitude in favor of the premises up to the sanitary sewerage system which has been accepted and

maintained by the city-parish. It shall also be the duty of such owners to close any opening that allows the drainage of surface water into the sanitary sewer system. It shall only be the duty of the city-parish to maintain that portion of any service line located in a right-of-way dedicated to the public.

(b) Any person who violates the provisions of subsection (a) above shall be fined not more than five hundred dollars ($500.00) for domestic users and one thousand dollars ($1,000.00) for nondomestic users or imprisoned for not more than thirty (30) days, or both, at the discretion of the court.

(c) Any person who violates the provisions of subsection (a) above may be subject to the following:

(1) When the director of public works, or his representative, upon evidence establishing more probably than not that the provisions of subsection (a) above have been violated, the director of public works, or his representative, shall send notice personally or by certified mail that the person who violates the provisions of subsection (a) shall begin to make efforts to remedy such violation within ten (10) days, and steadily and without delay continue such efforts to remedy such violation under the monitoring of the director of public works, or his representative. If the certified letter is not claimed or if no effort is made to remedy such violation of the provisions of subsection (a) above within ten (10) days upon receipt of the letter, or upon reasonable notice, suit shall be filed requiring the remedy of the violation of the provisions of subsection (a) above and authorizing fines up to five hundred dollars ($500.00) a day for domestic users and one thousand dollars ($1,000.00) a day for nondomestic users in which no efforts are made toward remedying such violation. Said suit may recover reasonable attorney's fees, court costs, court reporter's fees, and other expenses of litigation against the person who violates the provisions of subsection (a) above.

(2) Where in the perception of the director of public works, or his representative, that public health will be threatened by the delays involved in the proceeding, as provided in the above paragraph, injunctive relief shall be permitted.

(3) Where immediate action is required to avoid a threat to public health, the director of public works, or his representative, may act to remedy such violation of subsection (a) above and seek damages from the person committing the violation of subsection (a) above. Fines up to five hundred dollars ($500.00) a day for domestic users and one thousand dollars ($1,000.00) a day for nondomestic users until the threat to public health is abated, and costs incurred in remedying such violation of subsection (a) above may be recovered. Also, said suit may recover reasonable attorney's fees, and other expenses of litigation against the person who violates the provisions of subsection (a) above.

(4) If the director of public works, or his representative, acts to remedy such violation of subsection (a), or if the owner is an absentee or has no known mailing address, the director of public works, or his representative, shall then cause the necessary work to be done to effect compliance with the provisions of this section at the owner's expense; and the director of public works, or his representative, may have such work done either with the personnel and equipment of his department, or by means of a contract with a third person; except that if the work is done by private contract, the work shall only be done after advertisement for bids in accordance with the purchasing regulations.
(5) Upon completion of such work, the director of public works, or his representative, shall cause to be prepared and filed with the recorder of mortgages of this parish a certificate showing the cost of such work, a penalty of ten (10) percent thereof or fifty

dollars ($50.00), whichever is greater, the name of the owner and a description of the property involved. The certificate shall operate from the date of filing as a tax lien or assessment on the property affected. This lien shall prescribe only in ten (10) years from the date of filing such certificate, may be enforced in a summary manner as other tax liens or assessments, and shall be subject to the same penalties, interest and attorney's fees.

(6) Upon the filing of this certificate, the director of public works, or his representative, in writing shall advise the director of finance and the parish attorney thereof; and the latter shall institute suit or take such other steps as may be required or necessary for the enforcement of such lien.

(City Ord. No. 4791, 10-27-82; Parish Ord. No. 5998, 10-27-82; Ord. No. 10069, § 1, 11-9-94; Ord. No. 10440, § 1, 9-13-95; Ord. No. 11568, § 1, 10-13-99)

Sec. 2:309. Violation and penalties.
(a) It shall be prohibited for anyone to create an opening into the sanitary sewer system that will allow the flow of surface water into said system, and any such opening is declared to be a nuisance detrimental to the public health and safety and as such, a misdemeanor, punishable as provided in subsection (b).

(b) Anyone who creates such an opening shall be guilty of a misdemeanor, and shall, upon conviction thereof, be punishable by a fine of not more than five hundred dollars ($500.00) for domestic users and one thousand dollars ($1,000.00) for nondomestic users or imprisonment for not more than thirty (30) days, or both, at the discretion of the court.

(Ord. No. 11569, § 1, 10-13-99)

The City/Parish has researched a number of private lateral rehabilitation programs across the country to determine program elements that have been effective. A key consideration of a program to address private sewer lateral rehabilitation in the State of Louisiana is that Article 7, § 14 of the Louisiana Constitution prohibits "the use of public funds, credit, property, or things of value of the state or of any political subdivision as loans, pledges, or donations to or for any private person, association, or corporation." However, there are exceptions to this prohibition, including an exception that allows "the use of public funds for programs of social welfare for the aid and support of the needy." Further, the Louisiana Attorney General provided the City/Parish with a formal opinion indicating that the City/Parish can make repairs to private property and then seek to recover the costs through its legal authority under the ordinances above. The same opinion as well as the jurisprudence also indicates that if the City/Parish is legally obligated to provide something of value, such is not contrary to the Constitution.

Thus, there are a number of potential alternatives that the City/Parish can use to accomplish private system rehabilitation both under its existing ordinances/program and under potential amendments. The City/Parish is committed to using and enhancing its existing program by improving its public education program such as through updates to websites and/or mail-outs with sewer user bills and through including additional information with the 10 day notice letters to private landowners

such as lists and contact information for certified plumbers. The City/Parish will also work with the Community Development organization to improve the process of securing financial aid under the Sewerline Assistance Program noted above.

The City/Parish is also committed to reviewing and discussing with the Metro Council for potential adoption a number of the options reviewed from other communities and options allowed under the Attorney General's opinion. Some of these potential mechanisms are discussed below.

First, as the Constitution contains an exemption to the "public purpose" doctrine for assisting needy residents, the City/Parish will consider and evaluate an amendment to the ordinances to create such an exemption. For example, public funds could pay for the repairs of residents who met a specifically defined and consistently applied criteria to determine whether they were needy. A process could be developed to create a form response to a 10 day notice letter of required repair work which could allow the recipient to certify that it meets the criteria for this exemption.

Second, the City/Parish may consider proposing to the Metro Council an amendment addressing improvements to the system for recovering the cost of work it performs. Currently, a lien is required, along with a lawsuit for collection. A potential amendment would consist of allowing the private owner to authorize the City/Parish to perform the work and then collect reimbursement through additions to that person's monthly sewer user bill, potentially even beginning at the point of receipt of the 10 day notice.

Third, the City/Parish could explore ways to use funds that are not considered to be public. For example, sewer customers could be charged "insurance" through the existing sewer user fee program on a monthly basis that would go toward a self-funded program of repairing private laterals that were found to be defective. This funding mechanism could be administered by the City/Parish or a selected trustee, but would remain as private funds in a separate pool maintained solely for the purpose of rehabilitating private laterals. Several insurance systems of this type have been adopted by other states. The City/Parish will review the efficacy of these existing programs for possible proposal and consideration by the Metro Council.

A fourth potential option involves the use of funds for which the City/Parish is legally obligated to pay. We are aware that at least two other municipalities have performed Supplemental Environmental Projects (SEPs) as part of Consent Decrees with EPA that have consisted of funding pilot programs for private sewer repair. A possibility the City/Parish may consider is proposing to resolve outstanding stipulated penalties under the Consent Decree through performance of a Supplemental Environmental Project to fund private sewer lateral repair within specified priority basins. Because the City/Parish is legally obligated to pay the stipulated penalties or to satisfy them with a SEP, such expenditure should not contravene the constitutional requirement.

A final possibility would be for the City/Parish to seek special legislation that would clarify or amend the existing Constitutional provisions so as to allow the use of public funds for the repairs of private service laterals. Because this is becoming a significant issue at the state and national levels, this special legislation may find solid support.

A summary table that contains information on private service lateral policies and programs from other communities around the country is provided in **Appendix D**. This table is presented as evidence that this issue has been and can be successfully addressed by a number of alternative means. Based on its existing authorities, the City/Parish is confident that it can successfully reduce the RDII contributions from private property to a level that meets the RDII reduction targets of the recommended plan. The adoption of additional enhancements may make these targets more easily achievable, and the City/Parish intends to evaluate these additional options. An article discussing private sewer lateral rehabilitation is also provided in **Appendix D**.

3.2.1.3 Sewer Rehabilitation Cost and RDII Reduction

Sewer rehabilitation costs vary widely depending upon the site-specific sewer conditions and the selected sewer rehabilitation approach and technique, as shown in **Table 3-1**. The costs reflect rehabilitation of 8-inch diameter sewers (which is the typical collection sewer size) and are based upon recent regional bid tabulations and manufacturer quotations.

Table 3-1
Cost Estimate for Sewer Rehabilitation

Rehabilitation Approach	*Estimated Cost ($/LF)*
Comprehensive rehabilitation of all sewers within both public rights-of-way and on private property	$90 - $120
Comprehensive rehabilitation of all sewers located within public rights-of-way only	$70 - $100
Structural rehabilitation - removal of major identified inflow sources, repair of structural defects in pipes and manholes	$10 - $60

3.2.1.4 Structural Rehabilitation Approach

Point repairs are an important element of any sewer rehabilitation program. A point repair program will contribute to meeting the three "common" sewer rehabilitation objectives: eliminate RDII sources (limited), correct structural problems, and correct alignment and maintenance problems. Defects that are identified during SSES work that can be corrected using point repairs include:

- Replacing structurally defective pipe segments
- Repairing defective lateral connections (hammer taps)

- Removing roots from joints
- Repairing offset joints
- Repairing sags in pipes or pipe joints
- Replacing and/or repairing defective manholes and manhole casings
- Removing other major inflow sources such as storm water connections

Performing point repairs will meet the rehabilitation objectives of repairing structural defects and maintenance concerns within the system. However, it has been found that significant RDII reduction is typically not achievable through a point repair program alone. Therefore, for the City/Parish program, it is recommended that a comprehensive approach be used where RDII reduction is the primary objective. A structural rehabilitation approach may be used where localized rehabilitation is needed to correct structural or maintenance deficiencies.

The primary drawback to a point repair rehabilitation program for RDII is migration. Construction techniques using trenching and/or stone bedding for sewer pipe encourage migration by providing a path for groundwater to follow. Unless all defects within a reach of sewer are found, RDII will migrate from the location of the repaired defect to an adjacent defect. It is very difficult to find all defects within a sewer system, even if every foot of pipe is inspected by closed circuit television (CCTV). Based on past projects, it has been found that a rehabilitation program that relies on point repairs alone can result in an RDII volume reduction on the order of 0 to 25 percent, and RDII peak reduction of 0 to 10 percent. To ensure that all defects are corrected within a reach of sewer and to achieve higher levels of RDII reduction, a comprehensive rehabilitation approach must be used.

3.2.2 Trunk Sewer System Improvements

Trunk sewer system improvements can increase the hydraulic capacity of existing pipelines prone to surcharging, thereby reducing overflows associated with insufficient transmission capacity. These improvements also offer the benefit of providing additional dry-weather wastewater conveyance capacity to accommodate future growth in a service area. Trunk sewer improvement alternatives include (1) replacement or relief sewers and (2) sewer "pressurization." Each of these options is described below. Because trunk sewer system improvements will result in increased downstream wet-weather peak flows, downstream sewer system improvements (additional trunk sewer capacity, pump station upgrades, plant equalization, and plant improvements) may be required in conjunction with upstream improvements.

3.2.2.1 Replacement and Relief Sewers

Replacement or relief sewers are typically required to convey projected dry-weather flows that exceed existing trunk sewer capacity. In addition, SSOs can be eliminated

by constructing replacement or relief sewers designed with increased capacity to effectively convey peak wet-weather flows.

Relief sewers may be constructed parallel to an existing trunk sewer, or along an independent route designed to bypass areas that are hydraulically limited. Relief sewers may be designed as on-line or off-line systems. On-line relief sewers would convey both dry- and wet-weather flows. On-line relief sewers should be designed to ensure that minimum hour dry-weather flow velocities are maintained above 2.0 feet per second to prevent solids deposition and resultant odor and maintenance problems. Off-line relief sewers are only used during wet-weather conditions. Flow into off-line relief sewers can be controlled hydraulically via a fixed weir or junction box, or mechanically using a power-operated gate or similar device. In addition to providing necessary wet-weather conveyance capacity, relief sewers can increase sewer maintenance flexibility by allowing one sewer line to be removed from service (without bypass pumping).

Replacement sewers may be preferable to relief sewer construction if the existing trunk sewer is in poor condition or if construction easement limitations and/or land acquisition requirements preclude cost-effective relief sewer construction. However, replacement sewer material costs are typically higher than relief sewer costs since the replacement sewers need to be sized larger to offer equivalent capacity as parallel sewers (existing and relief sewer). In addition, the need to maintain sewer flow during replacement sewer construction may necessitate special construction procedures (e.g., bypass pumping) that can significantly increase costs.

3.2.2.2 Sewer Pressurization

Sewer pressurization can increase the hydraulic and storage capacity of existing trunk sewers (and eliminate localized overflows) by increasing the hydraulic grade line in the reach until the sewer is surcharged. Typically, manholes along the reach are either sealed or raised to allow the sewer to be surcharged during peak wet-weather conditions without creating an overflow situation.

Sewer pressurization is not a conventional improvement, and potential impacts should be carefully considered on a case-by-case basis. The structural integrity and design of the sewer in question must be carefully checked to ensure that it can withstand the anticipated increase in pressure. It is equally important that the hydraulics be carefully considered to ensure that the higher water level does not cause sewage backups into homes or other connected systems, and that the backwater does not reduce upstream carrying capacity. It should be noted that if manhole inverts are formed to convey flow from one-half of the pipe depth, then pressurization may not increase hydraulic capacity because of significant entrance and exit losses. To achieve this benefit the channel must be reconstructed for conveyance of flows that will fill the pipe. If these criteria are met, sewer pressurization can be one of the most cost-effective means of eliminating localized overflows and increasing hydraulic carrying capacity and in-line storage.

3.2.3 Pump Station Improvements

The sewer system model was evaluated with sewer system line improvements to reduce the R-values; however, the model indicates overflows will occur even with sewer system rehabilitation if additional capacity improvements are not made. Capacity upgrades to the City/Parish existing pump stations or the construction of new pump stations will be required to convey wet-weather flows and to prevent overflows upstream of the pump station. The model indicates most pump station capacity improvements of less than 12 million gallons per day (MGD), with a large percentage requiring upgrade of less than 1 MGD. In the South service area, the model indicates several pump stations require significant capacity increase.

There were also a number of pump stations included in the model that could not overcome the system head required to allow the pump stations to pump into the system. It is difficult to assess the improvements required to allow all the pumps stations to operate; therefore, detailed field investigation of each pump station is required prior to determining the specific improvements required for each pump station. Improvements may require minor adjustments, or may require pump, motor or impeller replacement.

3.2.4 Flow Equalization

Flow equalization facilities offer a means of reducing or eliminating wet-weather overflows by storing peak flows in excess of the sewer capacity. Flow equalization can be effective in reducing localized overflows, as well as upstream and downstream overflows (by reducing the hydraulic grade line elevation upstream, and by reducing downstream peak flow rates). Flow equalization can be constructed within the sewer system (in-system) or at pump stations and wastewater treatment plants. Flow equalization basins sited at plants can also be used for dry-weather diurnal equalization to dampen daily flow fluctuations and improve treatment performance.

Flow equalization storage can be designed and operated either as on-line or off-line facilities, as discussed below.

3.2.4.1 On-Line Flow Equalization

With on-line flow equalization facilities, flow is continuously routed through the system (during both dry- and wet-weather), and storage is reserved for wet-weather events. On-line flow equalization can be achieved by replacing a portion of an existing sewer with a larger sized conduit, or by constructing a parallel conduit to provide additional storage capacity. Flow into and out of the on-line flow equalization system is by gravity, and wet-weather flow equalization can be regulated by the downstream hydraulic grade line or by a physical control device. Alternative control devices include rate-of-flow control valves, regulators, orifices, and inflatable dams. The volume of flow equalization available from on-line facilities is proportional to the length of the structure; and therefore, correction of large overflows may necessitate construction of long conduits. Odor control in flow equalization facilities is an issue that must be considered.

3.2.4.2 Off-Line Flow Equalization

Typical off-line flow equalization facilities include equalization basins. Flow equalization basins typically consist of lagoons, tanks (below-ground or above-ground), and box culverts sized to store peak wet-weather flows that cannot be accommodated by the sewer system. A flow diversion chamber or pump station is required to divert peak flows from the sewer to the flow equalization tank. It is good design and operating practice to segment the tank into multiple cells and fill the tank one cell at a time. This approach minimizes the tank area to be cleaned after the wet-weather event, and can expedite tank draining by gravity. The basins can be covered and provided with odor control systems to reduce public nuisance potential. Tank mixing systems are also frequently provided (mixers, blowers, pumps) to keep solids in suspension and minimize clean-up and odor potential.

3.3 Wastewater Treatment Plant Evaluation

As part of the model verification and development of the Revised Remedial Action Plan (RMAP2), the three wastewater treatment plants were evaluated based upon peak flows projected to reach the plants and historical impact from wet weather events.

3.3.1 Results of Hydraulic Modeling Related to the WWTPs

Hydraulic modeling results for peak flows at each of the wastewater treatment plants are shown below. The current peak 1-hour design capacity for each treatment plant along with the expected peak 1-hour flows for each treatment plant following program completion are show in Table 3-2, below.

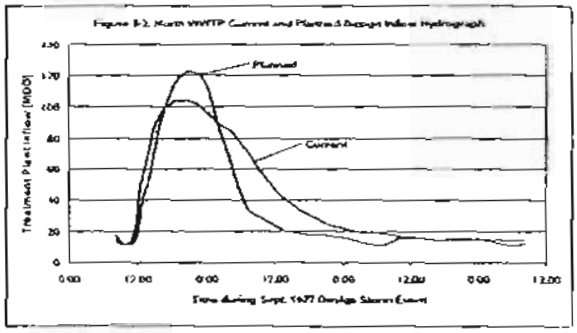
Table 3-2
Treatment Plant Capacity and Expected Peak Flow

Treatment Plant	*Current Peak Hour Design Capacity (MGD)*	*Peak Hour Flow Expected (MGD)*
North WWTP	130	125
Central WWTP	65	62
South WWTP	120	273

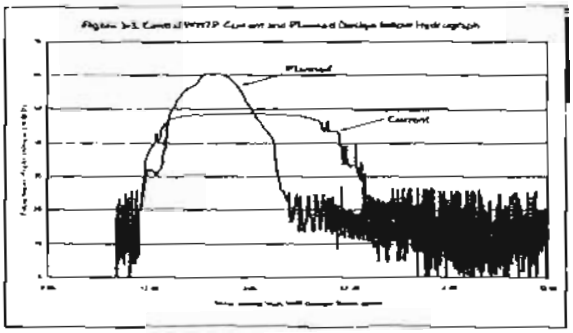
The peak flows predicted by the model for the North WWTP and Central WWTP are slightly less than the plants' current treatment capacities; therefore, the two plants have adequate treatment capacity. The flows predicted for the South WWTP are significantly above the capacity of the plant and cannot be managed through pump station and flow control.

Flow hydrographs for each treatment plant are presented below. These hydrographs clearly illustrate the wet-weather flow impacts at the South WWTP.

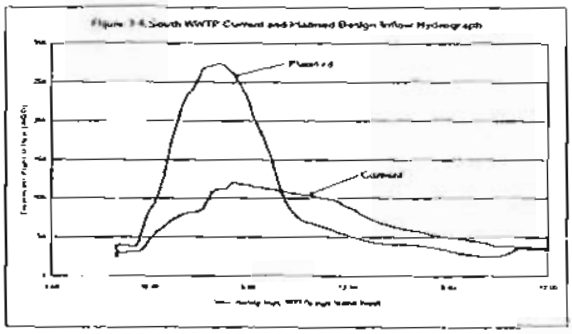
North WWTP Hydrograph



Central WWTP Hydrograph

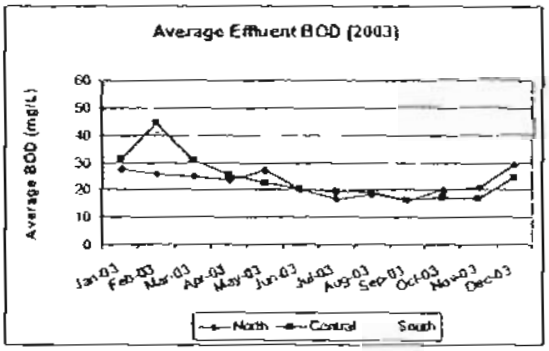


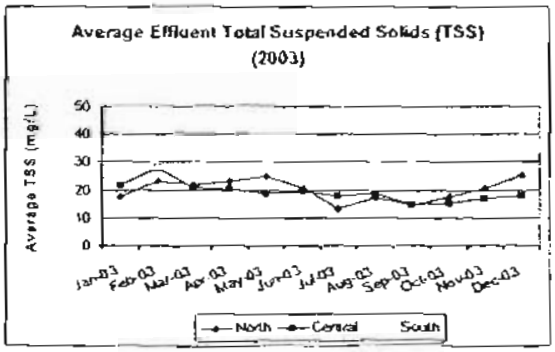
South WWTP Hydrograph

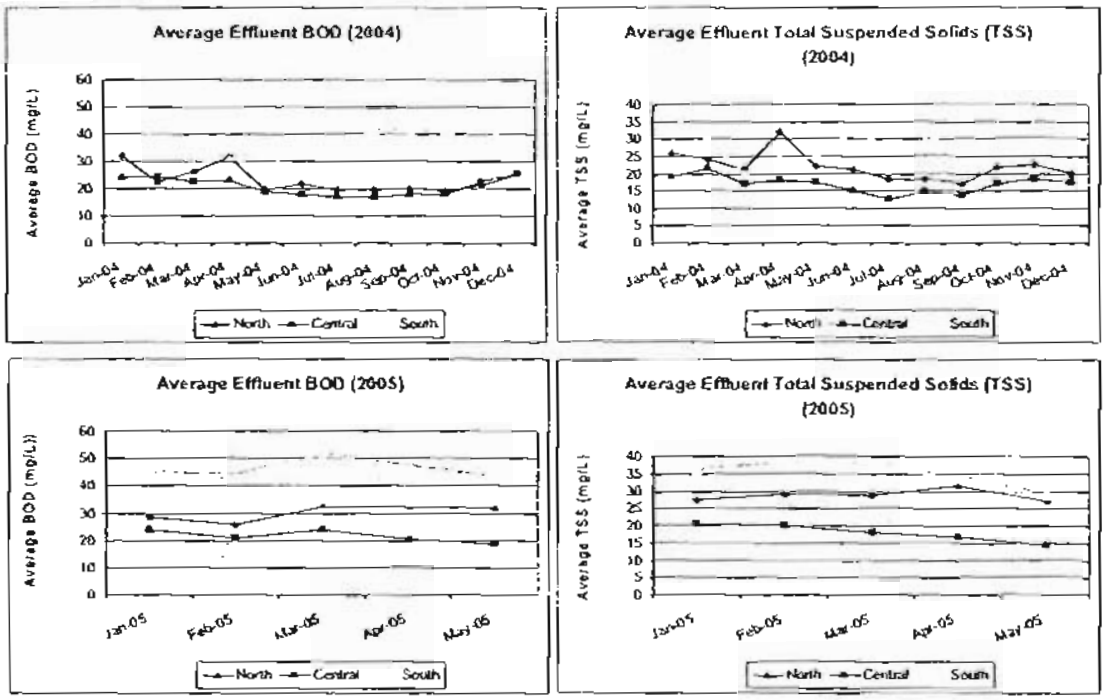


3.3.2 WWTP Effluent Quality

The six (6) charts below show the 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) concentrations in milligram per liter (mg/l) leaving each wastewater treatment plant for the years 2003 through May of 2005.







The Louisiana Pollution Discharge Elimination System (LPDES) permit limits for the 30-day average for 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) is 30 milligrams per liter (mg/l). The one week average for BOD_5 and TSS is 45 mg/l. The effluent quality data shows that the North WWTP and Central WWTP have consistently met their LPDES permit discharge limitations. However, the South WWTP continues to be in violation of its discharge permit for BOD_5 and TSS parameters.

Since the flows to the South WWTP under this plan will be increased, the plant was evaluated as part of this project to determine what could be done to enable the plant to handle peak flow conditions and to meet its discharge permit requirements.

3.3.2.1 Evaluation of South WWTP

On July 6, 2005 representatives from CDM met with wastewater treatment plant operations staff and toured the South WWTP. The following areas of the plant were listed by plant personnel as problem areas.

- *Bar Screens* - Inadequate bar screens are causing damage and downtime to all downstream equipment (i.e., grit removal equipment, primary clarifier equipment, trickling filters and sludge digesters).

- *Grit Removal* – The interior walls of the grit basin have structurally deteriorated from hydrogen sulfide (H_2S) corrosion. The basins are undersized for the flows they currently receive. The grit classification equipment is worn and the air headers and electrical wires are badly corroded.

- *Influent and Primary Effluent Control* – The flow into the plant is erratic and causes "spikes" of flow through the plant. The South WWTP receives flow from two separate systems, the South gravity system (SCSD) and the South pressure system (SSTN). At these two systems peak during wet-weather events, the plant receives considerable flow increases. These "spikes" of flow to and through the plant cause operational problems such as sludge pop-ups in the clarifiers. The spikes also damage equipment such as the primary clarifiers and trickling filter rotary distributors.

- *Primary Clarifiers* – Due to inadequate screening, Primary Clarifiers 1 and 2 get damaged from rags and other debris that hangs up on the equipment. Basins 3 through 6 are badly worn from grit and rags. Staff has problems obtaining replacement parts.

- *Trickling Filters* – There is limited recirculation available for the trickling filters. The trickling filters are sources of snails, which cause problems to downstream equipment. The trickling filter media gets plugged with debris and grit. Spikes in flow cause erratic treatment.

- *Secondary Clarifiers* – The secondary clarifiers are loaded with snails, which plug sludge lines and create inadequate capacity for sludge removal.

All of the above problems have a direct or indirect affect on overall performance of the South WWTP and should be addressed as part of any recommended improvements at this plant. Modifications to correct these operational issues will enhance the ability of the plant to operate within LPDES permit discharge limits.

Section 4
Improvement Plan

Using the system model described in Section 3, input from City of Baton Rouge/Parish of East Baton Rouge (City/Parish) operations and engineering staff, and an alternatives evaluation process, a revised sewer system improvements program was developed for the North, Central, and South wastewater treatment plant service areas. The alternatives evaluation included an iterative process of simulating the rainfall dependent infiltration and inflow (RDII) reduction benefits of various levels of comprehensive sewer rehabilitation in each of the service areas. The required system capacity and treatment upgrades were determined to control overflows for the design condition for each rehabilitation level. Through this iterative process, the best balance of comprehensive sewer rehabilitation and other system capacity upgrades was determined to meet the City/Parish system performance and cost-effectiveness objectives.

The recommended program strategy is to conduct comprehensive rehabilitation of the sewer system in all areas where the RDII rate currently exceeds 10 percent of the rainfall volume (i.e., the system R value exceeds 10 percent). This will result in significant reductions in wet-weather flows throughout the City/Parish system, thus improving system performance and controlling system overflows and house back-ups. In addition, the comprehensive rehabilitation program will provide substantial additional benefits in terms of reduced operation and maintenance costs as well as improved structural integrity.

The recommended improvements program includes three categories of improvements. The rehabilitation in each of the basins with R values in excess of 10 percent is considered part of the Category 1 improvements, which also includes minor pump station modifications needed to boost their pumping head (i.e., new impellors, larger motors, piping modifications).

Sewer and pump station improvement plans were devised to resolve all remaining conveyance deficiencies in each basin. The pump station and conveyance system improvements include capacity increases to the stations and piping. The pump station and conveyance system improvements are referred to as Category 2 improvements.

The models of the improved collection systems were also used to develop predicted hydrographs of flows to the treatment plants during the design storm condition once the improvements are in place. Improvements to provide flow equalization and wastewater treatment enhancements are referred to as Category 3.

4.1 Category 1: Comprehensive Sewer Basin Rehabilitation and Pump Station Upgrades

Based upon sewer system model results and flow monitoring, numerous basins within the Baton Rouge system require comprehensive rehabilitation. The basins identified through the system model are scheduled for rehabilitation based upon the

modeled R-values. The implementation schedule and preliminary opinion of probable construction cost is discussed in Section 5.

The first group of basins scheduled for rehabilitation are those with the highest existing R-values. Figures 4-1, 4-2, and 4-3 show the basins with high R-values for each service area and scheduled for comprehensive rehabilitation. The Central area R-values indicate the sewer lines in this area are generally in worse condition than other areas of the City's system. A greater portion of the Central system requires rehabilitation than other systems, likely due to the age of the system and service connections. Cross-connections may also be more likely in the older, congested area. The South system is generally in significantly better condition than the other systems; hence a lower percentage of the system requires rehabilitation.

Category 1 also provides for pump station inspection and mechanical improvements at select pump station to allow for head increase. Figures 4-4, 4-5, and 4-6 show the pump stations that require mechanical improvements to allow adequate pumping into the system. These improvements include assessing and potentially making mechanical upgrades to 43 pump stations in the North CSD area, three pump stations in the Central CSD area, and 41 pump stations in the South SCD/STN area. The assessment of the pump stations will determine specific improvements required to allow each pump station to operate against the system head. Improvements may include replacement of impellers, motors, pumps, and/or piping and will be determined for each station during design.

4.2 Category 2: Pump Station and Transmission/Conveyance System Improvements

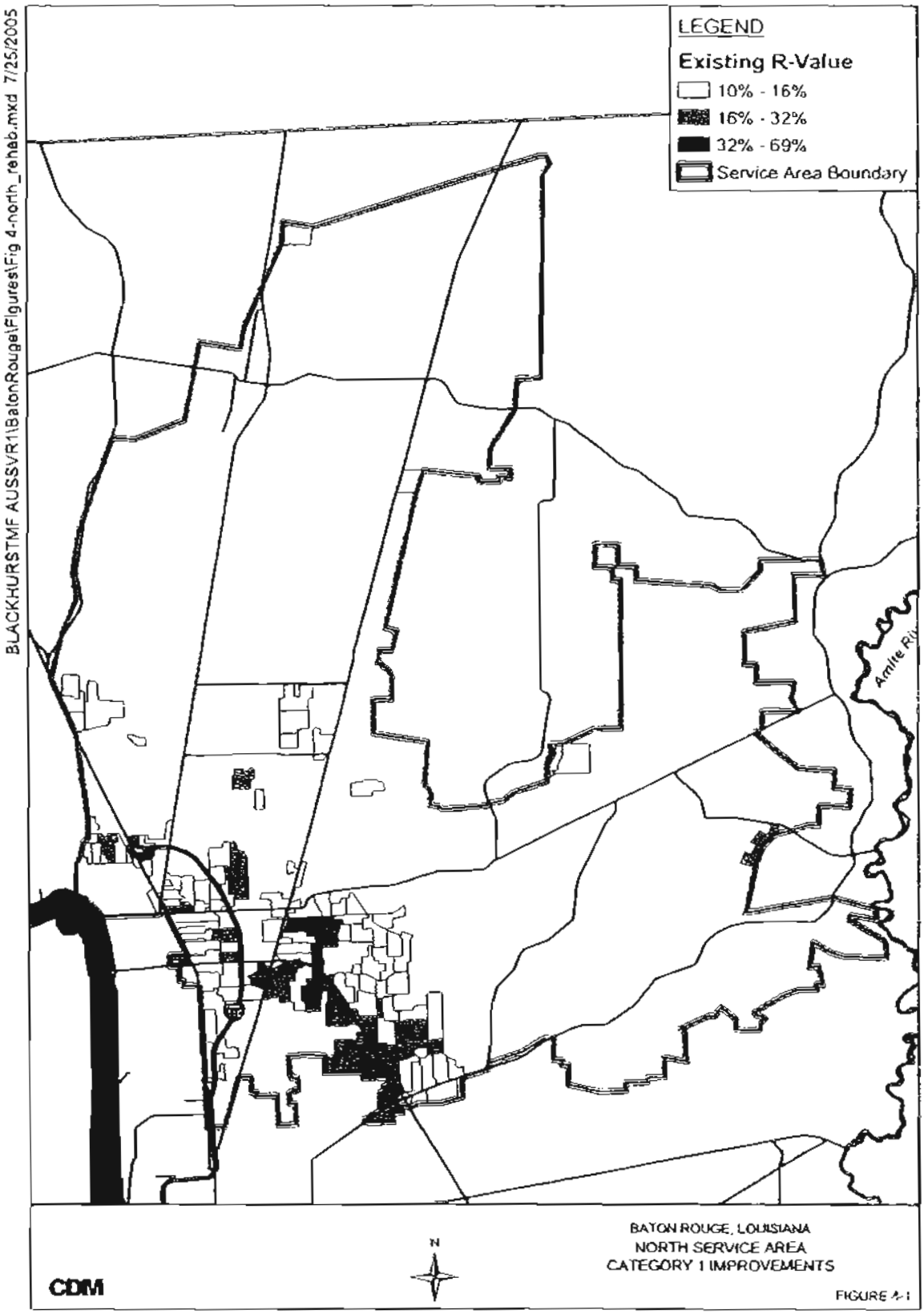
The system model was used to identify pump stations and conveyance lines where capacity is not adequate for the peak wastewater flows. Category 2 provides for pump station and conveyance system upgrades in capacity. Figures 4-4, 4-5, and 4-6 show pump stations requiring capacity increases. A more detailed listing of the pump station and pipelines requiring capacity increases are provided in the Revised Second Remedial Action Plan as provided in Appendix B. The projects are generally discussed below.

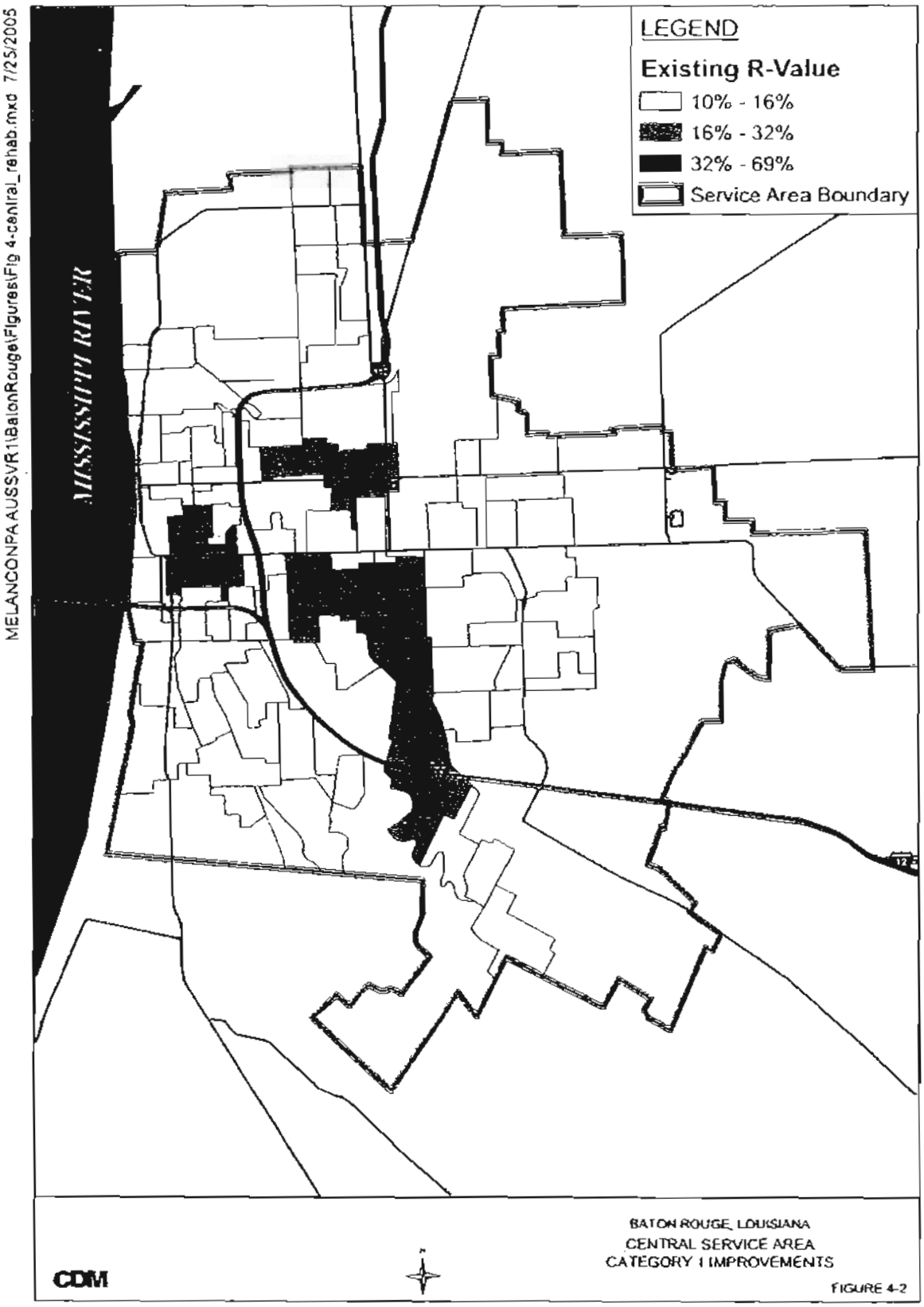
The Category 2 improvements are identified by service area below.

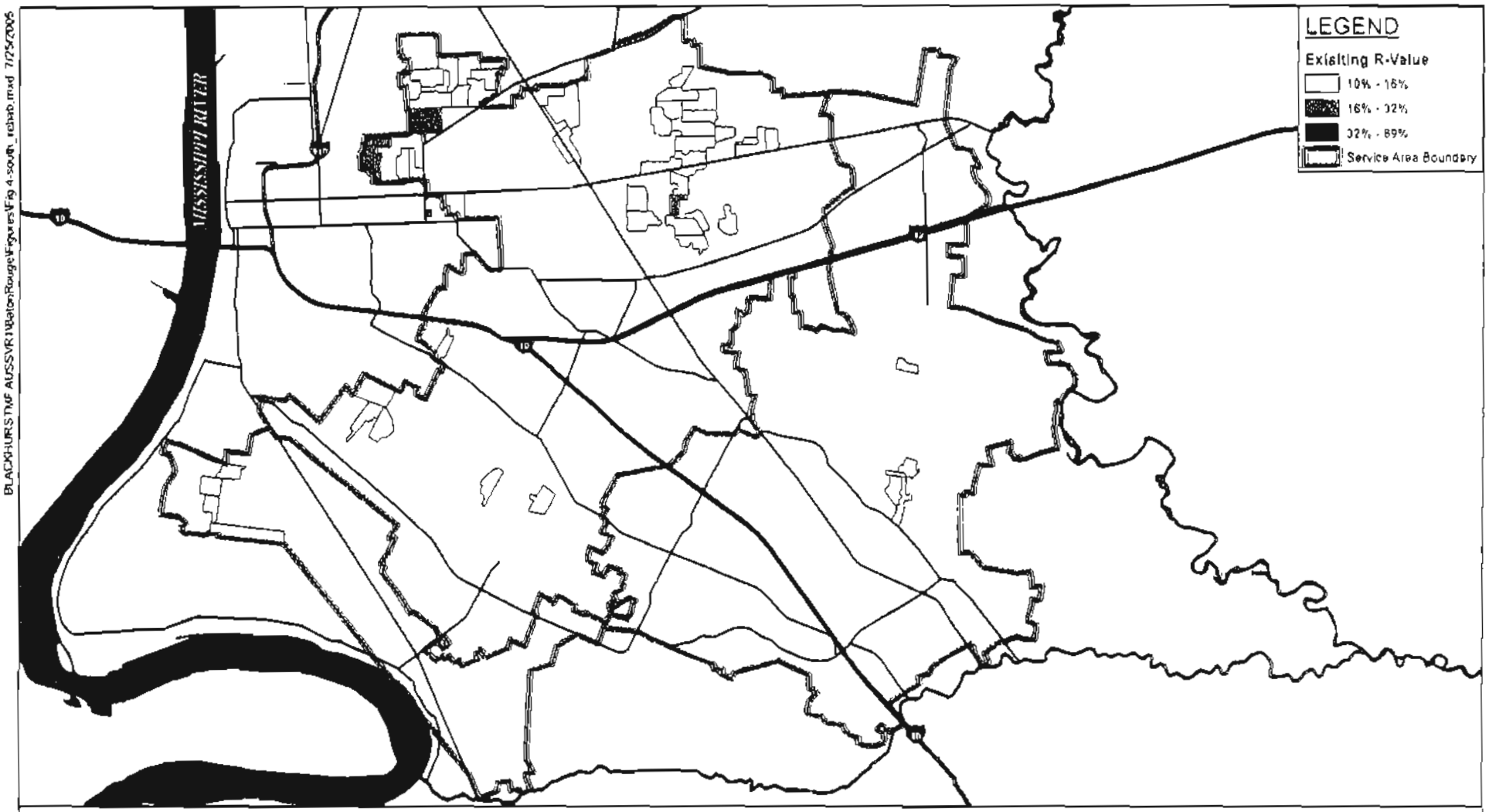
North CSD/STN Area

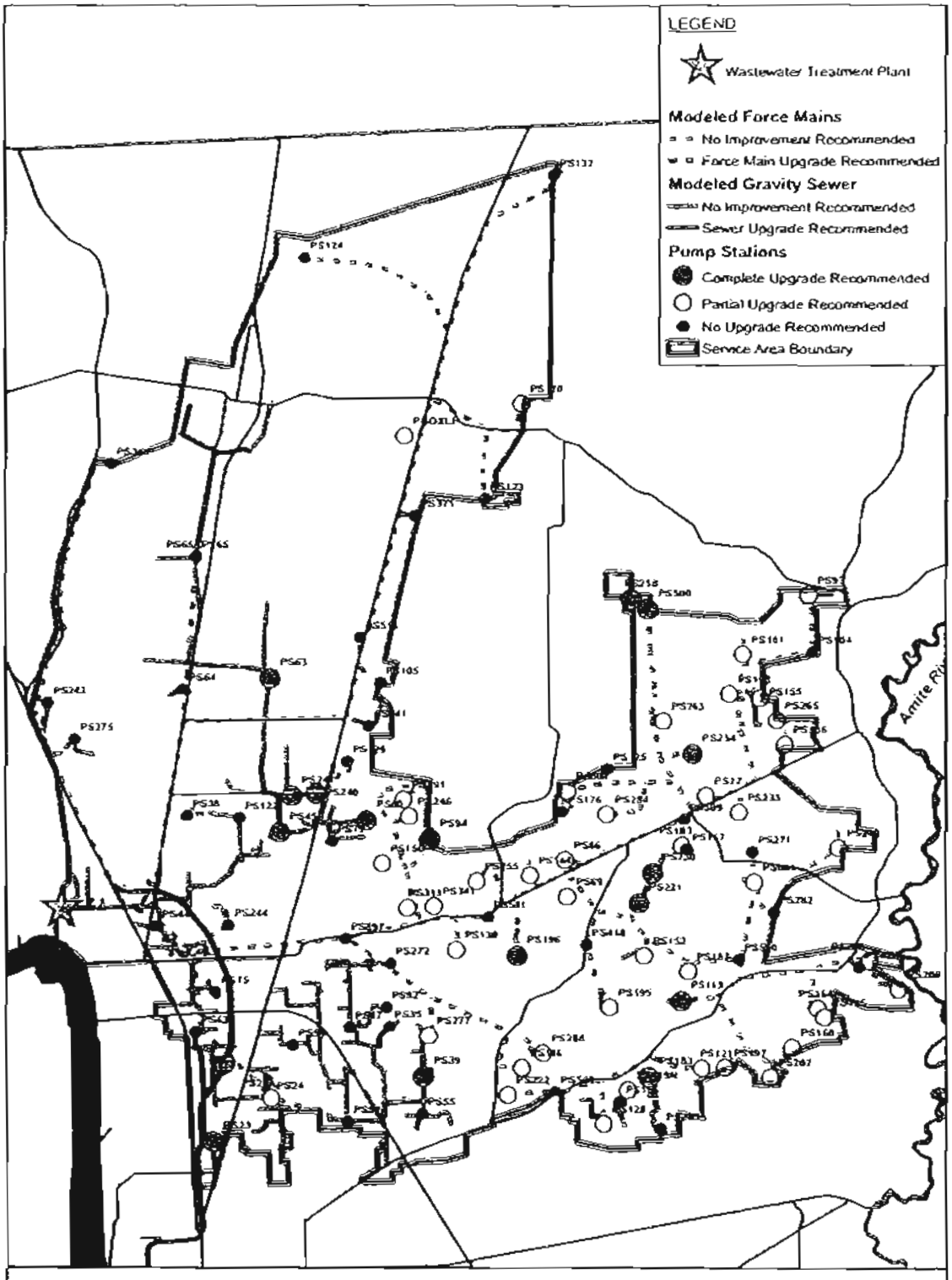
In the North CSD/STN area, minor capacity upgrades are required at 16 pump stations. There are no significant increases in pump station capacity projected to be required in the North area. The capacity increases required are generally less than 2 millions gallons per day (MGD). Pump Station 241 requires an increase of 12.5 MGD, which is the largest increase in the service area.

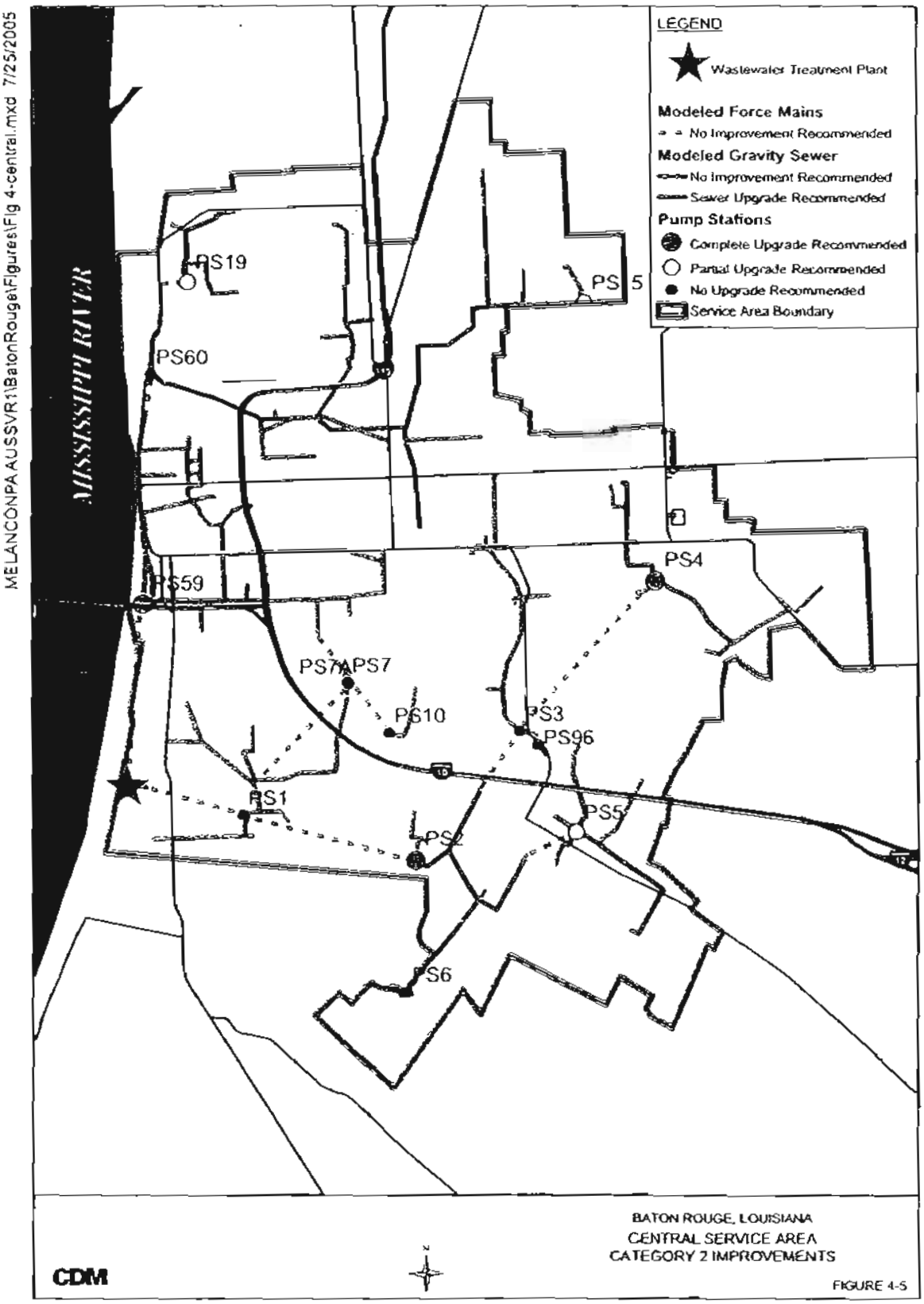
Pipeline capacity improvements include replacement of approximately 37,000 linear feet (LF) of replacement gravity sewer, installation of approximately 84,000 LF of new

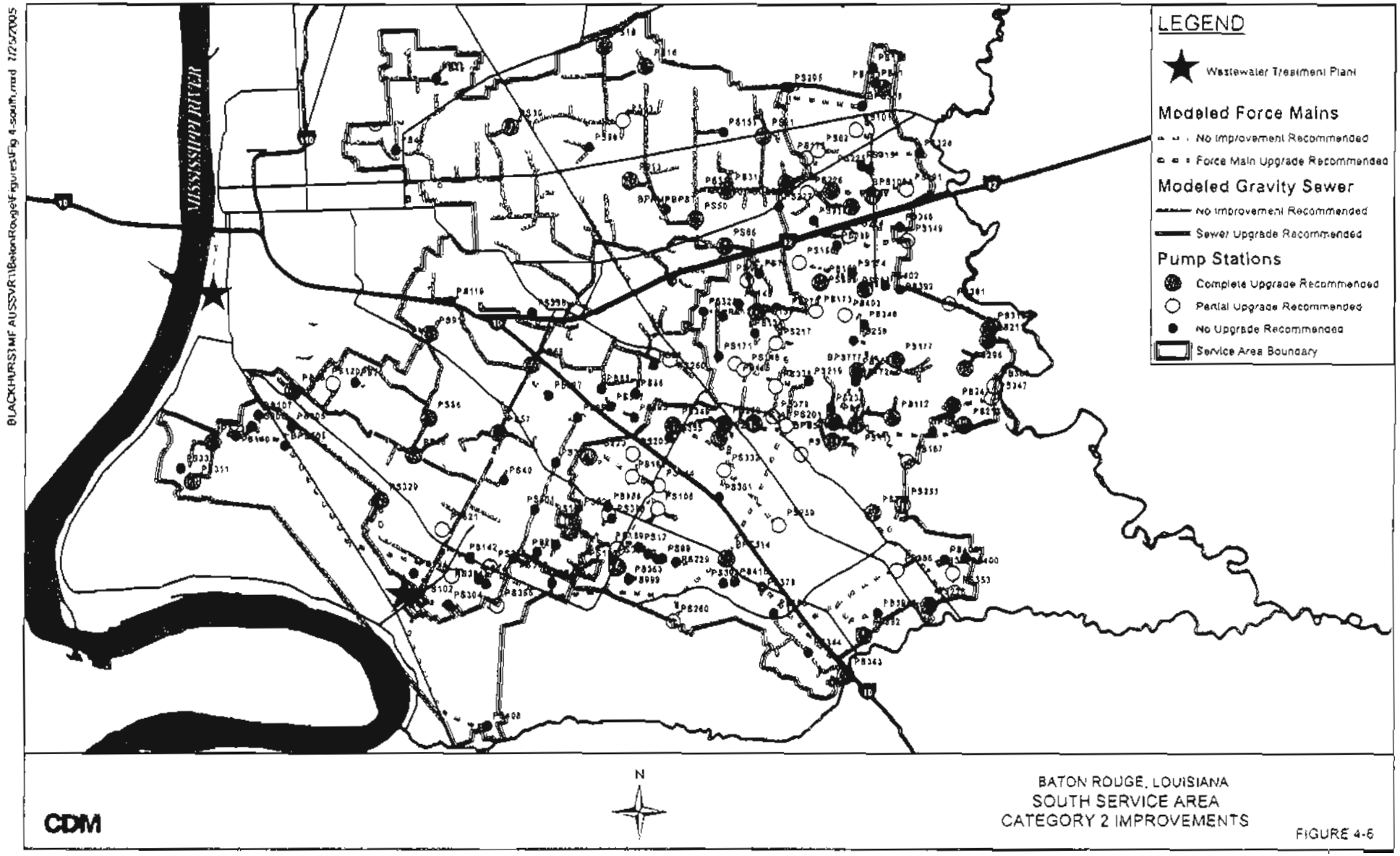

BLACKHURSTMF AUSSVR1\BatonRouge\Figures\Fig 4-north_rehab.mxd 7/25/2005
LEGEND
Existing R-Value
10% - 16%
16% - 32%
32% - 69%
Service Area Boundary
Amite Ri
N
BATON ROUGE, LOUISIANA
NORTH SERVICE AREA
CATEGORY 1 IMPROVEMENTS
CDM
FIGURE 4-1


MELANCONPA AUSSVR1\BatonRouge\Figures\Fig 4-central_rehab.mxd 7/25/2005
MISSISSIPPI RIVER
LEGEND
Existing R-Value
10% - 16%
16% - 32%
32% - 69%
Service Area Boundary
BATON ROUGE, LOUISIANA
CENTRAL SERVICE AREA
CATEGORY I IMPROVEMENTS
CDM
FIGURE 4-2


LEGEND
Existing R-Value
10% - 16%
16% - 32%
32% - 89%
Service Area Boundary
MISSISSIPPI RIVER
N
CDM
BATON ROUGE, LOUISIANA
SOUTH SERVICE AREA
CATEGORY 1 IMPROVEMENTS
FIGURE 4-3


LEGEND
Wastewater Treatment Plant
Modeled Force Mains
No Improvement Recommended
Force Main Upgrade Recommended
Modeled Gravity Sewer
No Improvement Recommended
Sewer Upgrade Recommended
Pump Stations
Complete Upgrade Recommended
Partial Upgrade Recommended
No Upgrade Recommended
Service Area Boundary
Amite River
N
BATON ROUGE, LOUISIANA
NORTH SERVICE AREA
CATEGORY 2 IMPROVEMENTS
CDM
FIGURE 4-4


MELANCONPA AUSSVR1\BatonRouge\Figures\Fig 4-central.mxd 7/25/2005
MISSISSIPPI RIVER
LEGEND
Wastewater Treatment Plant
Modeled Force Mains
No Improvement Recommended
Modeled Gravity Sewer
No Improvement Recommended
Sewer Upgrade Recommended
Pump Stations
Complete Upgrade Recommended
Partial Upgrade Recommended
No Upgrade Recommended
Service Area Boundary
PS19
PS 5
PS60
PS4
PS59
PS7A
PS7
PS10
PS3
PS96
PS1
PS5
PS2
PS6
BATON ROUGE, LOUISIANA
CENTRAL SERVICE AREA
CATEGORY 2 IMPROVEMENTS
CDM
FIGURE 4-5


LEGEND
Wastewater Treatment Plant
Modeled Force Mains
No Improvement Recommended
Force Main Upgrade Recommended
Modeled Gravity Sewer
No Improvement Recommended
Sewer Upgrade Recommended
Pump Stations
Complete Upgrade Recommended
Partial Upgrade Recommended
No Upgrade Recommended
Service Area Boundary
MISSISSIPPI RIVER
N
CDM
BATON ROUGE, LOUISIANA
SOUTH SERVICE AREA
CATEGORY 2 IMPROVEMENTS
FIGURE 4-6

parallel gravity sewer, approximately 51,000 LF of replacement force main, and 2,700 LF of parallel force main.

Central CSD Area

In the Central CSD area, capacity upgrades are required at three pump stations. The largest upgrade required based upon model results is at Pump Station 2. This pump station will require a capacity increase of approximately 17 MGD. Improvements to obtain this increased capacity will be determined during design.

Pipeline capacity improvements include replacement of approximately 22,000 LF of replacement gravity sewer and installation of approximately 38,000 LF of new parallel gravity sewer. Based upon model results, no new force main based upon capacity needs is required in this service area.

South CSD/STN Area

In the South CSD/STN area, capacity upgrades are required at 35 pump stations. The largest upgrades required based upon model results are at Pump Station 57, Pump Station 58, and Pump Station 514. Pump Station 57 requires an increase in capacity of 76 MGD. Pump Station 58 requires an increase in capacity of 56 MGD, and Pump Station 514 requires an increase in capacity of 52 MGD. This significant capacity increase will likely require construction of a new pump station or significant increase to the existing pump station wet well and pump/pipe systems.

Pipeline capacity improvements include replacement of approximately 126,000 LF of replacement gravity sewer, installation of approximately 174,000 LF of new parallel gravity sewer, approximately 26,000 LF of replacement force main, and 7,000 LF of parallel force main.

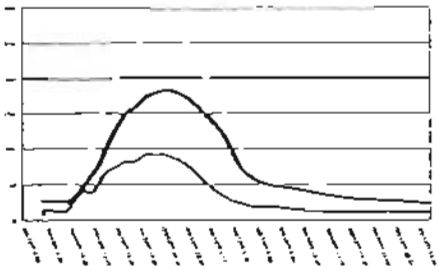
4.3 Category 3: Flow Equalization and Wastewater Treatment Improvements

The conveyance improvements described in the previous sections will decrease peak flows to the North and Central Wastewater Treatment Plants (WWTP) and increase peak flow to the South WWTP. Therefore, flow equalization and/or treatment capacity improvements will be necessary to address these larger peak flows at the South WWTP. The peak flows predicted by the model for the North WWTP and Central WWTP are slightly less than the plants' current peak treatment capacities.

Sewer rehabilitation will actually decrease dry weather flows in the basins because infiltration of groundwater will be reduced. No redirection of flows from one treatment plant service area to another was found to be beneficial during the development of the program.

Based upon the predicted increase in flow to the South WWTP and the historical performance of the treatment plant, the following improvements to the treatment plant are recommended.

- *New Headworks and Flow Equalization Basin* – Peak flows to the South WWTP from the gravity collection system (SCSD) and the force main system (SSTN) will be 273 MGD. If the South WWTP is upgraded to a peak capacity of 200 MGD, flow equalization facilities with the ability to accommodate the remaining 73 MGD are required. The hydrograph shows the time duration of the 73 mgd and through integration it has been determined that the volume needed to store this peak flow would be 19 million gallons. The construction of a new headworks facility with screening, grit removal facilities and influent pumping in the vicinity of the proposed 19 million gallon equalization basin is required. With a new headworks facility, the two poorly functioning headworks facilities at the South WWTP can be eliminated and the spikes in flow through the plant can be eliminated. Several locations for the new headworks and flow equalization facilities are being evaluated and are shown on Figure 4-7. All three locations are near the existing South WWTP. However, the Alternative 1 location offers an advantage in that the existing influent line to the South WWTP traverses this property.



South WWTP Hydrograph

- *Upgrade the South WWTP to a 200 mgd Activated Sludge WWTP* – Since it is not practical or economical to add more trickling filters (biotowers) to the South WWTP, abandoning the trickling filters and constructing a new activated sludge process is recommended. Construction of an activated sludge process has numerous advantages; several of which are: 1) achieves effluent quality better than 30/30, 2) consistently meets Louisiana Pollution Discharge Elimination System (NPDES) limits, 3) enables elimination of primary effluent pump stations, 4) enables abandonment of chlorination facilities for disinfection and allows use of ultraviolet light for disinfection, 5) helps to control odors, 6) helps with aesthetics in the surrounding quickly developing section of town, and 7) eliminates current problems with snails.

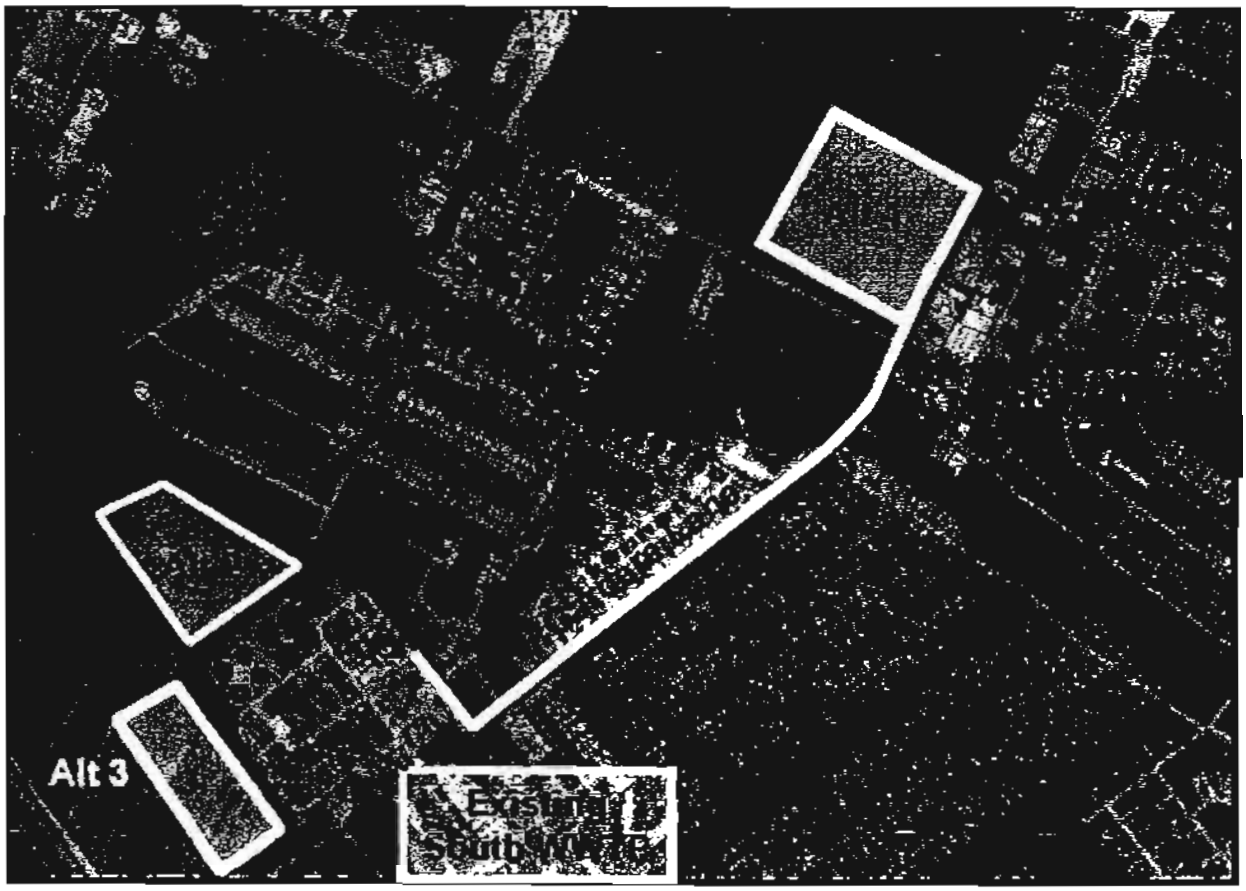


Figure 4-7
Alternative Locations for the New South WWTP Headworks and Flow Equalization Facility

Section 5
Implementation Plan

5.1 Requirements

The Consent Decree entered into by the Environmental Protection Agency (EPA), the Louisiana Department of Environmental Quality (LDEQ) and the City of Baton Rouge/Parish of East Baton Rouge (City/Parish) requires the Second Remedial Measures Action Plan (RMAP2) to provide specific information related to system improvements to reduce overflows and comply with the requirements of the Consent Decree. Specifically, the Consent Decree states the following:

> "In the Second RMAP, the City/Parish shall provide a detailed description of the selected remedial measure and shall specify a schedule for beginning and completing construction of each element of the selected remedial measure not addressed in the First RMAP. The Second RMAP shall also set forth a process for evaluating and providing the personnel and training that will be required to successfully implement the selected remedial measure. The Second RMAP shall also provide an estimate of the cost of the selected remedial measure and a detailed description of how the City/Parish will fund the remedial measure to be implemented."

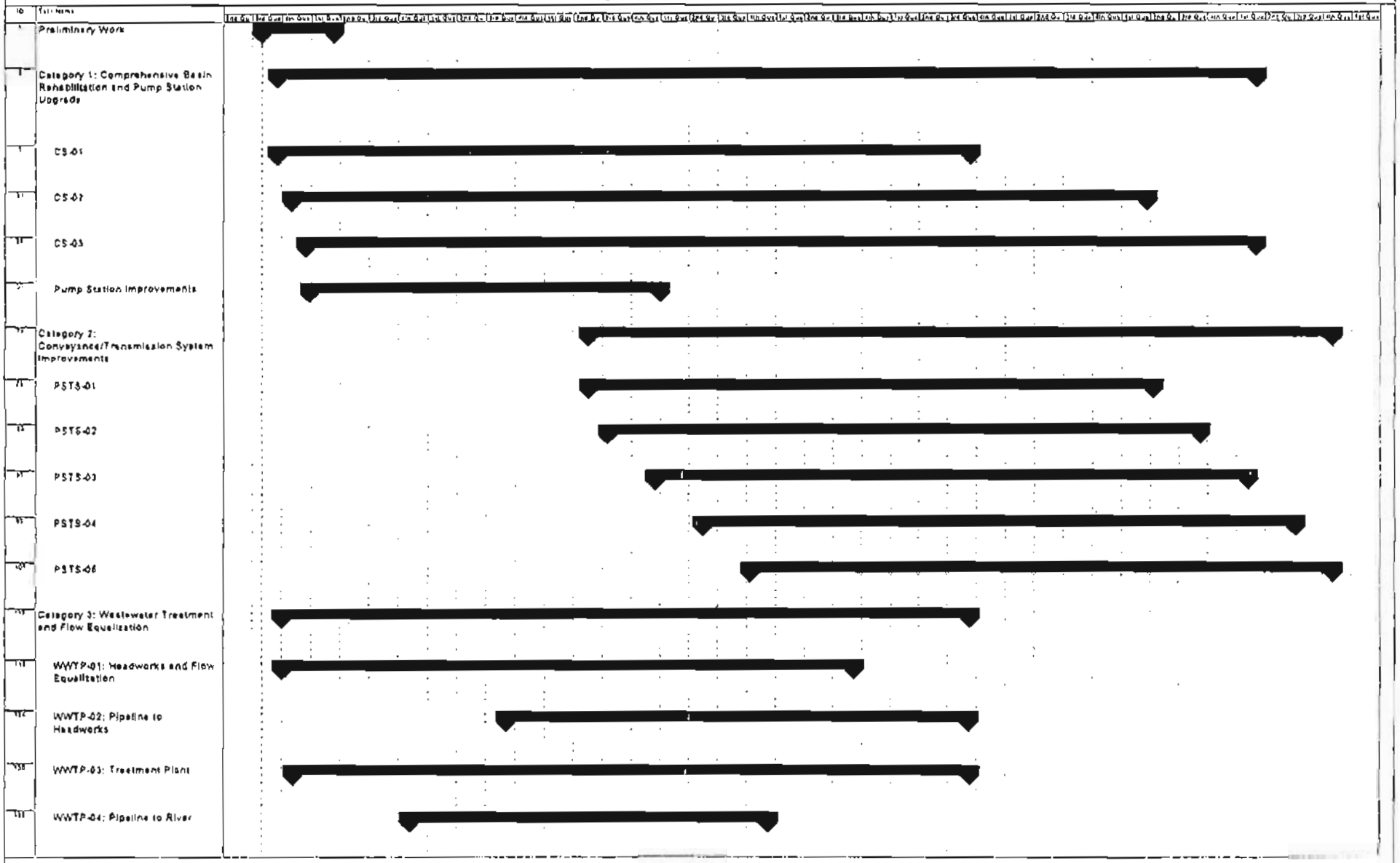
The revised RMAP2 is provided as **Appendix B** to this report and is summarized in this section. Each of the required elements is addressed.

5.2 Construction Sequence and Schedule

Prior to commencing design on any facilities required to implement the recommended plan and modified RMAP2, approval is required from EPA as well as the City/Parish government. Per the Consent Decree, EPA has up to 120 days for approval of the revised plan. Following approval of the plan, there is a 45 day period for public comment for the proposed amended Consent Decree. After EPA review and approval, LDEQ has to place a public notice for 45 days. After the 45 day public comment period is complete, the Court should approve the revised Consent Decree. Upon approval of the revised plan, site analysis, design and construction will commence for projects required to implement the recommended plan. The EPA and City/Parish approval process is noted in the schedule shown in **Figure 5-1**. A detailed schedule is provided in **Appendix E**.

A project schedule has been developed that reflected the design, bidding, construction, and start-up of the projects included in Category 1, 2 and 3. As required by the Consent Decree, the schedule reflects a completely operational system by January 2015, with milestones noted for completion of individual projects. The construction projects included in the schedule allow the City/Parish to comply with the requirements of the Consent Decree for reduction of sewer system overflows (SSO) within the collection area and for the discharge from the wastewater treatment plants to be within permit limits.

Figure 5-1
Program Implementation Schedule



CDM

Float time has been added to each project activity to allow for unforeseen design or construction events and for agency review. Generally, 120 days have been allotted for bidding and award of each project, between 60 days and 120 days have been allotted for start-up of the collection system improvements and 120 days have been allotted for start-up of the pump stations and treatment plant. Additional float time is built into the end of each project in the start-up/float time activity.

The City/Parish has an on-going street improvement program. A number of the sewers selected for rehabilitation, replacement, or parallel including new pipeline and parallel lines are adjacent to or directly under street scheduled for improvements. **The program must consider the street improvements projects (the *Green Light Plan*) when developing a final schedule for implementation, and there are significant opportunities to save costs by coordinating the City/Parish street improvements and sewer improvements programs.**

The schedule developed for each Category is discussed below.

5.2.1 Category 1: Comprehensive Sewer Basin Rehabilitation and Pump Station Improvements

The Category 1 improvements are those improvements identified for each sewer sub-basin including pipeline rehabilitation and mechanical improvements to pump stations. The pipeline improvements include repair and/or replacement of local gravity sewer lines and manholes as well as rehabilitation of service lateral connections to the main line. The improvements also include rehabilitation from the main line connection point to the property line and installation of clean-outs near the property line. Once rehabilitation of pipelines located within the public right-of-way is complete, post-construction flow monitoring will be conducted to confirm the reduction in inflow and infiltration has been adequate to achieve an R-value of 2 percent for the basin. In the event that a basin R-value is not reduced to 2 percent, private side lateral rehabilitation will be implemented as discussed in Section 3.2.1.

Pump Station Head Increase

Eighty-seven pump stations were identified in the model as requiring an increase in head, likely due to pumping against another pump station in the conveyance system. For these pump stations, 120 days have been allotted for investigation of the pump stations and determination of specific improvements. The improvements may include replacement of impellers, pumps or piping to allow for increased head. These pump stations do not require capacity increases based on their design capacity. The field investigation is scheduled to commence immediately upon approval by EPA of Revised RMAP2. The bidding is scheduled between June 2006 and July 2007. Construction for each project is scheduled for 365 days, with 90 days provided for start-up services and float time. The projects will be fully operational by December 2008.

Collection System Improvements

The collection system rehabilitation has been divided into multiple projects. The rehabilitation includes the manholes and laterals along the pipe route and replacement or upsize of pipe within the basin being rehabilitated. The projects are intended to include the collection pipeline within each basin, with larger conveyance system projects included in Category 2 work.

Each rehabilitation area will be inspected by closed circuit television (CCTV) and manhole inspection prior to design. This inspection will be used to determine the condition of the pipeline and manholes within the basin and will serve as the basis of design for the remaining portion of the basin. The basin delineation will be consistent with that defined in the model; however, each project will consist of more than one basin. The projects have been separated to generate a total length per bid package group of up to 150,000 linear feet, with the assumption that each contractor crew can rehabilitate approximately 40,000 linear feet of pipe per year. While contractors can typically rehabilitate sewers at a higher rate than this, this assumption will provide some contingency and float time in the proposed project schedule. It is recommended that the projects will generally be bid based upon rehabilitation projects totaling between $3 million and $6 million per bid package.

Field work is scheduled to commence immediately, with a project ready to advertise within 3 months of start of field work. The schedule includes extended bidding to provide for multiple projects. It is anticipated more than one project will be under construction during most of the consent decree duration.

The Category 1 construction is scheduled for completion by August, 2013. The comprehensive rehabilitation will fully functional by March 2014. The limitation for this schedule is the ability of the contractors and the City/Parish to bid projects at this rapid pace.

5.2.2 Category 2: Pump Station and Transmission/Conveyance System Improvements

The Category 2 improvements include repair and/or replacement of the main conveyance system. The conveyance system includes the larger diameter gravity lines, force mains, pump stations, and booster stations. These improvements were identified through the model as: 1) pipes that have limited capacity and cause surcharging and potential overflows upstream, or; 2) new pipelines that are required to convey the wastewater.

These improvements are generally split into pipe line projects and pump station projects. It is likely different contractors will bid the pump station and pipeline projects. The pipeline projects are force main or large diameter gravity replacement or parallel lines and are not associated with collection system basin work (discussed in Section 5.2.1). The pump station capacity increases are generally significant enough to warrant new pump stations or increases in wet well capacity and are considered complex construction projects.

The implementation schedule for the capacity increase projects includes time for property acquisition and zoning for new pump stations sites and pipeline servitude, design, and staggered bidding between June 2010 and June 2012. Completion of construction is scheduled for July 2014, with an additional 120 days for start-up and float. The projects will be fully operational by November 2014.

5.2.3 Category 3: Flow Equalization and Wastewater Treatment Improvements

The treatment plant improvements have been split into four projects. Project WWTP-01 consists of construction of the new 273 million gallon per day (MGD) headworks facility, 19 million gallon flow equalization facility, and 200 MGD pump station serving the South Wastewater Treatment Plant (WWTP). This project includes a stub-out for connection to the facility. Project WWTP-02 consists of construction of the piping required to connect the new headworks with the existing gravity and transmission influent pipes and the pipe required to connect the new headworks with the South WWTP. Project WWTP-03 consists of the construction of the new activated sludge facilities and demolition of existing facilities at the South WWTP. Project WWTP-04 consists of the construction of the new pipeline from the South WWTP to the Mississippi River. This pipeline is required because of the increase in treatment plant capacity at the South WWTP. The projects and proposed schedule are summarized below.

Project WWTP-01: New 273 MGD Headworks and Flow Equalization
This project includes construction of a new 273 MGD headworks including: screening and grit removal, an electrical building, a new 200 MGD pump station with six pumps with variable speed drives and motors, a 19 million gallon below ground flow equalization facility, and odor control facilities.

Prior to design and land acquisition, 90 days are provided for development of a site analysis and selection. Following site selection, 90 days are provided for land acquisition by the City/Parish. Design is scheduled for 545 days and includes permitting and float time. The project is schedule for construction to start in May 2007 and to be complete in May 2010. The new facilities will be fully functional by September 2010.

Project WWTP-02: Pipeline Connection to New Headworks
This project provides for the construction of new pipeline connecting the existing pipeline from the force main side and gravity side of the South WWTP to the new headworks. The surveying is scheduled for 90 days, and design and property acquisition are scheduled for 365 days. The construction is scheduled for 540 days, with start-up scheduled for 120 days. The project construction is scheduled to commence in August 2008 and final start-up complete by September 2011. The project will be fully operational upon completion of the headworks (discussed above) and connection to the South WWTP.

Project WWTP-03: South WWTP Improvements - Activated Sludge Process
The South WWTP improvements provide for conversion of the treatment process to activated sludge, demolition of portions of the existing treatment system, and other process improvements, enabling the treatment plant to comply with the Louisiana Pollution Discharge Elimination System (LPDES) permit limitations. The schedule for this project provides for 545 days for design commencing in January 2006. Construction is scheduled to start in May 2007 and the system will be fully functional by September 2011.

Project WWTP-04: Pipeline to the Mississippi River
With the addition of treatment plant flow to the South WWTP, additional capacity is required in the discharge line. A parallel pipeline to the existing discharge point is provided in this project. The schedule includes adequate time for permitting and agency coordination. Surveying is scheduled for 90 days, with an additional 300 days provided for permitting and property acquisition. Construction is scheduled to commence in April 2008 and be complete in August 2009. The project will be fully operational by December 2009.

5.3 Estimated Design and Construction Cost

The cost estimate for the recommended improvements includes administration, design, contingency, bidding, and construction costs and includes an allowance for normal inflation. The costs do not include land acquisition required for easements or for new facilities. The opinion of probable construction cost for each of the categories of improvements is discussed below. Additional cost information is provided in Appendix F.

5.3.1 Category 1: Comprehensive Sewer Basin Rehabilitation and Pump Station Upgrades

Category 1 is the cost associated with basin rehabilitation, which includes local gravity collection system pipe lining and bursting, manhole rehabilitation, and rehabilitation of active service lateral connections to the main line. The projects have been separated to generate bid packages valued at between $3 million and $6 million. This cost includes manhole and public-side lateral rehabilitation. Additional costs for service lateral rehabilitation has been included if private-side lateral rehabilitation is required to reduce the basin R-values. The private-side lateral rehabilitation allowance includes administration of the private lateral program to provide potential funding for needy residents and seed money for any potential loan program. The preliminary opinion of probable construction cost for the comprehensive sewer rehabilitation in Category 1 is $170 million to rehabilitate approximately 350 miles of sewer lines and $30 million for pump station improvements. The rehabilitation costs are based upon a unit price ranging between $80 and $90 per linear foot of pipe rehabilitated and $5 to $10 per foot of pipe for engineering and field work. This is consistent with the information presented in Table 3-1 for comprehensive rehabilitation including manholes and sewer lateral rehabilitation.

Eighty-seven pump stations were identified in the model as requiring an increase in head, likely due to pumping against another pump station in the conveyance system. It is anticipated not all pump stations will require improvements once detailed field investigation has been completed. These improvements are divided into seven construction contracts valued between $3 and $6 million per project for a preliminary opinion of probable construction cost of $30 million. The total preliminary opinion of probable construction cost for Category 1 improvements is approximately $200 million.

5.3.2 Category 2: Pump Station and Transmission/Conveyance System Improvements

The Category 2 improvements include capacity increases including pipeline replacement or parallel lines and pump station capacity increases. These improvements are considered part of the revised RMAP2. The cost estimates developed for these improvements are discussed below.

Pump Station or Pipe Line Capacity Increase:
These improvements are generally split into pipe line projects and pump station projects. The pipeline project contracts are split into bid projects generally valued between $3 million and $12 million. The pump station capacity increases are generally significant enough to warrant new pump stations or increases in wet well capacity and are considered complex construction projects. Several of these pump station construction contracts will be over $20 million each.

The replacement or parallel pipeline costs are based upon unit prices for new pipe including installation and roadway crossings. All unit costs include engineering and contingency. The unit cost of the installed pipe ranges from $5.50 to $20 per inch diameter per foot. The price variation is due to depth of installation and material for pipe. The cost does not include land acquisition. The total Category 2 preliminary opinion of probable construction cost is $232 million.

5.3.3 Category 3: Flow Equalization and Wastewater Treatment Improvements

Category 3 costs include costs associated with treatment and flow equalization improvements. As previously discussed, no treatment plant improvements are required at the North WWTP or Central WWTP in order to meet the wet-weather requirements of the Consent Decree. The treatment plant improvements required to meet the Consent Decree and manage the wet weather at the South WWTP are construction of a new aeration basin/activated sludge tank with six cells and two new final clarifiers, demolition of the existing trickling filters. In additional, the cost includes purchase of land for construction of a new headworks facility, connection of the existing influent plant flow to this facility, and demolition of the existing headworks facilities for the gravity and force main sides of the treatment plant. The preliminary opinion of probable construction cost for Category 3 is $68 million and

includes administration, construction, engineering, and contingency. This cost does not include land acquisition.

5.4 Operation and Maintenance (O&M)

Implementation of the revised RMAP2 program will have a number of implications related to operation and maintenance (O&M) costs to the City/Parish. To evaluate these impacts, CDM obtained the detailed City/Parish line item wastewater budget and used this budget to determine how O&M costs would be expected to change upon implementation of the improvements program.

O&M cost savings are expected in wastewater treatment, pumping, and sewer system maintenance as a result of infiltration reductions that will be achieved by the comprehensive rehabilitation program. Based on previous flow monitoring and modeling done in the City/Parish system, a significant portion of the sewer system has average groundwater infiltration rates of 3,000 gallons per foot per year or greater. It is planned that comprehensive rehabilitation would remove 80 percent of this groundwater infiltration in the rehabilitated areas - past studies have shown groundwater infiltration reductions of between 75 to 90 percent have been achieved through comprehensive rehabilitation, as discussed earlier in this report.

5.4.1 Wastewater Treatment Plant O&M Costs

Based on the City/Parish budget, treatment plant power and chemical costs average approximately $0.18 per 1,000 gallons of wastewater treated. Considering the projected reduction in groundwater infiltration that is treated at the wastewater treatment plants as a result of comprehensive rehabilitation, a savings in treatment costs of approximately $890,000 per year is expected at the completion of the RMAP2 rehabilitation program. This cost savings is the result of reduced groundwater infiltration. Additional treatment costs savings can be realized from the modifications to the South WWTP process and equipment.

The addition of blowers at the plant because of the conversion to an activate sludge process are expected to add approximately $500,000 in annual power costs. The addition of ultraviolet disinfection will also add approximately $300,000 in annual operating costs; however, this cost will be offset by a savings of approximately $400,000 in chlorine, sulfur dioxide and caustic costs that will no longer be incurred.

In addition, the existing two headworks facilities require extensive maintenance and operate poorly. Considerable grit and rags continue to pass through the headworks and impact downstream equipment. Maintenance to remove rags, repair damaged equipment due to grit, and remove snails from sludge pumping and piping is required. More frequent cleaning of the clarifiers and digesters also results from poor headworks performance. Electrical savings will be realized by removing the gravity side influent pump station from service. In addition, the two primary effluent pump stations will no longer be in service and will provide additional electrical savings. The

total projected savings due to process and equipment modification at the South WWTP is an additional $700,000.

The net decrease in wastewater treatment plant O&M cost is expected to be approximately $1.6 million once the RMAP2 program is complete.

5.4.2 Pumping O&M Costs

Based on current costs, system pumping costs approximately $0.06 per 1,000 gallons of wastewater that reaches the treatment plant. Infiltration reduction from comprehensive rehabilitation is projected to reduce pumping costs in the system by approximately $275,000 annually. While there will be a number of pump stations that are upgraded and/or reconstructed as part of the improvements program, the total rate of pumping and amount of power used will not change significantly except as reduced by the comprehensive rehabilitation.

In fact, there are a number of design improvements that can be made to the pump stations during the upgrades that will have an overall benefit in terms of reduced power usage. It is often possible to realize significant energy savings through proper pump selection and operation. Variable speed pumping is an effective method of minimizing the hydraulic velocities in the piping systems (while maintaining adequate velocities to keep solids in suspension), which in turn reduces friction losses and typically saves energy, especially in systems with long force mains. Energy savings can also be realized by proper pump selection and operation of pumps near their best efficiency point.

5.4.3 Collection System O&M Costs

Additional O&M savings will be achieved as a result of a decrease in overflow and stoppage response and a decrease in the frequency of cleaning needed for the rehabilitated pipes. At the completion of the RMAP2 comprehensive rehabilitation program, it is anticipated that the City/Parish costs for emergency point repairs of structural failures will be decreased from its current $2,000,000 annual cost to approximately $1,100,000 (a $900,000 savings) given that much of the oldest sewers will be included in the rehabilitation program. In addition, it is anticipated that the responsive (emergency) maintenance costs will be reduced by approximately $460,000 based on a reduced cleaning frequency that will be required in the rehabilitated areas.

5.4.4 Total Operation and Maintenance Savings

Based on this analysis, CDM estimates the following changes in the annual City/Parish operation and maintenance costs as a result of implementing the revised RMAP2 program:

Wastewater Treatment Plant O&M:	$1.6 million savings
Pumping O&M:	$0.3 million savings
Collection System O&M:	$1.3 million savings
TOTAL O&M:	**$3.2 million savings**

5.5 Program Costs

Table 5-1 presents a summary of the SSO construction costs for the Category 1, 2 and 3 projects. The total cost of the program is $500 million and is based on the annual costs for each year of construction. The inflation index of 2.282 percent was used to calculate the present value of the construction costs as of 2005, or a total present value of approximately $448.6 million for the period of 2005 through 2014.

Table 5-1
Projected Cash Flow Requirements

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Category 1: Collection System Basin Rehabilitation											
SSO Collection System	1,700,000	21,140,000	31,510,000	68,928,100	47,443,000	18,411,600	5,500,000	2,427,300	1,340,000	700,000	199,100,000
Category 2: Pump Station and Transmission/Conveyance System Improvements											
Pump Station & Transmission	500,000	500,000	-	-	5,342,900	18,393,500	60,065,000	84,967,000	49,338,000	14,620,000	233,726,400
Category 3: Treatment Plant and Flow Equalization											
WWTP & Flow Equalization Basin	-	3,176,000	11,864,000	20,188,000	19,956,000	9,634,000	3,182,000				68,000,000
Total Annual Cost	**2,200,000**	**24,816,000**	**43,374,000**	**89,116,100**	**72,741,900**	**46,439,100**	**68,747,000**	**87,394,300**	**50,678,000**	**15,320,000**	**500,826,400**

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ATTACHMENTS TO THE CONSENT DECREE

Exhibit A.	Sanitary Sewer Overflow Response Plan
Exhibit B.	Map Depicting the Primary Features of collection System Remedial Action Program Alternative 1
Exhibit C.	Map Depicting the Primary Features of collection System Remedial Action Program Alternative 3
Exhibit D.	Map Depicting the Primary Features of collection System Remedial Action Program Alternative 4
Exhibit E.	Map Depicting the Primary Features of collection System Remedial Action Program Alternative 7
Exhibit F.	First Remedial Action Plan
Exhibit G	Environmental Results Monitoring Plan
Exhibit H.	Outreach and Public Awareness Plan
Exhibit I.	Quarterly and Annual Report Format
Exhibit J.	Supplemental Environmental Project Plan Requirements
Exhibit K.	Revised Second Remedial Action Plan

I. BACKGROUND

A. The City of Baton Rouge, Louisiana and the Parish of East Baton Rouge, Louisiana (collectively "the City/Parish") jointly own and operate three waste water treatment plants known as the North Waste Treatment ("the North plant") located at 55 Mills Avenue, in East Baton Rouge Parish; the South Waste Treatment plant ("the South plant") located at 2850 Gardere Lane, in East Baton Rouge Parish; and the Central Waste Treatment plant ("the Central plant") located at 2443 River Road, in East Baton Rouge Parish, Louisiana.

B. On March 3, 1988, the United States filed United States v. Baton Rouge, No. 88-191A (M.D. La.) alleging civil claims for violations of the Clean Water Act ("CWA"), 33 U.S.C. § 1251 et seq., at the North, Central, and South plants. On April 26, 1988, the United States amended its Complaint to add the Parish of East Baton Rouge as a Defendant.

C. On December 23, 1988, a Modified Consent Decree ("the 1988 Consent Decree") was entered settling the claims alleged in United States v. Baton Rouge, No. 88-191A (M.D. La.). Pursuant to the 1988 Consent Decree, the City/Parish consolidated most of its wastewater treatments plants into the North, Central, and South plants and made certain improvements to those plants. The 1988 Consent Decree continues in effect until the Date of Entry of this Consent Decree and, after that date, is terminated and superceded by this Consent Decree

D. The State of Louisiana is a plaintiff in this action and is joined as a party under Section 309(e) of the Act, 33 U.S.C. § 1319(e). Whenever a municipality is a party to a civil action brought by the United States under section 309, the Act requires the State

in which the municipality is located to be joined as a party. In addition, on August 27, 1996 and pursuant to CWA Section 402, 33 U.S.C. § 1342, EPA granted to the State of Louisiana authority to administer its own permit program for discharges into navigable waters within Louisiana.

E. The United States and the State of Louisiana file the present civil action against the City/Parish seeking injunctive relief and civil penalties pursuant to Clean Water Act ("CWA") Sections 301 and 309, 33 U.S.C. §§ 1311 and 1319, for violations of the CWA and National Pollution Discharge Elimination System (NPDES")/Louisiana Pollution Discharge Elimination System ("LPDES") permits issued to the City/Parish for its sewage treatment plants. The violations alleged in the Complaint are:

i. Violation of NPDES/LPDES permit requirements which require the permittee to reduce the amount of biochemical oxygen demand (BOD") and total suspended solids ("TSS") such that the thirty (30) day average amount of BOD and TSS in the waste water discharged from the North, Central, and South plants is at least eighty-five percent (85%) less than the amount of BOD and TSS in the sewage entering the plant. This requirement is known as the "Eight-Five Percent Rule;"

ii. Violation of CWA Section 301, 33 U.S.C. § 1311, by discharging untreated sewage to navigable waters from the North, Central, and South plant sewage collection systems. Such overflows are often referred to as "sanitary sewer overflows" or "SSOs;"

iii. Violation of NPDES/LPDES permit requirements related to operation and maintenance by maintaining the North, Central, and South plant

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sewage collection systems in a condition such that blockages and other failures in the sewage lines caused SSOs; and

iv Violation of CWA Section 301 U.S.C. § 1311, by the Parish of East Baton Rouge by failing to obtain an NPDES/LPDES permit for discharges from the North, Central, and South plants.

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F. Neither the City of Baton Rouge nor the Parish of East Baton Rouge is aware of any laws of the State of Louisiana which prevent the City of Baton Rouge or the Parish of East Baton Rouge from raising revenues needed to comply with the requirements of this Consent Decree.

G. The United States, the State of Louisiana, the City of Baton Rouge, and the Parish of East Baton Rouge have determined that a modification of the original Consent Decree that was entered on March 14, 2001, is desirable.

H. The United States, the State of Louisiana, the City of Baton Rouge, and the Parish of East Baton Rouge ("collectively "the Parties") recognize, and the Court by entering this Modified Consent Decree finds, that this Modified Consent Decree has been negotiated by the Parties in good faith, that implementation of this Modified Consent Decree will allow the City/Parish of come into compliance with the requirements of the CWA and regulations enacted pursuant to the CWA, that entry of this Modified Consent Decree will avoid complicated litigation between the Parties, and that this Modified Consent Decree is fair, reasonable, and in the public interest.

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NOW THEREFORE, it is hereby ORDERED, ADJUDGED and DECREED as follows:

II. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action pursuant to CWA Section 309, 33 U.S.C. § 1319, and 28 U.S.C. §§ 1331, 1345, 1355, and 1367.

2. the Complaint states claims upon which relief may be granted against the City/Parish under Section 309 of the Clean Water Act, 33 U.S.C. § 1319, for injunctive relief and civil penalties.

3. Venue is proper in this judicial district pursuant to CWA Section 309, 33 U.S.C. § 1319, and 28 U.S.C. § 1391 because this is the district in which the City/Parish is located and the district in which the violations occurred.

III. PARTIES

4. Plaintiff, the United States of America ("United States"), is acting at the request and on behalf of the Administrator of the United States Environmental Protection Agency.

5. Plaintiff, the State of Louisiana (the State"), is a person within the meaning of CWA Sections 502(5) and 505, 33 U.S.C. §§ 1362(5) and 1367.

6. Defendant, the City of Baton Rouge is a political subdivision created by the State of Louisiana, and a municipality within the meaning of CWA Section 502(4), 33 U.S.C. § 1362(4)

7. Defendant, the City/Parish of East Baton Rouge is a political subdivision created by the State of Louisiana, and a municipality within the meaning of CWA Section 502(4), 33 U.S.C. § 1362(4).

IV. BINDING EFFECT

8. The provisions of this Consent Decree shall apply to and be binding on the Parties, their officers, directors, employees, agents, servants, successors and assigns, and

all persons, firms and corporations in active concert or participation with the Parties and/or the Parties' officers, directors, agents, employees, servants, successors and assigns.

9. The City/Parish shall give written notice of this Consent Decree to any person or entity to whom the City/Parish transfers ownership or operation of the North, Central, or South Plants and/or the sewage collection systems for those plants, and the City/Parish shall provide a copy of this Consent Decree to any such person or entity. The City/Parish shall notify the State and the United States in writing at least twenty-one (21) days prior to any such transfer.

10. The City/Parish shall provide a copy of this Consent Decree to each engineering, consulting and contracting firm to be retained to perform Work within ten (10) days of after entry of this Consent Decree or, for Work commenced after such date, upon execution of any contract relating to such Work. The City/Parish shall provide a copy of any modifications to the Consent Decree to each contractor or consultant within (10) days after entry of such modification. The City/Parish shall condition all contracts entered into to perform Work upon conformity with the terms of this Consent Decree. Any action taken by any contractor or consultant retained by the City/Parish to implement the City/Parish's obligations under this Consent Decree shall be considered an action of the City/Parish for purposes of determining compliance with this Consent Decree. In any action against the City/Parish of enforce this Consent Decree, no act or failure to act by any officer, director, employee, agent, servant, contractor, subcontractor, successor, or assign of the City/Parish shall excuse any failure to comply with the requirements of this Consent Decree.

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V. OBJECTIVES

11. It is the express purpose of the Parties entering into this Consent Decree:

A. To require the City/Parish to achieve and maintain compliance with its NPDES/LPDES permits and the CWA;

B. To require the City/Parish to perform the Work required by this Consent Decree in compliance with the applicable schedules; and

C. To further the goals and objectives of the CWA, particularly Sections 101, 301 and 307, 33 U.S.C. §§ 1251, 1311, and 1317.

VI. DEFINITIONS

12. Unless otherwise defined herein, terms used in this Consent Decree shall have the meanings given to those terms in the Clean Water Act, 33 U.S.C. §§ 1251 et seq., and the regulations promulgated thereunder.

13. Whenever terms listed in this Paragraph are used in this Consent Decree, the following definitions shall apply:

- "BOD" means biochemical oxygen demand.
- "Calendar quarter" means a three month period ending on March 31st, June 30th, September 30th or December 31st.
- "The Central Plant" means the Central Wastewater Treatment plant located at 2553 River Road, in East Baton Rouge Parish, Louisiana.
- "The City/Parish" means the City of Baton Rouge, Louisiana and the Parish of East Baton Rouge, Louisiana.
- "City" means the City of Baton Rouge, Louisiana.
- "Collection system" means the sanitary sewer collection and transmission system (including all pipes, force mains, gravity sewer lines, lift stations, pump stations, manholes, and appurtenances thereto) owned or operated by the City/Parish that serves the North, Central, and South plants, For purposes of this Consent Decree, "Collection System" does not include the sewage collection and transmission

systems owned or operated by Baker, Louisiana; Zachary, Louisiana; Louisiana State University and Agricultural and Mechanical College; Southern University and Agricultural and Mechanical College; agencies of the State of Louisiana; or any other privately maintained sewage collection and transmission systems

- "Consent Decree" means this Decree, all attachments and exhibits to this Decree, and all items approved by EPA and LDEQ pursuant to Section XVII (Review of Submittals) and any modifications to the Consent Decree approved by the court pursuant to Section XXXIV. In the event of any conflict between this Decree and any attachment, exhibit, or approved item, this Decree shall control.

- "Cross Connection" shall mean any physical connection which allows stormwater or other waters (except sanitary sewage and industrial wastewaters) to flow into the Collection System.

- "CWA" means the Clean Water Act, 33 U.S.C. §§ 1251 et seq.

- "Date of Lodging" means the date this Consent Decree is received by the Clerk of the United States District Court for the Middle District of Louisiana prior to signature by the District Judge assigned to this civil action.

- "Date of Entry" means the date this Consent Decree is filed by the Clerk of the United States District Court for the Middle District of Louisiana after being signed by the District Judge assigned to this civil action.

- "Day" or "days" as used herein shall mean a calendar day or calendar days where the period of time allowed is eleven (11) days or more. "Day" or "Days" shall mean a day other than a Saturday, Sunday, or a State or Federal holiday where the period of time allowed is less than eleven (11) days. When the deadline for submission of a report or other deliverable falls on a Saturday, Sunday or a State or Federal holiday, submission will not be required until the next calendar day that is not a Saturday, Sunday, or State or Federal holiday.

- "Effective Date of this Consent Decree" means the Date of Entry.

- "Eighty-Five Percent Rule" means the monthly average percent removal requirements for TSS and BOD specified in Section A (Effluent Characteristics) of NPDES/LPDES Permits Nos. LA0036412, LA0036421, and LA 0036439. Deleted: NPDES

- "EPA" means the United State Environmental Protection Agency.

- "Fully Operational" means all items identified under a particular requirement have been fully completed and are consistently functioning within the design plan and specifications.

- "Infiltration and Inflow" or "I & I" means the infiltration and the inflow into the North, Central, and South Plant Collection Systems.

- "Infiltration" is the water entering a sewer system and service connections from the ground, through such means as, but not limited to, defective pipes, pipe joints, connections, or manhole walls.

- "Inflow" is the water discharged to a sewer system, including service connections, from such sources as, but not limited to, roof leaders; cellar, yard, and area drains; crushed laterals; foundation drains; cooling water discharge; drains from springs and swampy areas; manhole covers; cross-connections from storm sewers; catch basin laterals; stormwater; surface runoff; street wash water; or drainage.

- "LDEQ" means the Louisiana Department of Environmental Quality.

- "Non-Compliant Discharge" means any discharge of wastewater through an outfall from which the City and/or the Parish is permitted to discharge pursuant to NPDES/LPDES Permit Nos. LA0036439, LA0036412, and LA0036421 which is not in compliance with requirements and conditions specified in those permits, except as specifically provided in Section XVI (Interim Effluent Limits).

- "The North Plant" means the North Wastewater Treatment Plant located at 55 Mills Avenue in East Baton Rouge Parish, Louisiana.

- "NPDES/LPDES Permit No. LA 0036412" means National Pollutant Discharge Elimination System ("NPDES") "/ Louisiana Pollutant Discharge Elimination System ("LPDES") permit number LA0036412 issued pursuant to CWA Section 402, 33 U.S.C. § 1342, for the South Plant and any future, extended, modified, or reissued NPDES/LPDES permit for the same facility.

- "NPDES/LPDES Permit No. LA 0036421" means National Pollutant Discharge Elimination System ("NPDES")/ Louisiana Pollutant Discharge Elimination System ("LPDES") permit number LA0036421 issued pursuant to CWA Section 402, 33 U.S.C. § 1342, for the Central Plant and any future, extended, modified, or reissued NPDES/LPDES permit for the same facility.

- "NPDES/LPDES Permit No. LA 0036439" means National Pollutant Discharge Elimination System ("NPDES") "/ Louisiana Pollutant Discharge Elimination System ("LPDES") permit number LA0036439 issued pursuant to CWA Section 402, 33 U.S.C. § 1342, for the North Plant and any future, extended, modified, or reissued NPDES?LPDES permit for the same facility.

- "Paragraph" means a portion of this Consent Decree identified by an Arabic numeral.

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42. In the case of decisions by EPA and LDEQ on an item submitted for review and approval which are issued on the same day, the City/Parish shall commence implementation of the Work required by the item in accordance with the approved schedule within thirty (30) days after receipt of notice of EPA and LDEQ's decisions.

43. In the case of decisions on an item submitted for review and approval which are issued by EPA and LDEQ on different days, the City/Parish shall commence implementation of the Work required by the item in accordance with the approved schedule within thirty (30) days after the soonest of the following dates:

A. The date of the decision issued by the agency to decide first in time if the other agency has previously notified the City/Parish pursuant to Paragraph 41 that it waives its right to decide;

B. The date that the second agency notifies the City/Parish pursuant to Paragraph 41 that it waives its right to decide, if that notice is issued after the decision issued by the agency to decide first in time;

C. The date of the decision issued by the agency that decides second in time; or

D. The date that the right of the second agency to issue decision is waived under Paragraph 41.

44. In the case of an item approved subject to specified conditions or modified and approved in a decision issued by EPA or LDEQ, the City/Parish may invoke the dispute resolution procedures set forth in Section XXIV (Dispute Resolution) with respect to EPA's or LDEQ's decision. Regardless of whether the City/Parish invokes such dispute resolution procedures, if the City/Parish fails to timely commence

implementation of the Work required by the item approved subject to specified conditions or modified and approved, it shall be liable for any stipulated penalties due under Section XXI (Stipulated Penalties).

45. A. In the case of an item which as been disapproved, in whole or in part, by EPA or LDEQ, the City/Parish shall, within thirty (30) days of receipt of the notice of disapproval, correct the deficiencies and resubmit the item for approval. The City/Parish may also invoke the dispute resolution procedures set forth in Section XXIV (Dispute Resolution) with respect to a notice of disapproval. Regardless of whether the City/Parish invokes such dispute resolution procedures, if it fails to timely correct the deficiencies specified in the notice of disapproval and resubmit the item, (i) the City/Parish shall be liable for any stipulated penalties due under Section XXI (Stipulated Penalties) and (ii) EPA and/or LDEQ may modify and approve the item. An item that is resubmitted with the same deficiencies which were identified in the notice of disapproval or with substantially similar deficiencies shall be deemed to have never been submitted for purposes of calculating stipulated penalties.

B. Notwithstanding the receipt of a notice of disapproval pursuant to Paragraph 40, the City/Parish shall proceed, if so directed by EPA or LDEQ in the notice, to take any action required by any non-deficient portion of the item. The City/Parish shall commence implementation of such actions by the dates specified in Paragraphs 42 and 43.

C. In the event that a resubmitted item, or portion thereof, is disapproved by EPA or LDEQ, EPA and/or LDEQ may again require the

after the date the item was submitted, then the City/Parish shall be entitled to an extension of any interim or final deadlines which the City/Parish will be unable to meet as a result of the length of the review process. Any such request must be in writing and must identify the deadlines for which an extension is requested, the length of the extension requested, and set forth the basis for (1) the City/Parish's claim that it is unable to meet the deadline(s) due to the length of the review process and (2) the length of the extension requested. An extension will be considered granted after both EPA and LDEQ consent to the extension in writing.

48. If the City/Parish determines that a difference in the decisions by EPA and LDEQ regarding an item submitted for review under this Consent Decree will impose inconsistent obligations upon it, the City/Parish may invoke the procedures set forth in Section XXIV (Dispute Resolution). If, after the completion of the dispute resolution procedures set forth in Paragraph 93(B) or 94(A), the City/Parish still maintains that the decisions by EPA and LDEQ impose inconsistent obligations upon it, the City/Parish may move the Court to stay performance of the obligations which the City/Parish maintains are inconsistent until the matter is fully resolved pursuant to the procedures set forth in Section XXIV (Dispute Resolution).

49. all documents to be submitted for review and approval pursuant to this Consent Decree, including but not limited to, reports, approvals, disapprovals, and related correspondence, shall be sent to the following addresses or any other address that the City/Parish, EPA, and LDEQ hereafter agree upon in writing:

A. Three (3) copies of each document to be submitted to EPA should be sent to:

Chief
NPDES Compliance Monitoring Section (6EN-WC)

Water Enforcement Branch
Compliance Assurance and Enforcement Division
United States Environmental Protection Agency—Region 6
1445 Ross Avenue
Dallas, Texas 75202
re: Baton Rouge Consent Decree

B. Three (3) copies of each document to be submitted to LDEQ should be sent to:

Administrator
Office of Environmental Compliance
Louisiana Department of Environmental Quality
P.O. Box 4312
Baton Rouge, LA 70821-4312

Street Address:
621 N. Fifth Street
Galvez Building
Baton Rouge, LA 70802

Deleted: Bruce Hamman
Deleted: 82215
Deleted: 84
Deleted: 2215
Deleted: 7290 Blackbourne Road
Deleted: ¶ LDEQ
Deleted: 10-1611¶

C. One copy of each document to be submitted to the City/Parish should be sent to:

Deleted: Fred E. Raiford III

Director
Department of Public Works
City of Baton Rouge
Parish of East Baton Rouge
Post Office Box 1471
Baton Rouge, Louisiana 70821

Street Address:
300 North Boulevard, Rm. 208
Old Municipal Building
Baton Rouge, Louisiana 70802

50. Except as specifically provided in Section XVIII (Reporting), all documents submitted by the City/Parish to EPA and LDEQ for review and approval under this Consent Decree shall be signed by an authorized representative of the City/Parish and shall include the following certification statement:

I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of either the person or persons who manage the system and/or the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify, to the best of my knowledge and belief, that this document is consistent with the applicable requirements of the Consent Decree entered among the United States, the State of Louisiana, the City of Baton Rouge, and the Parish of East Baton Rouge in the matter of United States v. Baton Rouge, No. 88-191A (M.D. La.). I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

XVIII. REPORTING

51. Beginning with the first Calendar Quarter following entry of this Consent Decree, and each Calendar Quarter thereafter until termination of the decree, the City/Parish shall submit to EPA and LDEQ for review and approval a Quarterly Report. The Quarterly Report shall be due on the thirtieth day following the end of each Calendar Quarter. The Quarterly Report shall address the items set forth in Exhibit I to this Consent Decree (Quarterly and Annual Report Format). The items to be addressed in the Quarterly Report may be modified by written agreement of the Parties or by EPA and LDEQ approval of an Annual Report submitted pursuant to Paragraph 52 which contains a request by the City/Parish to modify the items to be addressed in the Quarterly Report.

52 Beginning on January 31, 2002 and every twelve (12) months thereafter until termination of this Consent Decree, the City/Parish shall submit to EPA and LDEQ for review and approval an Annual Report. The Annual Report shall cover the most recent one year period from January 1 to December 31. The Annual Report shall address the items set forth in Exhibit I to this Consent Decree (Quarterly and Annual Report Format). The items to be addressed in the Annual Report may be modified by written

agreement of the Parities or by EPA and LDEQ approval of an Annual Report submitted pursuant to this Paragraph which contains a request by City/Parish to modify the items to be addressed in the Annual Report.

53. No later than twenty-one (21) days following completion of any milestone set pursuant to Paragraph 30 or 34, the City/Parish shall submit to EPA and LDEQ a written statement indicating when the milestone was achieved.

54. All reports required to be submitted pursuant to this section shall contain a certification signed by a responsible official of the City/Parish. The certification shall read as follows:

> I certify that the information contained in or accompanying this [insert name of submission/document] is true, accurate and complete. As to (the/those) identified portion(s) of this (submission/document) for which I cannot personally verify (its/their) truth and accuracy, I certify as the official having supervisory responsibility for the person(s) who, acting under my direct instructions, made the verification, that this is true, accurate and complete.

XIX. CIVIL PENALTY

55. The City/Parish shall pay a civil penalty in the amount of Seven Hundred Twenty Nine Thousand Five Hundred dollars ($729,500). Payment shall be due within thirty days after the Date of Entry of the Consent Decree. Payment of the civil penalty shall be made as follows:

A. The City/Parish shall pay $364,750 to the United States by Electronic Funds Transfer ("EFT") to the U.S. Department of Justice ("DOJ") lockbox bank, referencing DOJ No. 90-5-1-1-2769/1. Payment shall be made in accordance with instructions provided by the United States to the City/Parish

following lodging of this Consent Decree. Any EFT received at the DOJ lockbox bank after 11:00 A.M. Eastern Time will be credited on the next business day.

B. The City/Parish shall pay $374,750 to Louisiana in the form of a certified check, made payable to the "Louisiana Department of Environmental Quality," and delivered to Darryl Serio, Office of the Secretary, P.O. Box 82263, Baton Rouge, Louisiana, 70884.

56. This civil penalty shall be considered a money judgment in favor of the United States and the State of Louisiana. The remedies provided in the Federal Debt Collection Procedures Act, 28 U.S.C. § 3001 et seq., shall be available to the United States for purposes of collection of this civil penalty. Remedies under any applicable federal or state law shall be available to the State of Louisiana for purposes of collection of this civil penalty.

57. At the time the City/Parish makes payment pursuant to Paragraph 55, it shall send a letter to the persons listed below which states the date payment was made and the amount of the payment. The letter shall include the caption, civil action number and judicial district of this action. The letter should be mailed to the following:

Regional Counsel
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Chief
NPDES Compliance Monitoring Section (6EN-WC)
Water Enforcement Branch
Compliance Assurance and Enforcement Division
United States Environmental Protection Agency—Region 6
1445 Ross Avenue
Dallas, Texas 75202
re: Baton Rouge Consent Decree

Chief
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, DC 20044-7611
re: DOJ No. 90-5-1-1-2769/1

Chief, Civil Division
United States Attorney's Office for the
Middle District of Louisiana
777 Florida St., Room 208
Baton Rouge, Louisiana 70801

Ted Broyles
Legal Affairs Division
Louisiana Department of Environmental Quality
P.O. Box _____
Baton Rouge, LA 70821-

Deleted: John B. King¶
Chief Attorney
Deleted: q
Deleted: 82287¶
Deleted: 84
Deleted: 2282

58. If the City/Parish fails to tender all or any portion of the civil penalty payment within thirty (30) days of the Effective Date of this Consent Decree, then interest on the civil penalty shall accrue from the date payment was due on any unpaid portion of the penalty at the rate established pursuant to 28 U.S.C. § 1961 in effect on the Date of Entry and shall continue to accrue until full payment is made. Interest shall be compounded annually. The City/Parish shall also be liable for stipulated penalties pursuant to Section XXI (Stipulated Penalties) for any failure to comply with the requirements of Paragraph 55.

59. If the City/Parish fails to pay the civil penalty when due, the United States and/or Louisiana may institute proceedings to collect the penalties and interest. If such a proceeding is instituted, the City/Parish shall be liable to reimburse the United States and/or Louisiana for its expenses and attorney fees connected with the proceeding.

Attorney fees shall be allowable at the maximum rate permitted under 28 U.S.C. § 2412(d)(2)(A)(ii) without finding of special factors.

XX. SUPPLEMENTAL ENVIRONMENTAL PROJECTS

60. The City/Parish shall conduct a Supplemental Environmental Project ("SEP") in accordance with the SEP Plan Requirements attached as Exhibit J. The SEP will consist of connecting sewage lines in certain subdivisions and urbanized areas within the City/Parish to the City/Parish treatment plants. The SEP will be completed in accordance with the schedule specified in the SEP Plan Requirements.

61. The City/Parish shall spend no less than $1,125,000 on the SEP. No part of this expenditure shall include federal funds, including low interest federal loans, federal contracts or federal grants. Expenditures unrelated to the goals of the SEP as stated about will not count towards the requisite expenditure amount. The City/Parish shall also sponsor a public information program designed to educate the public in the City of Baton Rouge and the Parish of East Baton Rouge of the benefits of the SEP. The public information program must acknowledge that the SEP will be implemented as part of this Consent Decree.

62. The City/Parish shall complete the SEP in accordance with the milestones contained in the SEP Plan Requirements (Exhibit J) and submit a SEP Completion Report no later than two years and six months from the Date of Entry of this Consent Decree. The SEP report shall contain the following information.

A. A detailed description of the SEP as implemented and of any aspects of the work performed which differed from the SEP Plan Requirements;

B. A description of any operating problems encountered and the solutions thereto;

C. Itemized costs, documented by copies of purchase orders, force accounts and receipts or canceled checks (which shall be made available to the United States, if requested);

D. Certification that the SEP has been fully implemented pursuant to the SEP Plan Requirements and the provisions of this Consent Decree;

E. A description of the environmental and public health benefits resulting from implementation of the SEP.

63. If, following receipt of the City/Parish's SEP Completion Report pursuant to Paragraph 72, EPA or LDEQ determine that the SEP has not been completed in compliance with the requirements of this Consent Decree:

A. The City/Parish shall pay an additional civil penalty in the amounts specified in this subparagraph except as specifically provided Subparagraph B. For each SEP Project described in the SEP Plan Requirements which is not completed in compliance with the requirements of this Consent Decree, the City/Parish shall pay additional civil penalties in the amounts shown in the table below:

Additional Civil Penalties for Failure to Complete SEP Projects in Compliance with the Requirements of this Consent Decree	
SEP Project	**Amount of Additional Civil Penalty**
Donwood/Oak Manor Project	$125,000
Pleasant Hills/Green Acres Project	$250,000
Sharon Hills/Cedar Glenn/Pleasant Hills Project	$650,000
Stumberg Lane Project	$100,000

B. If EPA and LDEQ determine that the City/Parish (i) made good faith and timely efforts to complete the project and (ii) has certified, with supporting documentation, that at least ninety percent (90%) of the amount of money which was required to be spent was expended on the SEP, then the City/Parish will not be required to pay any additional civil penalty.

Any payments of additional civil penalties pursuant to this Paragraph shall be made according to the method set forth in Paragraph 55.

64. If, following receipt of the City/Parish's SEP Completion Report pursuant to Paragraph 62, EPA and LDEQ determine that the SEP has been completed in compliance with the requirements of this Consent Decree and that the City/Parish:

A. Expended less than $1,012,500 on the SEP, then the City/Parish shall pay any portion of that amount not expended or obligated on the SEP to the United States' Treasury as an additional civil penalty.

B. Expenses $1,012,500 or more on the SEP, then the City/Parish will not be required to pay any additional civil penalty.

Any payments of additional civil penalties pursuant to this Paragraph shall be made according to the method set forth in Paragraph 55.

65. The City/Parish hereby certifies that it is not required to perform or develop the SEP by any federal, state or local law or regulation; nor is the City/Parish required to perform or develop the measures to be taken under the SEP by agreement, grant or as injunctive relief in this or any other case or in compliance with state or local requirements. The City/Parish further certifies that it has not received, and is not presently negotiating to receive, credit for the SEP in any other enforcement action.

XXI. STIPULATED PENALTIES

66. Past Stipulated Penalties: In settlement of claims by the United States for stipulated penalties under the 1988 Consent Decree in United States v. Baton Rouge, No. 88-191A (M.D. La.) through the Effective Date of this Consent Decree, the City/Parish shall pay to the United States stipulated penalties in the amount of $216,000. Payment shall be made within thirty (30) days of the Date of Entry according to the method set forth in Paragraph 55(A).

67 Failure to Submit Timely Reports: The City/Parish shall be liable to Plaintiffs for stipulated penalties in the amounts set forth below for each day past the applicable deadline the City/Parish fails to submit the Collection System Preventive Maintenance Program Plan pursuant to Paragraph 19, the Treatment Facility Assessment Report pursuant to Paragraph 36, a Quarterly Report pursuant to Paragraph 51, and Annual Report pursuant to Paragraph 52, the SEP Completion Report pursuant to Paragraph 62, or to resubmit any disapproved item (except the Second RMAP) pursuant to Paragraph 45 The stipulated penalties for failure to meet the deadline for submission of these reports shall be as follows:

Stipulated Penalties for Failure to Submit Timely Reports	
Period of Noncompliance	Penalty per Day per Violation
1st to 30th day	$500
31st to 60th day	$1000
More than 60 days	$2500

68. Failure to Submit Timely and Complete Second RMAP: The City/Parish shall be liable to Plaintiffs for stipulated penalties, as set forth below, for each day the City/Parish fails to timely submit a complete Second RMAP pursuant to Paragraph 31 or to resubmit a disapproved Second RMAP pursuant to Paragraph 45. The stipulated

penalties for failure to meet the deadline for submission of the RMAPs shall be as follows:

Stipulated Penalties for Failure to Timely Submit Second RMAP	
Period of Noncompliance	Penalty per Day per Violation
1st to 30th day	$1000
31st to 60th day	$2000
More than 60 days	$5000

69. Failure to meet RMAP and Construction Milestones: The City/Parish shall be liable to Plaintiffs for stipulated penalties in the amounts set forth below for each day the City/Parish fails to meet the milestone dates set pursuant to Paragraphs 30 and 34. The stipulated penalties for failure to meet the milestones shall be as follows:

Stipulated Penalties for Failure to Meet Milestone	
Period of Noncompliance	Penalty per Day per Violation
1st to 30th day	$2000
31st to 60th day	$5000
More than 60 days	$10,000

Provided that construction is begun on or before the required date, the City/parish shall place in an account approved by EPA any stipulated penalties due for failure to meet an interim construction milestone set pursuant to Paragraph 30 or 34. Within thirty days of completion of the remedial measure, the City/Parish shall pay such stipulated penalties together with all accrued interest, unless it establishes that the construction of the remedial measure was completed and full operational status achieved on or before the milestone date set pursuant to Paragraph 34(D).

70 The City/Parish shall be liable to Plaintiffs for stipulated penalties as set forth below for each day the City/Parish fails to satisfy any of the following requirements:

A. $2,000 for each day the City/Parish fails to seal or eliminate newly discovered cross connections by the deadline specified in Paragraph 16;

B. $15,000 for each day the City/Parish fails to submit the civil penalty required by Paragraph 55 or the stipulated penalty required by Paragraph 66.

71. Pre-Remedial Action Unauthorized Discharges: Prior to the date for completion of all Work specified in the First and Second RMAPs, the City/Parish shall be liable to Plaintiffs for stipulated penalties as follows:

A. For any Unauthorized Discharge which results in the release of less than one million (1,000,000) gallons during its entire duration, the City/Parish shall be liable to Plaintiffs for stipulated penalties of $5000 per day for each day of each such Unauthorized Discharge except as specifically provided in this Subparagraph. The City/Parish shall not be liable to Plaintiffs for stipulated penalties if the City/Parish is in compliance with the Collection system Preventive Maintenance Program Plan (if approved by EPA and/or LDEQ pursuant to Section XVII (Review of Submittals) at the time of the discharge) and the City/Parish followed the SSO Response Plan in responding to and mitigating the impact of the discharge.

B. For any Unauthorized Discharge which results in the release of one million (1,000,000) gallons or more during its entire duration, the City/Parish shall be liable to Plaintiffs for stipulated penalties of $5000 per day for each day of each such Unauthorized Discharge.

72. Post-Remedial Action Unauthorized Discharges: After the date for completion of all Work specified in the First and Second RMAPs:

A. For any Unauthorized Discharge which results in the release of less than one million (1,000,000) gallons during its entire duration:

i. The City/Parish shall be liable to Plaintiffs for stipulated penalties of $5,000 per day for each day of each Unauthorized Discharge if the City/Parish is not in compliance with the Collection system Preventive Maintenance Program Plan or if the City/Parish failed to follow the SSO Response Plan in responding to and mitigating the impact of the discharge.

ii. The City/Parish shall be liable to Plaintiffs for stipulated penalties of $1,000 per day for each day of each Unauthorized Discharge if the City/Parish is in compliance with the Collection System Preventive Maintenance Program Plan and the City/Parish followed the SSO Response Plan in responding to and mitigating the impact of the discharge.

B. For any Unauthorized Discharge which results in the release of one million (1,000,000) gallons or more during its entire duration, the City/Parish shall be liable to Plaintiffs for stipulated penalties of $5,000 per day for each day of each such Unauthorized Discharge.

73. Non-Compliant Discharge: The City/Parish shall be liable to Plaintiffs for stipulated penalties for Non-Compliant Discharges. For violations of any Daily Maximum limits, the City/Parish shall be liable to Plaintiffs for stipulated penalties of $1,000 per parameter per day per facility. For violations of any Weekly Average limits,

the City/Parish shall be liable to Plaintiffs for stipulated penalties of $1,000 per parameter per week per facility. For violations of any 30-Day Average or Monthly Average limits, the City/Parish shall be liable to Plaintiffs for stipulated penalties of $2,500 per parameter per month per facility.

74. Supplemental Environmental Projects: The City/Parish shall be liable to Plaintiffs for stipulated penalties of $2,500 per day for each day that the City/Parish fails to meet the milestone dates for commencement of work for the Supplemental Environmental Projects in accordance with the schedule contained in the Supplemental Environmental Project Plan Requirements (Exhibit J).

75. All stipulated penalties shall begin to accrue on the first day the City/Parish fails to satisfy any obligation or requirement of this Consent Decree and shall continue to accrue through the day the City/Parish satisfies the obligation or requirement of this Consent Decree.

[Note: no paragraph 76 in original]

77. Payment of stipulated penalties as set forth above shall be in addition to any other rights or remedies which may be available to the United States or the State of Louisiana by reason of the City/Parish's failure to comply with the requirements of this Consent Decree and all applicable Federal, state or local laws, regulations, wastewater discharge permit(s) and all other applicable permits.

78. Unless otherwise specifically provided in this Consent Decree, stipulated penalties shall be due and owing no later than thirty (30) days following the City/Parish's receipt from the United States or the State of Louisiana setting forth a demand for payment, except as specifically provided in Paragraph 79. However, nether Plaintiff may

accept payment in an amount less than the full amount of the stipulated penalties owed for the violation identified in the demand for payment without the written consent of the other Plaintiff. One half of the total amount of stipulated penalties due shall be paid to the United States by tendering a certified or cashier's check in an amount due payable to "Treasurer, the United States of America" to the Unites States Attorney for the Middle District of Louisiana, 777 Florida St., Room 208, Baton Rouge, Louisiana 70801. The other half of the total amount due shall be paid to the State of Louisiana in the form of a certified check, made payable to the "Louisiana Department of Environmental Quality," and delivered to Darryl Serio, Office of the Secretary, P>O> Box 82263, Baton Rouge, Louisiana, 70884. Payments shall be accompanied by a transmittal letter which references United States v. Baton Rouge (M.D. La.) and the civil action number of this case, states the amount being paid, and specifically describes the violations which are the basis for the stipulated penalty being paid. At the time of payment, copies of the transmittal letter and the certified and/or cashier's check shall be sent to:

Chief
Environmental Enforcement Section
Environmental and Natural Resources Division
United States Department of Justice
Post Office Box 7611
Washington, D.C. 20044-7611
Ref: DOJ# 90-5-1-1-2769/1

Director
Compliance Assurance and Enforcement Division
United States Environmental Protection Agency, Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Ted Broyles
Legal Affairs Division
Louisiana Department of Environmental Quality
P.O. Box ____

Deleted: John B. King¶
. Chief Attorney

Deleted: 82263

Baton Rouge, LA 70821-

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79. If the City/Parish invokes dispute resolution pursuant to Section XXIV (Dispute Resolution), stipulated penalties shall continue to accrue as provided in this Section during the pendency of any dispute resolution proceeding but such stipulated penalties need not be paid until the following:

A. If the dispute is resolved by agreement or by a decision by the Director of the Compliance Assurance and Enforcement Division of EPA Region 6 or the Secretary of LDEQ that is not appealed to this Court, accrued penalties shall be paid within fifteen (15) days of the agreement or decision. The City/Parish shall not be liable for any stipulated penalties if it prevails in the dispute or if the parties to the dispute so agree.

B. If the dispute is appealed to the Court and the EPA or LDEQ prevails in whole or in part, accrued penalties determined by the Court to be owing shall be paid within thirty (30) days of receipt of the Court's decision or order, except as provided in Subparagraph C;

C. If the District Court's decision is appealed by any Party, the City/Parish shall pay all accrued penalties determined by the District Court to be owing into an interest-bearing escrow account within thirty (30) days of receipt of the Court's decision or order. Every thirty (30) days after making the initial payment into the escrow account, the City/Parish shall pay into the escrow account all stipulated penalties which have accrued during the interim since the last payment. Within fifteen (15) days of receipt of the final appellate court decision, the escrow agent shall pay the balance of the account to the Plaintiffs (in

accordance with the payment instruction set forth in Paragraph 78) or to the City/Parish, whichever prevails.

80. In the event that a stipulated penalty is not paid when due, the stipulated penalty shall be payable with interest from the original due date to the date of payment at a rate equal to the statutory judgment rate set forth at 28 U.S.C. § 1961(a) in effect on the date the penalty becomes due plus ten percent (10%).

81. The payment of stipulated penalties shall not alter in any way the City/Parish's obligation to complete performance of the Work required under this Consent Decree.

82. If the City/Parish fails to pay any stipulated penalties when due, the United States and/or the State of Louisiana may institute proceedings to collect the stipulated penalties and interest. If such a proceeding is instituted, the City/Parish shall be liable to reimburse the United States and/or the State of Louisiana for its expenses and attorney fees connected with the proceeding. Attorney fees shall be allowable at the maximum rate permitted under 28 U.S.C. § 2412(d)(2)(A)(ii) without a finding of special factors.

83. For purposes of collection, any stipulated penalties which become due shall be considered a money judgment in favor of the United States and the State of Louisiana. The remedies provided in the Federal Debt Collection Procedures Act (except the provisions of § 3201(e)), 28 U.S.C. § 3001 et seq., shall be available to the United States for purposes of collection of any stipulated penalties.

XXII. FORCE MAJEURE

84 "Force Majeure" for the purposes of this Consent Decree is defined as an event arising from causes beyond the control of the City/Parish or the control of any entity controlled by the City/Parish, including their agents, consultants and contractors, which delays or prevents the performance of any obligation under this Consent Decree despite the City/Parish's best efforts to fulfill the obligation. Unanticipated or increased costs or expenses associated with implementation of this Consent Decree and changed financial circumstances shall not, in any event, be considered force majeure events. Failure to apply for a required permit or approval or to provide in a timely manner all information required to obtain a permit or approval that is necessary to meet the requirements of this Consent Decree, or failure of the City to approve contracts, shall not, in any event, be considered force majeure events. The requirement that the City/Parish exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure event and best efforts to address the effects of a potential force majeure event (a) as it is occurring and (b) following the potential force majeure event, such that the delay is minimized to the greatest extent practicable. "Force Majeure" does not include financial inability to complete the Work.

85. Within ten days of the date the City/Parish knew or, by the exercise of due diligence, should have known, whichever is first in time, of an event that might delay completion of any requirement of this Consent Decree, regardless of whether the event is a Force Majeure event, the City/Parish shall notify EPA and LDEQ, in writing, within ten (10) business days. The notice shall indicate whether the City/Parish claims that the delay should be excused due to a Force Majeure event. The notice shall describe in detail the basis for the City/Parish's contention that they experienced a Force Majeure delay,

the anticipated length of the delay, the precise cause or causes of the delay, the measures taken or to be taken to prevent or minimize the delay, and the timetable by which those measures will be implemented. The City/Parish shall adopt all reasonable measures to avoid or minimize such delay. Failure to so notify EPA and LDEQ shall render this Section void and of no effect as to the event in question, and shall be a waiver of the City/Parish's right to obtain an extension of time for the obligations based on such event.

86. If EPA and LDEQ agree that the delay or anticipated delay is attributable to a force majeure event, the time for performance of the obligations under this consent Decree that are affected by the force majeure event will be extended by at least the amount of time lost due to the force majeure event. If EPA or LDEQ does not agree that the delay or anticipated delay has been or will be caused by a force majeure event, then the City/Parish will be notified in writing of this decision and the reasons for the decision. If EPA and LDEQ agree that the delay is attributable to a force majeure event, they will notify the City/Parish in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure event.

87. If the City/Parish elects to invoke the dispute resolution procedure set forth in Section XXIV (Dispute Resolution) in connection with EPA's and/or LDEQ's decision that a delay or anticipated delay is not attributable to a force majeure event, it shall do so no later than fifteen (15) days after receipt of EPA and/or LDEQ's notice pursuant to Paragraph 86. In any such proceedings, the City/Parish shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure event, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were

exercised to avoid and mitigate the effects of the delay, and that the City/Parish complied with the requirements of Paragraphs 84 and 85. If the City/Parish carries this burden, the delay at issue shall be deemed not to be a violation by the City/Parish of this Consent Decree.

88. An extension of one compliance date based on a particular force majeure event shall not automatically extend any other compliance date. The City/Parish shall make an individual showing of proof regarding the cause of each delayed incremental step or other requirement for which an extension is sought.

XXIII. RETENTION OF JURISDICTION

89. This Court shall retain jurisdiction of this matter for the purposes of implementing and enforcing the terms and conditions of this Consent Decree and for the purpose of adjudicating all disputes among the parties that may arise under the provisions of this Consent Decree, to the extent that this Consent Decree provides for resolution of disputes by the Court.

XXIV. DISPUTE RESOLUTION

90. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. However, the procedures set forth in this Section shall not apply to actions by the United States or the State of Louisiana to enforce obligations of the City/Parish that have not been disputed in accordance with this Section. Within thirty (30) days after a decision is issued by EPA or LDEQ under Section XVII (Review of Submittals), that decision shall be final and not

subject to dispute resolution unless the City/Parish has invoked dispute resolution pursuant to this Section prior to the expiration of the thirty (30) day period.

91. Any dispute which arises under or with respect to this Consent Decree shall in the first instance be the subject of good-faith informal negotiations between the parties to the dispute. In the case of a dispute regarding a decision by EPA or LDEQ regarding an item submitted for review and approval under Section XVII (Review of Submittals), the parties to the dispute shall be the City/Parish and the agency that issued the disputed decision. The goal of the informal negotiations shall be to resolve the dispute without further proceedings. The period for informal negotiations shall not exceed thirty (30) days from the time the dispute arises, unless (a) EPA or LDEQ (whichever is a party to the dispute), in their sole discretion, determines that a shorter period shall be allowed due to an immediate threat to the environment or (b) all parties to the dispute agree in writing to an extension. The dispute shall be considered to have arisen when the City/Parish sends Plaintiffs a written Notice of Dispute. The Notice of Dispute shall contain a concise statement of the issue or issues in dispute. If informal negotiations result in an agreement between the parties to the dispute, then those parties shall state the agreement in a single document in writing. If informal negotiations do not result in an agreement between the parties to the dispute, then the agency that issued the disputed decision shall provide to the City/Parish in writing its opinion on the disputed issue or issues.

92. A. If the parties to the dispute cannot resolve it by informal dispute resolution, then the position advanced by the agency that issued the disputed decision shall be considered binding unless, within fifteen (15) days after the

issuance of a written opinion under Paragraph 91 by the agency that issued the disputed decision, the City/Parish invokes the formal dispute resolution procedures of this Section by serving on the agency that issued the disputed decision a written Statement of Position on the matter in dispute. In its Statement of Position, the City/Parish shall describe the subject of the dispute, state its position on the dispute, and set forth in detail the basis for that position. The Statement of Position shall include the factual data, analysis, and opinions supporting the City/Parish's position and the supporting documentation relied upon by the City/Parish. The Statement of Position shall specify the City/Parish's position as to whether formal dispute resolution should proceed under Paragraph 93 or Paragraph 94.

B. Within fifteen (15) days after receipt of the City/Parish's Statement of Position, the agency that issued the disputed decision will serve on the City/Parish its Statement of Position. In its Statement of Position, that agency shall describe the subject of the dispute, state its position on the dispute, and set forth in detail the basis for that position. The Statement of Position shall include the factual data, analysis, and opinions supporting the agency's position and the supporting documentation relied upon by it. The Statement of Position shall specify the agency's position as to whether formal dispute resolution should proceed under Paragraph 93 or Paragraph 94.

C. Within seven (7) days after receipt of the Statement of Position by the agency that issued the disputed decision, the City/Parish may submit a Reply to that agency's Statement of Position.

D. If there is a disagreement between the parties to the dispute as to whether dispute resolution should proceed under paragraph 93 or 94, the parties to the dispute shall follow the procedures set forth in the Paragraph determined by the agency that issued the disputed decision to be applicable. However, after a decision is issued under Paragraph 93(c) or 94(a), if the City/Parish appeals the dispute to the Court for resolution under Paragraph 93(d) or 94(a), the Court shall determine which Paragraph is applicable in accordance with the standards of applicability set forth in Paragraphs 93 and 94.

93. the formal dispute resolution procedures set forth in this Paragraph shall apply to disputes pertaining to matters that are accorded review on the administrative record under applicable principles of administrative law. The provisions of this Paragraph shall apply, without limitation, to (1) disputes regarding items requiring approval by EPA and LDEQ under this Consent Decree including, but not limited to, disputes regarding the adequacy or appropriateness of and procedures to implement Work, and (2) disputes regarding the selection, evaluation, implementation, performance, or adequacy of any Work.

A. An administrative record of the dispute shall be maintained by the agency that issued the disputed decision and shall contain all Statements of Position submitted pursuant to Paragraph 92, including supporting documentation, submitted pursuant to this Section. Where appropriate, the agency that issued the disputed decision may allow submittal of supplemental statements of position by the parties to the dispute.

B. In a case where the disputed decision was issued by EPA, the Director of the Compliance Assurance and Enforcement Division for EPA Region 6 will issue a final administrative decision resolving the dispute based on the administrative record described in Subparagraph (A) above. In a case where the disputed decision was issued by LDEQ, the Secretary of the LDEQ will issue a final administrative decision resolving the dispute based on the administrative record described in Subparagraph (a) above. This decision shall be binding upon the City/Parish subject only to the right to seek judicial review pursuant to Subparagraphs (C) and (D).

C. Any administrative decision pursuant to Subparagraph (B) above shall be reviewable by this Court, provided that a motion for judicial review of the decision is filed by the City/Parish with the Court and served on all Parties within twenty (20) days of receipt of the decision. The motion shall include a description of the matter in dispute, the efforts made to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Consent Decree. Both EPA and LDEQ may file a response to the City/Parish's motion.

D. In proceedings on any dispute governed by this Paragraph, the City/Parish shall have the burden of demonstrating that the decision under subparagraph (B) above is arbitrary and capricious or otherwise not in accordance with law. Judicial review of decisions under Subparagraph (B) above shall be limited to the administrative record compiled pursuant to Subparagraph (A) above.

98. Formal dispute resolution for disputes that do not pertain to (1) the adequacy or appropriateness of and procedures to implement Work; (2) the selection, evaluation, implementation, performance, or adequacy of any Work; or (3) that are not otherwise accorded review on the administrative record under applicable principles of administrative law shall be governed by this Paragraph. The provisions of this Paragraph shall apply, without limitation to disputes arising under Section XXII (Force Majeure) regarding whether any failure by the City/Parish to meet a deadline was caused by a force majeure event.

A. In a case where the disputed decision was issued by EPA, the Director of the Compliance Assurance and Enforcement Division, EPA Region 6 will issue a final decision resolving the dispute. In a case where the disputed decision was issued by LDEQ, the Secretary of the LDEQ will issue a final decision resolving the dispute. Such decision shall be binding on the City/Parish unless, within twenty 920) days of receipt of the decision, the City/Parish files with the Court and serves on the other Parties a motion for judicial review of the decision setting forth the matter in dispute, the efforts made to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of the Consent Decree. Both EPA and LDEQ may file a response to the City/Parish's motion.

B. Judicial review of any dispute governed by this Paragraph shall be governed by applicable principles of law.

95. In the event of any re-organization of EPA which affects the Compliance Assurance and Enforcement Division for EPA Region 6 and/or any substantial change in

the responsibilities of the Director of the Compliance Assurance and Enforcement Division for EPA Region 6, EPA may notify the City/Parish that the authorities and responsibilities of the Director of the Compliance Assurance and Enforcement Division for EPA Region 6 will be transferred to an official specified in the notice.

96. Invocation of the dispute resolution procedures under this Section shall not extend, postpone or affect in any way any obligation of the City/Parish under this Consent Decree not directly in dispute, unless EPA and LDEQ agree otherwise or the Court so orders or directs.

XXV. RIGHT OF ENTRY

97. The United States and the State of Louisiana and their authorized representatives and contractors shall have authority at all times, upon the presentation of credentials, to enter the premises and/or worksite of the City/Parish to:

A. Monitor the progress of activities required by this Consent Decree;

B. Verify any data or information submitted to the United States or the State of Louisiana;

C. Obtain samples, and, upon request, obtain splits of any samples collected by the City/Parish or their consultants and contractors;

D. Inspect and evaluate any portions of the North, Central, or South Plants and related Collection Systems; and

E. Inspect and review any records required to be kept under the terms and conditions of this Consent Decree, applicable NPDES/LPDES Permits, or the CWA.

Deleted: NPDES

These inspection rights are in addition to, and in no way limit or otherwise affect, the United States' and the State of Louisiana's statutory authorities to conduct inspections, to require monitoring, and to obtain information from the City/Parish as authorized by law.

XXVI. NOT A PERMIT/COMPLIANCE WITH OTHER STATUES/REGULATIONS

98. This Consent Decree is not and shall not be construed as a permit issued pursuant to CWA Section 402, 33 U.S.C. § 1342, nor as a modification of any existing permit so issued, nor shall it in any way relieve the City/Parish of their obligations to obtain and maintain NPDES/LPDES permits for the North, Central, and South Plant or any other part of their wastewater treatment and collection system or facilities and to comply with the requirements of any NPDES/LPDES permit; Section XVI (Interim Effluent Limits), if applicable; and any other applicable federal or state law or regulation. Any new permit, or modification of existing permits, must be complied with in accordance with applicable federal and state laws and regulations.

99. Nothing here shall be construed as relieving the City/Parish of the duty to comply with the CWA, regulations promulgated under the CWA, and all permits issued under the CWA (except as specifically provided in Section XVI (Interim Effluent Limits)).

100. This Consent Decree shall not be construed as a ruling or determination of any issue related to any federal, state, or local permit required in order to implement this Consent Decree or required to continue operation of the North, South, and Central plants and related Collection Systems. The City/Parish shall be responsible for obtaining any federal, state, or local permit(s) required for Work under this Consent Decree.

XXVII. FAILURE OF COMPLIANCE

101 The United States does not, by its consent to the entry of this Consent Decree, warrant or aver in any manner that the City/Parish's complete compliance with this Consent Decree will result in compliance with the provisions of the Clean Water Act, 33 U.S.C. §§ 1251 et seq., or with the City/Parish's NPDES/LPDES permits. Deleted: NPDES

Notwithstanding EPA's review or approval of any plans, reports, policies, or procedures formulated pursuant to this Consent Decree, the City/Parish shall remain solely responsible for any non-compliance with the terms of this Consent Decree, all applicable permits, the CWA and regulations promulgated under the CWA. The pendency or outcome of any proceeding concerning issuance, re-issuance, or modifications of any permit shall neither affect nor postpone the City/Parish's duties and obligations as set forth in this Consent Decree.

XXVIII. NON-WAIVER PROVISIONS

102. This Consent Decree in no way affects or relieves the City/Parish of any responsibility to comply with any federal, state, or local law or regulation. However, nothing in this Paragraph shall be deemed to conflict with the provisions of Section XVI (Interim Effluent Limits).

103. The parties agree that the City/Parish is responsible for achieving and maintaining complete compliance with all applicable federal and state laws, regulations, and permits, and that compliance with this Consent Decree shall be no defense to any actions commenced pursuant to said laws, regulations, or permits, except as otherwise expressly specified in the Consent Decree.

104. This Consent Decree does not limit or affect the rights of the City/Parish, the United States, or the State of Louisiana as against any third parties that are not parties to this Consent Decree.

105. The Parties reserve any and all legal and equitable remedies available to enforce the provisions of this Consent Decree.

106. Except as expressly provided herein, Plaintiffs hereby reserve all statutory and regulatory powers, authorities, rights, and remedies (including all such legal, equitable, civil, criminal, and administrative powers), including, without limitation, those that may pertain to the City/Parish's failure to comply with any of the requirements of this Consent Decree, the CWA, or state law. Such powers, authorities, rights, and remedies shall include, without limitation, additional enforcement action and the assessment of penalties under the CWA against the City/Parish, the authority to seek information from the City/Parish, and the authority to seek access to the property of the City/Parish.

107. Performance of the terms of this Consent Decree by the City/Parish is not conditioned on the receipt of any federal or state funds.

108. Obligations of the City/Parish under the provisions of this Consent Decree to perform Work scheduled to occur after the Date of Lodging, but prior to the Date of Entry, shall be legal enforceable from the Date of Lodging of this Consent Decree. Liability for stipulated penalties for any such obligations shall not begin to accrue until the date of Entry of this Consent Decree. Obligations in the Consent Decree, unless otherwise stated, shall be initiated upon Entry of the Consent Decree.

109. It is the intent of the Parties hereto that the clauses hereof are severable, and should any clause(s) be declared by a court of competent jurisdiction to be invalid and unenforceable, the remaining clauses shall remain in full force and effect

XXIX. COVENANT NOT TO SUE BY THE UNITED STATES AND THE STATE OF LOUISIANA

110. In consideration of the actions that will be performed under the terms of this Consent Decree by the City/Parish and the payments that the City/Parish will make pursuant to Paragraphs 55 (Civil Penalty) and 66 (Past Stipulated Penalties) and except as otherwise specifically provided in this Consent Decree, the United States covenants not to sue or to take administrative action against the City/Parish for civil claims specifically alleged in the Complaint which accrue on or before the Date of Entry. In consideration of the actions that will be performed under the terms of this Consent Decree by the City/Parish and the payment that the City/Parish will make pursuant to Paragraph 55 (Civil Penalty) and except as otherwise specifically provided in this Consent Decree, the State of Louisiana covenants not to sue or to take administrative action against he City/Parish for civil claims specifically alleged in the Complaint which accrue on or before the Date of Entry and for the following civil claims which accrue on or before the Date of Entry:

- Civil claims against the City/Parish for Unauthorized Discharges from the Collection System pursuant to LA. R.S. 30:2075;
- Civil claims against the City/Parish for violations of NPDES/LPDES Permits Nos. LA0036412, LA0036421, and LA0036439 pursuant to LA. R.S. 30:2076(A); and
- Civil claims against the Parish for discharges without a permit from the North, Central, and South Plants pursuant to LA. R.S. 30:2075.

This covenant not to sue is conditioned upon satisfactory performance by the City/Parish of its obligations under this Consent Decree. This covenant not to sue shall take effect upon the receipt by the United States and the State of Louisiana of the full payment required by Paragraphs 55 (Civil Penalty) and Paragraph 66 (Past Stipulated Penalties). This covenant not to sue extends only to the City/Parish and does not extend to any other person.

111. Except as specifically provided in Section XVI (Interim Effluent Limits), the United States and the State of Louisiana reserve all remedies available to it for violations of the CWA by the City/Parish which are not alleged in the Complaints and for violations of the CWA by the City/Parish which occur after the Date of Lodging of this Consent Decree

112. This Consent Decree does not resolve criminal liability, if any, that any person might have for violations of the Clean Water Act.

113. Nothing in this Consent Decree shall be construed to limit the authority of the United States or the State of Louisiana to undertake any action against any person, including the City/Parish, in response to conditions that may present an imminent and substantial endangerment to the environment or to the public health or welfare.

XXX. ENDANGERMENT

114. If EPA or LDEQ determine that any activities undertaken pursuant to this Consent Decree have caused or may cause an imminent and substantial risk of harm to the public health or the environment, either Agency may order the City/Parish to (1) stop immediately any specified activities under this Consent Decree for such period of time as may be needed to abate any such risk and (2) undertake any action which EPA or LDEQ

determines is necessary to abate such release or threat. Relevant schedules affected by the work stoppage shall be extended by any period during which implementation is stopped by order of EPA or LDEQ plus any reasonable demobilization and/or re-mobilization periods, provided that the release or threat is not due to noncompliance by the City/Parish with this Consent Decree.

XXXI. COSTS OF SUIT

115. Each party shall bear its own costs and attorney's fees with respect to matters resolved by this Consent Decree. Should the City/Parish subsequently be determined by the Court to have violated the terms and conditions of this Consent Decree, the City/Parish shall be liable to the United States for any expenses and attorney's fees incurred by the United States in actions against the City/parish to enforce the requirements of this Consent Decree. Attorneys fees shall be allowable at the maximum rate permitted under 28 U.S.C. § 2412(d)(2)(A)(ii) without a finding of special factors.

XXXII. RECORD KEEPING

116. The City/Parish shall maintain copies of any underlying research and data for any and all documents, reports, or permits submitted to EPA and LDEQ pursuant to this Consent Decree which are in the possession, custody or control of the City/Parish or its agents, contractors, subcontractors, officers, servants, employees, attorneys, successors, or assigns for a period of three (3) years from date of submission. The City/Parish shall submit such supporting documents to EPA upon request.

XXXIII. FORM OF NOTICE

117. Unless otherwise specified, all reports, notices, or any other written communications required to be submitted under this Consent Decree shall be sent to the respective parties at the following addresses:

As to the United States:
Chief
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611

Street Address (No USPS delivery)
1425 N.Y. Ave., NW, 13th Floor
Washington, D.C. 20005

Chief, Water Enforcement Branch (6EN-W)
Compliance Assurance and Enforcement Division
U.S. Environmental Protection Agency, Region VI
1445 Ross Avenue
Dallas, Texas 75202-2733

As to EPA:
Chief, Water Enforcement Branch (6EN-W)
Compliance Assurance and Enforcement Division
U.S. Environmental Protection Agency, Region VI
1445 Ross Avenue
Dallas, Texas 75202-2733

As to LDEQ:
Administrator
Office of Environmental Compliance
Louisiana Department of Environmental Quality
P.O. Box 4312
Baton Rouge, LA 70821-4312

Street Address:
521 N. Fifth Street
Galvez Building
Baton Rouge, LA 70802

As to City/Parish:
Director
Department of Public Works

Deleted: Bruce Hamman
Deleted: 82215
Deleted: 84-2215
Deleted: 7290 Bluebonnet Rd
Deleted: .
Deleted: LDEQ
Deleted: 1
Deleted: -1611
Deleted: Fred E. Raiford, III

City of Baton Rouge
Parish of East Baton Rouge
Post Office Box 1471
Baton Rouge, Louisiana 70821

Street Address:
300 North Boulevard, Rm. 208
Old Municipal Building
Baton Rouge, Louisiana 70802

Notifications to or communications, if received, shall be deemed submitted on the date they are postmarked and sent by certified mail, return receipt requested or, when sent by non-postal delivery, the date of pickup provided same is for next day delivery.

XXXIV. MODIFICATION

118. Schedules for completion of the Work, except the deadline for completion of the Collection System Remedial Program set pursuant to Paragraphs 34(D) and 34A(D), may be modified by agreement of EPA, LDEQ, and the City/Parish. All such modifications shall be made in writing.

119. Material modifications may be made to this Consent Decree only with written notification to and written approval of each of the Parties and the Court and with an opportunity for public notice and comment in a manner consistent with Paragraphs 122 and 123. Modifications to attachments or exhibits to this Consent Decree that do not materially alter that document may be made by written agreement between the United States, LDEQ and the City/Parish.

120. Nothing in this Consent Decree shall be deemed to alter the Court's power to enforce, supervise, or approve modifications to this Consent Decree.

XXXV. CONTINGENT LIABILITY OF STATE OF LOUISIANA

121. This Consent Decree does not resolve the contingent liability of the State of Louisiana under Section 309(e) of the Act, 33 U.S.C. § 1319(e). The United States specifically reserves its claims against the State, and the State reserves its defenses.

XXXVI. PUBLIC COMMENT AND ENTRY

122. After this Consent Decree has been signed by all Parties, it shall be lodged with the Court for a period of not less than thirty (3) days for public notice and comment in accordance with U.S. Department of Justice Policy and 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if comments by the public regarding the Consent Decree disclose facts or considerations which indicate that the Consent Decree is inappropriate, improper, or inadequate. This Paragraph does not create any rights exercisable by the City/Parish.

123. The Parties agree and acknowledge that final approval by Plaintiff the State of Louisiana, Department of Environmental Quality, and entry of this consent Decree is subject to the requirements of La. R.S. 30:2050.7, which provides for public notice of this Consent Decree in newspapers of general circulation and the official journals of the Parish of East Baton Rouge, and opportunity for public comment, consideration of any comments, and concurrence by the State Attorney General. This Paragraph does not create any rights exercisable by the City/Parish.

124. By the signature of its authorized representative below, the City/Parish agrees to entry of this Consent Decree without further notice.

XXXVII. THE 1988 CONSENT DECREE

125. This Consent Decree is intended to supercede and replace the December 23, 1988 Modified Consent Decree ("the 1988 Consent Decree") in United States v.

Baton Rouge, No. 88-191A (M.D. La.) Accordingly, the 1988 Consent Decree is terminated as of the Effective Date of this Consent Decree.

XXXVIII. TERMINATION

126. The Consent Decree shall remain in effect until terminated by the Court pursuant to a Motion for Termination filed by a Party. As a requirement of termination, the City/Parish shall have the burden to demonstrate the following items:

A. The remedial measures set forth in the First and Second RMAPs have been completed and are fully operational;

B. All SEPs have been completed in compliance with all applicable requirements;

C. There have been no Non-Compliant Discharges from the North Plant during any twelve (12) month period following the completion of construction of all elements of the Collection System Remedial Program related to the North Plant and its Collection System;

D. There have been no Non-Compliant Discharges from the Central Plant during any twelve (12) month period following the completion of construction of all elements of the Collection System Remedial Program related to the Central Plant and its Collection System;

E. There have been no Non-Compliant Discharges from the South Plant during any twelve (12) month period following the completion of construction of all elements of the Collection System Remedial Program related to the South Plant and its Collection System;

F. The City/Parish has paid all civil penalties, costs, damages, stipulated penalties, and other sums due under this Consent Decree; and

G. The City/Parish has fulfilled all other obligations under this Consent Decree and been in compliance with all other requirements of this Consent Decree during the preceding six months.

If the condition set forth in Subparagraphs (C), (D), and/or (E) has not been met, the City/Parish may still file a Motion for Termination; however, if EPA or LDEQ, in their sole discretion, objects to termination based upon the City/Parish's failure to meet the condition set forth in Subparagraphs (C), (D), and/or (E), then the Court shall deny termination until all the conditions specified have been met. The United States and the State of Louisiana shall have the opportunity to file a response to any motion filed by the City/Parish for termination of this Consent Decree.

XXXIX. SIGNATORIES

127. The Assistant Attorney General on behalf of the United States and the undersigned representatives of the City/Parish and the State of Louisiana certify that they are fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind such party to this document.

Entered this ____ day of _____, 2005.

Deleted: 14th
Deleted: March
Deleted: 1

_____
United States District Judge

FOR THE UNITED STATES OF AMERICA:

November 22, 2001
Date

JOHN C. CRUDEN ?
Acting Assistant Attorney General
Environment and Natural Resources Division
United States Department of Justice

Formatted: Highlight

October 4, 2001
Date

MICHAEL T. DONNELLAN
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
United States Department of Justice
P.O. Box 7611
Washington, D.C. 20044
(202) 514-4226

DAVID R. DUGAS
United States Attorney
Middle District of Louisiana

November 13, 2001
Date

JOHN J. GAUPP, LA. Bar Roll No. 14976
Assistant United States Attorney
Middle District of Louisiana
777 Florida St., Suite 208
Baton Rouge, Louisiana 70801
(225) 389-0443

FOR THE ENVIRONMENTAL PROTECTION AGENCY:

November 2, 2001
Date

SYLVIA LOWRANCE
Acting Assistant Administrator
Office of Enforcement and Compliance Assurance
United States Environmental Protection Agency
Washington, D.C. 20460

November 6, 2001
Date

GREGG A. COOKE
Regional Administrator
U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

November 6, 2001
Date

CARLOS A. ZEQUEIRA
Enforcement Counsel
U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

OF COUNSEL:
ELYSE DIBIAGIO-WOOD
Attorney/Advisor
Office of Regulatory Enforcement
United States Environmental Protection Agency
1200 Pennsylvania Ave., NW
Washington, D.C. 20460

PRELIMINARILY:

FOR THE STATE OF LOUISIANA, THROUGH THE DEPARTMENT OF ENVIRONMENTAL QUALITY:

August 30, 2001
Date

Harold Leggett
Assistance Secretary
Office of Environmental Compliance
Louisiana Department of Environmental Quality

Deleted: LINDA KORN LEVY

August 30, 2001
Date

Ted Broyles
Legal Division
Louisiana Department of Environmental Quality
P.O. Box
Baton Rouge, Louisiana 70821-

Deleted: JOHN B. KING
Deleted: Chief Attorney
Deleted: 82282
Deleted: 84
Deleted: 2282

FOR THE CITY OF BATON ROUGE AND THE PARISH OF EAST BATON ROUGE:

Date

Melvin Holden
Mayor-President
City of Baton Rouge, Louisiana
Parish of East Baton Rouge, Louisiana
222 St. Louis Street
Baton Rouge, Louisiana 70802

Deleted: September 26, 2001

Deleted: Bobby Simpson

Consent Decree
Collection System Remedial Program
Revised Second Remedial Action Plan (RMAP2) Projects

These descriptions are to provide general information about the type of work to be completed for each project, as identified through hydraulic computer modeling. It is anticipated that, during engineering and design, the project details may change due to site constraints or optimization of the design; however, the overall program objectives will be met and the final consent decree deadline will be achieved. Particular basins are identified herein based upon best available flow monitoring and modeling information available at time of Revised RMAP2 development. As additional data become available and field conditions are confirmed, the specific basins for rehabilitation and pipe and pump size changes maybe updated.

Project Descriptions, Schedule and Preliminary Opinion of Probable Construction Cost

The projects are separated into three categories, with description of the projects, schedule and preliminary opinion of probable construction cost for each project provided. Following the project descriptions, the funding method is described.

Category 1: Comprehensive Sewer Basin Rehabilitation and Pump Station Upgrades

Based upon sewer system model results and flow monitoring, numerous basins within the Baton Rouge system require comprehensive rehabilitation. The basins identified through the system model are scheduled for rehabilitation based upon the modeled R-values.

Improvements to pump stations to allow them to pump into the system will be required at a number of pump stations. The improvements by service area are:

North CSD/STN Area

- Asses and potentially perform mechanical upgrades at 43 pump stations.

Central CSD Area

- Asses and potentially perform mechanical upgrades at 3 pump stations.

South CSD/STN Area

- Asses and potentially perform mechanical upgrades at 41 pump stations.

These Category 1 projects are listed below along with the projected start construction and complete construction dates. Field work is scheduled to commence immediately

upon acceptance of this Revised RMAP2 by EPA and DEQ. Seven project groups scheduled for immediate rehabilitation have been identified as follows.

Project Group	Approximate Footage Per Project Group	Preliminary Opinion of Probable Construction Cost	Start Construction	Complete Construction	Fully Operational
CSR-01	80,000	$7,000,000	March 2006	March 2007	October 2007
CSR-02	150,000	$14,100,000	June 2006	May 2008	December 2008
CSR-03	150,000	$14,100,000	August 2006	August 2008	March 2009
CSR-04	150,000	$14,000,000	November 2006	November 2008	June 2009
CSR-05	150,000	$14,000,000	February 2007	February 2009	September 2009

* Preliminary Opinion of Probable Construction Cost includes Contingency, Engineering, Administration, and Legal costs.

The remaining sewer basins identified as requiring rehabilitation because of the R-value will be separated into projects ranging with construction costs of between $3 million and $5 million per project.

The schedule for implementation and the preliminary opinion of probable construction cost for the remaining rehabilitation projects and pump station mechanical improvements are included in the table below.

Project	Preliminary Opinion of Probable Construction Cost	Start Construction	Complete Construction	Fully Operational
Comprehensive Rehabilitation	$106,700,000	March 2007	August 2013	March 2014
Pump Station Improvements	$29,200,000	January 2007	September 2008	December 2008

* Preliminary Opinion of Probable Construction Cost includes Contingency, Engineering, Administration, and Legal costs.

Category 2: Pump Station and Transmission Improvements

The system model was used to identify pump stations where existing pump head is not adequate to pump against the system and to identify pump stations and conveyance lines where capacity is not adequate for the peak wastewater flows. Based upon this analysis, two project groups have been developed. The schedule for implementation is provided below.

Project	Preliminary Opinion of Probable Construction Cost	Start Construction	Complete Construction	Fully Operational
Capacity Improvements	$233,756,000	August 2010	July 2014	November 2014

* Preliminary Opinion of Probable Construction Cost includes Contingency, Engineering, Administration, and Legal costs.

The Category 2 improvements are identified by service area below.

North CSD/STN Area

PS106/155/198/181 Areas

- Replace approximately 2,000 LF of gravity sewer in PS155 area and 3800 LF of gravity sewer in remaining pump station areas.

Area Upstream of PS509

- Make capacity upgrades to PS234, PS500, and PS218.
- Replace approximately 7,400 LF of force main in PS509, PS72, PS234, and PS103 areas.
- Replace approximately 300 LF of gravity sewer.

Area Upstream of PS510

- Make capacity upgrade to PS113.
- Replace approximately 15,600 LF of force main.
- Replace approximately 1,100 LF of gravity sewer.

Area Upstream of PS511

- Make capacity upgrade to PS230, PS231, and PS196.
- Replace approximately 7,700 LF of force main.
- Replace approximately 3,000 LF of gravity sewer.

Area Upstream of PS503

- Make capacity upgrade to PS183.
- Replace approximately 5,300 LF of gravity sewer and parallel approximately 1,450 LF of gravity sewer.

Area Upstream of PS897

- Make capacity upgrade to PS94.
- Replace approximately 3,600 LF of force main.
- Replace approximately 650 LF of gravity sewer.

Area Upstream of PS45

- Make capacity upgrade to PS45, PS63, PS240, PS241 and PS80
- Replace approximately 2,600 LF of force main in the PS45 and PS63 areas.
- Replace approximately 5,300 LF of gravity sewer and parallel approximately 22,000 LF of gravity sewer.

North Pressure System

- Make capacity upgrade to PS39.
- Replace approximately 2,400 LF of force main in PS141, PS47, and PS39 areas.
- Replace approximately 14,000 LF of gravity sewer and parallel approximately 13,200 LF of gravity sewer.

North WWTP Gravity Influent Line

- Make capacity upgrade to PS23
- Replace approximately 1,400 LF of force main in PS23 area
- Replace approximately 5,700 LF of gravity sewer and parallel approximately 28,000 gravity sewer.

Central CSD Area

Area South of I-10/Downtown

- Make capacity upgrade to PS2
- Parallel approximately 13,000 LF gravity sewer and replace approximately 9,000 LF of gravity sewer

Area North of I-10/Downtown and Capital Area

- Make capacity upgrade to PS4.
- Assess and make possible mechanical upgrades to PS5, PS15, and PS19
- Replace approximately 8,000 LF of gravity sewer and parallel approximately 17,000 LF of gravity sewer.

South CSD/STN Area

Area North of I-12 at Sherwood Forrest to Airline Highway

- Make capacity upgrades to PS50, PS53, PS57 and PS 58 including new parallel force main.
- Replace approximately 14,000 LF of gravity sewer and install approximately 81,000 LF of parallel gravity sewer in PS58 area.
- Replace approximately 26,000 LF gravity sewer and install approximately 34,000 LF of parallel gravity sewer.
- Replace approximately 2,500 LF of force main.

Area Upstream of PS889

- Replace approximately 7,800 LF of gravity sewer.

- Replace approximately 9,000 LF of force main and install approximately 200 LF of parallel force main.

- Make capacity improvements at PS153, PS100, PS189, PS889 and PS104.

Area Upstream of BPS514/East of Highland Road

- Make significant capacity upgrade to PS514.

- Replace approximately 3,000 LF of gravity sewer and parallel approximately 2,800 LF of gravity sewer.

- Assess and potentially make capacity improvements to PS327, PS253, PS278, PS382, and PS343.

O'Neal Lane South Area

- Assess and potentially make capacity improvements to PS316, PS211, PS296, PS247, and PS213.

- Replace approximately 5,000 LF of gravity sewer.

- Replace approximately 3,000 LF of force main.

Area Upstream of BPS507

- Assess and make potential capacity improvements to PS162, PS177, PS274, and PS170.

- Make significant capacity improvements to PS777.

- Replace approximately 20,000 LF of gravity sewer and parallel over 1,100 LF of gravity sewer.

- Replace approximately 1,600 LF of force main and parallel approximately 100 LF of force main.

Area South of I-12/Sherwood Forrest and Jefferson

- Make capacity improvements to PS287

- Replace approximately 1,800 LF of gravity sewer and install approximately 600 LF of parallel gravity sewer.

- Replace approximately 1,100 LF of force main.

Areas Upstream of PS302/PS27/PS999

- Make significant capacity improvements to PS999.

- Inspect and potentially make capacity improvements to PS223, PS118, and PS161.

- Replace approximately 5,600 LF of gravity sewer.

Essen Lane Area South of I-10

- Make significant capacity improvements to PS57, PS58, and PS53
- Make capacity improvements at PS56, PS68, and PS91.
- Replace approximately 38,000 LF of gravity sewer and parallel approximately 109,000 LF of gravity sewer.
- Replace approximately 700 LF of force main and parallel approximately 5,100 LF of force main.

PS236, PS311, PS329, PS102

- Make capacity improvements to PS236, PS311, and PS329
- Replace approximately 9,300 LF of gravity sewer.
- Replace approximately 2,200 LF of force main.

Category 3: Wastewater Treatment and Flow Equalization

The system model was used to determine the peak wastewater flow expected at each treatment plant. The South Wastewater Treatment Plant was identified as requiring improvements to provide for a peak flow of 300 million gallons per day (MGD). This peak flow will be managed through construction of a 24 million gallon flow equalization facility. A new headworks facility sized for 300 MGD will be provided to screen the wastewater prior to entering the flow equalization facility or being pumped to the South WWTP by a new 200 MGD pump station. The flow equalization facility, headworks and pump station are provided in Project WWTP-01.

The South WWTP capacity will be increased to 200 MGD and process modifications will be made to convert the plant from a trickling filter facility to an activated sludge treatment facility. This process modification will provide for increased ability to comply with discharge permit limitations. These improvements are provided in Project WWTP-03.

Piping from the new headworks/flow equalization facility to the existing South WWTP and piping from the South WWTP to the discharge point in the Mississippi River are also provided as Projects WWTP-02 and WWTP-04, respectively.

The schedule for construction and the Preliminary Opinion of Probable Construction Cost are provided below.

Project	*Preliminary Opinion of Probable Construction Cost*	*Start Construction*	*Complete Construction*	*Fully Operational*
Project WWTP-01: Headworks and Flow Equalization	$29,530,000	May 2008	May 2011	August 2011
Project WWTP-02: Pipeline to South WWTP	$2,940,000	August 2008	August 2009	December 2009
Project WWTP-03: South WWTP	$33,030,000	April 2008	April 2011	August 2011

Upgrade				
Project WWTP-04: Pipeline to Mississippi River	$2,500,000	April 2008	August 2009	December 2009

Preliminary Opinion of Probable Construction Cost includes Contingency, Engineering, Administration, and Legal costs.

Personnel and Training for Implementation of Remedial Actions

The process for evaluating and providing personnel and training for successful implementation of the remedial actions is provided below as required by the Consent Decree.

Category 1: Comprehensive Sewer Basin Rehabilitation

The Category 1 improvement projects do not require additional personnel or training for implementation because the City/Parish currently operates the collection system. The collection system staff may be reduced once overflows, blockages, and system maintenance decreases as a result of improvements to the system. Crew call-outs for emergency line repairs should be significantly reduced.

These improvements make no changes to the existing system requiring modification to the current Standard Operating Procedure. Current training and staff are adequate to meet the needs of the remedial actions included in Category 1 improvements.

Category 2: Pump Station and Transmission Improvements and Pump Station Upgrades

The Category 2 improvement projects do not require additional personnel or training for implementation because the City/Parish currently operates the pump station and conveyance systems. These improvements make no changes to the existing system requiring modification to the current Standard Operating Procedure. Current training and staff are adequate to meet the needs of the remedial actions included in Category 2 improvements.

Category 3: Wastewater Treatment and Flow Equalization

The Category 3 improvement projects will require a shift of personnel to provide adequate staff at the new headworks and flow equalization facility. It is currently anticipated that two staff from the existing treatment plants can be transferred to the new headworks and flow equalization facility and no additional staff will be required.

Additional training regarding the operation of an activated sludge treatment process as well as training regarding the operation and maintenance of the new flow equalization facility, headworks and pump station will be required. This training will be provided during the construction of the new facilities. It is anticipated 6 classroom sessions will be required per employee and up to 80 hours of on-the-job training. The remaining classroom training will be provided by Louisiana licensed wastewater treatment plant operators and/or engineers.

LOUISIANA

MUNICIPAL WATER POLLUTION PREVENTION

MWPP

Facility Name:	NORTH TREATMENT PLANT
LWDPS Permit Number:	
NPDES Permit Number:	LA0036439 AI# 4843
Address:	55 MILLS AVENUE
	BATON ROUGE
	LOUISIANA
Parish:	EAST BATON ROUGE
(Person Completing Form) Name:	GARCIA D. DIALEKWA
Title:	WASTEWATER LABORATORY SUPERVISOR
Date Completed:	MAY 22, 2006

Instructions to the Operator-in-Charge

1. Complete only the sections of the Environmental Audit which apply to your wastewater treatment system. Leave sections that do not apply blank and enter a "0" for the point value.

2. Parts 1 through 7 contain questions for which points may be generated. These points are intended to communicate to the department and the governing body or owner what actions will be necessary to prevent effluent violations. Place the point totals from parts 1 through 7 on the Point Calculation page.

3. Add up the point totals.

4. Submit the Environmental Audit to the governing body or owner for their review and approval.

5. The governing body must pass a resolution which contains the following items:

   a. The resolution or letter must acknowledge the governing body or owner has reviewed the Environmental Audit.

   b. The resolution must indicate <u>specific</u> actions, if any, will be taken to maintain compliance and prevent effluent violations. Proposed actions should address the parts where maximum or close to maximum points were generated in the Environmental Audit.

   c. The resolution should provide any other information the governing body deems appropriate.

Facility Name | LA0036439 NORTH PLANT

PART 1: INFLUENT FLOW/LOADINGS

Part 1: Influent Flow/Loadings (All plants)

A. **List the average monthly volumetric flows and BOD loadings received at your facility during the last reporting year.**

Col. 1 Average Monthly Flow (million gallons per day, MGD)		Col. 2 Average Monthly BOD_5 Concentration (mg/l)		Col. 3 Average Monthly BOD_5 Loading (pounds per day)
16.87	X	138	X 8.34 =	19,416
17.79	X	140	X 8.34 =	20,772
15.48	X	122	X 8.34 =	15,750
13.77	X	131	X 8.34 =	15,044
15.29	X	121	X 8.34 =	15,430
18.52	X	137	X 8.34 =	21,160
14.14	X	147	X 8.34 =	17,335
13.10	X	150	X 8.34 =	16,388
16.77	X	134	X 8.34 =	18,741
15.77	X	143	X 8.34 =	18,092
19.67	X	136	X 8.34 =	22,310
13.21	X	150	X 8.34 =	16,526

BOD loading = Average Monthly Flow (in MGD) x Average Monthly BOD concentration (in mg/l) x 8.34.

B. List the design flow and design BOD loading for your facility in the blanks below. If you are not aware of these design quantities, refer to your Operation and Maintenance Manual (O & M) or contact your consulting engineer.

Design Flow, MGD	54	X 0.90 =	48.60
Design BOD, lb/day	75,210	X 0.90 =	67,689

Facility Name | LA0036439 NORTH PLANT |

C. How many months did the monthly flow (Col. 1) to the wastewater treatment plant (WWTP) exceed 90% of design flow?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	0	0	0	5	5	5	5	5	5	5	5	points

Write 0 or 5 in the C point total box | 0 | C Point Total

D. How many months did the monthly flow (Col. 1) to the WWTP exceed the design flow?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	5	5	10	10	15	15	15	15	15	15	15	15	points

Write 0, 5, 10, or 15 in the D point total box | 0 | D Point Total

E. How many months did the monthly BOD loading (Col. 3) to the WWTP exceed 90% of the design loading?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	5	5	5	10	10	10	10	10	10	10	10	points

Write 0, 5, or 10 in the E point total box | 0 | E Point Total

F. How many times did the monthly BOD loading (Col. 3) to the WWTP exceed the design loading?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	10	20	30	40	50	50	50	50	50	50	50	50	points

Write 0, 10, 20, 30, 40, or 50 in the F point total box | 0 | F Point Total

G. Add together each point total for C through F and place this sum in the box below at the right.

TOTAL POINT VALUE FOR PART 1 | 0 | (max=80)

Also enter this value on the point calculation table on page 16.

Facility Name: LA0036439 NORTH PLANT

PART 2: EFFLUENT QUALITY/PLANT PERFORMANCE

A. List the monthly average effluent BOD and TSS concentrations produced by your facility during the last reporting year.

Month	Column 1 Avg. Monthly BOD (mg/l)	Column 2 Avg. Monthly TSS (mg/l)
APRIL	32	31
MAY	32	27
JUNE	23	21
JULY	20	15
AUGUST	18	15
SEPTEMBER	22	20
OCTOBER	29	21
NOVEMBER	32	27
DECEMBER	30	30
JANUARY	35	29
FEBRUARY	31	25
MARCH	34	24

B. List the monthly average permit limits for your facility in the blanks below.

	Permit Limit		90% of Permit Limit
BOD, mg/l	30	X 0.90 =	27
TSS, mg/l	30	X 0.90 =	27

Facility Name | LA0036439 NORTH PLANT

C. Continuous Discharge to Surface Water

i. How many months did the effluent BOD concentration (Col. 1) exceed 90% of permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	1	2	3	4	5	6	7	**8**	9	10	11	12	months
points	0	0	10	20	30	40	40	40	**40**	40	40	40	40	points

Write 0, 10, 20, 30 or 40 in the i point total box [40] i Point Total

ii. How many months did the effluent BOD concentration (Col. 1) exceed permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	1	2	3	4	5	**6**	7	8	9	10	11	12	months
points	0	5	5	10	10	10	**10**	10	10	10	10	10	10	points

Write 0, 5, or 10 in the ii point total box [10] ii Point Total

iii. How many months did the effluent TSS concentration (Col. 2) exceed 90% of permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	1	2	**3**	4	5	6	7	8	9	10	11	12	months
points	0	0	10	**20**	30	40	40	40	40	40	40	40	40	points

Write 0, 10, 20, 30, or 40 in the iii point total box [20] iii Point Total

iv. How many months did the effluent TSS concentration (Col.2) exceed permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	**1**	2	3	4	5	6	7	8	9	10	11	12	months
points	0	**5**	5	10	10	10	10	10	10	10	10	10	10	points

Write 0, 5, or 10 in the iv point total box [5] iv Point Total

v. Add together each point total for i through iv and place this sum in the box below at the right.

TOTAL POINT VALUE FOR PART 2 [75] **(max=100)**
Also enter this value on the point calculation table on page 16.

Facility Name | LA0036439 NORTH PLANT

D. Other Monitoring and Limits

i. At any time in the past year was there an exceedance of a permit limit for other pollutants such as: ammonia-nitrogen, phosphorus, pH, residual chlorine, or fecal coliform?

✓ Check one box ☐ Yes ☒ No If yes, please describe:

ii. At any time in the past year was there a "failure" of a Biomonitoring (Whole Effluent Toxicity) test of the effluent?

✓ Check one box ☐ Yes ☒ No If yes, please describe:

iii. At any time in the past year was there an exceedance of a permit limit for a toxic substance?

✓ Check one box ☐ Yes ☒ No If yes, please describe:

Facility Name | LA0036439 NORTH PLANT

PART 3. AGE OF THE WASTEWATER TREATMENT FACILITIES

A. What year was the wastewater treatment plant constructed or last major expansion/improvements completed? 1998

Current Year - (Answer to A) = Age in years

2006 - 1998 = 8 years

Enter Age in Part C below.

B. Check the type of treatment facility that is employed:

		Factor
X	Mechanical Treatment Plant (Trickling filter, activated sludge, etc.) Specify Type Trickling Filter	(2.5)
	Aerated Lagoon	2.0
	Stabilization Pond	1.5
	Other (Specify)	1.0

C. Multiply the factor listed next to the type of facility your community employs by the age of your facility to determine the total point value of Part 3:

TOTAL POINT VALUE FOR PART 3 = 2.5 (FACTOR) x 8 (AGE) = [20] **(max = 50)**

Also enter this value or 50, which ever is less, on the point calculation table on page 16.

D. Please attach a schematic of the treatment plant.

Facility Name: LA0036439 NORTH PLANT

PART 4: OVERFLOWS AND BYPASSES

A. (1) List the number of times in the last year there was an overflow, bypass, or unpermitted discharge of untreated or incompletely treated wastewater due to heavy rain: 0

(Circle One) (0 = 0 points) 1 = 5 points 2 = 10 points
3 = 15 points 4 = 30 points 5 or more = 50 points

(2) List the number of bypasses, overflows, or unpermitted discharges shown in A (1) that were within the collection system and the number at the treatment plant.

Collection System 0 Treatment Plant 0

B. (1) List the number of times in the last year there was a bypass or overflow of untreated or incompletely treated wastewater due to equipment failure, either at the treatment plant or due to pumping problems in the collection system: 65

(Circle One) 0 = 0 points 1 = 5 points 2 = 10 points
3 = 15 points 4 = 30 points (5 or more = 50 points)

(2) List the number of bypasses or overflows shown in B (1) that were within the collection system and the number at the treatment plant.

Collection System 63 Treatment Plant 2

C. Specify whether the bypasses came from the city or village sewer system or from contract or tributary communities/sanitary districts, etc.

D. Add the point values circled for A and B and place the total in the box below.

TOTAL POINT VALUE FOR PART 4 [50] **(max=100)**

Also enter this value on the point calculation table on page 16.

E. List the person responsible for reporting overflows, bypasses, or unpermitted discharges to State and Federal authorities:

GARCIA D. DIALEKWA, WASTEWATER LABORATORY SUPERVISOR
(225) 389-3240

Describe the procedure for gathering, compiling, and reporting:

THE PROCEDURE FOR GATHERING, COMPILING AND REPORTING IS SPECIFIED IN THE PERMIT.

Facility Name: LA0036439 NORTH PLANT

PART 5: SLUDGE STORAGE AND DISPOSAL SITES

A. Sludge Storage

How many months of sludge storage capacity does your wastewater treatment facility have available, either on-site or off-site?

Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	<2	2	3	4 to 5	>6	months
points	50	30	20	10	0	points

Write 0, 10, 20, 30, or 50 in the A point total box [10] A Point Total

B. For how many months does your facility have access to (and approval for) sufficient land disposal sites to provide proper land disposal?

Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	<2	6 to 11	12 to 23	24 to 35	>36	months
points	50	30	20	10	0	points

Write 0, 10, 20, 30, or 50 in the B point total box [0] B Point Total

C. Add together the A and B point values and place this sum in the box below at the right:

TOTAL POINT VALUE FOR PART 5 [10] **(max=100)**

Also enter this value on the point calculation table on page 16.

Facility Name LA0036439 NORTH PLANT

PART 6: NEW DEVELOPMENT

A. Please provide the following information for the total of all sewer line extensions which were installed during the last year.

Design Population: 3304

Design Flow: 1.38 MGD

Design BOD_5: 96 mg/l

B. Has an industry (or other development) moved into the community or expanded production in the past year, such that either flow or pollutant loadings to the sewerage system were significantly increased (5% or greater)?

(Circle One) (No = 0 points) Yes = 15 points

Describe: _____

List any new pollutants: _____

C. Is there any development (industrial, commercial, or residential) anticipated in the next 2-3 years, such that either flow or pollutant loadings to the sewerage system could significantly increase?

(Circle One) (No = 0 points) Yes = 15 points

Describe: _____

List any new pollutants that you anticipate: _____

D. Add together the point value circled in B and C and place the sum in the blank below.

TOTAL POINT VALUE FOR PART 6 [0] **(max=30)**

Also enter this value on the point calculation table on page 16.

Facility Name | LA0036439 NORTH PLANT

PART 7: OPERATOR CERTIFICATION AND EDUCATION

A. What was the name of the operator-in-charge for the reporting year? GERALD SPRULL Name

B. What is his/her certification number? 10-560 Cert. #

C. What level of certification is the operator-in-charge required to have to operate the wastewater treatment plant? WASTEWATER TRMT. IV Level Required

D. What is the level of certification of the operator-in-charge? WASTEWATER TRMT. IV Level Certified

E. Was the operator-in-charge of the report year certified at least at the grade level required in order to operate this plant? ✓ Check one box ☒ yes = 0 points ☐ no = 50 points

Write 0 or 50 in the E point total box [0] E Point Total

F. Has the operator-in-charge maintained recertification requirements during the reporting year? ✓ Check one box ☒ yes ☐ no

G. How many hours of continuing education has the operator-in-charge completed over the last two calendar years? ✓ Check one box ☒ 12 hours or more = 0 points ☐ Less than 12 hours = 50 points

Write 0 or 50 in the G point total box [0] G Point Total

H. Is there a written policy regarding continuing education and training for wastewater treatment plant employees? ✓ Check one box ☒ yes ☐ no

Explain:

16 HOURS OF TRAINING IN WASTEWATER TREATMENT EVERY TWO YEARS.

I. What percentage of the continuing education expenses of the operator-in-charge were paid for:

By the permittee? 100%

By the operator? 0

J. Add together the E and G point values and place this sum in the box below at the right:

TOTAL POINT VALUE FOR PART 7 [0] **(max=100)**

Also enter this value on the point calculation table on page 16.

Facility Name | LA0036439 NORTH PLANT

PART 8: FINANCIAL STATUS

A. Are User-Charge Revenues sufficient to cover operation and maintenance expenses?
✓ Check one box ☒ Yes ☐ No If no, how are O & M costs being financed?
Explain:

SAME AS B

B. What financial resources do you have available to pay for your wastewater improvements and reconstruction needs?

WASTEWATER IMPROVEMENTS AND RECONSTRUCTION NEEDS ARE FUNDED FROM FOUR MAIN REVENUE SOURCES. THEY ARE A ONE HALF PERCENT SALES & USE TAX, SEWER USER FEES, SEWER IMPACT FEES, AND A $4 MILLION SUBSIDY FROM THE GENERAL FUND SUPPORTED FROM GAMING REVENUES.

Facility Name | LA0036439 NORTH PLANT

PART 9: SUBJECTIVE EVALUATION

A. Collection System Maintenance

1. Describe what sewer system maintenance work has been done in the last year.

SEE ATTACHMENT

2. Describe what lift station work has been done in the last year.

ROUTINE MAINTENANCE

3. What collection system improvements does the community have under consideration for the next 5 years?

SEE ATTACHMENT

B. If you have ponds, please answer the following questions:

1. Do you have duckweed buildup in your ponds? ☐ Yes ☐ No
2. Do you mow your dikes regularly (at least monthly), to the waters edge? ☐ Yes ☐ No
3. Do you have bushes or trees growing on the dikes or in the ponds? ☐ Yes ☐ No
4. Do you have excess sludge buildup (> 1 foot) on the bottom of any of your ponds? ☐ Yes ☐ No
5. Do you exercise all of your valves? ☐ Yes ☐ No
6. Are your control manholes in good structural shape? ☐ Yes ☐ No
7. Do you maintain at least three feet of freeboard in all your ponds? ☐ Yes ☐ No
8. Do you visit your pond system, at least weekly? ☐ Yes ☐ No

LA0036439 NORTH PLANT

LA MWPP Environmental Audit

Part 9: Subjective Evaluation

A3. As part of the Consent Decree, Operation and Maintenance of the North Treatment Plant Collection Area is performed and reported on a quarterly basis. The following table is a breakdown / summary of activities performed within the North Treatment Plant Collection System Area during the reporting period.

North Treatment Area
Monitoring Period (4/05- 3/06)

Line Cleaned	5 3%
CCTV Inspected	1.1%
Smoke Tested	3.1%
Dye Tested	19.9%
Manhole Inspected	27.9%
Line Repaired	9.7%
Manhole Rehabilitated	2.9%
Force Main – Inspected	95.8%
Repaired	5.0%
Air Release Valves – Inspected	220%
Repaired	86.3%
Wet Wells Cleaned	81.6%
Pump Stations - Repaired	22.7%

A3. During the next 5 years,15 - 20 projects in the North Treatment Plant Collection Area (related to the SSO Consent Decree Program) are scheduled to be implemented. The projects will include pump stations upgrades, force main improvements, gravity sewers, storage, and wet weather treatment facilities. Additionally, annual contracts for sewer rehabilitation including lining, point repair, upsizing, and other rehabilitation methods will also be implemented. However, a change in the Consent Decree has been submitted for review and approval. Any approved changes may affect the currently proposed projects.

Facility Name LA0036439 NORTH PLANT

C. Treatment Plants

1. Have the influent and effluent flow meters been calibrated in the last year? ☒ Yes ☐ No

Influent flow meter calibration dates(s):				Effluent flow meter calibration date(s):		
gravity		force main				
11/29/05	5/12/05	12/1/05	5/12/05	Final	5/12/05	12/2/05

2. What problems, if any, have been experienced over the last year that have threatened treatment?

Experienced high levels of hydrocarbons in the plant influent stream on force main influent caused by illegal dumping.

3. Is your community presently involved in formal planning for treatment facility upgrading?

☐ Yes ☒ No If yes, describe:

Facility Name: LA0036439 NORTH PLANT

D. Preventive Maintenance

1. Does your plant have a written plan for preventive maintenance on major equipment items?

☒ Yes ☐ No If yes, describe:

Weekly, monthly and semi-annual preventive maintenance sheets that reflect type and frequency as specified in the O&M manuals. A new computer program will manage the maintenance and preventive maintenance of plant equipment and spare parts.

2. Does this preventive maintenance program depict frequency of intervals, types of lubrication, and other preventive maintenance tasks necessary for each piece of equipment? ☒ Yes ☐ No

3. Are these preventive maintenance tasks, as well as equipment problems, being recorded and filed so future maintenance problems can be assessed properly? ☒ Yes ☐ No

E. Sewer Use Ordinance

1. Does your community have a sewer use ordinance that limits or prohibits the discharge of excessive conventional pollutants (BOD, TSS, or pH) or toxic substances to the sewer from industries, commercial users, and residences?

☒ Yes ☐ No If yes, describe:

Sewer User Fee Ordinance (No. 7853) limits the discharge of BOD & TSS to 200 mg/l and 250 mg/l respectively. Any discharge above these limits is surchaged at a rate of 2% of the monthly sewer user fee for each limit of 10 mg/l. Pretreatment ordinance (No. 9195) limits the discharge of heavy metals, chemicals and toxic substances.

2. Has it been necessary to enforce? ☒ Yes ☐ No If yes, describe:

The Sewer User Fee Ordinance is strictly enforced by City-Parish and self monitoring sampling. The same apply to the Pretreatment Ordinance. Enforce mechanisms include discharge permits, surcharges, letter and notice of violations, administrative orders, water termination and fines.

F. Any additional comments about your treatment plant or collection system? (Attach additional sheet if necessary.)

NO

Facility Name LA0036439 NORTH PLANT

POINT CALCULATION TABLE

Fill in the values from parts 1 through 7 in the columns below. Add the numbers in the left column to determine the point total that the wastewater system has generated for the previous year.

Actual Values	Actual Values	Maximum
Part 1: Influent Flow/Loadings	0	80 Points
Part 2: Effluent Quality/Plant Performance	75	100 Points
Part 3: Age of WWTT	20	50 Points
Part 4: Overflows and Bypasses	50	100 Points
Part 5: Ultimate Disposition of Sludge	10	100 Points
Part 6: New Development	0	30 Points
Part 7: Operator Certification Training	0	100 Points

TOTAL POINTS 155

ATTACHMENT 3

SAMPLE MWPP RESOLUTION

Resolved that the city/town of BATON ROUGE informs Louisiana Department of Environmental Quality that the following actions were taken by the CITY/PARISH METROPOLITAN COUNCIL (governing body).

1. Reviewed the Municipal Water Pollution Prevention Environmental Audit Report which is attached to this resolution.

2. Set forth the following actions necessary to maintain permit requirements contained in the Louisiana Water Discharge Permit System (LWDPS) number LA0036439 AI #4843.

   (Please be specific in listing the actions that will be taken to address the problems identified in the audit report.)

   a. CURRENTLY, WE ARE OPERATING UNDER A CONSENT DECREE WHICH BECAME EFFECTIVE MARCH 14, 2002.

   b. IMPLEMENTATION OF AGGRESSIVE PROCESS CONTROL STRATEGIES.

   c. A PROJECT IS UNDERWAY TO REDUCE THE HIGH CONCENTRATION OF HYDROGEN SULFIDE (H_2S).

   d.

   etc.

Passed by a majority/unanimous (circle one) vote of the CITY/PARISH METROPOLITAN COUNCIL, on June 14, 2006 (date).

CLERK

ADOPTED
METROPOLITAN COUNCIL

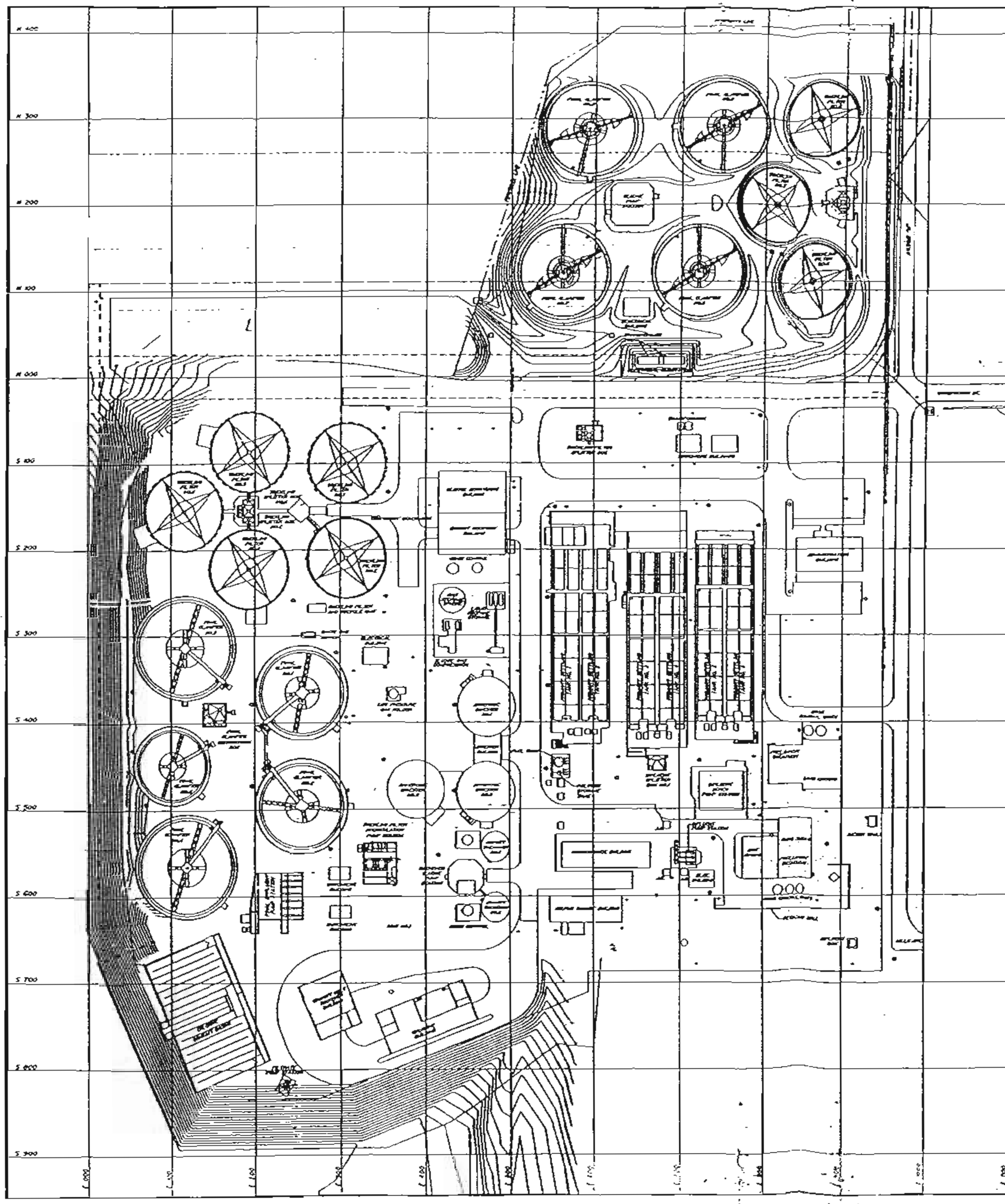
JUN 14 2006

749 RESOLUTION 44841

COUNCIL ADMINISTRATOR TREASURER

REQUESTING APPROVAL FOR SUBMITTAL OF THE LOUISIANA MUNICIPAL WATER POLLUTION PREVENTION (MWPP) ENVIRONMENTAL AUDIT REPORT FOR THE NORTH WASTEWATER TREATMENT PLANT TO THE DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ) FOR THE MONITORING PERIOD OF APRIL 1, 2005 THROUGH MARCH 1, 2006.

BE IT RESOLVED by the Metropolitan Council of the Parish of East Baton Rouge and City of Baton Rouge that the submittal of the Louisiana Municipal Water Pollution Prevention (MWPP) Environmental Audit Report for the North Wastewater Treatment Plant to the Department of Environmental Quality (DEQ) for the monitoring period of April 1, 2005 through March 1, 2006, is hereby approved.



N

1" = 60'

0 30 60

LEGEND

▲ TBM TEMPORARY BENCHMARK ELEV 52.27 WEST SIDE OF SLAB FOR TRICKLING FILTER NO. 2

GENERAL NOTES:

1. LOCATION ELEVATIONS, AND DIMENSIONS OF EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES ARE SHOWN ACCORDING TO THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION OF THESE PLANS, BUT DO NOT PURPORT TO BE ABSOLUTELY CORRECT. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VERIFY AND AGREE TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES THAT OCCUR DUE TO CONSTRUCTION OPERATIONS. ANYTHING NOT SHOWN ON THESE DRAWINGS SHOULD BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND SHALL NOT CONSTITUTE AN EXTRA, UNLESS APPROVED BY THE ENGINEER.
2. THE CONTRACTOR SHALL CONTACT THE ENGINEER'S OFFICE IMMEDIATELY CONCERNING ANY CONFLICTS ARISING DURING CONSTRUCTION OF ANY IMPROVEMENTS SHOWN ON THESE DRAWINGS.
3. THE CONTRACTOR SHALL REPLACE ALL PAVING, STABILIZED EARTH, CURBS, DRIVEWAYS, SIDEWALKS, ETC., WITH THE SAME TYPE OF MATERIAL AND TO THE SAME CONDITION THAT WAS REMOVED OR DISTURBED DURING CONSTRUCTION AT NO ADDITIONAL COST TO THE OWNER.
4. ALL PROSPECTIVE BIDDERS ARE DIRECTED, PRIOR TO BIDDING, TO CONDUCT WHATEVER INVESTIGATIONS THEY MAY DEEM NECESSARY TO ARRIVE AT THEIR OWN CONCLUSION REGARDING THE ACTUAL CONDITIONS THAT WILL BE ENCOUNTERED, AND UPON WHICH THEIR BIDS WILL BE BASED.
5. TOPOGRAPHIC INFORMATION SHOWN WAS PROVIDED BY PROFESSIONAL ENGINEERING CONSULTANTS (PECI), SIMMONS J. BARRY & ASSOC. (SJB), OR FERRIS ENGINEERING & SURVEYING.
6. FINISHED GRADE FOR GROUND ELEVATIONS ON GRATINGS REFER TO GRADE AFTER SODDING.
7. SPECIAL PIPE FOUNDATIONS, IF REQUIRED, SHALL BE DETERMINED IN THE FIELD AND THE TYPE REQUIRED WILL BE AS DIRECTED BY THE ENGINEER.
8. ALL PRESSURE PIPE JOINTS AND FITTINGS 4 INCHES IN DIAMETER AND LARGER SHALL HAVE RESTRAINED JOINTS IN ACCORDANCE WITH THE SPECIFICATIONS.
9. ALL FITTINGS 6 INCHES AND LARGER ON GRAVITY LINES SHALL HAVE RESTRAINED JOINTS IN ACCORDANCE WITH THE SPECIFICATIONS.
10. PIPES UNDERNEATH STRUCTURES AND SLABS SHALL HAVE 6 INCHES MINIMUM CONCRETE ENCASEMENT FOR PIPES 24 INCHES AND SMALLER, 8 INCHES MINIMUM CONCRETE ENCASEMENT FOR PIPES LARGER THAN 24 INCHES AND UP TO AND INCLUDING 36 INCHES, AND 9 INCHES MAXIMUM CONCRETE ENCASEMENT FOR PIPES LARGER THAN 36 INCHES. CONCRETE ENCASEMENT SHALL EXTEND A MINIMUM OF 12 INCHES PAST EDGE OF STRUCTURE OR SLAB. (SEE NOTE 11 FOR REINFORCEMENT REQUIREMENTS)
11. PIPING INSTALLED UNDERNEATH STRUCTURES AND ENCASED IN CONCRETE SHALL HAVE THE FOLLOWING REINFORCEMENT:
    A. PROVIDE #5's AT 12" C/C LONGITUDINALLY, WITH #5 STIRRUP BANDS AT 12" C/C.
    B. SHOULD T.O.C. ENCASEMENT FALL WITHIN 3" FROM UNDERSIDE OF SLAB, THE STIRRUP BAND SHALL DOWEL INTO SLAB.
    C. IF T.O.C. OF ENCASEMENT IS LOWER THAN 3" FROM UNDERSIDE OF SLAB, ENCASEMENT WILL BE A SEPARATE SECTION.
    D. CONCRETE THICKNESS ENCASING THE PIPE IS 6" MINIMUM.
    E. REINFORCED CONCRETE ENCASEMENT SHALL EXTEND BEYOND THE OUTER FACE OF THE STRUCTURE AND SHALL TERMINATE AT THE FIRST JOINT WITHIN THE LENGTH OF THE PIPE.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ACTUAL TIE-IN CONNECTIONS TO ALL WATER, RECLAIMED WATER, WASTEWATER, NATURAL GAS AND OTHER LINES AS INDICATED ON THE DRAWINGS.
13. ALL FITTINGS FOR PVC/DI 3" IN DIAMETER AND LARGER SHALL BE CAST IRON/DUCTILE IRON, SHORT BODY WITH MECHANICAL JOINTS, WITH HIGH STRENGTH CORTEN CORROSION RESISTANT T-HEAD BOLTS, SUBJECT TO THE APPROVAL OF THE ENGINEER. (△1)
14. ALL GATE VALVES, WHERE SPECIFIED, FOR SIZES 4" THROUGH 12" SHALL BE RESILIENT SEATED GATE VALVES IN CONFORMANCE WITH THE SPECIFICATIONS.
15. SOILS EXPLORATION WORK FOR THIS FACILITY WAS PERFORMED BY LOUIS J. CAPOZZOLI & ASSOCIATES. SOIL EXPLORATION WORK IS SOLELY TO ASSIST BIDDERS IN ASSESSING THE NATURE AND EXTENT OF TESTING PROCEDURES REQUIRED TO MAKE THEIR OWN DETERMINATION OF ACTUAL CONDITIONS WHICH WILL BE ENCOUNTERED DURING THE COURSE OF THE WORK. NO REPRESENTATION IS MADE OR WILL BE GIVEN BY THE ENGINEER CONCERNING ACTUAL CONDITIONS WHICH WILL BE ENCOUNTERED DURING THE COURSE OF THE WORK AND BIDDERS ARE DIRECTED, PRIOR TO BIDDING, TO CONDUCT WHATEVER INVESTIGATIONS THEY DEEM NECESSARY TO ARRIVE AT THEIR OWN CONCLUSION REGARDING SUCH CONDITIONS.
16. DURING EXCAVATIONS, CONTRACTOR SHALL, AS A MINIMUM, COMPLY WITH THE OSHA EXCAVATION SAFETY STANDARDS INCLUDING OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION EXCAVATION SAFETY STANDARD 29 CFR 1926.650 SUBPART P AS AMENDED.
17. ALL FILL SHALL BE COMPACTED TO 90% OF ITS MAXIMUM MODIFIED PROCTOR DRY DENSITY IN ACCORDANCE WITH THE SPECIFICATIONS IN THE GEOTECHNICAL REPORT FOR COMPACTION OF CLAY SOILS. THE CLAY SHALL BE A CL MATERIAL.
18. MECHANICAL JOINTS SHOWN ON THE PLANS MAY, AT THE CONTRACTORS OPTION, BE SUBSTITUTED WITH PUSH-ON JOINT PIPE. ALL RESTRAINTS, THRUST BLOCKS AS SPECIFIED OR NOTED ON THE DRAWINGS STILL APPLY, REGARDLESS OF PIPE JOINTS TYPE USED.
19. LOCATIONS ARE TO OUTSIDE CORNER OF STRUCTURES OR CENTER OF MANHOLES OR OTHER CIRCULAR STRUCTURES UNLESS NOTED OTHERWISE.

STATE OF LOUISIANA — JUSTIN S. HAYDEL JR. — REG. No. 25321 — PROFESSIONAL ENGINEER — CIVIL ENGINEERING

REV.	DATE	BY	APP.	REMARKS
△1	1/99	EDI	JSH	ADDENDUM 1

DESIGNED BY: A. KERLEY
DRAWN BY: B. BROWN
FILE: HC-ES-PL
CHECKED BY: J. HAYDEL
APPROVED BY: J. HAYDEL
DATE: JUNE 1998

CAMP DRESSER & McKEE INC. CDM
R/S CONSULTANTS
RUSS ENGINEERING
PROFESSIONAL ENGINEERING CONSULTANTS

PHASE-IIIB

NWWTP - EXISTING SITE PLAN

CITY OF BATON ROUGE / PARISH OF EAST BATON ROUGE

PROJECT NO. 24340/1/2

SHEET NO. CN-1

LOUISIANA

MUNICIPAL WATER POLLUTION PREVENTION

MWPP

Facility Name:	SOUTH TREATMENT PLANT
LWDPS Permit Number:	
NPDES Permit Number:	LA0036412 AI# 4841
Address:	2850 GARDERE LANE
	BATON ROUGE
	LOUISIANA
Parish:	EAST BATON ROUGE
(Person Completing Form) Name:	CHARLES M. O'BRIEN
Title:	WW LABORATORY SUPERVISOR
Date Completed:	AUGUST 8, 2006

Instructions to the Operator-in-Charge

1. Complete only the sections of the Environmental Audit which apply to your wastewater treatment system. Leave sections that do not apply blank and enter a "0" for the point value.

2. Parts 1 through 7 contain questions for which points may be generated. These points are intended to communicate to the department and the governing body or owner what actions will be necessary to prevent effluent violations. Place the point totals from parts 1 through 7 on the Point Calculation page.

3. Add up the point totals.

4. Submit the Environmental Audit to the governing body or owner for their review and approval.

5. The governing body must pass a resolution which contains the following items:

   a. The resolution or letter must acknowledge the governing body or owner has reviewed the Environmental Audit.

   b. The resolution must indicate <u>specific</u> actions, if any, will be taken to maintain compliance and prevent effluent violations. Proposed actions should address the parts where maximum or close to maximum points were generated in the Environmental Audit.

   c. The resolution should provide any other information the governing body deems appropriate.

Facility Name | LA0036412 SOUTH PLANT

PART II: INFLUENT FLOW/LOADINGS

Part 1: Influent Flow/Loadings (All plants)

A. **List the average monthly volumetric flows and BOD loadings received at your facility during the last reporting year.**

Col. 1 Average Monthly Flow (million gallons per day, MGD)		Col. 2 Average Monthly BOD_5 Concentration (mg/l)		Col. 3 Average Monthly BOD_5 Loading (pounds per day)
30.50	X	134	X 8.34 =	34,086
29.03	X	131	X 8.34 =	31,716
29.67	X	135	X 8.34 =	33,405
33.08	X	145	X 8.34 =	40,004
29.37	X	160	X 8.34 =	39,191
30.76	X	158	X 8.34 =	40,533
33.29	X	160	X 8.34 =	44,422
31.20	X	166	X 8.34 =	43,194
34.46	X	154	X 8.34 =	44,259
33.03	X	167	X 8.34 =	46,004
30.53	X	152	X 8.34 =	38,702
34.09	X	150	X 8.34 =	42,646

BOD loading = Average Monthly Flow (in MGD) x Average Monthly BOD concentration (in mg/l) x 8.34.

B. List the design flow and design BOD loading for your facility in the blanks below. If you are not aware of these design quantities, refer to your Operation and Maintenance Manual (O & M) or contact your consulting engineer.

Design Flow, MGD	54	X 0.90 =	48.60
Design BOD, lb/day	93,224	X 0.90 =	83,902

Facility Name LA0036412 SOUTH PLANT

C. How many months did the monthly flow (Col. 1) to the wastewater treatment plant (WWTP) exceed 90% of design flow?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	0	0	0	5	5	5	5	5	5	5	5	points

Write 0 or 5 in the C point total box [0] C Point Total

D. How many months did the monthly flow (Col. 1) to the WWTP exceed the design flow?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	5	5	10	10	15	15	15	15	15	15	15	15	points

Write 0, 5, 10, or 15 in the D point total box [0] D Point Total

E. How many months did the monthly BOD loading (Col. 3) to the WWTP exceed 90% of the design loading?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	5	5	5	10	10	10	10	10	10	10	10	points

Write 0, 5, or 10 in the E point total box [0] E Point Total

F. How many times did the monthly BOD loading (Col. 3) to the WWTP exceed the design loading?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	10	20	30	40	50	50	50	50	50	50	50	50	points

Write 0, 10, 20, 30, 40, or 50 in the F point total box [0] F Point Total

G. Add together each point total for C through F and place this sum in the box below at the right.

TOTAL POINT VALUE FOR PART 1 [0] **(max=80)**

Also enter this value on the point calculation table on page 16.

Facility Name | LA0036412 SOUTH PLANT

PART 2 EFFLUENT QUALITY/PLANT PERFORMANCE

A. List the monthly average effluent BOD and TSS concentrations produced by your facility during the last reporting year.

Month	Column 1 Avg. Monthly BOD (mg/l)	Column 2 Avg. Monthly TSS (mg/l)
JUNE	40	32
JULY	37	29
AUGUST	34	27
SEPTEMBER	38	25
OCTOBER	39	25
NOVEMBER	36	26
DECEMBER	38	26
JANUARY	36	26
FEBRUARY	26	23
MARCH	24	18
APRIL	29	20
MAY	37	20

B. List the monthly average permit limits for your facility in the blanks below.

	Permit Limit		90% of Permit Limit
BOD, mg/l	30	X 0.90 =	27
TSS, mg/l	30	X 0.90 =	27

Facility Name LA0036412 SOUTH PLANT

C. Continuous Discharge to Surface Water

i. How many months did the effluent BOD concentration (Col. 1) exceed 90% of permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	1	2	3	4	5	6	7	8	9	**10**	11	12	months
points	0	0	10	20	30	40	40	40	40	40	**40**	40	40	points

Write 0, 10, 20, 30 or 40 in the i point total box [40] i Point Total

ii. How many months did the effluent BOD concentration (Col. 1) exceed permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	1	2	3	4	5	6	7	8	**9**	10	11	12	months
points	0	5	5	10	10	10	10	10	10	**10**	10	10	10	points

Write 0, 5, or 10 in the ii point total box [10] ii Point Total

iii. How many months did the effluent TSS concentration (Col. 2) exceed 90% of permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	1	**2**	3	4	5	6	7	8	9	10	11	12	months
points	0	0	**10**	20	30	40	40	40	40	40	40	40	40	points

Write 0, 10, 20, 30, or 40 in the iii point total box [10] iii Point Total

iv. How many months did the effluent TSS concentration (Col.2) exceed permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	0	**1**	2	3	4	5	6	7	8	9	10	11	12	months
points	0	**5**	5	10	10	10	10	10	10	10	10	10	10	points

Write 0, 5, or 10 in the iv point total box [5] iv Point Total

v. Add together each point total for i through iv and place this sum in the box below at the right.

TOTAL POINT VALUE FOR PART 2 [65] **(max=100)**
Also enter this value on the point calculation table on page 16.

Facility Name LA0036412 SOUTH PLANT

D. Other Monitoring and Limits

i. At any time in the past year was there an exceedance of a permit limit for other pollutants such as: ammonia-nitrogen, phosphorus, pH, residual chlorine, or fecal coliform?

✓ Check one box ☒ Yes ☐ No If yes, please describe:

FECAL COLIFORM - 7/19-25/2005	442 COL./100ML
FECAL COLIRORM - 9/20-26/2005	402 COL./100ML
FECAL COLIFORM - 10/4-10/2005	427 COL./100ML
FECAL COLIFORM - 12/13-19/2005	689 COL./100ML

ii. At any time in the past year was there a "failure" of a Biomonitoring (Whole Effluent Toxicity) test of the effluent?

✓ Check one box ☐ Yes ☒ No If yes, please describe:

iii. At any time in the past year was there an exceedance of a permit limit for a toxic substance?

✓ Check one box ☐ Yes ☒ No If yes, please describe:

Facility Name LA0036412 SOUTH PLANT

PART 3 - AGE OF THE WASTEWATER TREATMENT FACILITIES

A. What year was the wastewater treatment plant constructed or last major expansion/improvements completed? 1998

Current Year - (Answer to A) = Age in years

2006 - 1998 = 8 years

Enter Age in Part C below.

B. Check the type of treatment facility that is employed:

		Factor
X	Mechanical Treatment Plant (Trickling filter, activated sludge, etc.) Specify Type Trickling Filter	2.5
	Aerated Lagoon	2.0
	Stabilization Pond	1.5
	Other (Specify) _____	1.0

C. Multiply the factor listed next to the type of facility your community employs by the age of your facility to determine the total point value of Part 3:

TOTAL POINT VALUE FOR PART 3 = 2.5 (**FACTOR**) x 8 (**AGE**) = 20 (max = 50)

Also enter this value or 50, which ever is less, on the point calculation table on page 16.

D. Please attach a schematic of the treatment plant.

Facility Name | LA0036412 SOUTH PLANT

PART 4: OVERFLOWS AND BYPASSES

A. (1) List the number of times in the last year there was an overflow, bypass, or unpermitted discharge of untreated or incompletely treated wastewater due to heavy rain: 9

(Circle One) 0 = 0 points 1 = 5 points 2 = 10 points
3 = 15 points 4 = 30 points (5 or more = 50 points)

(2) List the number of bypasses, overflows, or unpermitted discharges shown in A (1) that were within the collection system and the number at the treatment plant.

Collection System 9 Treatment Plant 0

B. (1) List the number of times in the last year there was a bypass or overflow of untreated or incompletely treated wastewater due to equipment failure, either at the treatment plant or due to pumping problems in the collection system: 123

(Circle One) 0 = 0 points 1 = 5 points 2 = 10 points
3 = 15 points 4 = 30 points (5 or more = 50 points)

(2) List the number of bypasses or overflows shown in B (1) that were within the collection system and the number at the treatment plant.

Collection System 117 Treatment Plant 6

C. Specify whether the bypasses came from the city or village sewer system or from contract or tributary communities/sanitary districts, etc.

D. Add the point values circled for A and B and place the total in the box below.

TOTAL POINT VALUE FOR PART 4 [100] **(max=100)**

Also enter this value on the point calculation table on page 16.

E. List the person responsible for reporting overflows, bypasses, or unpermitted discharges to State and Federal authorities:

CHARLES M. O'BRIEN, WASTEWATER LABORATORY SUPERVISOR
(225) 389-3240

Describe the procedure for gathering, compiling, and reporting:

THE PROCEDURE FOR GATHERING, COMPILING, AND REPORTING IS SPECIFIED IN THE PERMIT.

Facility Name LA0036412 SOUTH PLANT

PART 5: SLUDGE STORAGE AND DISPOSAL SITES

A. Sludge Storage

How many months of sludge storage capacity does your wastewater treatment facility have available, either on-site or off-site?

Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	<2	2	3	(4 to 5)	>6	months
points	50	30	20	(10)	0	points

Write 0, 10, 20, 30, or 50 in the A point total box [10] A Point Total

B. For how many months does your facility have access to (and approval for) sufficient land disposal sites to provide proper land disposal?

Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	<2	6 to 11	12 to 23	24 to 35	(>36)	months
points	50	30	20	10	(0)	points

Write 0, 10, 20, 30, or 50 in the B point total box [0] B Point Total

C. Add together the A and B point values and place this sum in the box below at the right:

TOTAL POINT VALUE FOR PART 5 [10] **(max=100)**

Also enter this value on the point calculation table on page 16.

Facility Name LA0036412 SOUTH PLANT

PART 6: NEW DEVELOPMENT

A. Please provide the following information for the total of all sewer line extensions which were installed during the last year.

Design Population: 11,045

Design Flow: 4.76 MGD

Design BOD_5: 190 mg/l

B. Has an industry (or other development) moved into the community or expanded production in the past year, such that either flow or pollutant loadings to the sewerage system were significantly increased (5% or greater)?

(Circle One) (No = 0 points) Yes = 15 points

Describe: _____

List any new pollutants: _____

C. Is there any development (industrial, commercial, or residential) anticipated in the next 2-3 years, such that either flow or pollutant loadings to the sewerage system could significantly increase?

(Circle One) (No = 0 points) Yes = 15 points

Describe: _____

List any new pollutants that you anticipate: _____

D. Add together the point value circled in B and C and place the sum in the blank below.

TOTAL POINT VALUE FOR PART 6 [0] **(max=30)**

Also enter this value on the point calculation table on page 16.

Facility Name LA0036412 SOUTH PLANT

PART 7: OPERATOR CERTIFICATION AND EDUCATION

A. What was the name of the operator-in-charge for the reporting year? HUGH TAYLOR Name

B. What is his/her certification number? 10-628 Cert. #

C. What level of certification is the operator-in-charge required to have to operate the wastewater treatment plant? WASTEWATER TRMT. IV Level Required

D. What is the level of certification of the operator-in-charge? WASTEWATER TRMT. IV Level Certified

E. Was the operator-in-charge of the report year certified at least at the grade level required in order to operate this plant? ✓ Check one box ☒ yes = 0 points ☐ no = 50 points

Write 0 or 50 in the E point total box [0] E Point Total

F. Has the operator-in-charge maintained recertification requirements during the reporting year? ✓ Check one box ☒ yes ☐ no

G. How many hours of continuing education has the operator-in-charge completed over the last two calendar years? ✓ Check one box ☒ 12 hours or more = 0 points ☐ Less than 12 hours = 50 points

Write 0 or 50 in the G point total box [0] G Point Total

H. Is there a written policy regarding continuing education and training for wastewater treatment plant employees? ✓ Check one box ☒ yes ☐ no

Explain:

REQUIREMENTS: FOR EACH TWO YEAR PERIOD, MUST COMPLETE 16 HOURS OF WASTEWATER TRAINING.

I. What percentage of the continuing education expenses of the operator-in-charge were paid for:

By the permittee? 100%

By the operator? 0%

J. Add together the E and G point values and place this sum in the box below at the right:

TOTAL POINT VALUE FOR PART 7 [0] (max=100)

Also enter this value on the point calculation table on page 16.

Facility Name: LA0036412 SOUTH PLANT

PART 8: FINANCIAL STATUS

A. Are User-Charge Revenues sufficient to cover operation and maintenance expenses?
✓ Check one box ☐ Yes ☒ No If no, how are O & M costs being financed?
Explain:

SAME AS B.

B. What financial resources do you have available to pay for your wastewater improvements and reconstruction needs?

WASTEWATER IMPROVEMENTS AND RECONSTRUCTION NEEDS ARE FUNDED FROM FOUR MAIN REVENUE SOURCES. THEY ARE A ONE HALF PERCENT SALES & USE TAX, SEWER USER FEES, SEWER IMPACT FEES, AND A $4 MILLION SUBSIDY FROM THE GENERAL FUND SUPPORTED FROM GAMING REVENUES.

Facility Name | LA0036412 SOUTH PLANT

PART 9: SUBJECTIVE EVALUATION

A. Collection System Maintenance

1. Describe what sewer system maintenance work has been done in the last year.

SEE ATTACHMENT

2. Describe what lift station work has been done in the last year.

ROUTINE MAINTENANCE

3. What collection system improvements does the community have under consideration for the next 5 years?

SEE ATTACHMENT

B. If you have ponds, please answer the following questions:

1. Do you have duckweed buildup in your ponds? ☐ Yes ☐ No
2. Do you mow your dikes regularly (at least monthly), to the waters edge? ☐ Yes ☐ No
3. Do you have bushes or trees growing on the dikes or in the ponds? ☐ Yes ☐ No
4. Do you have excess sludge buildup (> 1 foot) on the bottom of any of your ponds? ☐ Yes ☐ No
5. Do you exercise all of your valves? ☐ Yes ☐ No
6. Are your control manholes in good structural shape? ☐ Yes ☐ No
7. Do you maintain at least three feet of freeboard in all your ponds? ☐ Yes ☐ No
8. Do you visit your pond system, at least weekly? ☐ Yes ☐ No

LA0036412 SOUTH PLANT

LA MWPP ENVIRONMENTAL AUDIT

PART 9: SUBJECTIVE EVALUATION

A1. AS PART OF THE CONSENT DECREE, OPERATION AND MAINTENANCE OF THE SOUTH TREATMENT PLANT COLLECTION AREA IS PERFORMED AND REPORTED ON A QUARTERLY BASIS. THE FOLLOWING TABLE IS A BREAKDOWN/SUMMARY OF ACTIVITIES PERFORMED WITHIN THE SOUTH TREATMENT PLANT COLLECTION SYSTEM AREA DURING THE REPORTING PERIOD.

SOUTH TREATMENT AREA
MONITORING PERIOD (6/05 – 5/06)

LINE CLEANING	18%
CCTV INSPECTIONS	13%
SMOKE TESTING	1%
DYE TESTING	13%
MANHOLE INSPECTION	40%
LINE REPAIRED	4%
MANHOLE REHABILITATION	1%
FORCEMAIN-INSPECTIONS	48%
REPAIRED	10%
AIR RELEASE VALVES-INSPECTIONS	134%
REPAIRED	81%
WET WELL CLEANED	44%
PUMP STATIONS-REPAIRED	11%

A3. DURING THE NEXT 5 YEARS APPROXIMATELY 29 PROJECTS IN THE SOUTH TREATMENT PLANT COLLECTION AREA (RELATED TO THE SSO CONSENT DECREE PROGRAM) ARE SCHEDULED TO BE IMPLEMENTED, EITHER DESIGN OR BEGIN CONSTRUCTION. THE PROJECTS WILL INCLUDE PUMP STATION UPGRADES, FORCE MAIN IMPROVEMENTS, GRAVITY SEWERS, STORAGE AND UPGRADE AND/OR EXPANSION OF TREATMENT FACILITIES. ADDITIONALLY, ANNUAL CONTRACTS FOR SEWER REHABILITATION INCLUDING LINING, POINT REPAIR, UPSIZING, AND OTHER REHABILITATION METHODS WILL ALSO BE IMPLEMENTED. FOLLOWING OF A LISTING OF THE CURRENTLY PROPOSED PROJECTS.

Future South Wastewater Treatment Plant Collection System Improvements

Proposed Capital Improvement Plan

The recommended program strategy is to conduct comprehensive rehabilitation of the sewer system in all areas where the rainfall dependent infiltration and inflow (RDII) rate currently exceeds 10 percent of the rainfall volume (i.e., the system R value exceeds 10 percent). This will result in significant reductions in wet-weather flows throughout the City/Parish system, thus improving system performance and controlling system overflows and house back-ups. In addition, the comprehensive rehabilitation program will provide substantial additional benefits in terms of reduced operation and maintenance costs as well as improved structural integrity.

The recommended improvements program includes three categories of improvements. The rehabilitation in each of the basins with R-values in excess of 10 percent is considered part of the Category 1 improvements, which also includes minor pump station modifications needed to boost their pumping head (i.e., new impellors, larger motors, piping modifications).

Sewer and pump station improvement plans were devised to resolve all remaining conveyance deficiencies in each basin. The pump station and conveyance system improvements include capacity increases to the stations and piping. The pump station and conveyance system improvements are referred to as Category 2 improvements. Improvements to provide flow equalization and wastewater treatment enhancements are referred to as Category 3.

Category 1: Comprehensive Sewer Basin Rehabilitation and Pump Station Upgrades

Based upon sewer system model results and flow monitoring, numerous basins within the Baton Rouge system require comprehensive rehabilitation. The basins identified through the system model are scheduled for rehabilitation based upon the modeled R-values. The first group of basins scheduled for rehabilitation are those with the highest existing R-values.

Category 1 also provides for pump station inspection and mechanical improvements at select pump station to allow for head increase. These improvements include assessing and potentially making mechanical upgrades 41 pump stations in the South SCD/STN area. The assessment of the pump stations will determine specific improvements required to allow each pump station to operate against the system head. Improvements may include replacement of impellers, motors, pumps, and/or piping and will be determined for each station during design.

Category 2: Pump Station and Transmission/Conveyance System Improvements

The system model was used to identify pump stations and conveyance lines where capacity is not adequate for the peak wastewater flows. Category 2 provides for pump station and conveyance system upgrades in capacity. The projects are generally discussed below.

In the South CSD/STN area, capacity upgrades are required at 35 pump stations. The largest upgrades required based upon model results are at Pump Station 57, Pump Station 58, and Pump Station 514. Pump Station 57 requires an increase in capacity of 76 MGD. Pump Station 58 requires an increase in capacity of 56 MGD, and Pump Station 514 requires an increase in capacity of 52 MGD. This significant capacity increase will likely require construction of a new pump station or significant increase to the existing pump station wet well and pump/pipe systems.

Pipeline capacity improvements include replacement of approximately 126,000 LF of replacement gravity sewer, installation of approximately 174,000 LF of new parallel gravity sewer, approximately 26,000 LF of replacement force main, and 7,000 LF of parallel force main.

- A detailed listing of the pump station and pipelines requiring capacity increases are as follows: Make capacity upgrades to PS50, PS53, PS57 and PS 58 including new parallel force main.

- Replace approximately 14,000 LF of gravity sewer and install approximately 81,000 LF of parallel gravity sewer in PS58 area.

- Replace approximately 26,000 LF gravity sewer and install approximately 34,000 LF of parallel gravity sewer.

- Replace approximately 2,500 LF of force main.

Area Upstream of PS889
- Replace approximately 7,800 LF of gravity sewer.

- Replace approximately 9,000 LF of force main and install approximately 200 LF of parallel force main.

- Make capacity improvements at PS153, PS100, PS189, PS889 and PS104.

Area Upstream of BPS514/East of Highland Road
- Make significant capacity upgrade to PS514.

- Replace approximately 3,000 LF of gravity sewer and parallel approximately 2,800 LF of gravity sewer.

- Assess and potentially make capacity improvements to PS327, PS253, PS278, PS382, and PS343.

O'Neal Lane South Area
- Assess and potentially make capacity improvements to PS316, PS211, PS296, PS247, and PS213.

- Replace approximately 5,000 LF of gravity sewer.

- Replace approximately 3,000 LF of force main.

Area Upstream of BPS507

- Assess and make potential capacity improvements to PS162, PS177, PS274, and PS170.
- Make significant capacity improvements to PS777.
- Replace approximately 20,000 LF of gravity sewer and parallel over 1,100 LF of gravity sewer.
- Replace approximately 1,600 LF of force main and parallel approximately 100 LF of force main.

Area South of I-12/Sherwood Forrest and Jefferson

- Make capacity improvements to PS287
- Replace approximately 1,800 LF of gravity sewer and install approximately 600 LF of parallel gravity sewer.
- Replace approximately 1,100 LF of force main.

Areas Upstream of PS302/PS27/PS999

- Make significant capacity improvements to PS999.
- Inspect and potentially make capacity improvements to PS223, PS118, and PS161.
- Replace approximately 5,600 LF of gravity sewer.

Essen Lane Area South of I-10

- Make significant capacity improvements to PS57, PS58, and PS53.
- Make capacity improvements at PS56, PS68, and PS91.
- Replace approximately 38,000 LF of gravity sewer and parallel approximately 109,000 LF of gravity sewer.
- Replace approximately 700 LF of force main and parallel approximately 5,100 LF of force main.

PS236, PS311, PS329, PS102

- Make capacity improvements to PS236, PS311, and PS329
- Replace approximately 9,300 LF of gravity sewer.
- Replace approximately 2,200 LF of force main.

Category 3: Flow Equalization and Wastewater Treatment Improvements

The conveyance improvements described in the previous sections will increase peak flow to the South WWTP. Therefore, flow equalization and/or treatment capacity improvements will be necessary to address these larger peak flows at the South WWTP.

Sewer rehabilitation will actually decrease dry weather flows in the basins because infiltration of groundwater will be reduced. No redirection of flows from one treatment plant service area to another was found to be beneficial during the development of the program.

Based upon the predicted increase in flow to the South WWTP and the historical performance of the treatment plant, the following improvements to the treatment plant are recommended.

New Headworks and Flow Equalization Basin

Peak flows to the South WWTP from the gravity collection system (SCSD) and the force main system (SSTN) will be 273 MGD. If the South WWTP is upgraded to a peak capacity of 200 MGD, flow equalization facilities with the ability to accommodate the remaining 73 MGD are required. A hydrograph shows the time duration of the 73 MGD and it has been determined that the volume needed to store this peak flow would be 19 million gallons. The construction of a new headworks facility with screening, grit removal facilities and influent pumping in the vicinity of the proposed 19 million gallon equalization basin is required. With a new headworks facility, the two poorly functioning headworks facilities at the South WWTP can be eliminated and the spikes in flow through the plant can be eliminated. Several locations for the new headworks and flow equalization facilities are being evaluated. All three locations are near the existing South WWTP.

Upgrade the South WWTP to 200 MGD

A review of the current operating processes will be conducted with possible modifications made in conjunction with the expansion of the South WWTP to 200 MGD. An additional effluent outfall to the Mississippi River is also proposed.

Facility Name LA0036412 SOUTH PLANT

C. Treatment Plants

1. Have the influent and effluent flow meters been calibrated in the last year? ☐ Yes ☐ No

Influent flow meter calibration dates(s):	Effluent flow meter calibration date(s):
* SEE BELOW	** SEE BELOW

2. What problems, if any, have been experienced over the last year that have threatened treatment?

1. PRIMARY BASINS #2, #4 and #6 - DRIVE UNIT FAILURE
2. BAR SCREENS E-101, E-102 and E-103 - MECHANICAL FAILURE

3. Is your community presently involved in formal planning for treatment facility upgrading?

☐ Yes ☒ No If yes, describe:

* GRAVITY INFLUENT CALIBRATION DATES:
6/3/05, 8/15/05, 12/12/05, 5/24/06

FORCE MAIN CALIBRATION DATES:
6/3/05, 8/15/05, 12/12/05

** FINAL EFFLUENT CHAMBER

NORTH CHAMBER: 6/22/05, 8/15/05, 11/7/05, 12/12/05, 5/18/06

SOUTH CHAMBER: 6/22/05, 8/24/05, 12/12/05, 5/18/06

Facility Name | LA0036412 SOUTH PLANT

D. Preventive Maintenance

1. Does your plant have a written plan for preventive maintenance on major equipment items?

☒ Yes ☐ No If yes, describe:

Weekly, monthly and semi-anually preventive maintenance sheets that reflect type and frequency as specified in the O & M manuals. A new computer program will manage the maintenance and preventive maintenance of plant equipment and spare parts.

2. Does this preventive maintenance program depict frequency of intervals, types of lubrication, and other preventive maintenance tasks necessary for each piece of equipment? ☒ Yes ☐ No

3. Are these preventive maintenance tasks, as well as equipment problems, being recorded and filed so future maintenance problems can be assessed properly? ☒ Yes ☐ No

E. Sewer Use Ordinance

1. Does your community have a sewer use ordinance that limits or prohibits the discharge of excessive conventional pollutants (BOD, TSS, or pH) or toxic substances to the sewer from industries, commercial users, and residences?

☒ Yes ☐ No If yes, describe:

Sewer User Fee Ordinance (No. 7853) limits the discharge of BOD & TSS to 200 mg/l and 250 mg/l respectively. Any discharge above these limits is surcharged at a rate of 2% of the monthly sewer user fee for each limit of 10 mg/l. Pretreatment Ordinance (No. 9195) limits the discharge of heavy metals, chemicals and toxic substances.

2. Has it been necessary to enforce? ☒ Yes ☐ No If yes, describe:

The Sewer User Fee Ordinance is strictly enforced by City-Parish and self monitoring sampling. The same apply to the Pretreatment Ordinance. Enforcement mechanisms include discharge permits, surcharges, letter and notice of violations, administrative orders, water termination and fines.

F. Any additional comments about your treatment plant or collection system? (Attach additional sheet if necessary.)

NO

Facility Name LA0036412 SOUTH PLANT

POINT CALCULATION TABLE

Fill in the values from parts 1 through 7 in the columns below. Add the numbers in the left column to determine the point total that the wastewater system has generated for the previous year.

Actual Values	Actual Values	Maximum
Part 1: Influent Flow/Loadings	0	80 Points
Part 2: Effluent Quality/Plant Performance	65	100 Points
Part 3: Age of WWTT	20	50 Points
Part 4: Overflows and Bypasses	100	100 Points
Part 5: Ultimate Disposition of Sludge	10	100 Points
Part 6: New Development	0	30 Points
Part 7: Operator Certification Training	0	100 Points

TOTAL POINTS 195

ATTACHMENT 3

SAMPLE MWPP RESOLUTION

Resolved that the city/town of BATON ROUGE informs Louisiana Department of Environmental Quality that the following actions were taken by the CITY/PARISH METROPOLITAN COUNCIL (governing body).

1. Reviewed the Municipal Water Pollution Prevention Environmental Audit Report which is attached to this resolution.

2. Set forth the following actions necessary to maintain permit requirements contained in the Louisiana Water Discharge Permit System (LWDPS) number LA0036412.

   (Please be specific in listing the actions that will be taken to address the problems identified in the audit report.)

   a. CURRENTLY, WE ARE OPERATING UNDER A CONSENT DECREE WHICH BECAME EFFECTIVE MARCH 14, 2002.

   b. A PROJECT IS UNDERWAY TO REDUCE THE HIGH CONCENTRATION OF HYDROGEN SULFIDE (H_2S).

   c.

   d.

   etc.

Passed by a majority/unanimous (circle one) vote of the CITY/PARISH METROPOLITAN COUNCIL, on (date).

CLERK

SWMTP-EXISTING SITE PLAN

CITY OF BATON ROUGE / PARISH OF EAST BATON ROUGE

CS-1

AGENDA SPACE REQUEST

DATE: August 8, 2006

BY: Director of Public Works

___ **Regular Council Meeting – "Introduction"**
___ **Regular Council Meeting – "Item"**
___ **Regular Council Meeting – "Administrative Matter"**
_X_ **Capital Improvements Committee**
___ **Finance and Executive Committee**

ITEM:

Requesting approval for submittal to the Louisiana Municipal Water Pollution Prevention (MWPP) Environmental Audit Report for the South Treatment Plant to the Department of Environmental Quality (DEQ) for the monitoring period of June 1, 2005, through May 31, 2006. By: Director of Public Works.

APPROVED BY CAO-(MAYOR'S OFFICE):

APPROVED BY COUNCIL BUDGET OFFICE:
(Grant Matters)

ITEM TO APPEAR ON THE AGENDA: August 16, 2006

Any request for an item to be placed on the agenda must be received in writing by the Council Administrator-Treasurer prior to 12:00 noon on Thursday preceding the next regular meeting of the Council. If prior approval is needed for the item, then the proper procedure must be followed before it is placed on the agenda.

Please be sure that all information for the preparation of the Resolution or Ordinance in connection with this matter is attached.

Please make sure you go through Finance Budgeting to have a budget supplement prepared for your project, if that is necessary.

LOUISIANA

MUNICIPAL WATER POLLUTION PREVENTION

MWPP

Facility Name:	CENTRAL, PLANT
LWDPS Permit Number:	
NPDES Permit Number:	LA0036421
Address:	2443 RIVER ROAD
	BATON ROUGE
	LOUISIANA
Parish:	EAST BATON ROUGE
(Person Completing Form) Name:	WARREN BRANDON
Title:	ASSISTANT WW LAB SUPERVISOR
Date Completed:	OCTOBER 31, 2006

Instructions to the Operator-in-Charge

1. Complete only the sections of the Environmental Audit which apply to your wastewater treatment system. Leave sections that do not apply blank and enter a "0" for the point value.

2. Parts 1 through 7 contain questions for which points may be generated. These points are intended to communicate to the department and the governing body or owner what actions will be necessary to prevent effluent violations. Place the point totals from parts 1 through 7 on the Point Calculation page.

3. Add up the point totals.

4. Submit the Environmental Audit to the governing body or owner for their review and approval.

5. The governing body must pass a resolution which contains the following items:

   a. The resolution or letter must acknowledge the governing body or owner has reviewed the Environmental Audit.

   b. The resolution must indicate specific actions, if any, will be taken to maintain compliance and prevent effluent violations. Proposed actions should address the parts where maximum or close to maximum points were generated in the Environmental Audit.

   c. The resolution should provide any other information the governing body deems appropriate.

Facility Name | LA0036421 CENTRAL PLANT

PART 1: INFLUENT FLOW/LOADINGS

Part 1: Influent Flow/Loadings (All plants)

A. **List the average monthly volumetric flows and BOD loadings received at your facility during the last reporting year.**

Col. 1 Average Monthly Flow (million gallons per day, MGD)		Col. 2 Average Monthly BOD_5 Concentration (mg/l)		Col. 3 Average Monthly BOD_5 Loading (pounds per day)
11.78	X	146	X 8.34 =	14,344
9.66	X	157	X 8.34 =	12,649
10.41	X	150	X 8.34 =	13,023
10.48	X	133	X 8.34 =	11,625
9.96	X	135	X 8.34 =	11,214
12.06	X	122	X 8.34 =	12,271
9.84	X	132	X 8.34 =	10,833
10.48	X	117	X 8.34 =	10,226
9.40	X	140	X 8.34 =	10,975
8.99	X	145	X 8.34 =	10,872
10.46	X	112	X 8.34 =	9,770
12.41	X	119	X 8.34 =	12,316

BOD loading = Average Monthly Flow (in MGD) x Average Monthly BOD concentration (in mg/l) x 8.34.

B. List the design flow and design BOD loading for your facility in the blanks below. If you are not aware of these design quantities, refer to your Operation and Maintenance Manual (O & M) or contact your consulting engineer.

Design Flow, MGD	32	X 0.90 =	28.80
Design BOD, lb/day	55,244	X 0.90 =	49,720

C. How many months did the monthly flow (Col. 1) to the wastewater treatment plant (WWTP) exceed 90% of design flow?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	0	0	0	5	5	5	5	5	5	5	5	points

Write 0 or 5 in the C point total box [0] C Point Total

D. How many months did the monthly flow (Col. 1) to the WWTP exceed the design flow?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	5	5	10	10	15	15	15	15	15	15	15	15	points

Write 0, 5, 10, or 15 in the D point total box [0] D Point Total

E. How many months did the monthly BOD loading (Col. 3) to the WWTP exceed 90% of the design loading?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	5	5	5	10	10	10	10	10	10	10	10	points

Write 0, 5, or 10 in the E point total box [0] E Point Total

F. How many times did the monthly BOD loading (Col. 3) to the WWTP exceed the design loading?
Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	10	20	30	40	50	50	50	50	50	50	50	50	points

Write 0, 10, 20, 30, 40, or 50 in the F point total box [0] F Point Total

G. Add together each point total for C through F and place this sum in the box below at the right.

TOTAL POINT VALUE FOR PART 1 [0] **(max=80)**

Also enter this value on the point calculation table on page 16.

Facility Name | LA0036421 CENTRAL PLANT

PART 2: EFFLUENT QUALITY/PLANT PERFORMANCE

A. List the monthly average effluent BOD and TSS concentrations produced by your facility during the last reporting year.

Month	Column 1 Avg. Monthly BOD (mg/l)	Column 2 Avg. Monthly TSS (mg/l)
SEPTEMBER	19	15
OCTOBER	21	17
NOVEMBER	26	20
DECEMBER	26	19
JANUARY	27	18
FEBRUARY	26	18
MARCH	24	15
APRIL	16	16
MAY	18	15
JUNE	14	12
JULY	14	13
AUGUST	15	14

B. List the monthly average permit limits for your facility in the blanks below.

	Permit Limit		90% of Permit Limit
BOD, mg/l	30	X 0.90 =	27
TSS, mg/l	30	X 0.90 =	27

Facility Name | LA0036421 CENTRAL PLANT

C. Continuous Discharge to Surface Water

i. How many months did the effluent BOD concentration (Col. 1) exceed 90% of permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	10	20	30	40	40	40	40	40	40	40	40	points

Write 0, 10, 20, 30 or 40 in the i point total box [0] i Point Total

ii. How many months did the effluent BOD concentration (Col. 1) exceed permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	5	5	10	10	10	10	10	10	10	10	10	10	points

Write 0, 5, or 10 in the ii point total box [0] ii Point Total

iii. How many months did the effluent TSS concentration (Col. 2) exceed 90% of permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	0	10	20	30	40	40	40	40	40	40	40	40	points

Write 0, 10, 20, 30, or 40 in the iii point total box [0] iii Point Total

iv. How many months did the effluent TSS concentration (Col.2) exceed permit limits? Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	(0)	1	2	3	4	5	6	7	8	9	10	11	12	months
points	(0)	5	5	10	10	10	10	10	10	10	10	10	10	points

Write 0, 5, or 10 in the iv point total box [0] iv Point Total

v. Add together each point total for i through iv and place this sum in the box below at the right.

TOTAL POINT VALUE FOR PART 2 [0] **(max=100)**

Also enter this value on the point calculation table on page 16.

Facility Name LA0036421 CENTRAL PLANT

D. Other Monitoring and Limits

i. At any time in the past year was there an exceedance of a permit limit for other pollutants such as: ammonia-nitrogen, phosphorus, pH, residual chlorine, or fecal coliform?

✓ Check one box ☒ Yes ☐ No If yes, please describe:

FECAL COLIFORM _ 2/14-20/2006 521 col./100ML

ii. At any time in the past year was there a "failure" of a Biomonitoring (Whole Effluent Toxicity) test of the effluent?

✓ Check one box ☐ Yes ☒ No If yes, please describe:

iii. At any time in the past year was there an exceedance of a permit limit for a toxic substance?

✓ Check one box ☐ Yes ☒ No If yes, please describe:

Facility Name | LA0036421 CENTRAL PLANT

PART 3: AGE OF THE WASTEWATER TREATMENT FACILITIES

A. What year was the wastewater treatment plant constructed or last major expansion/improvements completed? 1998

Current Year - (Answer to A) = Age in years

2006 - 1998 = 8 years

Enter Age in Part C below.

B. Check the type of treatment facility that is employed:

		Factor
X	Mechanical Treatment Plant (Trickling filter, activated sludge, etc.) Specify Type _____	2.5
_____	Aerated Lagoon	2.0
_____	Stabilization Pond	1.5
_____	Other (Specify) _____	1.0

C. Multiply the factor listed next to the type of facility your community employs by the age of your facility to determine the total point value of Part 3:

TOTAL POINT VALUE FOR PART 3 = 2.5 (FACTOR) x 8 (AGE) = 20 **(max = 50)**

Also enter this value or 50, which ever is less, on the point calculation table on page 16.

D. Please attach a schematic of the treatment plant.

Facility Name | LA0036421 CENTRAL PLANT

PART 4: OVERFLOWS AND BYPASSES

A. (1) List the number of times in the last year there was an overflow, bypass, or unpermitted discharge of untreated or incompletely treated wastewater due to heavy rain: 5

(Circle One) 0 = 0 points 1 = 5 points 2 = 10 points
3 = 15 points 4 = 30 points 5 or more = 50 points

(2) List the number of bypasses, overflows, or unpermitted discharges shown in A (1) that were within the collection system and the number at the treatment plant.

Collection System 5 Treatment Plant 0

B. (1) List the number of times in the last year there was a bypass or overflow of untreated or incompletely treated wastewater due to equipment failure, either at the treatment plant or due to pumping problems in the collection system: 13

(Circle One) 0 = 0 points 1 = 5 points 2 = 10 points
3 = 15 points 4 = 30 points 5 or more = 50 points

(2) List the number of bypasses or overflows shown in B (1) that were within the collection system and the number at the treatment plant.

Collection System 12 Treatment Plant 1

C. Specify whether the bypasses came from the city or village sewer system or from contract or tributary communities/sanitary districts, etc.

D. Add the point values circled for A and B and place the total in the box below.

TOTAL POINT VALUE FOR PART 4 | 100 | **(max=100)**

Also enter this value on the point calculation table on page 16.

E. List the person responsible for reporting overflows, bypasses, or unpermitted discharges to State and Federal authorities:

WARREN BRANDON, ASSISTANT WASTEWATER LABORATORY SUPERVISOR
(225) 389-3240

Describe the procedure for gathering, compiling, and reporting:

THE PROCEDURE FOR GATHERING, COMPILING AND REPORTING IS SPECIFIED IN THE PERMIT.

Facility Name | LA0036421 CENTRAL PLANT

PART 5: SLUDGE STORAGE AND DISPOSAL SITES

A. Sludge Storage

How many months of sludge storage capacity does your wastewater treatment facility have available, either on-site or off-site?

Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	<2	2	3	(4 to 5)	>6	months
points	50	30	20	(10)	0	points

Write 0, 10, 20, 30, or 50 in the A point total box [10] A Point Total

B. For how many months does your facility have access to (and approval for) sufficient land disposal sites to provide proper land disposal?

Circle the number of months and corresponding point total. Write the point total in the box below at the right.

months	<2	6 to 11	12 to 23	24 to 35	(>36)	months
points	50	30	20	10	(0)	points

Write 0, 10, 20, 30, or 50 in the B point total box [0] B Point Total

C. Add together the A and B point values and place this sum in the box below at the right:

TOTAL POINT VALUE FOR PART 5 [10] **(max=100)**

Also enter this value on the point calculation table on page 16.

Facility Name LA0036421 CENTRAL PLANT

PART 6: NEW DEVELOPMENT

A. Please provide the following information for the total of all sewer line extensions which were installed during the last year.

Design Population: 0

Design Flow: 0 MGD

Design BOD_5: 190 mg/l

B. Has an industry (or other development) moved into the community or expanded production in the past year, such that either flow or pollutant loadings to the sewerage system were significantly increased (5% or greater)?

(Circle One) (No = 0 points) Yes = 15 points

Describe: _____

List any new pollutants: _____

C. Is there any development (industrial, commercial, or residential) anticipated in the next 2-3 years, such that either flow or pollutant loadings to the sewerage system could significantly increase?

(Circle One) (No = 0 points) Yes = 15 points

Describe: _____

List any new pollutants that you anticipate: _____

D. Add together the point value circled in B and C and place the sum in the blank below.

TOTAL POINT VALUE FOR PART 6 [0] **(max=30)**

Also enter this value on the point calculation table on page 16.

Facility Name | LA0036421 CENTRAL PLANT

PART 7: OPERATOR CERTIFICATION AND EDUCATION

A. What was the name of the operator-in-charge for the reporting year? Robert Florida **Name**

B. What is his/her certification number? #10-549 **Cert. #**

C. What level of certification is the operator-in-charge required to have to operate the wastewater treatment plant? Wastewater Trmt. IV **Level Required**

D. What is the level of certification of the operator-in-charge? Wastewater Trmt. IV **Level Certified**

E. Was the operator-in-charge of the report year certified at least at the grade level required in order to operate this plant? ✓ Check one box ☒ yes = 0 points ☐ no = 50 points

Write 0 or 50 in the E point total box [0] E Point Total

F. Has the operator-in-charge maintained recertification requirements during the reporting year? ✓ Check one box ☒ yes ☐ no

G. How many hours of continuing education has the operator-in-charge completed over the last two calendar years? ✓ Check one box ☒ 12 hours or more = 0 points ☐ Less than 12 hours = 50 points

Write 0 or 50 in the G point total box [0] G Point Total

H. Is there a written policy regarding continuing education and training for wastewater treatment plant employees? ✓ Check one box ☒ yes ☐ no

Explain:

The State of Louisiana requires that an operator have at least 16 hours of continuing education in a two-year period to maintain his/her certification.

I. What percentage of the continuing education expenses of the operator-in-charge were paid for:

By the permittee? 100%

By the operator? 0%

J. Add together the E and G point values and place this sum in the box below at the right:

TOTAL POINT VALUE FOR PART 7 [0] **(max=100)**

Also enter this value on the point calculation table on page 16.

Facility Name: LA0036421 CENTRAL PLANT

PART 8: FINANCIAL STATUS

A. Are User-Charge Revenues sufficient to cover operation and maintenance expenses?
✓ Check one box ☐ Yes ☐ No If no, how are O & M costs being financed?

Explain:

SAME AS B.

B. What financial resources do you have available to pay for your wastewater improvements and reconstruction needs?

WASTEWATER IMPROVEMENTS AND RECONSTRUCTION NEEDS ARE FUNDED FROM FOUR MAIN REVENUE SOURCES. THEY ARE A ONE HALF PERCENT SALES & USE TAX, SEWER USER FEES, SEWER IMPACT FEED, AND A $4 MILLION SUBSIDY FROM THE GENERAL FUND SUPPORTED FROM GAMING REVENUES.

Facility Name | LA0036421 CENTRAL PLANT

PART 9: SUBJECTIVE EVALUATION

A. Collection System Maintenance

1. Describe what sewer system maintenance work has been done in the last year.

SEE ATTACHMENT

2. Describe what lift station work has been done in the last year.

SEE ATTACHMENT

3. What collection system improvements does the community have under consideration for the next 5 years?

SEE ATTACHMENT

B. If you have ponds, please answer the following questions:

1. Do you have duckweed buildup in your ponds? ☐ Yes ☐ No
2. Do you mow your dikes regularly (at least monthly), to the waters edge? ☐ Yes ☐ No
3. Do you have bushes or trees growing on the dikes or in the ponds? ☐ Yes ☐ No
4. Do you have excess sludge buildup (> 1 foot) on the bottom of any of your ponds? ☐ Yes ☐ No
5. Do you exercise all of your valves? ☐ Yes ☐ No
6. Are your control manholes in good structural shape? ☐ Yes ☐ No
7. Do you maintain at least three feet of freeboard in all your ponds? ☐ Yes ☐ No
8. Do you visit your pond system, at least weekly? ☐ Yes ☐ No

LA0036421 CENTRAL PLANT

LA MWPP ENVIRONMENTAL AUDIT

PART 9: SUBJECTIVE EVALUATION

A1. AS PART OF THE CONSENT DECREE, OPERATION AND MAINTENANCE OF THE CENTRAL TREATMENT PLANT COLLECTION AREA IS PERFORMED AND REPORTED ON A QUARTERLY BASIS. THE FOLLOWING TABLE IS A BREAKDOWN/SUMMARY OF ACTIVITIES PERFORMED WITHIN THE SOUTH TREATMENT PLANT COLLECTION SYSTEM AREA DURING THE REPORTING PERIOD.

CENTRAL TREATMENT AREA
MONITORING PERIOD (9/05 – 8/06)

LINE CLEANING	3%
CCTV INSPECTIONS	0%
SMOKE TESTING	2%
DYE TESTING	0%
MANHOLE INSPECTION	29%
LINE REPAIRED	4%
MANHOLE REHABILITATION	0%
FORCEMAIN-INSPECTIONS	33%
REPAIRED	0%
AIR RELEASE VALVES-INSPECTIONS	117%
REPAIRED	50%
WET WELL CLEANED	367%
PUMP STATIONS-REPAIRED	0%

A3. DURING THE NEXT 5 YEARS APPROXIMATELY 6 PROJECTS IN THE CENTRAL TREATMENT PLANT COLLECTION AREA (RELATED TO THE SSO CONSENT DECREE PROGRAM) ARE SCHEDULED TO BE IMPLEMENTED, EITHER DESIGN OR BEGIN CONSTRUCTION. THE PROJECTS WILL INCLUDE PUMP STATION UPGRADES, FORCE MAIN IMPROVEMENTS, GRAVITY SEWERS, STORAGE AND WET WEATHER TREATMENT FACILITIES. ADDITIONALLY, ANNUAL CONTRACTS FOR SEWER REHABILITATION INCLUDING LINING, POINT REPAIR, UPSIZING, AND OTHER REHABILITATION METHODS WILL ALSO BE IMPLEMENTED. FOLLOWING OF A LISTING OF THE CURRENTLY PROPOSED PROJECTS.

Future Central Wastewater Treatment Plant Collection System Improvements

Proposed Capital Improvement Plan

The recommended program strategy is to conduct comprehensive rehabilitation of the sewer system in all areas where the rainfall dependent infiltration and inflow (RDII) rate currently exceeds 10 percent of the rainfall volume (i.e., the system R value exceeds 10 percent). This will result in significant reductions in wet-weather flows throughout the City/Parish system, thus improving system performance and controlling system overflows and house back-ups. In addition, the comprehensive rehabilitation program will provide substantial additional benefits in terms of reduced operation and maintenance costs as well as improved structural integrity.

The recommended improvements program includes three categories of improvements. The rehabilitation in each of the basins with R-values in excess of 10 percent is considered part of the Category 1 improvements, which also includes minor pump station modifications needed to boost their pumping head (i.e., new impellors, larger motors, piping modifications).

Sewer and pump station improvement plans were devised to resolve all remaining conveyance deficiencies in each basin. The pump station and conveyance system improvements include capacity increases to the stations and piping. The pump station and conveyance system improvements are referred to as Category 2 improvements. Improvements to provide flow equalization and wastewater treatment enhancements are referred to as Category 3.

Category 1: Comprehensive Sewer Basin Rehabilitation and Pump Station Upgrades

Based upon sewer system model results and flow monitoring, numerous basins within the Baton Rouge system require comprehensive rehabilitation. The basins identified through the system model are scheduled for rehabilitation based upon the modeled R-values. The first group of basins scheduled for rehabilitation are those with the highest existing R-values. The Central area R-values indicate the sewer lines in this area are generally in worse condition than other areas of the City's system. A greater portion of the Central system requires rehabilitation than other systems, likely due to the age of the system and service connections. Cross-connections may also be more likely in the older, congested area.

Category 1 also provides for pump station inspection and mechanical improvements at select pump station to allow for head increase. These improvements include assessing and potentially making mechanical upgrades 3 pump stations in the Central CSD area. The assessment of the pump stations will determine specific improvements required to allow each pump station to operate against the system head. Improvements may include replacement of impellers, motors, pumps, and/or piping and will be determined for each station during design.

Category 2: Pump Station and Transmission/Conveyance System Improvements

The system model was used to identify pump stations and conveyance lines where capacity is not adequate for the peak wastewater flows. Category 2 provides for pump station and conveyance system upgrades in capacity. The projects are generally discussed below.

In the Central CSD area, capacity upgrades are required at three pump stations. The largest upgrade required based upon model results is at Pump Station 2. This pump station will require a capacity increase of approximately 17 MGD. Improvements to obtain this increased capacity will be determined during design.

Pipeline capacity improvements include replacement of approximately 22,000 LF of replacement gravity sewer and installation of approximately 38,000 LF of new parallel gravity sewer. Based upon model results, no new force main based upon capacity needs is required in this service area. A detailed listing of the pump station and pipelines requiring capacity increases are as follows:

- Make capacity upgrade to PS2
- Parallel approximately 13,000 LF gravity sewer and replace approximately 9,000 LF of gravity sewer
- Make capacity upgrade to PS4.
- Assess and make possible mechanical upgrades to PS5, PS15, and PS19
- Replace approximately 8,000 LF of gravity sewer and parallel approximately 17,000 LF of gravity sewer.
- Make capacity upgrade to PS 10

Category 3: Flow Equalization and Wastewater Treatment Improvements

The conveyance improvements described in the previous sections will decrease peak flows to the Central Wastewater Treatment Plant (WWTP). The peak flows predicted by the model for the Central WWTP is slightly less than the plant's current peak treatment capacities.

Sewer rehabilitation will actually decrease dry weather flows in the basins because infiltration of groundwater will be reduced. No redirection of flows from one treatment plant service area to another was found to be beneficial during the development of the program.

Therefore, no wastewater treatment improvements are necessary is the Central CSD area.

C. Treatment Plants

1. Have the influent and effluent flow meters been calibrated in the last year? ☐ Yes ☐ No

Influent flow meter calibration dates(s):	Effluent flow meter calibration date(s):
11-04-05 04-05-06 06-27-06	07-29-05 02-03-06 07-20-06

2. What problems, if any, have been experienced over the last year that have threatened treatment?

NONE

3. Is your community presently involved in formal planning for treatment facility upgrading?

☐ Yes ☒ No If yes, describe:

Facility Name | LA0036421 CENTRAL PLANT

D. Preventive Maintenance

1. Does your plant have a written plan for preventive maintenance on major equipment items?

☒ Yes ☐ No If yes, describe:

Weekly, monthly and semi-annual preventive maintenance sheets that reflect type and frequency as specified in the O&M manuals. A new computer program will manage the maintenance and preventive maintenance of plant equipment and spare parts.

2. Does this preventive maintenance program depict frequency of intervals, types of lubrication, and other preventive maintenance tasks necessary for each piece of equipment? ☒ Yes ☐ No

3. Are these preventive maintenance tasks, as well as equipment problems, being recorded and filed so future maintenance problems can be assessed properly? ☒ Yes ☐ No

E. Sewer Use Ordinance

1. Does your community have a sewer use ordinance that limits or prohibits the discharge of excessive conventional pollutants (BOD, TSS, or pH) or toxic substances to the sewer from industries, commercial users, and residences?

☒ Yes ☐ No If yes, describe:

Sewer User Fee Ordinance (No. 7853) limits the discharge of BOD & TSS to 200 mg/l and 250 mg/l respectively. Any discharge above these limits is surcharged at a rate of 2% of the monthly sewer user fee for each limit of 10 mg/l. Pretreatment Ordinance (No. 9195) limits the discharge of heavy metals, chemicals and toxic substances.

2. Has it been necessary to enforce? ☒ Yes ☐ No If yes, describe:

The Sewer User Fee Ordinance is strictly enforced by City-Parish and self monitoring sampling. The same apply to the Pretreatment Ordinance. Enforce mechanisms include discharge permits, surcharges, letter and notice of violations, administrative orders, water termination and fines.

F. Any additional comments about your treatment plant or collection system? (Attach additional sheet if necessary.)

NO

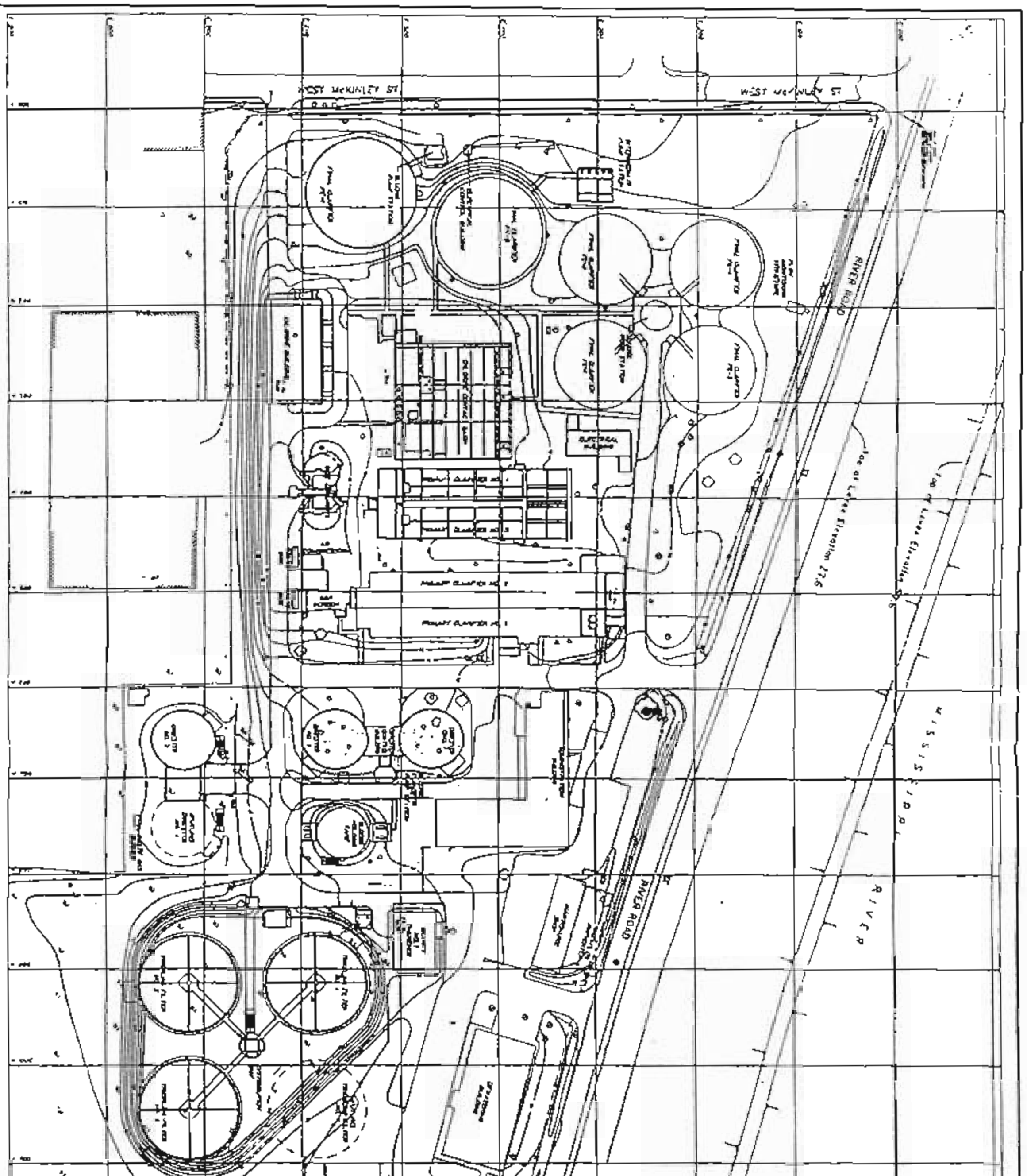
Facility Name | LA0036421 CENTRAL PLANT

POINT CALCULATION TABLE

Fill in the values from parts 1 through 7 in the columns below. Add the numbers in the left column to determine the point total that the wastewater system has generated for the previous year.

	Actual Values	Actual Values	Maximum
Part 1:	Influent Flow/Loadings	0	80 Points
Part 2:	Effluent Quality/Plant Performance	0	100 Points
Part 3:	Age of WWTT	20	50 Points
Part 4:	Overflows and Bypasses	100	100 Points
Part 5:	Ultimate Disposition of Sludge	10	100 Points
Part 6:	New Development	0	30 Points
Part 7:	Operator Certification Training	0	100 Points

TOTAL POINTS | 130



PHASE-IIB

CWWTP-EXISTING SITE PLAN

CITY OF BATON ROUGE / PARISH OF EAST BATON ROUGE

CAMP DRESSER & McKEE INC. CDM

PROFESSIONAL ENGINEERING CONSULTANTS

ATTACHMENT 3

SAMPLE MWPP RESOLUTION

Resolved that the city/town of BATON ROUGE informs Louisiana Department of Environmental Quality that the following actions were taken by the CITY/PARISH METROPOLITAN COUNCIL (governing body).

1. Reviewed the Municipal Water Pollution Prevention Environmental Audit Report which is attached to this resolution.

2. Set forth the following actions necessary to maintain permit requirements contained in the Louisiana Water Discharge Permit System (LWDPS) number LA0036421 AI# 4842.

   (Please be specific in listing the actions that will be taken to address the problems identified in the audit report.)

   a. CURRENTLY, WE ARE OPERATING UNDER A CONSENT DECREE WHICH BECAME EFFECTIVE MARCH 14, 2002.

   b.

   c.

   d.

   etc.

Passed by a majority/unanimous (circle one) vote of the CITY/PARISH METROPOLITAN COUNCIL on November 21, 2006 (date).

"Yeas: Messrs. Addison, Culbertson, Kelly, Greco, Sharper, Walker, Ourso, Boneno, Skyring and Mrs. Tassin.

CLERK

ADOPTED
METROPOLITAN COUNCIL

NOV 21 2006

COUNCIL ADMINISTRATOR TREASURER

REVISED

219 RESOLUTION 45166

REQUESTING APPROVAL FOR SUBMITTAL OF THE LOUISIANA MUNICIPAL WATER POLLUTION PREVENTION (MWPP) ENVIRONMENTAL AUDIT REPORT FOR THE CENTRAL WASTEWATER TREATMENT PLANT TO THE DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ) FOR THE MONITORING PERIOD OF SEPTEMBER 1, 2005 THROUGH AUGUST 31, 2006.

BE IT RESOLVED by the Metropolitan Council of the Parish of East Baton Rouge and City of Baton Rouge that the submittal of the Louisiana Municipal Water Pollution Prevention (MWPP) Environmental Audit Report for the Central Wastewater Treatment Plant to the Department of Environmental Quality (DEQ) for the monitoring period of September 1, 2005 through August 31, 2006, is hereby approved.

CDM

City of Baton Rouge / Parish of East Baton Rouge

Project No: STT-04-01

South Wastewater Treatment Plant Digesters No. 3 and 4 Cover Replacement

August 2006

Contract Documents

TABLE OF CONTENTS

FOR

THE CITY OF BATON ROUGE AND PARISH OF EAST BATON ROUGE

SOUTH WASTEWATER TREATMENT PLANT
DIGESTERS NO. 3 AND 4 COVER REPLACEMENT

PROJECT NO. STT-04-01

VOLUME I

DIVISION 13 - SPECIAL CONSTRUCTION

DIVISION 14 - CONVEYING SYSTEMS

(NOT USED)

DIVISION 15 - MECHANICAL

DIVISION 16 - ELECTRICAL

Special Provisions:

The 1997 Standard Specifications for Public Works Construction, Department of Public Works, Engineering Division, City / Parish of East Baton Rouge, referred to as the Blue Book, are hereby made part of these contract documents. These specifications are to supplement, provide further detail and support for the Blue Book.

CITY OF BATON ROUGE AND PARISH OF EAST BATON ROUGE
DEPARTMENT OF PUBLIC WORKS

PART 1

BID FORMS

PROJECT NAME: South WWTP Digester Nos. 3 and 4 Cover Replacement
PROJECT NUMBER: STT-04-01

BID DATE: December 5, 2006

BID TIME: 2:00 P.M.

BID OF:_____BIDDER'S NAME

INSTRUCTIONS TO BIDDERS

1. Submit "Part 1, Bid Forms" only as your bid.
2. Retain "Part2, Special Provisions and Contract Documents" for your records

CITY OF BATON ROUGE
PARISH OF EAST BATON ROUGE

CONSTRUCTION PROPOSAL

PROJECT NAME: South WWTP Digester Nos. 3 and 4 Cover Replacement
PROJECT NUMBER STT-04-01

Proposals will be received up to 2:00 p.m., local time, December 5, 2006, by the Purchasing Division, Room 309 Municipal Building, Baton Rouge, Louisiana. No proposals will be received after 2:00 p.m. At 2:00 p.m. of the same day and date, the bids will be publicly opened and read aloud in Room 415, Municipal building.

THIS BID IS SUBMITTED TO: East Baton Rouge Sewerage Commission

BID OF:_____

ADDRESS:_____

DATE:_____

The Purchasing Agent
City of Baton Rouge
Parish of East Baton Rouge
Baton Rouge, Louisiana

Dear Sir or Madam:

I (We) hereby agree to perform all work known and described by you as PROJECT NO. STT-04-01 which includes the construction of the following: South WWTP Digester Nos. 3 and 4 Cover Replacement, as set forth in the following documents:

1. Notice to Contractors
2. Construction Proposals
3. Agreement
4. Special Provisions
5. The Construction Drawings
6. The Standard Specifications
7. The following enumerated addenda:

The Specifications, contract and bonds, governing the construction of the work contemplated are those known and designated as 1997 Standard Specification for Public Works Construction, Department of Public Works, together with all Addenda enumerated in this proposal, if any, the Special Provisions, attached to this proposal, together with related contract documents.

The plans herein referred to are the plans approved by the Chief Engineer and marked with the project number, together with all standards or special designs that may be designated in such plans.

The undersigned, as bidder, declares that the only persons or parties interested in this proposal as principals are those named herein; that this proposal made without collusion or combination of any kind or character with any

other person, firm, association or corporation, or any member or official thereof, that he has (or they have) carefully examined the site of the proposed work, the plans, Standard Specifications and Special Provisions above mentioned, and the form of contract and contract bond; that he (or they) proposes, and agrees, if this proposal is accepted to provide all necessary machinery, tools, apparatus, and other means of construction and will do all the work and furnish all the materials specified in the contract, in the manner and time therein prescribed and in accordance with the requirements of the Engineer as therein set forth; and that he (or they) hereby proposes to accept as full compensation therefore the amount of the summation of the products of the quantities of work and material actually incorporated in the complete project, as determined by the Engineer, multiplied by the respective unit prices when applicable, or per the lump sum price, herein bid.

The undersigned further agrees that the bid proposal is firm for a period of sixty (60 days) from the opening of bids and no bid proposal can be withdrawn for any reason during this period of time.

The undersigned further agrees that within fifteen (15) days after notice the Parish has been authorized to enter into a contract, he (or they) will execute the contract and furnish to the Parish of East Baton Rouge all insurance certificates required by Contract, and a satisfactory performance and payment surety bond in an amount equal to the amount of the contract.

The undersigned further agrees that the work will begin not later than ten (10) calendar days after the date of the Work Order and shall be diligently prosecuted at such rate in a such manner as, in the opinion of the Chief Engineer, is necessary for the completion of the work within the time specified in the contract, it being understood that time is the essence of the contract.

Accompanying this proposal is a certified check, cashiers check or a bid bond in the amount of Five Percent (5%) of the amount of this bid, payable to the Parish of East Baton Rouge.

If this proposal shall be accepted and the undersigned shall fail to exercise the contract and furnish performance and payment surety bond as provided above, then the bid security shall be forfeited.

The Bidder understands that the unit quantities are estimates, and are to be used for bidding purposes only.

Submitted on _____, 2006.

_____
(Company Name)

_____
(Signature)

_____
(Printed Name)

The following attached sheet [CP-5] must be completed to indicate whether bidder is an individual, unincorporated firm, or a corporation.

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	TOTAL AMOUNT
1	1 Each	Lump Sum work associated with demolition and replacement of existing digester covers (No. 3 and 4), gas system, sludge mixing system, appurtenances, civil/site work, electrical and instrumentation as provided in the Contract Documents excepting items for which there is a specific bid item. _____ Dollars per	$_____	$_____
2	3,700 CY	Remove and dispose of digester contents _____ Dollars per	$_____	$_____
3	1 LS	Furnish all labor, equipment and materials as necessary for installation of new sludge heaters to replace existing spiral heat exchanges. Work includes piping and appurtenances, electrical and instrumentation as shown on the drawings and given in the specifications _____ Dollars per	$_____	$_____
4	Each	Price Per Test Pit _____ Dollars per	$_____	$_____

TOTAL BID (Summation of all items) _____ Company Name	**IN NUMBERS** $_____

BIDDER'S ORGANIZATION

BIDDER IS:

AN INDIVIDUAL

Individual's Name: _____

Doing business as: _____

Address: _____

Telephone No.: _____ Fax No.: _____

A PARTNERSHIP

Firm Name: _____

Address: _____

Name of person authorized to sign: _____

Title: _____

Telephone No.: _____ Fax No.: _____

A LIMITED LIABILITY COMPANY

Company Name: _____

Address: _____

Name of person authorized to sign: _____

Title: _____

Telephone No.: _____ Fax No.: _____

A CORPORATION

IF BID IS BY A CORPORATION, THE CORPORATE RESOLUTION MUST BE SUBMITTED WITH BID

Corporation Name: _____

Address: _____

State of Incorporation: _____

Name of person authorized to sign: _____

Title: _____

Telephone No.: _____ Fax No.: _____

IF BID IS BY A JOINT VENTURE, ALL PARTIES TO THE BID MUST COMPLETE THIS FORM.

CORPORATE RESOLUTION

A meeting of the Board of Directors of _____, a corporation organized under the laws of the State of _____ and domiciled in _____ was held this _____ day of _____, 200_ and was attended by a quorum of the members of the Board of Directors.

The following resolution was offered, duly seconded and after discussion was unanimously adopted by said quorum:

BE IT RESOLVED, that _____ is hereby authorized to submit proposals and execute agreements on behalf of this corporation with the East Baton Rouge Sewerage Commission.

BE IT FURTHER RESOLVED, that said authorization and appointment shall remain in full force and effect, unless revoked by resolution of this Board of Directors and that said revocation will not take effect until the Purchasing Director of the Parish of East Baton Rouge, shall have been furnished a copy of said resolution, duly certified.

I, _____, hereby certify that I am the Secretary of _____ a corporation created under the laws of the State of _____ domiciled in _____ that the foregoing is a true and exact copy of a resolution adopted by a quorum of the Board of Directors of said corporation at a meeting legally called and held on the _____ day of _____ 2003, as said resolution appears of record in the Official Minutes of the Board of Directors in my possession. This _____ day of _____, 200_.

_____
SECRETARY

BID BOND

That we, the undersigned, _____, as Principal (Bidder), and _____ as Surety, are hereby held and firmly bound unto the East Baton Rouge Sewerage Commission as Owner, in the penal sum of five percent (5%) of the amount bid for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

The Condition of the above obligation is such that whereas the Principal has submitted to the Owner a certain Bid, attached hereto and hereby made a part hereof to enter into an Agreement in writing, for _____

_____

NOW THEREFORE,

(a) If said Bid shall be rejected, or in the alternative,

(b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish bonds for his faithful performance of said Contract and for furnishing materials in connection therewith and shall in all other respects perfect the Agreement created by the acceptance of said Bid,

then this obligation shall be void; otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any extension.

IN WITNESS WHEREOF, Said Principal and Surety have hereunto set their hands and seals this _____ day of _____, 2006.

PRINCIPAL (BIDDER)	**SURETY**
_____	_____
_____	_____
_____	_____
(Address)	(Address)
By: _____	By: _____
_____	_____
(Typed Name and Title)	(Typed Name and Title)

END OF SECTION

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SCHEDULE OF SUPPLIERS/MATERIALS

PROJECT NAME: South WWTP Digester Nos. 3 and 4 Cover Replacement

PROJECT NUMBER: STT-04-01

The Schedule of Supplier/Materials is a list of equipment or products which are available from the one or more suppliers as shown and as identified in the Project Specifications and must be submitted with the Bidder's Construction Proposal. The Bidder shall indicate in his Bid, which supplier/material the Bidder intends to use for each item of equipment or product listed in the Schedule by circling the selected supplier/material. Should a Bidder fail to indicate a listed supplier or material for each item, he hereby agrees to provide the item listed as "A". If the Bidder indicates more than one supplier or material for a particular item, he hereby agrees to provide the first supplier or material indicated. If the Bidder fails to indicate which supplier he intends to use or if an alternate is rejected, the Bidder shall use the supplier or material listed as "A".

For each of the following items the Bidder shall indicate the supplier or material to be used on this contract by circling the appropriate selection and filling in the appropriate blanks.

Ductile Iron Pipe and Fittings – SECTION 02610

SUPPLIER DESIGNATION	SUPPLIER
A	American
B	Clow
C	U.S. Pipe
D	(other)_____

Digester Mixing Equipment – SECTION 13230

SUPPLIER DESIGNATION	SUPPLIER
A	Vaughn Company
B	Liquid Dynamics
C	(other)_____

Floating Digester Gas Holding Cover and Appurtenances – SECTION 13234

SUPPLIER DESIGNATION	SUPPLIER
A	Envirex, Inc
B	JDV/Carter
C	Eimco
D	(other)_____

SUPPLIER DESIGNATION	PUMPS
A	Envirex, Inc
B	JDV/Carter
C	(other)_____

After receipt of Bids, the Contractor may not substitute any Manufacturer, Supplier or material marked above except as permitted under the Contract Documents. Approval of a Supplier or material by the Owner shall not waive the requirement for the products furnished to meet all requirements of the Project Specifications.

END OF SECTION

CITY OF BATON ROUGE AND PARISH OF EAST BATON ROUGE
DEPARTMENT OF PUBLIC WORKS

PART 2

SPECIAL PROVISIONS

AND

CONTRACT DOCUMENTS

FOR

EAST BATON ROUGE SEWERAGE COMMISSION

PROJECT NAME: SOUTH WWTP DIGESTER NOS. 3 AND 4 COVER REPLACEMENT)
PROJECT NUMBER: STT-04-01

BID DATE: December 5, 2006

BID TIME: 2:00 P.M.

RETAIN PART 2 FOR YOUR RECORDS

Issue Date: September 8, 2006

To be published 3 times - Legal
November 3, 10, and 17, 2006

CITY OF BATON ROUGE AND PARISH OF EAST BATON ROUGE

NOTICE TO CONTRACTORS

The City of Baton Rouge and Parish of East Baton Rouge hereby advertise for Bids for construction of wastewater facilities for the **East Baton Rouge Sewerage Commission** as follows:

Project Name: **South WWTP Digester Nos. 3 and 4 Cover Replacement**
Project No.: **STT-04-01**

The Contract Work is comprised of demolition of the existing:

- concrete digester cover for Digesters 3 and 4,
- digester mixing system which includes gas piping and valves, gas manifold/flow meters, mixing cannons, digester level detection systems, and hatches as shown on the plans and including removal of debris and sludge contained within the digesters,
- spiral heat exchangers and associates water piping, and
- gas piping from Digester No. 5 from the top of Digester No. 3 including the roof penetration to the existing gas system.

Project also includes installation of new:

- digester mixing system consisting of two pumps per system, piping and valves for Digester 3 and Digester 4 (2 complete systems),
- check valves to replace existing check valves at sludge pumps in the digester pump station,
- three new digester sludge heaters and associated piping, valves and appurtenances,
- new gas piping from Digester No. 5 to the existing gas processing system including aerial pipe support and wall penetration to allow connection to the existing gas system,
- paving and grading in the vicinity of the work.

Sealed Bids must be received by the Purchasing Agent, City of Baton Rouge and Parish of East Baton Rouge, Room 309, Municipal Building, 300 North Boulevard, Baton Rouge, Louisiana, either by mail or hand delivery, no later than **2:00 p.m.**, local time, **December 5, 2006.** Promptly thereafter, Bids will be publicly opened and read aloud in Room 415 of the Municipal Building.

The Bidding Documents (Special Provisions, Contract Documents, and Drawings) are on file and may be obtained by Contractors who are properly licensed in Louisiana in the Municipal and Public Works Construction classification or by bona fide suppliers of materials and equipment, from the Sewer Operation – General Administration, Room 408, Municipal Building, 300 North Boulevard, Baton Rouge, Louisiana, upon payment of **Forty-Five ($45.00)**. Make checks payable to the City of Baton Rouge, Parish of East Baton Rouge. This deposit represents reproduction costs only, and is **non-refundable** in accordance with Louisiana Revised Statutes.

The Contractor is advised that this work is part of a consent decree between the City-Parish, U.S. EPA and LDEQ. Therefore, all work performed by the contractor shall be in conformity with the terms of the Consent Decree, which is available on the SSO Program website www.brsewer.com.

A certified check or cashier's check, payable to the Parish of East Baton Rouge, or a satisfactory Bid Bond executed by the Bidder and an acceptable Surety, in an amount equal to five percent (5%) of the total, shall be submitted with each Bid.

A **Mandatory Pre-Bid Conference** to discuss the scope of the project and requirements of the Bidding and Contract Documents will be held at **10:00 a.m.** on **Thursday, November 9, 2006**, in the City-Parish Sewer Operation – General Administration, Conference Room (Room 415), Municipal Building, 300 North Boulevard, Baton Rouge, Louisiana. For any additional information contact Richard P. Wright at 389-5623.

EAST BATON ROUGE SEWERAGE COMMISSION

CITY OF BATON ROUGE
PARISH OF EAST BATON ROUGE

CONSTRUCTION PROPOSAL

PROJECT NAME: South WWTP Digester Nos. 3 and 4 Cover Replacement
PROJECT NUMBER STT-04-01

Proposals will be received up to 2:00 p.m., local time, December 5, 2006, by the Purchasing Division, Room 309 Municipal Building, Baton Rouge, Louisiana. No proposals will be received after 2:00 p.m. At 2:00 p.m. of the same day and date, the bids will be publicly opened and read aloud in Room 415, Municipal building.

THIS BID IS SUBMITTED TO: East Baton Rouge Sewerage Commission

BID OF:_____

ADDRESS:_____

DATE:_____

The Purchasing Agent
City of Baton Rouge
Parish of East Baton Rouge
Baton Rouge, Louisiana

ear Sir or Madam:

I (We) hereby agree to perform all work known and described by you as PROJECT NO. STT-04-01which includes the construction of the following: SOUTH WWTP DIGESTER Nos. 3 AND 4 COVER REPLACEMENT as set forth in the following documents:

1. Notice to Contractors
2. Construction Proposals
3. Agreement
4. Special Provisions
5. The Construction Drawings
6. The Standard Specifications
7. The following enumerated addenda:

The Specifications, contract and bonds, governing the construction of the work contemplated are those known and designated as 1997 Standard Specification for Public Works Construction, Department of Public Works, together with all Addenda enumerated in this proposal, if any, the Special Provisions, attached to this proposal, together with related contract documents.

The plans herein referred to are the plans approved by the Chief Engineer and marked with the project number, together with all standards or special designs that may be designated in such plans.

he undersigned, as bidder, declares that the only persons or parties interested in this proposal as principals are those named herein; that this proposal made without collusion or combination of any kind or character with any

other person, firm, association or corporation, or any member or official thereof, that he has (or they have) carefully examined the site of the proposed work, the plans, Standard Specifications and Special Provisions above mentioned, and the form of contract and contract bond; that he (or they) proposes, and agrees, if this proposal is accepted to provide all necessary machinery, tools, apparatus, and other means of construction and will do all the work and furnish all the materials specified in the contract, in the manner and time therein prescribed and in accordance with the requirements of the Engineer as therein set forth; and that he (or they) hereby proposes to accept as full compensation therefore the amount of the summation of the products of the quantities of work and material actually incorporated in the complete project, as determined by the Engineer, multiplied by the respective unit prices when applicable, or per the lump sum price, herein bid.

The undersigned further agrees that the bid proposal is firm for a period of sixty (60 days) from the opening of bids and no bid proposal can be withdrawn for any reason during this period of time.

The undersigned further agrees that within fifteen (15) days after notice the Parish has been authorized to enter into a contract, he (or they) will execute the contract and furnish to the Parish of East Baton Rouge all insurance certificates required by Contract, and a satisfactory performance and payment surety bond in an amount equal to the amount of the contract.

The undersigned further agrees that the work will begin not later than ten (10) calendar days after the date of the Work Order and shall be diligently prosecuted at such rate in a such manner as, in the opinion of the Chief Engineer, is necessary for the completion of the work within the time specified in the contract, it being understood that time is the essence of the contract.

Accompanying this proposal is a certified check, cashiers check or a bid bond in the amount of
Five Percent (5%) of the amount of this bid, payable to the Parish of East Baton Rouge.

If this proposal shall be accepted and the undersigned shall fail to exercise the contract and furnish performance and payment surety bond as provided above, then the bid security shall be forfeited.

The Bidder understands that the unit quantities are estimates, and are to be used for bidding purposes only.

Submitted on _____, 2006.

_____
(Company Name)

_____
(Signature)

_____
(Printed Name)

The following attached sheet [CP-5] must be completed to indicate whether bidder is an individual, unincorporated firm, or a corporation.

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE	TOTAL AMOUNT
1	1 Each	Lump Sum work associated with demolition and replacement of existing digester covers (No. 3 and 4), gas system, sludge mixing system, appurtenances, civil/site work, electrical and instrumentation as provided in the Contract Documents excepting items for which there is a specific bid item. _____ Dollars per	$_____	$_____
2	3,700 CY	Remove and dispose of digester contents _____ Dollars per	$_____	$_____
3	1 LS	Furnish all labor, equipment and materials as necessary for installation of new sludge heaters to replace existing spiral heat exchanges. Work includes piping and appurtenances, electrical and instrumentation as shown on the drawings and given in the specifications _____ Dollars per	$_____	$_____
4	Each	Price Per Test Pit _____ Dollars per	$_____	$_____

TOTAL BID (Summation of all items) _____ Company Name	**IN NUMBERS** $_____

BIDDER'S ORGANIZATION

BIDDER IS:

AN INDIVIDUAL

Individual's Name: _____

Doing business as: _____

Address: _____

Telephone No.: _____ Fax No.: _____

A PARTNERSHIP

Firm Name: _____

Address: _____

Name of person authorized to sign: _____

Title: _____

Telephone No.: _____ Fax No.: _____

A LIMITED LIABILITY COMPANY

Company Name: _____

Address: _____

Name of person authorized to sign: _____

Title: _____

Telephone No.: _____ Fax No.: _____

A CORPORATION

IF BID IS BY A CORPORATION, THE CORPORATE RESOLUTION MUST BE SUBMITTED WITH BID.

Corporation Name: _____

Address: _____

State of Incorporation: _____

Name of person authorized to sign: _____

Title: _____

Telephone No.: _____ Fax No.: _____

IF BID IS BY A JOINT VENTURE, ALL PARTIES TO THE BID MUST COMPLETE THIS FORM.

CORPORATE RESOLUTION

A meeting of the Board of Directors of _____, a corporation organized under the laws of the State of _____ and domiciled in _____ was held this _____ day of _____, 200_ and was attended by a quorum of the members of the Board of Directors.

The following resolution was offered, duly seconded and after discussion was unanimously adopted by said quorum:

BE IT RESOLVED, that _____ is hereby authorized to submit proposals and execute agreements on behalf of this corporation with the East Baton Rouge Sewerage Commission.

BE IT FURTHER RESOLVED, that said authorization and appointment shall remain in full force and effect, unless revoked by resolution of this Board of Directors and that said revocation will not take effect until the Purchasing Director of the Parish of East Baton Rouge, shall have been furnished a copy of said resolution, duly certified.

I, _____, hereby certify that I am the Secretary of _____ a corporation created under the laws of the State of _____ domiciled in _____ that the foregoing is a true and exact copy of a resolution adopted by a quorum of the Board of Directors of said corporation at a meeting legally called and held on the _____ day of _____ 200_, as said resolution appears of record in the Official Minutes of the Board of Directors in my possession. This _____ day of _____, 2006.

_____
SECRETARY

BID BOND

That we, the undersigned, _____, as Principal (Bidder), and _____ as Surety, are hereby held and firmly bound unto the East Baton Rouge Sewerage Commission as Owner, in the penal sum of five percent (5%) of the amount bid for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

The Condition of the above obligation is such that whereas the Principal has submitted to the Owner a certain Bid, attached hereto and hereby made a part hereof to enter into an Agreement in writing, for _____ _____.

NOW THEREFORE,

(a) If said Bid shall be rejected, or in the alternative,

(b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish bonds for his faithful performance of said Contract and for furnishing materials in connection therewith and shall in all other respects perfect the Agreement created by the acceptance of said Bid,

then this obligation shall be void; otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any extension.

IN WITNESS WHEREOF, Said Principal and Surety have hereunto set their hands and seals this _____ day of _____, 20___.

PRINCIPAL (BIDDER)	**SURETY**
_____	_____
_____	_____
_____	_____
(Address)	(Address)
By: _____	By: _____
_____	_____
(Typed Name and Title)	(Typed Name and Title)

END OF SECTION

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SCHEDULE OF SUPPLIERS/MATERIALS

PROJECT NAME: South WWTP Digester Nos. 3 and 4 Cover Replacement

PROJECT NUMBER: STT-04-01

The Schedule of Supplier/Materials is a list of equipment or products which are available from the one or more suppliers as shown and as identified in the Project Specifications and must be submitted with the Bidder's Construction Proposal. The Bidder shall indicate in his Bid, which supplier/material the Bidder intends to use for each item of equipment or product listed in the Schedule by circling the selected supplier/material. Should a Bidder fail to indicate a listed supplier or material for each item, he hereby agrees to provide the item listed as "A". If the Bidder indicates more than one supplier or material for a particular item, he hereby agrees to provide the first supplier or material indicated. If the Bidder fails to indicate which supplier he intends to use or if an alternate is rejected, the Bidder shall use the supplier or material listed as "A".

For each of the following items the Bidder shall indicate the supplier or material to be used on this contract by circling the appropriate selection and filling in the appropriate blanks.

Ductile Iron Pipe and Fittings – SECTION 02610

SUPPLIER DESIGNATION	SUPPLIER
A	American
B	Clow
C	U.S. Pipe
D	(other)_____

Digester Mixing Equipment – SECTION 13230

SUPPLIER DESIGNATION	SUPPLIER
A	Vaughn Company
B	Liquid Dynamics
C	(other)_____

Floating Digester Gas Holding Cover and Appurtenances – SECTION 13234

SUPPLIER DESIGNATION	SUPPLIER
A	Envirex, Inc
B	JDV/Carter
C	Eimco
D	(other)_____

Digester Heating Equipment – SECTION 13237

SUPPLIER DESIGNATION	PUMPS
A	Envirex, Inc
B	JDV/Carter
C	(other)_____

After receipt of Bids, the Contractor may not substitute any Manufacturer, Supplier or material marked above except as permitted under the Contract Documents. Approval of a Supplier or material by the Owner shall not waive the requirement for the products furnished to meet all requirements of the Project Specifications.

END OF SECTION

AGREEMENT

THIS AGREEMENT made and entered into at Baton Rouge, Louisiana, effective this _____ day of _____ by and between the East Baton Rouge Sewerage Commission, an agency and instrumentality of the City of Baton Rouge/Parish of East Baton Rouge, hereinafter called "OWNER" and _____, hereinafter called "CONTRACTOR".

The Contractor shall perform all work required by the Contract Documents for the construction of **SOUTH WWTP DIGESTER NOS. 3 AND 4 COVER REPLACEMENT.**

The following Contract Documents are all hereby made a part of this Agreement to the same extent as if incorporated herein in full:

1. Invitation for Proposals
2. Construction Proposal
3. Special Provisions
4. The Construction Drawings
5. The Standard Specifications
6. The following enumerated addenda:

CONTRACT TIME

The entire contract shall be completed in all details and ready for final acceptance within three hundred sixty-five (365) calendar days after date stipulated in the Notice to Proceed. Time is of the essence in this contract and the Notice to Proceed will be issued promptly. Contract time extensions will only be allowed in accordance with provisions in the Contract Documents.

FAILURE TO COMPLETE WORK ON TIME

Should the Contractor fail to complete the work within the contract time, as extended, liquidated damages in the amount of $480.00 per day will be assessed Contractor in accordance with the Contract Documents.

INTERPRETATION OF CONTRACT PROVISIONS

The interpretations of the provisions of this contract by the Director, Department of Public Works shall be binding upon both parties hereto.

CONTRACT PRICE

The amount to be paid to the Contractor by the Owner for **SOUTH WWTP DIGESTER NOS 3 AND 4 COVER REPLACEMENT** is_____. The contract price shown is based on the Schedule of Items included in Contractor's Construction Proposal for the project showing approximate quantities and unit prices therefor. The final contract price will be determined by the actual quantities in place at the unit prices set forth in said schedule and any other modifications or changes as mutually agreed upon in writing.

PAYMENT

The East Baton Rouge Sewerage Commission will make partial or progress payments less applicable retainage, based upon monthly estimates, which exceed $5,000.00 on or about the 10th day of the following month in accordance with the Contract Documents.

Upon satisfactory completion and acceptance of the work, the East Baton Rouge Sewerage Commission will make final payment in accordance with provisions of the Contract Documents.

AUDITS

The Contractor shall permit the authorized representative of the City-Parish to periodically inspect and audit all data and records of the Contractor relating to his performance under this contract.

INSURANCE, INDEMNITY AND LEGAL REGULATIONS

Insurance, indemnity requirements and legal regulations shall conform to those stated in the Contract Documents.

IN WITNESS WHEREOF, the parties hereto have executed this agreement effective as of the date first written above.

WITNESSES:

EAST BATON ROUGE SEWERAGE COMMISSION

_____

By:_____
David Boneno, President -EBROSCO

_____

Contractor

_____

By:_____

_____
(Typed Name and Title)

PERFORMANCE AND PAYMENT BOND

That we, the undersigned _____ as principal, hereinafter referred to as "Contractor" and _____, duly authorized to transact business in the State of Louisiana as surety, are held and firmly bound unto the East Baton Rouge Sewerage Commission, hereinafter referred to as "Owner", in the penal sum of _____ ($_____) lawful money of the United States, for the payment of which well and truly to be made, the said principal and the said surety do hereby bind ourselves, our heirs, executors, administrators, and assigns, jointly and severally, by these presents as follows:

The condition of this obligation is such that whereas, the Contractor by an instrument in writing attached hereto and bearing date of _____, 2006 has agreed with said Owner to furnish labor, materials, tools and equipment to construct South WWTP Digester Nos. 3 and 4 Cover Replacement, Project No. STT-04-01as shown on plans and specified thereby and in the specifications, proposals and agreement forming the contract documents thereto attached.

NOW THEREFORE, if said Contractor shall well and truly in good, sufficient and workmanship manner, and to the satisfaction of the Owner, perform and complete the work required and shall pay all costs, charges, rentals and expenses for labor, material, supplies and equipment and deliver the said improvement to the Owner complete and ready for occupancy or operation, and free from all liens, encumbrances or claims for labor, material or otherwise; and shall pay all other expenses lawfully chargeable to the Owner by reason of any default or neglect of the said Contractor in the performance of said agreement and said work, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED FURTHER, That the said surety for value received hereby stipulates and agrees that no change, extension of time, alterations, or addition to the terms of that contract, or the work to be performed thereunder, or the specifications companying the same, shall in anywise affect its obligation on the bond and it does hereby waive notice of any change, extension of time, alterations, or addition to the terms of the contract, or the work, or the specifications.

PROVIDED FURTHER, That if the Contractor, or his, their, or its subcontractors fail to duly pay for any labor, materials, team hire, sustenance, provisions, provender or any other supplies or materials used or consumed or for any materials or supplies furnished for use by such contractors or his, their, or its subcontractors in performance of the work contract to be done, the Surety will pay the same in any amount not exceeding the sum specified in the bond, together with interest and attorney's fees as provided by law.

IN WITNESS WHEREOF, Said Principal and Surety have hereunto set their hands and seals this _____day of _____, 2006.

_____
(Contractor)

_____
(Address)

_____ By: _____
(WITNESS)

_____
(Surety)

_____
(Address)

_____ By: _____
(WITNESS)

Rev. 3/23/98

(Typed Name and Title)

AFFIDAVIT

STATE OF LOUISIANA
PARISH OF EAST BATON ROUGE

BEFORE ME, the undersigned authority, personally came and appeared

who, being duly sworn did depose and say:

That he is a duly authorized representative of

receiving value for services rendered in connection with

Project Contract No. STT-04-01

a public project of the East Baton Rouge Sewerage Commission, Parish of East Baton Rouge, Louisiana: that he has employed no person, corporation, firm, association, or other organization, either directly or indirectly, to secure the public contract under which he received payment, other than persons regularly employed by him whose services in connection with the construction, alteration, or demolition of the public building or project or in securing the public contract were in the regular course of their duties for him; and that no part of the contract price received by him was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the contract, other than the payment of their normal compensation to persons regularly employed by him whose services in connection with the construction of the public building or project were in the regular course of their duties for him.

This affidavit is executed in compliance with the provisions of LA R.S. 38:2224.

Affiant's Signature

SWORN TO AND SUBSCRIBED before me, on this day of
2006.
Baton Rouge, Louisiana.

NOTARY PUBLIC

End of Section

SPECIAL PROVISIONS

The City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works, Engineering Division, 1997 Standard Specifications for Public Works Construction are hereby amended to include the following Special Provisions which, where applicable, shall take precedence over the aforementioned Standard Specifications. When any part of the Standard Specifications is unaltered by the following Special provisions, the unaltered provisions of the Standard Specifications will remain in effect.

Copies of the Standard Specifications may be obtained from the Department of Public Works, Engineering Division, Municipal Building, 300 North Boulevard, Room 408, Baton Rouge, Louisiana 70802, (225) 389-3186.

IN PART I, GENERAL PROVISIONS

Section 2 BIDDING REQUIREMENTS

Subsection 2-2, page 8, insert the following paragraph after the first paragraph:

> The apparent low bidder shall submit a Schedule of Values for each item number series contained on the bid form. The breakdown of each item number shall include, at a minimum, the cost per bid item within the item number. The Schedule of Values must be submitted to the Owner by 9:00 am the day after the bid opening. **Failure to submit this information to the Owner may cause the bid to be rejected.**
>
> The Owner will review the Schedule of Values to confirm a fair and reasonable allocation of values was established. Front end loading will not be permitted. The Owner may require reallocation of values if in the opinion of the Owner such reallocation is necessary. The Schedule of Values must be agreed upon by the apparent low bidder and the Owner prior to recommendation of the apparent low bidder."

Subsection 2-3, page 9, delete the third paragraph.

Subsection 2-8, page 11, add the following after the first paragraph:

> "Each installer desiring to bid on this project must submit as part of his bid package evidence that he meets the requirements of Section 815-1.E."

Section 3 AWARD AND EXECUTION OF CONTRACT

Subsection 3-7, page 14, delete the third paragraph of Subsection 3-7.

~~Section 4 SCOPE OF WORK~~

~~Subsection 4-5, page 17, insert the following paragraph after the first paragraph:~~

> ~~"It is important that remedial or follow-up work required at each manhole and gravity line location be done in a timely manner. To this end, remedial or follow-up work must be started within a two (2) week period following the day of final backfill or completion of manhole and gravity line location and must be completed within one (1) additional week from the date of commencement. If this schedule is not followed, the Owner's representative will issue a formal warning to the Contractor notifying him that failure to start the follow-up work as scheduled or complete the follow-up work as scheduled will result in a directive to stop work on any future manholes or sewer lines pending the completion of all follow up work as directed by the Owner's representative."~~

Section 8 UTLITIES

Subsection 8-4.4, Page 36, insert the following paragraph after the first paragraph:

> "Wherever existing utilities such as water, gas, telephone, electrical, drains, or other service lines must be crossed by a force main, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the Owner or Engineer this procedure is not feasible, the Contractor may be directed to use fittings for a utility crossing as detailed on the Drawings."

Section 9 PROSECUTION AND PROGRESS OF WORK

~~Subsection 9-3, page 38, insert the following after the last paragraph:~~

> ~~"The contractor shall issue ten days prior to any open sewer excavation, a Homeowner Notification form letter, informing the homeowner of the impending sewer work."~~
>
> ~~Insert the attached " Homeowner Notification Letter" after the above paragraph.~~

Subsection 9-7, page 40, add the following paragraphs after the last paragraph:

> "In order to reduce air pollution, the contractor shall suspend all operations on this project, except those operations necessary to

protect against the loss or damage to life property, on days that the Louisiana Department of Environmental Quality (LaDEQ) forecasts will be "Ozone Alert" days. The order to suspend operations of the project will be in writing and will be sent to the contractor as soon as possible the day before the forecasted "Ozone Alert " day. The contractor shall resume operations on the project the following day, unless the LaDEQ forecasts the day will also be an "Ozone Alert" day whereupon the contractor will be issued another 1-day suspension order in writing."

"The contractor will be granted a 1 calendar day extension of contract time; however, the City-Parish will not be liable for any additional costs incurred by the contractor due to an "Ozone Alert" suspension order."

Subsection 9-8.2.2, page 41, insert the attached "Monthly Statement of Adverse Weather" form after this paragraph.

Subsection 9-9, page 43, add the following paragraph after the last paragraph:

"Any contractor placed in default for any of the conditions specified above shall be ineligible to bid any City-Parish work for a period of six months from the date of the default, or until the reason for the default is remedied, whichever is earlier."

MONTHLY REPORT OF ADVERSE WEATHER

PROJECT NAME South WWTP Digester Nos. 3 and 4 Cover Replacement

PROJECT NUMBER _____

BEGINNING DATE _____

ENDING DATE _____

_____ ACTUAL ADVERSE WEATHER DAYS THIS MONTH

_____ ANTICIPATED ADVERSE WEATHER DAYS THIS MONTH AS DEFINED IN CONTRACT

_____ EXCESS ADVERSE DAYS OF THIS MONTH, IF ANY

_____ TOTAL EXCESS OF ADVERSE WEATHER DAYS (FROM THE COMMENCEMENT DATE OF THIS PROJECT OR CONTRACT UNTIL THE END OF THIS REPORT PERIOD)

DATE	AAWD (Y/N)	REASON FOR ACTUAL ADVERSE WEATHER DAY (AAWD)	DATE	AAWD (Y/N)	REASON FOR ACTUAL ADVERSE WEATHER DAY (AAWD)
1			16		
2			17		
3			18		
4			19		
5			20		
6			21		
7			22		
8			23		
9			24		
10			25		
11			26		
12			27		
13			28		
14			29		
15			30		
			31		

APPROVED: _____ DATE: _____

CONTRACTOR REPRESENTATIVE

APPROVED: _____ DATE: _____

INSPECTOR

APPROVED: _____ DATE: _____

ENGINEER

SECTION 01171

ELECTRIC MOTORS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Motors, up to 200 Hp, furnished under other Sections, shall be in conformance with the requirements listed in this Section unless otherwise noted.

1.02 RELATED WORK

(NOT USED)

1.03 SUBMITTALS

A. Submittal of motor data for acceptance shall include complete nameplate data and test characteristics in accordance with NEMA Standard MG1-12 in addition to the following for motors typical of the units furnished:

1. Efficiency at 1/2, 3/4 and full load.
2. Power factor at 1/2, 3/4 and full load.
3. Motor outline, dimensions and weight, frame size and type.
4. Descriptive bulletins, including full description of insulation system.
5. Bearing design data, B-10 bearing life and which bearing is insulated when so required.
6. Special features (i.e., space heaters, temperature detectors, etc.) and wiring diagrams.
7. Insulation information.
8. Locked Rotor Amperes at rated voltage and NEMA starting code letter.
9. Temperature rise.
10. Service factor.

1.04 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

B. National Electrical Manufacturers Association (NEMA)

C. National Electrical Code (NEC)

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Routine tests shall be performed on representative motors, and shall include the information described on NEMA MG1-12. Efficiency shall be determined in accordance with IEEE Publication No. 112, Method B. Power factor shall be measured on representative motors.

1.06 SYSTEM DESCRIPTION

A. Motors specified herein are three phase, squirrel cage induction type for 1/2 Hp and above; single phase for less than 1/2 Hp; or DC motors.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling of motors shall comply with Blue Book.

1.08 PROJECT/SITE REQUIREMENTS

A. Ambient temperature at job site is 40 degrees Centigrade.

1.09 MAINTENANCE

A. Provide operation and maintenance data in compliance with Section 01730.

1.10 WARRANTY

A. All motors shall be warranted for a one-year period, beginning at substantial completion, in compliance with general conditions of the contract.

PART 2 PRODUCTS

2.01 RATING

A. Each motor shall develop ample torque for its required service throughout its acceleration range at a voltage 10 percent below nameplate rating. Where shown on the Electrical Drawings to be operated on a reduced voltage starter, the motor shall develop ample torque under the conditions imposed by the reduced voltage starting method.

B. The motor shall not be required to deliver more than its rated nameplate horsepower, at unity (1.0) service factor, under any condition of mechanical or hydraulic loading.

C. All motors shall be continuous time rated suitable for operation in a 40 degrees C ambient unless noted otherwise.

D. Specific motor data such as Hp, rpm, enclosure type, etc, is specified under the detailed specification for the equipment with which the motor is supplied.

E. Motors connected to Variable Frequency Drive Controllers shall be in inverter duty rated and conform to detailed standards outlined in NEMA MG1 Part 31, current edition.

2.02 ENCLOSURE TYPES

A. Motors specified herein will conform to one of the following standard enclosure designs:

1. Totally Enclosed Fan Cooled (TEFC).

2. Totally Enclosed Non-Ventilated (TENV).

3. Inverter Duty.

2.03 NAMEPLATES

A. The motor manufacturer's nameplates shall be engraved or embossed on stainless steel and fastened to the motor frame with stainless steel screws or drive pins. Nameplates shall indicate clearly all of the items of information enumerated in NEMA Standard MG1-10.39 or MG1-20.25, as applicable.

2.04 CONDENSATION HEATERS

A. All motors shall be provided with anti-condensation heater. Anti-Condensation heaters shall be of the cartridge or flexible wrap around type installed within the motor enclosure adjacent to core iron. Heaters shall be rated for 120 Volt, single phase with wattage as required to maintain internal temperature rise of 5 to 10 degrees centigrade above ambient during periods of shut down. The heater wattage and voltage shall be embossed on the motor nameplate. Power leads for heaters shall be brought out at the motor lead junction box.

2.05 WINDING TEMPERATURE DETECTORS

A. All motors shall be provided with winding temperature detectors. Winding temperature detectors shall be a factory installed, embedded, bi-metallic switch type and either three NC or NO thermostats one per phase. This device shall protect the motor against damage from overheating caused by single phasing, overload, high ambient temperature, abnormal voltage, locked rotor, frequent starts or ventilation failure. The switch shall have normally closed contacts. Not less than three detectors shall be furnished with each motor, 1 per phase.

2.06 SINGLE PHASE MOTORS

A. Unless otherwise specified, motors smaller than 1/2 Hp shall be single phase, capacitor start. Small fan motors may be split-phase or shaded pole type if such are standard for the equipment. Wound rotor or commutator type single-phase motors are not acceptable unless their specific characteristics are necessary for the application.

B. Motors shall be rated for operation at 115 Volts, single phase, 60 Hz.

C. Locked rotor current shall not be greater than specified in NEMA Standard MG1-12.32, Design "N".

D. Motors shall be totally-enclosed in conformance with NEMA Standard MG1. Small fan motors may be open type if suitably protected from moisture, dripping water and lint accumulation.

E. Motors shall be provided with sealed ball bearings lubricated for 10 years normal use.

2.07 THREE PHASE MOTORS-FRAMES 143T THROUGH 449T

A. General

1. Unless otherwise specified, motors 1/2 Hp and larger shall be 3 Phase, squirrel cage induction type.

2. All motors 3/4 Hp and larger shall be a NEMA frame 143T or larger. 1/2 Hp motors and 3/4 Hp motors rated 1800 and 3600 rpm, shall be a 56 frame. Motors shall be designed and connected for operation on a 480 Volt, 3 Phase, 60 Hz alternating current system. Dual voltage (230/460) rated motors are acceptable.

3. Unless otherwise required by the load, all motors shall be NEMA Design B, normal starting torque. Locked rotor kVA/Hp shall not exceed Code Letter G as described in NEMA Standard MG1-10.37 for motors 20 Hp and larger.

4. Motors connected to variable frequency drives shall be inverter duty rated.

5. Motors shall be by U.S. Electrical Motors, Division of Emerson Electric Co., or equal.

B. Bearings

1. Anti-friction motor bearings shall be designed to be regreasable and initially shall be filled with grease suitable to ambient temperature of 40 degrees C. Bearings shall be AFBMA Types BT, RU, TS or RN, heavy duty, or shall otherwise be shown to be suitable for the intended application in terms of L-10 rating life, or better.

2. All grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic type by the Alemite Division of the Stewart-Warner Corporation.

3. Steady bushings shall be provided when the motor is operated on a VFD, is a two-pole motor or is operated on a pump with mechanical seals.

C. Insulation

1. Insulation systems shall be Class F, operated at Class B temperature rise as measured by resistance based on 50 degrees C ambient and shall be manufacturer's premium grade, resistant to attack by moisture, acids, alkalies and mechanical or thermal shock for 480 Volt motors.

2. Motors for outdoor service shall have vacuum/pressure impregnated epoxy insulation for moisture resistance.

3. Insulation for inverter duty motor windings shall meet or exceed the Pulse Endurance Index for magnetic wire and shall not be injured when exposed to repeated pulse type waveforms, repetitive high voltage transients, switching frequency and rate of rise of the pulse. Class H varnish shall be used.

D. Enclosures

1. Motors shall have a steel or cast iron frame and a cast iron or stamped steel conduit box, as specified below. Conduit box shall be split from top to bottom and shall be capable of being rotated to four positions. Synthetic rubber-like gaskets shall be provided between the frame and the conduit box and between the conduit box and its cover. Motor leads shall be sealed with a non-wicking, non-hygroscopic insulating material. A frame mounted pad with drilled and tapped hole, not less than 1/4-in diameter, shall be provided inside the conduit box for motor frame grounding.

   a. Totally enclosed fan cooled: TEFC motors shall have a steel or cast iron frame, cast iron end brackets, cast iron conduit box, 1.15 service factor at 40 degrees C, tapped drain holes (corrosion resistant plugs for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger) and upgraded insulation by additional dips and bakes to increase moisture resistance.

   b. Totally enclosed non-ventilated: TENV motors shall include the same rating and accessories as specified for TEFC motors.

E. Inverter Duty Rated Motors

1. Inverter duty rated: Motors for operation on variable frequency drives shall meet current power quality levels published in NEMA MG1, Part 31 latest edition. Consideration shall be given to the primary factors of the variable frequency drive such as the modulation scheme (six-step, PWM, etc), the switching or carrier frequency and the type of power output devices utilized (IGBT etc). Consideration shall also be given to the installation methods such as output cable length, cable installation method, installation of output filters, etc. Motor shaft and bearings shall be insulated. Internal service factor shall be 1.0 that of the nameplate. Unless otherwise noted provide enclosures suitable for "severe duty". Ventilation system shall be designed for maximum heat transfer. Stator laminations shall be stagger-stacked and stamped from high grade electrical steel

to minimize eddy-current losses and heat build-up caused by inverter induced harmonics. Rotors shall be configured to minimize skin-effect heating.

F. Motor Efficiencies

1. Three phase motors rated 1 Hp and larger shall be premium efficiency and shall conform to the nomenclature identified as "NEMA PREMIUM".Motors shall carry the NEMA PREMIUM nameplate. Motors shall have a NEMA Nominal Efficiency not less than the values indicated by NEMA PREMIUM product. Efficiency values shall be based on tests performed in accordance with IEEE Publication No. 112, Method B. Motors with horsepower or rpm's not listed shall conform to comparable standards of construction and materials as those for listed motors.

G. Power Factor Correction Capacitors

1. All single speed motors over 5 horsepower (except motors powered from variable frequency drives) shall be provided with a heavy duty industrial type power factor correction capacitor selected, recommended and furnished by the motor manufacturer to raise the motor power factor to approximately 95 percent. For non-explosion-proof motors, the capacitor shall be mounted on the equipment base plate adjacent to the motor and shall be connected to the motor junction box with liquid tight flexible conduit. For explosion-proof motors, the capacitors shall be wall mounted in a non-hazardous area.

2. Capacitors shall be dry film or liquid insulated and shall be hermetically sealed in steel enclosures.

3. Each capacitor unit shall be furnished with three high interrupting capacity current limiting fuses. Fuses shall be equipped with "blown-fuse" indicators.

4. Capacitor enclosures shall be suitable for conduit connection. Covers shall be gasketed, bolt-on type.

5. Capacitors shall be UL listed.

6. Capacitors shall be by General Electric Co.; Square D Co. or equal.

2.08 SHOP TESTING

A. All motors shall be given a routine test per NEMA MG1 standard.

END OF SECTION

SECTION 01179

ORIGINAL EQUIPMENT MANUFACTURER PROVIDED (OEM) CONTROL PANELS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a functional control panel to manually or automatically operate the control system as specified in the detailed mechanical equipment specifications and Instrument and Electrical Contract Drawings.

B. Obtain all required control descriptions and data from the detailed mechanical equipment specifications, the Instrument and Electrical Contract Drawings.

C. Provide control system engineering to produce custom elementary drawings showing interwiring and interlocking with remote devices.

D. All control devices, unless specified otherwise, shall be mounted in the control panel.

1.02 RELATED WORK

A. Electrical work not herein specified is included in Division 16. Power supply and field control and signal wiring will be provided under Division 16 to the control panel.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data for the following:

1. Equipment outline drawings showing elevation, plan and interior views, front panel arrangement, dimensions, weight, shipping splits, conduit entrances and anchor bolt pattern. Indicate all options, special features, ratings and deviations from this Section. Furnish complete Bill of Materials and catalog cut-sheets indicating manufacturer's part numbers.

2. Power and control schematics including external connections. Show wire and terminal numbers and color coding.

3. Instruction and replacement parts books.

4. Certified shop test reports.

5. As-built final drawings.

6. Field tests and inspection reports.

7. Calculations to show that the panel internal temperature will be maintained at or below the equipment rating with 50 degrees C ambient conditions.

1.04 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

B. National Electrical Manufacturers Association (NEMA)

C. National Electric Code (NEC)

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. A factory authorized service and parts organization shall be able to respond to any service call for the project within 8 hours. Provide the name and address of the factory authorized service and parts organization nearest to the project location at the time of the bid.

B. Equipment components and devices shall be UL labeled to the extent possible where ever UL standards exist for such equipment.

C. The control panel manufacturer shall demonstrate at least three years of continuous field operating experience in control panel design and fabrication. Submit customer/user list with telephone numbers, addresses and names of customer/user representatives.

1.06 SYSTEM DESCRIPTION

A. Refer to the detailed mechanical equipment specifications, instrumentation and electrical contract drawings for description of system operation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Package the control panel for maximum protection during delivery and storage.

B. Store the control panel indoors in a clean, dry, heated storage facility until ready for installation. Do not install the control panel in its final location until the facilities are permanently weather tight. Protect the control panel at all times from exposure to moisture, chemicals, hydrogen sulfide and chlorine gas.

1.08 PROJECT/SITE REQUIREMENTS

A. The control panel shall consist of all devices and equipment required for complete functional system. Each control panel shall have a main circuit breaker.

B. Staggered start scheme shall be provided to prevent any two motors from starting within 15 seconds of each other.

C. The control panels in a non-air conditioned environment shall be provided with cooling mechanisms which will maintain all equipment within temperature tolerances under 50 degrees C ambient conditions. Cooling mechanisms shall not violate NEMA rating of the enclosure. In addition to cooling mechanisms, all outside panels shall be provided with sunshields extending out from tops and sides to ensure that the face of the panel remains in

shadow. LED, LCD and all other types of displays shall be provided with screening for ease of viewing.

1.09 SPARE PARTS

A. Provide the following spare parts for each control panel in the quantities specified:

1. One dozen replacement fuses, all types and sizes.

2. Two dozen replacement lamps for pilot lights.

3. One dozen of each color replacement lens caps for pilot lights.

4. One starter coil for each NEMA size furnished.

5. One, 3-pole set of replacement overload heaters of each size range used.

6. One, 3-pole set of starter contacts of each NEMA size used.

7. One can of aerosol touch-up paint.

B. Spare parts shall be boxed or packaged for long term storage. Identify each item with manufacturer's name, description and part number on the exterior of the package.

1.10 WARRANTY

A. Provide a 1-year minimum warranty on all parts and labor upon start-up and customer acceptance of the control panel.

PART 2 PRODUCTS

2.01 RATING

A. The control panel shall operate on a power supply as specified in detailed mechanical specifications or as shown on electrical contract drawings.

B. The overall withstand and interrupting rating of the equipment and devices shall not be less than 65,000 amperes R.M.S. symmetrical at 480 Volts. All circuit breakers and combination motor starters shall be fully rated for the above fault current interrupting capacity. Series connected short circuit ratings will not be acceptable.

C. The complete control panel assembly shall be UL certified or carry a UL listing for "Industrial Control Panels".

D. The control panel shall meet all applicable requirements of the National Electrical Code.

E. The control panel enclosure shall be as indicated in the detailed mechanical equipment requirements in accordance with the electrical area classification indicated on the Electrical Contract Drawings.

2.02 COMPONENTS

A. The main circuit breaker shall be NEMA rated, thermal-magnetic molded case breaker. Provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the OFF position.

B. A mechanical disconnect mechanism, with bypass, shall be installed on each motor circuit protector, capable of being locked in the "OFF" position to provide a means of disconnecting power to the motor.

C. An open frame, full voltage non-reversing, NEMA rated magnetic motor starter, Class 8536 by Square D Company or equal, shall be furnished for each motor. Motor starters shall be provided with motor circuit protectors and equipped to provide under-voltage release and overload protection on all three phases. Overload relays shall be bimetallic or eutectic melting alloy type adjustable, ambient compensated and manually reset. Solid state overloads shall not be used. Overload reset push-buttons shall be located on the exterior of the control panel door.

D. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by the detailed mechanical equipment requirements, the Instrumentation and electrical drawings.

E. All operating control devices and instruments shall be securely mounted on the exterior door. All controls shall be clearly labeled to indicate function and shall be NEMA rated as indicated in the detailed mechanical equipment requirements and in accordance with the electrical area classification indicated on the Electrical Contract Drawings.

1. Indicator lamps shall be heavy duty, industrial type, 30 mm, high-visibility LED, full voltage type. Units shall have screw on plastic lenses and shall have factory engraved legend plates as required. Lens color shall be green for OFF, red for ON and amber for FAIL or ALARM. For all control applications, indicator lamps shall incorporate a push-to-test feature. Indicator lamps shall be by Allen-Bradley or equal.

2. Mode selector switches (HAND-OFF-AUTO, LOCAL-OFF-REMOTE, PUMP SELECTOR, LEAD-LAG, etc) shall be heavy-duty, industrial type, 30 mm with contacts rated for 120 VAC at 10 Amps continuous. Units shall have standard size, black field, legend plates with white markings, as indicated. Operators shall be black knob type. Units shall have the number of positions and contact arrangements, as required. Units shall be single-hole mounting, accommodating panel thicknesses from 1/16-in minimum to 1/4-in maximum. Selector switches shall be by Allen-Bradley or equal.

3. Push-button, shall be heavy-duty, industrial type, 30mm with momentary or maintained contacts as required, rated for 120 VAC at 10 Amps continuous. Units shall have standard size, black field, legend plates with white markings, as indicated. Button color shall be red for EMERGENCY STOP or START and green for STOP. Contact arrangement shall be as required. Push-buttons shall be by Allen-Bradley or equal.

F. A six digit, non-resetable elapsed time meter shall be connected to each motor starter. Meter shall be Bulletin 705, HK Series by Eagle Signal or equal.

G. A failure alarm with horn and beacon light shall be provided where indicated in detailed mechanical equipment specifications. Silence and reset buttons shall be furnished. Alarm horn and beacon shall be by Federal Signal or equal.

H. The control panel shall be provided with a lightning and surge protection unit on the line side of the main circuit breaker. Unit shall be 600 Volt, 3 Phase, General Electric "Tranquell" Series or equal.

I. All interfaces between control panel and remote devices shall be isolated via an interposing relay. Interposing relays shall be of the 'Ice Cube' general-purpose plug-in relay having contacts rated for 250 VAC and 10 Amps continuous. Relays shall be by Allen Bradley, Series 700-HC or equal.

J. Control relays and timers shall be 120 Volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 Amps resistive, 1/4 Hp, at 120 VAC, with an operating temperature of minus 10 to plus 55 degrees C. Relays shall be Allen Bradley, 700-N Series or equal, with calibrated timing knob.

K. Panel mounted timers shall be flush mounted, plug-in type, Eagle Signal Bulletin 125 cycle-flex or equal, with ranges as shown on the Drawings, or as required by the detailed mechanical equipment specifications.

L. Specific control devices, control descriptions and other data are specified under the detailed specification for the mechanical equipment with which the control panel is supplied or shown on Instrument and Electrical Contract Drawings.

M. All control panels located in a corrosive rated area (where shown on the drawings) shall be furnished with an internally mounted, chemically treated corrosion inhibitor pad. The corrosion inhibitor pads shall be manufactured by Hoffman; 3M or equal.

2.03 ENCLOSURE TYPES

A. The control panel specified herein shall be rated in accordance with the electrical area classification indicated on the Electrical Contract Drawings and as noted in the detailed mechanical equipment specifications.

1. NEMA 4X enclosures shall be 316 stainless steel.

2. NEMA 12 enclosures shall be painted steel with gasket.

B. Steel enclosures shall be 14 gauge and constructed with continuously welded seams. The panel door(s) shall have continuous hinge and neoprene gasket. Door clamps shall be provided.

C. The enclosure shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to the enclosure with collar studs. The enclosure door shall be interlocked with the main circuit breaker by a door mounted

operating mechanism. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.

D. Print storage pockets shall be provided on the inside of the panel.

E. Overload tables shall be laminated and adhered to the inside of the door.

2.04 NAMEPLATES MARKINGS AND IDENTIFICATION

A. Provide 2-in by 5-in, nominal, engraved lamicoid master nameplate on the control panel fastened with stainless steel screws or rivets. Nameplate shall be black with white core, 3/8-in high lettering and shall indicate equipment designation as shown on the Drawing.

B. Provide legend plates or 1-in by 3-in engraved nameplates with 1/4-in lettering for identification of door mounted control devices, pilot lights and meters.

C. Provide permanent warning signs as follows:

1. "Danger- High Voltage- Keep Out" on all doors.

2. "Warning- Hazard of Electric Shock - Disconnect Power Before Opening or Working On This Unit" on main power disconnect.

2.05 CONDENSATION HEATERS

A. A thermostatically controlled strip heater shall be mounted inside the control panel.

1. Heater shall be Chromalox, Type OT, 1.5-in wide, 120 Volts, single phase, 150 watts, with rust resisting iron sheath, Catalog No. OT-715, Product Code No. 129314.

2. A control thermostat mounted inside the control Panel shall be Chromalox, Type WR, single stage, Catalog No. WR-80, Product Code No.263177.

3. The strip heater terminals shall be guarded by a protective terminal cover.

4. High temperature connecting lead wire shall be used between the thermostat and the heater terminals. Wire shall be No. 12 AWG stranded, nickel-plated copper with Teflon glass insulation and shall be the product of Chromalox, Catalog No. 6-CFI-12, Product Code No. 263783.

2.06 WIRING

A. Power and control wire shall be 600 Volt class, Type MTW insulated stranded copper and shall be of the sizes required for the current to be carried, but not smaller than No. 14 AWG. All wiring shall be enclosed in PVC wire trough with slotted side openings and removable cover.

B. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at numbered terminal blocks.

C. All control panel wiring shall be numbered at both ends with type written heat shrinkable wire markers.

2.07 TERMINAL BLOCKS

A. Terminal blocks shall be one-piece molded plastic blocks with screw type terminals and barriers rated for 600 volts. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits.

B. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed. Each terminal block shall have 20 percent spare terminals, but not less than two spare terminals.

C. Wires shall be terminated to the terminal blocks with crimp type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated.

D. Provide an AC ground bar bonded to the panel enclosure (if metal) with 20 percent spare terminals.

E. Terminal points for current transformer leads shall be provided with a shorting bar.

2.08 SHOP TEST

A. Perform manufacturer's standard production testing and inspection in accordance with NEMA and ANSI standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Repaint any damage to factory applied paint finish using touch-up paint furnished by the control panel manufacturer. The entire panel or section shall be repainted per the field painting requirements in Section 09902, at no additional cost to the Owner.

B. Any work not installed according to the Drawings and this Section shall be subject to change as required. No extra compensation will be allowed for making these changes.

C. All control panels installed outside shall face north, if possible. Location shall be roughed in for owner approval, prior to final installation.

3.02 FIELD TESTING

A. Check mechanical interlocks for proper operation. Make any adjustments required.

B. Adjust motor circuit protectors and voltage trip devices to their correct settings.

C. Install overload heaters per actual motor nameplate currents. If power factor capacitors are installed between starter and motor, use overload relay heaters based on measured motor

current.

D. Adjust motor circuit protectors for actual motor nameplate currents.

E. In the event of an equipment fault, notify the Engineer immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the Contractor, the Engineer and the control panel manufacturer's factory service technician. Repair or replace the equipment as directed by the Engineer prior to placing the equipment back into service.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Schedule, attend, and administer as specified periodic progress meetings, and specially called meetings throughout progress of the Work.

B. Representatives of Contractor, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. Meetings administered by Engineer may be tape recorded. If recorded, tapes will be used to prepare minutes and retained by Engineer for future reference.

D. Meetings, in addition to those specified in this Section, may be held when requested by the Owner, Engineer or Contractor.

1.02 RELATED WORK

A. Pre-bid conference is included in NC-1.

1.03 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference will be held after award of Contract and before Work is started. The conference will be scheduled by the Owner and Engineer and administered by the Engineer.

B. The Engineer will preside at the conference, prepare the minutes of the meeting and distribute copies of same to all participants who so request by fully completing the attendance form to be circulated at the beginning of the conference.

C. Attendance:

1. Owner's representatives.

2. Engineer representatives.

3. Contractor's project manager.

4. Contractor's superintendent.

5. Any subcontractor or supplier representatives whom the Contractor may desire to invite or the Owner may request.

6. Others as appropriate.

D. Preliminary Agenda:

1. Schedule.

2. Authority of Contractor.

3. Authority of Engineer and Owner.

4. Submittals

5. Work modifications.

6. Applications for Payment.

7. Project Record Documents.

8. Temporary construction facilities.

9. Temporary utilities.

10. Site maintenance.

1.04 PROGRESS MEETINGS

A. Progress meetings will be held at least once per month. Meetings will be scheduled by the Owner and administered by Engineer.

B. The Engineer will preside at the meeting, prepare the minutes of the meeting and distribute copies of same to all participants who so request by fully completing the attendance form to be circulated at the beginning of each meeting.

C. Attendance: Same as preconstruction conference.

D. Preliminary Agenda:

1. Review, approval of minutes of previous meeting.

2. Review of work progress since previous meeting.

3. Field observations, problems, conflicts.

4. Problems which impede construction schedule.

5. Review of off-site fabrication, delivery schedules.

6. Corrective measures and procedures to regain projected schedule.

7. Revisions to construction schedule.

8. Progress, schedule, during succeeding work period.

9. Coordination of schedules.

10. Review submittal schedules.

11. Maintenance of quality standards.

12. Pending changes and substitutions.

13. Review proposed changes for:

    a. Effect on construction schedule and on completion date.

    b. Effect on work by others.

14. Review Record Documents.

15. Review monthly pay request.

F. Contractor shall be prepared to discuss all agenda items.

G. Contractor shall provide a current submittal log at each progress meeting in accordance with Section 01300.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. This Section specifies the general methods and requirements of submissions applicable to the following work-related submittals: Shop Drawings, Product Data, Samples, Mock Ups and Construction Photographs. Detailed submittal requirements are specified in the technical specifications sections.

B All submittals shall be clearly identified by reference to Specification Section, Paragraph, Drawing Number or Detail as applicable. Submittals shall be clear and legible and of sufficient size for sufficient presentation of data.

1.02 RELATED WORK

A. Construction scheduling is included in Section 01311.

B. Project Record Documents are included in section 01720.

C. Operation and maintenance manuals are included in section 01730.

D. Warranties and bonds are included in Section 01740.

1.03 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

A Shop Drawings

1. Shop drawings, as specified in individual work Sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the Work.

2. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.

3. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.

4. All details on shop drawings submitted for approval shall show clearly the relation of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.

5. Submittals for equipment specified under Divisions 11, 13, 14, 15 and 16 shall include a listing of all installations where identical or similar equipment has been installed and been in operation for a period of at least one year.

6. Submittals for equipment furnished under Divisions 11, 12, 13, 14, 15 and 16 shall include maintenance and lubrication schedules for each piece of equipment. Schedules shall be similar to the following samples schedules:

SAMPLE MAINTENANCE SCHEDULE

Item	Action	Frequency	Remarks
Sedimentation Equipment	Check removal of scum washdown, if required; remove any debris, etc.	Daily	
	Dewater, examine structure, scrape and paint all exposed metals, examine scraping shoes.	6 mos	Scrape and clean walls of structure. Repair any damage to scraping shoes.
Sludge Collector Drive Unit	Remove shear pin, clean off rust, grease and replace.	6 mos	
Overflow Weir	Check	Daily	

SAMPLE LUBRICATION SCHEDULE

Item	Manufacturer's Recommendations	Type Lubricant	Frequency
Spur and Worm gearing	Check oil level	See below	Weekly
	Change oil (Winter)	75-80 NSMP Gem	6 mos
	(Summer)	80-90 NSMP Gem	
	Flush out drives before oil change	Kendall Flushing oil	Prior to oil change
* Gear Motors	Change oil (Winter)	Kenoil 053 R&O	2,000 hrs or 6 mos

(Summer) Kenoil 07 R&O

* See manufacturer's instructional manual for initial operation instructions. (IMPORTANT)

B. Product Data

1. Product data, as specified in individual Sections include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing and printed product warranties, as applicable to the Work.

C. Samples

1. Samples specified in individual Sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:

1. Field measurements

2. Field construction criteria

3. Catalog numbers and similar data

4. Conformance with the Specifications and Drawings.

B. Each shop drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have reviewed and approved this submittal and checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." Shop drawings and product data sheets 11-in x 17-in and smaller shall be bound.

C. The Contractor shall utilize the following submittal identification system:

1. Number each transmittal by the Section number for which it is being submitted. Number transmittals in sequence for each section. For example, Transmittal No. 15100-3 is the third

transmittal for Work covered under Section 15100.

2. Identify resubmittals with a letter of the alphabet following the original number, using A for the first submittal, B for the first resubmittal, etc. A second resubmittal affecting transmittal 15100-3 would be numbered 15100-3C. The number 15100-3B would then be entered on the submittal form in the space "Previous Transmittal', which is left blank except for resubmittals.

D. Notify the Engineer in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.

E. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from his/her responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility therefor.

F. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

G. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.

1.05 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule and in such sequence as to cause no delay in the Work or in the work of any other contractor.

B. Each submittal, appropriately coded, will be returned to the Contractor within 20 working days (Saturdays, Sundays and holidays excluded) following receipt of submittal by the Engineer.

C. Number of submittals required:

1. Shop Drawings as defined in Paragraph 1.03 A: Eight copies.

2. Product Data as defined in Paragraph 1.03 B: Eight copies.

3. Samples: Submit the number stated in the respective Specification Sections.

D. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.

2. The Project title and number.

3. Contractor identification.

4. The names of:

a. Contractor

b. Supplier

c. Manufacturer

5. Identification of the product, with the specification section number, page and paragraph(s).

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the Work or materials.

8. Applicable standards, such as ASTM or Federal Specification numbers.

9. Identification of deviations from Contract Documents.

10. Identification of revisions on resubmittals.

11. An 8-in by 3-in blank space for Contractor and Engineer stamps.

1.06 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

A. The review of shop drawings, data and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:

1. as permitting any departure from the Contract requirements;

2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;

3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.

B. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.

C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.

D. Submittals will be returned to the Contractor under one of the following codes.

Code 1 - "APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 - "APPROVED AS NOTED". This code is assigned when a confirmation of the notations and comments ARE NOT required by the Contractor. The Contractor may release the

equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 - "APPROVED AS NOTED/CONFIRM". This combination of codes is assigned when a confirmation of the notations and comments IS required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the confirmation.

Code 4 - "APPROVED AS NOTED/RESUBMIT". This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the resubmittal.

Code 5 - "NOT APPROVED" is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 - "COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the Contractor.

Code 7 - "RECEIPT ACKNOWLEDGED" - This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer's review and approval; and, is being filed for informational purposes only. This code is generally used in acknowledging receipt of *means and methods of construction* work plan, field conformance test reports, and Health and Safety plans.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.

F. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor and will be considered "Not Approved" until resubmitted. The Engineer may at his/her option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

G. Repetitive Review

1. Shop drawings and other submittals will be reviewed no more than twice at the Engineer's expense. All subsequent reviews will be performed at times convenient to the Engineer and at the Contractor's expense, based on the Engineer's then prevailing rates. The Contractor shall reimburse the Owner for all such fees invoiced to the Owner by the Engineer. Submittals are required until approved.

2. Any need for more than one resubmission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Time.

H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven working days prior to release for manufacture.

I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

1.07 DISTRIBUTION

A. After review the Engineer will make the following distribution of shop drawings and product data:

1. Codes 1 through 5: 2 copies to Owner; 3 copies to Contractor including 1 copy for Project Record Drawings; 3 copies to Engineer.

2 Code 6: 2 copies to Owner; 4 copies to Contractor; 2 copies to Engineer.

1.08 MOCK UPS

A. Mock Up units as specified in individual Sections, include but are not necessarily limited to, complete units of the standard of acceptance for that type of work to be used on the Project. Remove at the completion of the Work or when directed.

1.09 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall have an average of 24 color photographs per month made of the work during its progress and 48 color photographs of the completed facilities. The photographs shall be of such views and taken at such times as the Engineer directs. Photographs shall not be dated on the front.

B. All photographic work shall be done by a qualified photographer acceptable to the Engineer. Three prints of each photograph shall be furnished promptly to the Engineer, and each print shall have a glossy finish and be mounted in plastic sleeving on a substantial backing. The overall dimensions of each mounted print shall be 3-in by 5-in with 1-1/4-in flexible binding margin on the long top side to permit storage in standard 3-ring binders.

C. The film negatives shall be retained in the files of the photographer until the completion of the project and shall then be turned over to the Owner.

D. Each photograph shall have attached to the backing a paper label, approximately 2-1/4-in wide by 1-3/4-in high containing thereon in neat lettering:

1. Contractor's name
2. Short description of view
3. Photo number and date taken
4. Photographer's name and photographer's firm name

1.10 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM

A. If specifically required in other Sections of these Specifications, the Contractor shall submit a P.E. Certification for each item required, in the form attached to this Section, completely filled in and stamped.

1.11 GENERAL PROCEDURES FOR SUBMITTALS

A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

1.12 Y2K COMPLIANCE

A. All materials, products, equipment, electrical and electronic components, items and systems, hardware, software, and customized programming (Materials), provided under this Section Contract shall be Year 2000 (Y2K) Compliant, as defined in the Supplementary Conditions. A certificate of compliance indicating that the Materials are Y2K Compliant shall be provided to the Engineer as part of the shop drawing submittal and prior to shipping nay such Materials to the site. The Certificate shall be provided by supplier, vendor or subcontractor providing the Materials.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a Professional Engineer registered in the State of Louisiana and that he/she has been employed by (Name of Contractor) _____ to design _____ in accordance with Specification Section _____ for the (Name of Project) South Wastewater Treatment Plant Digesters No. 3 and 4 Cover Replacement. The undersigned further certifies that he/she has performed the design of the _____, that said design is in conformance with all applicable local, state and federal codes, rules, and regulations, and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to the City of Shreveport, or Owner's representative with seven days following written request therefor by the Owner.

_____
P.E. Name

_____
Signature

_____
Address

_____
Contractor's Name

_____
Signature

_____
Title

_____
Address

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SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1: GENERAL

1.01 REQUIREMENTS INCLUDED

A. Owner will employ and pay for the services of an Independent Testing Laboratory to perform testing or inspection specifically indicated on the Contract Documents and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.

1. Cooperate with the laboratory to facilitate the execution of its required services.

2. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the work of the Contract.

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.

B. Respective sections of specifications: Certification of products.

C. Each specification section listed: Laboratory tests required and standards for testing.

D. Testing Laboratory inspection, sampling and testing is required for but not limited to the following:

1. Site Preparation is included in Blue Book.

2. Concrete is included in Section 03300.

1.03 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.04 CONTRACTOR' S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to work, to manufacturer' s operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.

2. To obtain and handle samples at the project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assessment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor' s negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor=s convenience.

H. If the test results indicate the material or equipment complies with the Contractor Documents, the Owner shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1: GENERAL

1.01 MOBILIZATION AND PROGRESS OF THE WORK

A. The Owner will issue a written Notice to Proceed, indicating the date when the Contract Time shall begin. The Work shall progress as required to prevent delaying completion of the Project.

B. The Contractor shall furnish labor and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will ensure the completion of the Work within the time stipulated in the Contract Documents. If at any time such labor and equipment appears to the Owner or Engineer to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress specified, he may order the Contractor to increase the efficiency, change the character or increase the plant equipment at the expense of the Contractor, and the Contractor shall conform to such order. Failure of the Owner or Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of work and rate of progress required.

C. The Contractor shall be fully responsible for providing all temporary diversion and dewatering pumping and piping, plumbing, heating, ventilating, air conditioning, lighting, temporary structures, and such other items required to complete all indicated work in these contract specifications and drawings.

1.02 RELATED WORK

A. Environmental protection requirements are included in Blue Book.

1.03 TEMPORARY FACILITIES

A. Layout of Temporary Facilities

1. Before starting the Work, the Contractor shall submit to the Engineer for approval, his proposed plan and layout for all temporary offices, sanitary facilities, temporary construction roads, storage buildings, storage yards, temporary water service and distribution, temporary power service and distribution, and temporary telephone service. Should the Contractor require space in addition to that allocated, the Contractor shall make his own arrangements for storage of materials and equipment in locations off the construction site.

B. Contractor's Work Area

1. The Contractor shall limit his operations and storage of equipment and materials to the areas designated and/or as directed by the Engineer/Owner.

2. The Contractor, subcontractors, and their employees are not allowed in any building, structure, or facility unless construction work is being done at that building, structure, or facility.

3. Except as provided herein, no sidewalk, private property, or other area adjacent to the plant

site shall be used for storage of the Contractor's equipment and materials unless prior written approval is obtained from the legal owner.

4. The Contractor shall maintain the area during construction in a manner that will not obstruct operations on street areas. He shall proceed with his work in an orderly manner, maintaining the construction site free of debris, plant overgrowth, and unnecessary equipment or materials.

5. The Contractor shall protect all trees and bushes in the Contractor's work areas. If any tree(s) bush(es) is(are) damaged or destroyed without Owner's written permission, the Contractor shall replace the tree(s) or bush(es) at the Contractor's expense.

6. At all times, maintain areas covered by the Contract and public properties free from accumulations of waste, debris, and rubbish caused by construction operations. Follow cleaning procedures outlined in Section 01710.

7. Excavated materials which are not to be stockpiled on site shall be removed from the site in a manner that will cause the least damage to adjacent lawns, grassed areas, trees, gardens, shrubbery, or fences regardless of whether these are on private property or on public rights-of-way.

8. Provide approved containers for collection and disposal of waste materials, debris, and rubbish.

C. Temporary Offices

1. Temporary offices shall be established on the job site where approved or directed by the Owner, adequately furnished, and maintained in a clean, orderly condition by the Contractor. The Contractor or his/her authorized representative shall be present in the field office at all times while work is in progress. Instructions received there from the Engineer shall be considered as delivered to the Contractor.

2. Provide a separate 'like new' building of at least 500 square feet of floor space in three separate rooms for the exclusive use of the Engineer throughout the period of construction. The temporary office shall be weathertight, have a tight floor at least 8-in off the ground and shall be insulated all around with rigid insulation board not less than 2-in thick and suitably ventilated. The office shall have at least three screened windows capable of being opened and a solid door provided with cylinder lock and three keys. The office shall be kept clean by the Contractor, and shall have air conditioning and heating equipment, electrical wiring, outlets and fixtures suitable to light the tables and desk adequately as directed. The office for the Engineer shall have a restroom equipped with a toilet and lavatory. The Engineers and Contractor's main temporary office shall be located at the South Wastewater Treatment Plant.

3. The Engineer's office shall have the following furniture and equipment:

   a. Two plan tables, 3-ft by 5-ft and two stools

   b. Two desks, 3-ft by 5-ft with desk chairs

   c. Three additional chairs

   d. Two plan racks, as directed

e. Four shelves, as directed

f. Two four-drawer, filing cabinets with locks

g. Coat rack and hooks

h. Desk calculator

i. Air Conditioner (12,000 BTU)

j. Two telephones with two lines

k. Duplicating machine, Ricoh AFICIO 250 or equal

l. Fax machine (separate phone line), Ricoh Fax 3800L or equal

m. One conference table (6-ft)

n. Eight folding chairs

o. First aid kit suitable for ten people with manual, American White Cross No. K10 or equal.

p. Drinking water bottle -- cooler type.

q. Dell Dimension 8200 personal computer, with Intel Pentium 4 processor, 256 MB RAM, 17'inch flat panel monitor, 56K modem, and HP LaserJet 1200N printer.

4. The Contractor shall supply all fuel for heating and pay all electrical and project related phone bills.

5. An approved, suitably constructed and equipped trailer of proper size may be furnished for the Engineer's office.

D. Storage Buildings

1. The Contractor shall erect, or provide as approved, temporary storage buildings of the various sizes as required for the protection of mechanical and electrical equipment and materials recommended by manufacturers of such equipment and materials. The buildings shall be provided with such environmental control systems that meet recommendations of manufacturers of all equipment and materials stored in the buildings. The buildings shall be of sufficient size and so arranged or partitioned to provide security for their contents and provide ready access for inspection and inventory. At or near the completion of the Work, and as directed by the Owner, the temporary storage buildings shall be dismantled, removed from the site, and remain the property of the Contractor.

2. Combustible materials (paints, solvents, fuels, etc.) shall be stored in a well-ventilated building away from other buildings.

E. Storage Yard

1. The Contractor shall construct temporary storage yards as required for the storage of materials that are not subject to damage by weather conditions. Surfacing and fencing of the storage yards shall meet with the approval of the Owner.

F. Fill Material Storage

1. Excavated material suitable for use as fill shall be stored on-site in the area(s) designated by the Owner.

1.04 TEMPORARY UTILITIES

A. Temporary Telephone Service

1. The Contractor shall furnish separate on-site telephone services for his own use and for the Engineer's use as required during the period of construction of the Contract. The cost of installation and monthly bills for the telephone services shall be borne by the Contractor.

2. The Contractor shall furnish and install an automatic telephone answering machine and a facsimile machine with separate phone line for both the Contractor and the Engineer.

B. Temporary Sanitary Facilities

1. The Contractor shall provide and maintain toilets and other sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations for the State and local health departments and as directed by the Owner. Chemical toilets, if used, shall be of watertight construction. A minimum of one toilet per 20 employees shall be provided by the Contractor. Chemical toilets shall be maintained by the Contractor until the completion of construction or as directed by the Owner. Upon completion of the work, all sanitary facilities shall be removed and the area restored to its original condition.

2. Contractor shall not use Owner facilities.

C. Water For Construction

1. The Contractor shall arrange for the necessary temporary water service, including the securing of any necessary permits.

2. The Contractor shall make the necessary arrangement to supply water required for testing the work prior to acceptance of the work, unless otherwise specifically stated in the Specifications for the equipment, system, or facility.

3. The Contractor shall be responsible for any costs associated with water connections and for water service to the construction trailers.

D. Electric Power for Construction

1. The Contractor shall provide a meter and pay for all power costs to his/her construction trailer and the engineers construction trailer. All temporary systems and their components shall be furnished and installed in conformance with the requirements of the National Electric Code

and all local authorities having jurisdiction.

E. Temporary Light and Power

1. Provide connections to existing facilities, sized to provide service required for power and lighting as required. Owner will pay the costs of power used.

2. Install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the site by use of construction type power cords.

3. Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. For connection of power tools and equipment, provide outlets equipped with ground-fault circuit interrupters, reset button and pilot light.

4. Provide grounded extension cords. Use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if more than one length is required.

5. Provide general service incandescent lamps are required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Temporary Heat

1. Provide all heat as may be necessary for thawing out and heating materials and for proper execution, protection and drying out of the Work.

G. Fire Extinguishers

1. Provide portable UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide portable UL-rated class ABC dry chemical extinguishers or a combination of NFPA recommended Classes for the exposure. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

1.05 TEMPORARY PARKING SPACE

A. The Contractor shall park as directed by the Owner and maintain temporary parking facilities.

B. At the completion of the Work, the Contractor shall remove temporary parking facilities and restore the areas to the original condition as approved by the Owner.

1.06 TEMPORARY CONSTRUCTION

A. Open Excavations

1. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of

excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Owner. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Owner may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.

2. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

B. Test Pits

1. Test pits for the purpose of locating underground pipelines or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Owner.

1.07 TEMPORARY CONTROLS

A. Maintenance of Flow

1. The Contractor shall at his own cost, provide for the flow of drains and water courses interrupted during the progress of the Work, and shall immediately haul away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Owner well in advance of the interruption of any flow.

B. Protection of Sewers

1. Take adequate measures to prevent the impairment of the operation of the existing sewer system. Prevent construction material, pavement, concrete, earth, or other debris from entering a sewer or sewer structure.

2. All sewage flow interfering with construction and requiring diversion shall be diverted to a point acceptable to the Owner.

C. Protection of Waterways

1. The Contractor shall observe the rules and regulations of the State of Louisiana and agencies of the U.S. Government prohibiting the pollution of any lake, stream, river, or wetland by the dumping of any refuse, rubbish, dredge material, or debris therein.

2. The Contractor is specifically prohibited from disposal of materials into any waters of the State.

3. The Contractor shall be responsible for providing holding ponds or an approved method which will handle, carry through, or divert around his work all flows, including storm flows and flows created by construction activity, so as to prevent excessive silting of waterways or flooding damage to the property.

4. The Contractor shall comply with the procedures outlined in the U.S. Environmental Protection Agency manuals entitled, "Guidelines for Erosion and Sedimentation Control

Planning and Implementation" and "Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity", as well as erosion control measures indicated on the Drawings.

5. Water used during the course of this project shall be disposed of in accordance with the rules and regulations of the State of Louisiana's Department of Environmental Quality, the U.S. EPA and any other local, state or federal agencies governing the protection of groundwater or waterways.

D. Disposal of Excess Excavated and Other Waste Materials

1. Excess excavated material not required or suitable for backfill and other waste material shall be disposed of off site as approved by the Owner.

2. Unacceptable disposal sites include, but are not limited to, sites within a wetland or critical habitat and sites where disposal will have a detrimental effect on surface water or groundwater quality.

3. The Contractor shall make his own arrangements for disposal subject to submission of proof to the Owner that the owner(s) of the proposed sites(s) has a valid fill permit issued by the appropriate governmental agency and submission of a haul route plan including a map of the proposed route(s).

4. The Contractor shall provide watertight conveyance of any liquid, semi-liquid, or saturated solids which tend to bleed or leak during transport. No liquid loss from transported materials will be permitted whether being delivered to the construction site or being hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at the selected disposal site.

5. The Owner may suspend operations of the Contractor, at their discretion, for alleged non-compliance with the State of Louisiana or Environmental Protection Agency regulations.

E. Protection of Air Quality

1. Air pollution shall be minimized by wetting down bare soils during windy periods or, as requested by Owner, by requiring the use of properly operating combustion emission control devices on construction vehicles and equipment used by Contractor and by encouraging the shutdown of motorized equipment not actually in use.

2. Trash burning will not be permitted on the construction site.

3. If temporary heating devices are necessary for protection of the Work, such devices shall be of a type that will not cause pollution of the air.

F. Use of Chemicals

1. All chemicals used during Project construction or furnished for Project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture or any other applicable regulatory agency. Use of all such chemicals and disposal of residues shall be in conformance with the manufacturer's instructions.

2. The Contractor shall maintain Material Safety Data Sheets (MSDS) on site and available for review by the Contractor's employees and City employees.

G. Noise and Dust Control

1. The Contractor shall so conduct all his operations that they will cause the least annoyance to the residents in the vicinity of the work, and shall comply with all applicable local ordinances. Compressors, hoists, and other apparatus shall be equipped with such mechanical devices as may be necessary to minimize noise and dust. Compressors shall be equipped with silencers on intake lines. All gasoline or oil operated equipment shall be equipped with silencers or mufflers on intake and exhaust lines. Storage bins and hoppers shall be lined with material that will deaden the sounds if directed by Owner. The operation of dumping rock and of carrying rock away in trucks shall be so conducted as to cause a minimum of noise and dust. Vehicles carrying rock, concrete, or other material shall be routed over such streets as will cause the least annoyance to the public and shall not be operated on public streets between the hours of 5 p.m. and 8 a.m. or on Sundays or legal holidays unless approved by the Owner.

2. All unpaved streets, roads, detours, or haul roads used in the construction area shall be given an approved dust-preventive treatment or periodically watered to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

3. Blasting shall not be permitted for any excavations.

H. Nighttime Work

1. If the Contractor for his convenience and at his own expense, should desire to carry on his work at night or outside the Contractor's regular working hours as established at the preconstruction conference, he shall submit a written request to the Owner allowing ample time for satisfactory arrangements to be made for inspecting the work in progress. The Contractor shall provide lighting for active areas of the Project and shall provide noise abatement measures as required to comply with all applicable Federal and State regulations and with all applicable requirements of the City.

2. Night work may be established by the Contractor as a regular procedure with the written permission of the Owner. Such permission, however, may be revoked at any time by the Owner if the Contractor fails to maintain adequate lighting equipment, noise control, and supervision for the proper prosecution and controls of the work at night, or if the off-site effects of night construction are deemed by the Owner to be unacceptable.

I. Care and Protection of Property

1. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal to that existing before the damage was done, or he shall repair the damage in a manner acceptable to the Owner.

2. The Contractor shall not enter or occupy private land outside of easements, except by written permission of the respective landowner.

J. Protection of the Finished Construction

1. The Contractor shall assume the responsibility for the protection of all finished construction and shall repair and restore any and all damage to finished work to its original or better state.

2. Wheeling of any loads over finished floors, either with or without plank protection, shall not be permitted in anything except rubber tired wheelbarrows, buggies, trucks, or dollies. This applies to all finished floors and to all concrete floors, as well as those covered with composition tile or other applied surfacing, and shall apply to all trades.

3. Where structural concrete is also the finished surface, care shall be taken to avoid marking or damaging those surfaces.

K. Cleanup

1. During the course of the Work, the Contractor shall under the direction of the Owner or the Owner's Representative keep the site of his operation as clean and neat as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, concrete, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition.

2. Contractor shall remove all debris and waste daily so as not to interfere with plant operations.

1.08 REMOVAL OF TEMPORARY FACILITIES AND UTILITIES

A. At such time or times any temporary construction facilities and utilities are no longer required for the work, the Contractor shall notify the Owner of his intent and schedule for removal of the temporary facilities and utilities, and obtain the Owner's approval before removing the same. As approved, the Contractor shall disconnect and/or dismantle the temporary facilities and utilities and remove them from the site as his property. Leave the site in such condition as specified, as directed by the Owner, and/or as shown on the Drawings.

B. In unfinished areas, the condition of the site shall be left in a condition that will restore original drainage, evenly graded, seeded or planted and left with an appearance equal to, or better than, original.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01665

EQUIPMENT TESTING AND PLANT STARTUP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide a competent field services technician of the manufacturers of all equipment furnished under Divisions 11, 13, 14, 15 and 16 to supervise installation, adjustment, initial operation and testing, performance testing, final acceptance testing and startup of the equipment.

B. Perform specified equipment field performance tests, final acceptance tests and startup services.

1.02 RELATED WORK

A. Operation and Maintenance Data is included in Section 01730.

B. Performance and acceptance testing and startup requirements are included in the respective sections of Divisions 11, 13, 14, 15 and 16.

1.03 SUBMITTALS

A. Submit name, address and resume of proposed field services technicians at least 30 days in advance of the need for such services.

B. Submit for review in accordance with Section 01300 detailed testing procedures for shop tests, field performance tests and final acceptance tests as specified in the various equipment specification sections. Test procedures shall be submitted at least 30 days in advance of the proposed test dates and shall include at least the following information:

1. Name of equipment to be tested, including reference to specification section number and title.

2. Testing schedule of proposed dates and times for testing.

3. Summary of power, lighting, chemical, water, sludge, gas, etc, needs and identification of who will provide them.

4. Outline specific assignment of the responsibilities of the Contractor and manufacturers' factory representatives or field service personnel.

5. Detailed description of step-by-step testing requirements, with reference to appropriate standardized testing procedures and laboratory analyses by established technical organizations (e.g., ASTM, WPCF Standard Methods, etc).

6. Samples of forms to be used to collect and record test data and to present tabulated test results.

C. Submit in accordance with Section 01300 copies of test reports upon completion of specified shop, performance and acceptance tests. Test reports shall incorporate the information provided in the

test procedures submittals, modified to reflect actual conduct of the tests and the following additional information:

1. Copy of all test data sheets and results of lab analyses.

2. Summary comparison of specified test and performance requirements vs actual test results.

3. Should actual test results fail to meet specified test and performance requirements, describe action to be taken prior to re-testing equipment.

D. Submit in accordance with Section 01300 copies of the manufacturer's field service technician's report summarizing the results of his initial inspection, operation, adjustment and pre-tests. The report shall include detailed descriptions and tabulations of the points inspected, tests and adjustments made, quantitative results obtained, suggestions for precautions to be taken to ensure proper maintenance, and the equipment supplier's Certificate of Installation in the format specified hereinafter.

1.03 QUALITY ASSURANCE

A. Field service technicians shall be competent and experienced in the proper installation, adjustment, operation, testing and startup of the equipment and systems being installed.

B. Manufacturers' sales and marketing personnel will not be accepted as field service technicians.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRELIMINARY REQUIREMENTS

A. After installation of the equipment has been completed and the equipment is presumably ready for operation, before it is operated by others, the manufacturer's field service technician shall inspect, operate, test and adjust the equipment. The inspection shall include at least the following points where applicable:

1. Soundness (without cracked or otherwise damaged parts).

2. Completeness in all details, as specified and required.

3. Correctness of setting, alignment and relative arrangement of various parts.

4. Adequacy and correctness of packing, sealing and lubricants.

B. The operation, testing and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

C. Upon completion of this work, the manufacturer's field service technician shall submit a signed report of the results of his inspection, operation, adjustments and tests.

3.02 WITNESS REQUIREMENTS

A. Shop tests or factory tests may be witnessed by the Owner and Owner's representatives, as required by the various equipment specifications.

B. Field performance and acceptance tests shall be performed in the presence of the Owner and Owner's representatives.

3.03 STARTUP AND ACCEPTANCE OF THE NEW SYSTEMS

A. General Requirements

1. Successfully execute the step-by-step procedure of startup and performance demonstration specified hereinafter.

2. The startup and performance demonstration shall be successfully executed prior to Substantial Completion and acceptance by the Owner.

3. All performance tests and inspections shall be scheduled with the Owner and the Engineer at least ten working days in advance or as otherwise specified. All performance tests and inspections shall be conducted during the work week of Monday through Friday, unless otherwise specified.

B. Preparation for Startup

1. Upon completion of the new systems, all structure, channels, pipeline, etc. shall be cleaned and flushed with water. All process systems and pipelines shall be filled with water and hydraulically checked for leaks, cracks, and defects. All sumps, tanks, chambers, and wet wells which under normal operating conditions will contain water or process liquids shall also be hydraulically tested with water for leaks, cracks, and defects.

2. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. Preliminary run-ins of the various pumps, compressors, and other remaining equipment shall be made. All systems shall be purged as required. All sumps, tanks, basins, chambers, wet wells, and pipe lines which are hydraulically checked shall be drained and returned to their original condition once the water testing is complete.

3. All instruments and controls shall be calibrated through their full range. Any other adjustments required for proper operation of all instrumentation and control equipment (including interfacing with the South Wastewater Treatment Plant's SCADA system) shall be made.

4. The Contractor shall perform all other tasks needed for preparing and conditioning the treatment plant for proper operation.

5. No testing or equipment operation shall take place until it has been verified by the Engineer that all specified safety equipment has been installed and is in good working order.

6. No testing or equipment operation shall take place until it has been verified by the Engineer that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance data manuals have been furnished as specified.

C. Submit Start-up Plans to Engineer as per the requirements of Section 01300.

3.04 FIELD TESTS

A. Field Tests shall be made to confirm compliance with the Contract and to establish compliance with the technical provision. The tests shall be performed by the Contractor as specified in the Contract Documents. All gravity sewers, force mains, potable water lines, pressure piping, and equipment shall be tested in the field in the presence of the Engineer or his authorized representative, in the manner prescribed in the Sections of these Specifications pertaining to such installation.

B. Hydrostatic and Leakage Tests - Pipelines

1. All pipelines, buried and non-buried, shall be tested in accordance with Section 15051 and the respective pipe specification section in the Contract Documents.

3.05 INITIAL OPERATION TESTS

A. Upon completion of all structural, installation and adjustment of equipment, and pipe work, in a manner satisfactory to the Engineer and in compliance with the completion dates as described in the "Agreement", the Contractor shall designate a day for initial testing of the facilities. Prior to such completion date, the Contractor shall give the Owner ten (10) days notice thereof in writing and the Owner will then appoint the personnel who will operate the equipment, and on the test day designated, the Contractor shall make the initial test to determine performance using the personnel designated by the Owner and such other personnel of his own as is specified or as he deems necessary to complete the tests. The field tests required will be as described in the applicable Sections of these Specifications and modified as required to test the installed equipment by the Owner and Engineer.

B. The initial tests shall be limited to a period of 24 hours duration, or shorter if approved by the Owner and Engineer, and during this time the mechanical, electrical and instrumentation performance of all equipment shall be tested and demonstrated by the Contractor. If the demonstration and tests indicates satisfactory mechanical, electrical, instrumentation, and structural performance in the operation of the equipment, the Contractor will then be given a three (3) day notice by the Engineer to make a final guarantee test of the equipment under normal operation. During initial tests and the three day period between the initial tests and the final test, the Contractor's personnel shall supervise the operation of the equipment and assist and train the Owner's operating and maintenance personnel in their duties. Experts on equipment installation and operation and maintenance instructions shall be furnished by the contractor to insure proper training and instruction of the Owner's personnel at this time.

C. All performance tests and inspections shall be conducted during the normal work week of Monday through Friday, unless otherwise specified.

D. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner takes over the operation thereof.

E. The final guarantee tests for each item of equipment shall be for a period of 96 hours or as otherwise approved by the Engineer of successful operation, as a prerequisite of substantial completion and acceptance, and shall be made at the conclusion of the three day period of

operation and training. These tests shall be made under normal operating conditions under the supervision of the Contractor's personnel. These tests are for the purpose of demonstrating that all performance and efficiency guarantees of the equipment and other requirements in compliance with these Specifications have been met, that the operation of all equipment is coordinated, and that all controls operate satisfactorily in accordance with the equipment.

F. In the event the initial or final guarantee testing and demonstration of equipment and controls does not meet the guarantee conditions or is not demonstrated to the satisfaction of the Engineer and Owner, the Contractor shall, at his own expense, make such changes and adjustments in the equipment which is deemed necessary and shall conduct further tests until full satisfaction is received thereof.

G. Contractor shall provide and dispose of all water necessary for the flushing, cleaning, testing, and disinfection of pipelines and structures.

H. Equipment suppliers shall fill out and submit to the Engineer the attached form (Equipment Supplier's Certificate of Installation) after the equipment has been installed, tested, adjusted and is deemed ready by the Contractor and equipment supplier for final acceptance testing.

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EQUIPMENT SUPPLIER'S CERTIFICATE OF INSTALLATION

Owner City/Parish of East Baton Rouge

Project South Wastewater Treatment Plant Digesters No. 3 and 4 Cover Replacement

Contract No. WW-05-

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I _____, authorized representative of
(Print Name)

_____
(Print Manufacturer's Name)

hereby CERTIFY that _____
(Print Equipment Name and Model with Serial No.)

_____

installed for the subject project has (have) been installed in a satisfactory manner, has (have) been tested and adjusted, and is (are) ready for final acceptance testing and operation on Date _____Time_____.

CERTIFIED BY:

_____
(Signature of Manufacturer's Representative)

Date: _____

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Maintain at the site for the Owner one record copy of:

1. Conformed Drawings.
2. Conformed Specifications.
3. Change Orders and other modifications to the Contract.
4. Engineer's Field Orders or written instructions.
5. Approved Shop Drawings, Product Data and Samples.
6. Field test records.
7. Construction photographs.
8. Latest, approved progress schedule.

B. Progress payments will not be approved unless Project Record Documents are current with construction progress.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI section numbers.

C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer and Owner.

1.03 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

1.04 RECORDING

A. Label each document "PROJECT RECORD" with rubber stamp.

B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

C. Use yellow to denote no change. Use red to indicate additions, deletions and changes.

D. Drawings: Legibly mark to record actual construction:

1. Elevations of various structure elements in relation to elevation datum.

   a. Elevations referenced to control points established by the Owner's agent.

   b. Elevations of all structural finished floors and tops of concrete.

   c. Elevations of all weirs and other flow control devices.

   d. Bottom of pipe (B/P) or top of pipe (T/P) elevations for all exposed piping, indoors or outdoors.

2. All underground piping with elevations and dimensions, changes to piping location, horizontal and vertical locations of underground utilities and appurtenances, reference to permanent surface improvements, actual installed pipe material, class, etc.

   a. Top of pipe or top of concrete (TOC) elevations for all underground pipelines or encased pipes or conduits exposed during construction, whether being installed or not. On straight runs of new pipe or conduit, at least one T/P elevation shall be recorded every 10 feet of pipe or conduit.

   b. The horizontal location of every piping or conduit bend (vertical or horizontal), valves, other fitting, or specialty item exposed during construction, whether being installed or not, shall be recorded by noting its distance to the nearest tenth of a foot from three permanent above ground features. On long straight runs of pipe or conduit, similar information shall be recorded between bends and other fittings at least once every 30 feet.

   c. Locate all underground utilities, structures, obstacles, etc. encountered during construction, whether being installed or not, in the manner indicated above for underground pipes and conduits.

3. Location of internal utilities and appurtenances concealed in the construction by referencing to visible and accessible features of the structure.

4. Field changes of dimension and detail.

5. Changes made by Field Order or by Change Order.

6. Details not on original Drawings.

7. Equipment and piping relocations.

8. Identify the actual motor installed by manufacturer's name, nameplate horsepower and serial number.

9. Identify the actual pump installed by manufacturer's name, model number, impeller size, rated capacity and serial number.

10. Major architectural and structural changes, including relocation of doors, windows, etc.

E. Specifications and Addenda. Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Field Order, Change Order, or other modifications to the Contract.

F. Shop Drawings (after final review):

1. Five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

G. Certified site survey and line elevations and stationing at 100-ft increments and all points of change of direction of pipelines, per Section 01050.

1.05 SUBMITTAL

A. At Contract closeout, deliver Record Documents to the Engineer for the Owner.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date.

2. Project title and number.

3. Contractor's name and address.

4. Title and number of each Record Document.

5. Signature of Contractor or his authorized representative.

C. Final Acceptance will not be granted until the Record Documents have been turned over and approved by the Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK

A. Submittals are included in Section 01300.

B. Contract closeout is covered in Section 01700.

C. Warranties and bonds are covered in Section 01740.

1.03 SERVICES OF MANUFACTURERS' REPRESENTATIVE

A. Equipment furnished under Divisions 13, 14, 15 and 16 shall include the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance. This supervision may be divided into two or more time periods as required by the installation program or as directed by the Engineer.

B. See the detailed Specifications for additional requirements for furnishing the services of manufacturer's representatives.

C. A certificate in the form attached to this Section, from the manufacturer and signed by Owner's representative stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of the unit shall be submitted for each piece of equipment indicated above. Execution of this form is a prerequisite to substantial completion.

D. For equipment furnished under other Divisions, the Contractor shall furnish the services of accredited representatives of the manufacturer only when some evident malfunction or over-heating makes such services necessary in the opinion of the Engineer.

1.04 OPERATING MANUALS

A. Six complete sets of operation and maintenance instructions covering all equipment furnished under Divisions 13, 14, 15 and 16 shall be delivered directly to the Engineer.

1. The manual for each piece of equipment shall be a separate document with the following specific requirements:

a. Contents:

Table of contents and index

Brief description of each system and components

Starting and stopping procedures

Special operating instructions

Routine maintenance procedures

Manufacturer's printed operating and maintenance instructions, parts list, illustrations and diagrams

One copy of each wiring diagram

One copy of each approved shop drawing and each Contractor's coordination and layout drawing

List of spare parts, manufacturer's price, and recommended quantity

Name, address and telephone numbers of local service representatives

b. Material:

Loose leaf on 60 pound, punched paper

Holes reinforced with plastic cloth or metal

Page size, 8-1/2-in. by 11-in.

Diagrams, illustrations, and attached foldouts as required, of original quality, reproduced by dry copy method

Covers: oil, moisture and wear resistant 9 in. by 12 in. size

c. Submittals to the Engineer:

(1) Three preliminary copies of manuals shall be submitted to the Engineer no later than 15 days following approval of the shop drawings for each piece of equipment. Provide six final copies of complete manuals prior to testing.

1.05 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of project, names, addresses and telephone numbers of Engineer, subconsultants and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses and telephone numbers of subcontractors and suppliers; including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

E. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.

F. Warranties and Bonds as specified in Section 01740.

1.06 MANUAL FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials and Finishes: Include product data, with catalog number, size, composition and color and texture designations. Provide information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture Protection and Weather Exposed Products: Include product data listing, applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance and repair.

D. Additional Requirements: As specified in individual product specification Sections.

E. Provide a listing in Table of Contents for design data, if provided by Contractor, with tabbed fly sheet and space for insertion of data.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

A. For each Item of Equipment and Each System provide the following:

1. Overview of system and description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

2. Panelboard Circuit Directories including electrical service characteristics, controls and communications and color coded wiring diagrams as installed.

3. Operating Procedures: Include start-up, break-in and routine normal operating instructions and sequences; regulation, control, stopping, shut-down and emergency instructions; and summer, winter and any special operating instructions.

4. Maintenance Requirements:

a. Routine procedures and guide for trouble-shooting; disassembly, repair and reassembly instructions; and alignment, adjusting, balancing and checking instructions.

b. Servicing and lubrication schedule and list of lubricants required.

c. Manufacturer's printed operation and maintenance instructions.

d. Sequence of operation by controls manufacturer.

e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

5. Control diagrams by controls manufacturer as installed.

6. Contractor's coordination drawings, with color coded piping diagrams as installed.

7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

8. List of original manufacturer's spare parts, current prices and recommended quantities to be maintained in storage.

9. Test and balancing reports as specified.

10. Additional Requirements: As specified in individual product specification Sections.

B. Provide a listing in Table of Contents for design data, if provided by Contractor, with tabbed fly sheet and space for insertion of data.

1.08 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment and maintenance of products, equipment and systems, at agreed upon times.

B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

C. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

1.09 INTERACTICE ONLINE TRAINING

A. When indicated in specification sections, Online Learning Modules will be developed; quizzes and a test will be prepared with the full cooperation of the manufacturers. Course work, Hosting services and Programming will be provided by 360water, Inc. or prior approved equal.

B. The Modules will be able to evaluate and test the operators on:

1. Start-up /Shut down of equipment
2. Basic operations, maintenance and safety
3. Trouble shooting techniques

C. The Online Education Program will include the following functions:

1. Intermittent Quizzes and Test Questions;

2. Wrong answer notification;
3. 100% proficiency is required before a certificate of completion is generated;
4. A real time clock on screen that verifies the time spent on the course material;
5. The software program will automatically bookmark when the operator leaves a course (in case of power outage or an emergency in the facility).
6. The online education program needs to be approved by the state-regulating agency for continuing education. This is in the event of the facility choosing to apply for CH/CEU credits for their training program.

C. Equipment supplied in the following Specification Sections shall be included as part of the Interactive Online Training:

1. Section 13230 Digester Mixing Equipment
2. Section 13234 Floating Digester Gas Holder Cover and Appurtenances
3. Section 13237 Digester Heating Equipment

The manufacturers will provide all relevant information needed to train a new operator on mandatory procedures.

The hosting of this service shall last a minimum of 10-years. A Hard Copy and an electronic version must be provided for the client to use for other non-online training programs.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION TESTING AND INSTRUCTION

Owner: City of Baton Rouge/Parish of East Baton Rouge

Project: South Wastewater Treatment Plant Digesters No.3 and 4 Cover Replacement

Project No: _____

EQUIPMENT SPECIFICATION SECTION:_____

EQUIPMENT DESCRIPTION:_____

I _____ _____ Authorized representative of
(Print Name)

_____
Print Manufacturer's Name)

hereby CERTIFY that _____
(Print Equipment Name and Model with Serial No.)

installed for the subject project [has] [have] been installed in a satisfactory manner, [has] [have] been satisfactorily tested, [is] [are] ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit[s] on Date:_____ Time: _____.

CERTIFIED BY: _____ DATE: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

[I] [We] the undersigned, authorized representatives of the City of Baton Rouge and Parish of East Baton Rouge and/or Plant Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and [am] [are] prepared to assume normal operational responsibility for the equipment:

_____ DATE: _____

_____ DATE: _____

_____ DATE: _____

END OF SECTION

SECTION 02610

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install ductile iron pipe and ductile iron restrained joint fittings for pressure piping systems, complete, as shown on the Drawings and/or as specified herein.

1.02 QUALIFICATIONS

A. All ductile iron pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the material to be furnished. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.03 SUBMITTALS

A. The Contractor shall submit to the Engineer, within 30 days after receipt of Notice to Proceed, a list of materials to be furnished, and the names of the suppliers and the date of delivery of materials to the site.

B. Submit shop drawings to the Engineer for review in accordance with Section 01300, showing the complete laying plan of all pipe including all fittings, adapters, valves, and specials along with the manufacturer's drawings and specifications indicating complete details of all items. The pipe details shall include a pipe class laying schedule which specifies pipe class, class coding, joints, station limits, and transition stations, and a list of abbreviated terms with their full meaning. The Contractor shall provide details of fittings to be furnished. The above shall be submitted to the Engineer for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated on the Drawings. In most cases, a certain amount of flexibility in the positioning of pipes will be allowed. Horizontal and vertical deflections may require beveled, special deflection or short pipes. The deflections at joints shall not exceed 75 percent of that recommended by the manufacturer.

C. The Contractor shall submit the pipe manufacturer's certification of compliance with the Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall conform to ANSI A21.51 and AWWA C-115 and C-153 standards. Thickness of pipe shall be Class 50 unless otherwise indicated on the Drawings.

1. Provided the pipe bedding details shown on sheet CZ-1 are strictly followed, the following pressure class pipe may be used under the given maximum cover conditions. In all other areas, pipe wall thickness shall conform to Class 50.

Pipe Diameter (inches)	*Maximum Depth of Cover (feet)*	*Pressure Class (psi)*
4 - 12	28	350
14 – 24	20	250
30 - 54	13	150

B. Unrestrained joint pipe shall be supplied in lengths not in excess of 21 feet. Unrestrained joint pipe shall be either the rubber-ring type, push-on joint, or standard mechanical joint pipe as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, Clow Corp., or prior approved equal.

C. Unrestrained fittings shall meet the requirements of AWWA C-153. Rubber gaskets shall conform to ANSI A21.11 for mechanical and push-on type joints.

D. All ductile iron pipe and fittings for sewage force mains and yard piping shall have a ceramic epoxy lining on the interior and bituminous coating on the exterior except for 6 inches back from the spigot end. All ductile iron pipe and fittings for non-potable water service shall have a cement mortar lining and bituminous seal coat in accordance with ANSI/SWWA C104 / A21.4. The bituminous coating shall not be applied to the first 6 inches of the exterior of the spigot ends. All pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the pipe and fittings shall be as cast without ever having been lined with any substance prior to the application of the specified lining. Any pipe or fittings furnished for this project must not have been lined prior to the awarding of the contract for this project.

1. Lining Material - The material used for lining shall be a two component amine cured novalac epoxy of at least 87 percent solids. Lining material shall be Protecto 401 by Vulcan Painters, Birmingham, AL or approved equal. The following test requirements shall be certified by the material supplier and a history of satisfactory performance for the material in the service required and upon the surface specified shall be submitted. The following are the minimum requirements:

   a. A permeability rating of zero permeance when a film of at least 40 mils is tested according to ASTM D1653 or a permeability rating of 0.0 perms when measured using Method A of ASTM E66, Procedure A, with a test duration of 42 days.

   b. The material shall contain at least 20 percent by volume of ceramic quartz pigment in the dried film.

   c. The following test must be run on ductile iron panels, with the results certified by the lining material supplier of the material being submitted.

Test	*Rating/Method*
1. Salt Spray on Scribed Panel	ASTM B117
2. 3% Sulfuric Acid Immersion @ 120°F	ASTM D714
3. 25% Sodium Hydroxide Immersion @ 140°F	ASTM D714
4. Deionized Water Immersion @ 160°F	ASTM D714
5. Moisture and Ultraviolet Light Cycle 8 hours light/4 hours 100% humidity	ASTM G5377

d. A statement concerning re-coatability and repair of the lining.

2. Application of Lining- The lining shall be applied by a competent firm with at least a five-year history of applying linings to the interior of ductile pipe and fittings.

a. Surface Preparation: Prior to abrasive blasting, the entire area which will receive the protective compound shall be inspected for oil, grease, etc. Any area where oil, grease, or any substance which can be removed by solvent is present, shall be solvent cleaned using the guidelines outlined in SSPC-SP-1 Solvent Cleaning. After the surface has been made free of grease, oil, or other substances, all areas which are to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The blast media shall strike 100 percent of the surface area with sufficient force to remove rust and oxides. The entire surface to be lined shall be struck with the blast media so that all rust, loose materials, oxides, etc. are removed from the surface. Only slight stains and specks of tightly adhering oxides may be left on the surface. Any area where rust appears before coating must be reblasted to removed all rust.

b. Lining: After surface preparation and within 8 hours of surface preparation of the barrel of the pipe from the inside shoulder of the gasket groove to the end of the interior spigot shall receive a minimum coating of 40 mils dry film thickness of the protective lining. If flange fittings or pipe are included in the project, the linings must not be used on the face of the flange; however, full face gaskets must be used to protect the ends of the pipe. All fittings shall be lined with a minimum of 40 mils of the protective lining. Push-on type fittings shall be lined from the gasket groove to the gasket groove. The 40 mils system shall not be applied in the gasket grooves.

c. Coating of Gasket Groove and Spigot Ends: Due to the tolerances involved, the gasket groove and spigot end up to 6 inches back from the end of the spigot end must be coated with 10 mils (nominal) dry film thickness of Protecto Joint Compound. This coating shall be applied by brush to ensure coverage. Care should be taken to ensure that the coating is smooth without excess buildup in the gasket or on the spigot end. All materials for the gasket groove and spigot end shall be applied after the application of the lining.

d. Number of Coats: The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall the material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The time between coats shall never exceed that time recommended by the lining material manufacturer. No material shall be used for lining which cannot be recoated with itself without roughening of the surface after 4 hours cure at 100° F. If, at any time, the lining must be recoated beyond the lining material manufacturer's recommended recoat time, the surface of the existing lining shall be roughened sufficiently to prevent delamination between coats.

3. Inspection

a. All pipe shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Testing.

b. The barrel of all pipe and fittings shall be pinhole-detected with a non-destructive 2,500-volt test.

c. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on that date.

4. Certification: the pipe or fitting manufacturer must supply a certificate attesting to the fact that the Applicator met the requirements of this specification, that the material used was as specified, and that the material was applied as required by the specification.

5. Repair: all pinholes and damaged lined areas shall be repaired in accordance with written repair procedure for the lining material furnished by the manufacturer so that the repaired area is equal to performance of the undamaged lining areas.

6. The exterior of the pipe shall receive a bituminous coating approximately 1 mil thick in accordance with ANSI A21.51.

7. Pipe and fittings exposed to view in the finished work shall not receive the standard tar or asphalt coat on the outside surfaces, but shall be shop primed on the outside with one coat of Kop Coat No. 622 Rust Inhibitive Primer or equal and painted in accordance with Section 09900. All other pipe and fittings shall be shop coated on the outside with Kop Coat Bitumastic 300M, or equal, coal tar enamel 1 mil thick dry film thickness and will not require any other coating. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping, the surfaces shall be sealed with a non-bleeding sealer coat such as Kop Coat Tar Stop, Mobile Anti-Bleeding Aluminum Sealer, or prior approved equal. Sealing shall be a part of the work of this section.

E. Restrained joints for force mains shall be provided at all force main adjustments, horizontal bends, and at other locations as required. Restrained joint pipe and fittings for 12 inch and smaller diameter pipe shall be "Flex-Ring" as manufactured by the American Cast Iron Pipe Company, "TR Flex" as manufactured by U.S. Pipe Company, "Super-Lock" as manufactured by Clow Corporation, or prior approved equal. Restrained joint pipe and fittings for 14 inch and larger diameter pipe shall be "LOK-Ring" as manufactured by American Cast Iron Pipe Company, "TR-Flex" as manufactured by U.S. Pipe Company, "Super-Lock" as manufactured by Clow Corporation, or prior approved equal. Where bolts are required, they shall be high-strength Corten corrosion resistant. Field cut restrained joints shall be designed so that no welding will be required on the pipe resulting in either damage to the inner lining or crystallization of the metal in the pipe wall.

F. Restrained joints, where shown or specified, shall be designed to withstand vertical and longitudinal forces and be capable of holding against withdrawal with no axial movement resulting from an internal hydrostatic pressure of 125 psi for areas where Class 53 and thicker wall pipe is installed and 100 psi for areas where Class 50 pipe is installed.

G. Mechanical joint restraint systems making use of retainer glands designed to allow flexibility of the mechanical joint, Series 1100 Mega-Lug as manufactured by EBBA Iron, Inc., or prior approved equal, may be substituted for the restrained joint systems specified above when approved by the Engineer. Set screw restraint systems will not be considered an equivalent restraint.

H. Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe

shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the rest of the pipe.

I. Polyethylene wrap shall be installed on all buried ductile iron pipe. Polyethylene encasement furnished under these Specifications shall conform to AWWA C-105 or ANSI A21.5. Film shall be Class "C"-Black, with a minimum nominal thickness of 0.008 inches (8 mils). Tape for securing the film shall be thermoplastic material with a pressure sensitive adhesive face capable of bonding to metal, bituminous coating, and polyethylene. Tape shall have a minimum thickness of 8 mils and a minimum width of one inch. The polyethylene film envelope shall be free as is commercially possible of gels, streaks, pinholes, particles of foreign matter, and undispersed raw materials. There shall be no other visible defect such as holes, tears, blisters, or thinning out at folds. Manufacturers shall furnish a certification of conformance of the material to the requirement of AWWA C-105 or ANSI A21.5.

J. Joints

1. Ductile iron pipe shall have flanged joints. flange shall be flat face type, unless otherwise noted, meeting ANSI B16.1 Class 125 requirements.

2. Flange gasket shall be full face type per AWWA C111 to provide sealing for the flanged ductile iron joints. Thickness shall be 1/8-in unless otherwise indicated. Gaskets shall be compatible with fluids to be transported through the pipe and with all temperature requirements.

3. Assembly bolts shall be square headed carbon steel machine bolts with hexagon nuts per ANSI B18.2. Thread shall conform to ANSI B1.1. Bolt length shall be such that after joints are assembled, the bolts shall protrude through the nuts, but not more than 2-in.

4. Grooved joints shall conform to AWWA C606 standard rigid couplings and shall be Style 31 couplings as manufactured by Victaulic Company of America or equal.

5. Sleeve type couplings shall be Dresser Style 38 or 138 as manufactured by Dresser Industries or equal.

6. Flanged coupling adapters shall be Smith-Blair Type 913 or equal.

K. Fittings

1. Pipe fittings shall be ductile iron with a pressure rating of 250 psi. Fittings shall meet the requirements of AWWA C153 as applicable. Fittings shall have the same pressure rating, as a minimum, of the connecting pipe.

L. Sleeve Type Couplings

1. Sleeve-type couplings shall be as made by Dresser Mfg. Div., Bradford, PA; Smith-Blair, Inc., San Francisco, CA; R.H. Baker & Co., Inc., Huntington Park, CA; or equal.

2. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38; Smith-Blair Style 413; Baker Allsteel; or equal. The couplings shall be provided with black steel bolts and nuts unless indicated otherwise, except that couplings for buried pipe shall have cadmium plated bolts, washers and nuts.

3. Couplings shall be furnished with the pipe stop removed.

4. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

M. Wall Castings

1. Wall castings shall be of the sizes and types shown on the Drawings. Flanges and/or mechanical joint bells shall be drilled and tapped for studs where flush with the wall.

2. Wall castings shall be provided with an intermediate wall collar. The collar shall be located at the center of the overall length of casting for castings set flush with the wall. For castings which extend through the wall, the collar shall be located such that it is within the middle third of the wall. Collars shall either be cast integrally with the casting or shall be of the assembled type as manufactured by U.S. Pipe & Foundry Company, consisting of two mechanical joint retainer glands with gasket.

N. Base bends and base tees shall have machined and drilled bases.

O. Filler flanges and beveled filler flanges shall be furnished and installed as required. Filler flanges and beveled filler flanges shall be furnished faced and drilled complete with extra length bolts. Filler flanges shall be equal to Clow Fig. F-1984 and beveled filler flanges shall be equal to Clow Fig. F-1986.

P. Pipe Hangers and Supports

1. Pipe hangers and supports shall be provided at suitable distance along the pipeline regardless whether they are shown or not shown on the Drawings.

2. Pipe hangers and supports shall be as specified in Blue Book.

2.02 IDENTIFICATION

A. Each length of pipe and each fitting shall be marked with the name of the manufacturer, size, and class. All gaskets shall be marked with the name of the manufacturer, size, and proper insertion directions.

2.03 STRUCTURE AND MANHOLE CONNECTIONS

A. Pipe stubs for all manhole connections shall not exceed 24-inches in length. Caps shall be furnished where required.

PART 3 EXECUTION

3.01 INSTALLING DUCTILE IRON PIPE AND FITTINGS

A. All force mains shall be installed in accordance with recommendations of the pipe manufacturer and as specified herein.

B Care shall be taken in the handling, storage, and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installing, and no pipe that is found to be defective shall be installed. All damage to the pipe coatings shall be repaired according to the coating manufacturer's recommendations.

C. All pipe and fittings shall be kept clean and shall be thoroughly cleaned before installation.

D. Pipe shall be laid to the lines and grades shown on the Drawings with bedding and backfill as shown on the Drawings and as specified. Blocking under the pipe will not be permitted.

E. When installation is not in progress or the potential exists for dirt or debris to enter the pipe, the open ends of the pipe shall be closed with a plug or other approved means.

F. Under no circumstances shall the pipe or accessories be dropped into the trench.

3.02 FIELD TESTING

A. All pressure piping systems shall be field tested. The Contractor shall supply all labor, equipment, material, gages, pumps, valves, and incidentals required for testing.

B. The test pressure shall be 125 psi for Class 52 and thicker pipe or 100 psi for Class 50 pipe, unless noted otherwise. The test pressure shall be measured at the highest point along the test section by a recording type pressure gauge and a copy of the readout shall be submitted to the Engineer upon completion of the test.

C. Testing shall be conducted after backfilling has been completed and before placement of permanent surface.

D. Testing procedure shall be as follows:

1. Fill line slowly with water. Maintain flow velocity less than 2 feet per second.

2. Air shall be expelled through connections for air release valves installed at points of highest elevation where shown on the Drawings. Tapping of lined ductile iron pipe or fittings will not be permitted.
3. Apply test pressure as specified in Section 15051. Measure the quantity of water that must be pumped into the line to maintain pressure within 5 psi of the test pressure for period of 2 hours. This quantity is defined as leakage.

4. Carefully examine all exposed pipe, fittings, and joints during the test.

5. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the resident project representative at the point where the pressure is being monitored and shall show on the recorded pressure read-out submitted to the Engineer.

E. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\,(P)^{\frac{1}{2}}}{133{,}200}$$

in which L is the allowable leakage in gallons per hour; S is the length of pipe tested; D is the nominal diameter in inches; and P is the test pressure in psig.

F. If any test of pipe installed discloses leakage greater than that allowed, the Contractor shall, at no additional cost to the Owner, locate and repair the cause of leakage and retest the line.

G. All visible leaks are to be repaired regardless of the amount of leakage.

3.03 CLEANING FORCE MAINS

At the conclusion of the work, the Contractor shall thoroughly clean all of the new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed.

END OF SECTION

SECTION 02640

VALVES, HYDRANTS AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to provide all buried valves, valves in manholes and underground vaults, hydrants and appurtenances complete with actuators and all accessories as shown on the Drawings and as specified herein.

B. Valves specifically excluded from this Section are as follows:

1. All interior valves for process piping.

2. All valves for plumbing work.

3. All valves specifically included with equipment.

1.02 RELATED WORK

A. Trenching, backfilling and compaction are included in Blue Book.

B. Concrete is included in Division 3.

C. Valves and Pipe Specialties are included in Section 15100 and 15120 respectively.

D. Electrical work is included in Division 16.

1.03 SUBMITTALS

A. Submit materials required to establish compliance with these Specifications in accordance with Section 01300 for shop drawings. Submittals shall include but not be limited to the following:

1. Manufacturer's literature, illustrations, specifications and engineering data including:

a. Dimensions.

b. Size.

c. Materials of construction.

d. Weight.

e. Protection coating.

f. Actuator weight.

g. Calculations for actuator torque where applicable.

h. Wiring diagram including:

(1) Ladder diagrams.

(2) Point-to-point wiring.

B. Test Reports: Four copies of all certified shop test results specified herein.

C. Operation and Maintenance Manuals: Submit complete operation and maintenance manuals including copies of all approved Shop Drawings.

D. Certificates: Certificates of compliance where required by referenced standards: For each valve specified to be manufactured and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

1.04 REFERENCE STANDARDS

A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. American Water Works Association (AWWA)

1. AWWA C500 - Gate Valves, 3-in. through 48-in. NPS, for Water and Sewage Systems.

2. AWWA C502 - Dry-Barrel Fire Hydrants.

3. AWWA C504 - Rubber-Seated Butterfly Valves.

4. AWWA C509 - Resilient-Seated Gate Valves, 3-in. through 12-in. NPS, for Water and Sewage Systems.

C. American National Standards Institute (ANSI)

1. ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.

2. ANSI C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

D. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Gray Iron Castings.

2. ASTM A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings

3. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware

4. ASTM A276 - Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes.

5. ASTM A536 - Ductile Iron Castings.

E. Steel Structures Painting Council (SSPC)

1. SSPC SP-6 - Commercial Blast Cleaning

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Valves and appurtenances provided under this Section shall be the standard product in regular production by manufacturers whose products have proven reliable in similar service for at least five years. If required, the manufacturer shall furnish evidence of installation in satisfactory operation.

2. All units of the same type shall be the product of one manufacturer.

B. Design Criteria: All valves and appurtenances shall be new and in perfect working condition. Valves shall be designed for continuous use with a minimum of maintenance and service required and shall perform the required function without exceeding the safe limits for stress, strain or vibration. In no case will used or damaged valves be acceptable. The selection of equipment to meet the specified design conditions is the responsibility of the Contractor. Both workmanship and material shall be of the very best quality and shall be entirely suitable for the service conditions specified.

C. Source Quality Control

1. Valves shall be shop tested in accordance with the following:

a. Gate valves: AWWA C500.

b. Resilent Seated Gate Valves: AWWA C509

2. Obtain each type of valve from no more than one manufacturer.

3. Plug valves shall be hydrostatically tested for 30 minutes at two times the maximum working pressure with no evidence of distress, leakage or weeping in accordance with AWWA C504. Plug valves shall be capable of providing drip-tight shut-off up to the full pressure rating.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the work.

B. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of use.

C. Furnish covers for all openings.

1. All valves 3-in. and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.

2. All valves smaller than 3-in. shall be shipped and stored as above except that heavy card board covers may be furnished instead of wood.

D. Store equipment to permit easy access for inspection and identification. Any corrosion in evidence at the time of inspection for substantial completion shall be removed or the valve shall be removed from the job.

E. Store all equipment in covered storage off the ground.

1.07 COORDINATION

A. Review installation procedures under other Sections and coordinate with the work which is related to this Section including buried piping installation, site utilities, piping insulation, heating, ventilating and air conditioning, plumbing and chemical feed facilities.

B. Coordinate the location and placement of concrete thrust blocks, when required.

PART 2 PRODUCTS

2.01 GENERAL

A. All buried valves shall open counter-clockwise.

B. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

C. Valves shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.

D. Valves shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard to which they are manufactured cast in raised letters on some appropriate part of the body.

E. Unless otherwise noted, valves shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher, and suitable for the pressures noted where they are installed.

F. Valves shall be of the same nominal diameter as the pipe or fittings to which they connect. Except as otherwise noted, joints shall be mechanical joints with joint restraint where the adjacent piping is required to be restrained.

G. Valves shall be especially constructed for buried service.

2.02 GATE VALVES

A. General

1. Valves 2-1/2-in. and smaller shall be all bronze construction; valves 3-in. and larger shall be iron body, bronze mounted.

2. All gate valves shall conform to the requirements of AWWA C500, except as may be specifically modified herein.

B. Gate valves 2-1/2-in. and smaller

1. Screwed ends, solid wedge, rising stem and screwed-in bonnet with minimum nonshock working pressure of 150 psig.

2. Product and Manufacturer: Furnish valves as manufactured by one of the following:

a. Jenkins Brothers, Figure 47.

b. Crane Company, Figure 431-UB.

C. Gate valves 3-in. and larger

1. 250 psig working pressure

a. Valves shall be the resilent seated type with a minimum nonshock rating of 400 psig.

b. The design of the valves shall be such as to permit packing the valves without undue leakage while they are wide open and in service. Stuffing boxes shall be the O-ring type.

c. Extension stem diameters shall be as tabulated below:

Minimum Extension Stem

Valve Size (inches)	*Diameter (inches)*
3, 4	7/8
6	1
8	1-1/8
10, 12	1-1/4

d. Bolts and Nuts: Bolts and nuts shall be as described in the piping specifications.

e. Gaskets for Flanges: Gaskets for flanged end valves shall be as described in the piping specifications.

f. Furnish valves as manufactured by one of the following:

(1) Jenkins Brothers, Figure 204.
(2) American
(3) Mueller
(4) U.S. Pipe

(5) M&H
(6) McWane

2.03 BALL VALVES FOR PVC PIPE

A. Ball valves for PVC pipe shall be of PVC Type I with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Celanese Piping Systems, Inc.; Wallace and Tiernan Inc.; Plastiline, Inc.; or prior approved equal.

B. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

C. Ball valves with diameters 1/4 to 4-inches for above ground installations, where specified, shall be Tru Union type. All below ground valve installations for valves 3-inches and smaller in diameter shall be solvent cement welded joint type and all valves 4-inches and larger in diameter shall be of the push-on joint type.

2.04 TAPPING SLEEVES AND TAPPING VALVES

A. Tapping sleeves shall be of cast iron designated for working pressure not less than 200 psi. Armored end gaskets shall be provided for the full area of the sleeve flanges. Sleeves shall be as manufactured by A.P. Smith Division of U.S. Pipe; Mueller; JLM Industries, Inc.; Cascade Waterworks Mfg. Co.; or prior approved equal. Nuts and bolts shall be type 304 stainless steel or "Corten" conforming to ANSI A21.11 and A21.15 including ANSI B16.1.

B. Tapping valves shall conform to the requirements specified above for gate valves except that one end shall be flanged and one mechanical. Tapping valves shall be provided with an oversized opening to enable the use of full size cutters.

2.05 PLUG VALVES

A. All plug valves shall be of the nonlubricated, eccentric type with bodies and plugs of ASTM A126 Class B Cast Iron. Valves shall be rated for a minimum working pressure of 175 psi W.O.G. (Water, Oil, Gas) for valves 4-inch to 12-inch and 150 psi W.O.G. working pressure for sizes 14-inch and larger. The area at the valve port shall be at least 80 percent of the full pipe area. All valves shall open by turning counter-clockwise. Every valve shall be subjected to a hydrostatic and seat test results being certified.

B. Port openings for valves 24" and larger shall be 100% minimum regardless of published Cv factors.

C. Valves shall have balanced plug with a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be Chloroprene or resilient facing suitable for application.

D. Seats shall be a minimum 1/8" welded-in overlay of not less than 90 percent pure nickel on all surfaces contacting the plug face. Seat area shall be raised, with raised area completely covered

with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

E. Valves shall be furnished with bolted bonnets and externally adjustable and repackable multiple V-Ring type packing. Packing shall be replaceable without disassembling the valve or removing the bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

F. Corrosion-resistant, permanently-lubricated oil impregnated sleeve type metal type 316 ASTM A743 Grade CF8M bearings shall be provided at both ends of the valve shafts for valve sizes 4" - 36". For sizes larger than 36", the upper and lower plug journals shall be fitted with ASTM A240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.

G. Valves in vaults shall be flanged. Flange valves shall be faced and drilled to ANSI 125/150lb. Standard. Buried valves shall be supplied with mechanical joint ends conforming to AWWA Standard C111-64.

H. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc. as indicated on the plans. All valves 6-inches and larger shall be equipped with gear actuators. All gearing shall be enclosed in a cast iron housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. All actuator shafts shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed valve nuts, bolts, springs and washers shall be Type 316 stainless steel. Valve packing adjustment shall be accessible without disassembly of the actuator.

I. Valves and gear actuators and actuator mounting brackets for buried or submerged service shall have metal enclosed spring loaded rubber seals on all shafts on the valve and actuator covers to prevent entry of water and/or dirt. Actuator mounting brackets for buried or submerged service shall be totally enclosed. All buried or exposed pipe connection nuts, bolts, and washers shall be Type 316 stainless steel or low alloy, high strength steel equal to "Corten" conforming to ANSI B16.1 for Class 125 rating

J. Plug valves installed such that actuators are 6 feet or more above the floor shall have chain wheels.

K. All plug valves shall be installed so the direction of flow through the valve is in accordance with the manufacturer's recommendations.

L. All exterior hardware on valves shall be of Type 316 stainless steel.

M. Plug valves shall be as manufactured by Milliken.

2.06 CORPORATION STOPS

A. Corporation stops shall be brass with Mueller-type threads, not less than 1-in. in diameter and shall be installed where shown, specified or required. Corporation stops for use with service clamps shall have IPS threads.

B. Furnish corporation stops as manufactured by the following:

1. Mueller Company, Figure H-10003.

2.07 YARD HYDRANTS

A. Yard hydrants shall be of the anti-freezing type with a 1-in. hose nozzle and a 1-in. inlet connection. Yard hydrants shall be set at the locations as shown in the Drawings and shall have a depth of bury that will meet the elevations given in the Drawings. Yard hydrants shall be Series No. 71700 post type hydrant by Josam Manufacturing Co., Michigan City, IN or equal.

B. Caution sign shall be provided on each yard hydrant connected to the plant water system. Signs shall be of the plastic laminate type, suitable for outdoor application. The signs shall be a minimum of 1/8-in. thickness. Laminate shall be red in white. Signs shall be mounted to the yard hydrants using stainless steel No. 16 single jack chain. Signs shall be square cornered, approximately 3-in. by 8-in. with the following engraved text in ¾-in. high letters: PLANT WATER – UNFIT FOR DRINKING.

2.08 CURB STOPS

A. Curb stops shall be bronze with copper fittings and shall be of the inverted key type with base cap and stops.

2.9 SURFACE PREPARATION AND SHOP COATINGS

A. The interior ferrous metal surfaces, except finished or bearing surfaces, shall be blast cleaned in accordance with SSPC SP-6 and painted with two coats of an approved two-component coal tar epoxy coating specifically formulated for potable water use. The coating used must appear on the current edition of the United States Environmental Protection Agency's list entitled "Accepted Categories and Subcategories of Coatings, Liners and Paints for Potable Water Usage."

B. Exterior ferrous metal surfaces of all buried valves and hydrants shall be blast cleaned in accordance with Section 09902 and given two shop coats of a heavy coat tar enamel or an approved two-component coat tar epoxy paint.

C. Exterior ferrous metal surfaces of all nonburied valves shall be shop painted with one coat of primer in accordance with the requirements of Section 09901.

D. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating. Mounting surfaces shall be especially coated with a rust preventative.

E. Special care shall be taken to protect uncoated items and plastic items, especially from environmental damage.

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

A. During installation of all valves and appurtenances, verify that all items are clean, free of defects in material and workmanship, and function properly.

B. All valves shall be closed and kept closed until otherwise directed by the Engineer.

3.02 INSTALLATION OF BURIED VALVES AND VALVE BOXES

A. Buried valves shall be cleaned and manually operated before installation. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping pipe bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. The valve box shall be set so as not to transmit traffic loads to the valve.

B. Before backfilling, all exposed portions of any bolts shall be coated with two coats of bituminous paint comparable to Bitumastic No. 50 by Kop-Coat, Inc.

C. Install valve floorstand operators with stainless steel bolts.

3.03 FIELD TESTS AND ADJUSTMENTS

A. Conduct a functional field test of each valve, including actuators and valve control equipment, in presence of Engineer to demonstrate that each part and all components together function correctly. All testing equipment required shall be furnished by the Contractor.

3.04 MANUFACTURER'S SERVICE

A. Furnish the services of a qualified representative of the tapping equipment manufacturer to provide on-site instruction during wet tapping of the existing water mains indicated on the Drawings.

B. Following installation of the plug, gate and butterfly valves, furnish the services of a qualified, factory-trained representative of the manufacturer of the respective valves, to check the installations before they are placed in operation, supervise initial operations and testing in the presence of the Engineer, instruct the plant personnel in care and maintenance of the equipment, and make all necessary field adjustments. A minimum of one 8-hour day, which may not necessarily be consecutive, shall be provided for these services. In the event of trouble with the equipment, the representative of the respective manufacturer shall revisit the site as often as necessary until all troubles are corrected and the installation is entirely satisfactory.

END OF SECTION

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SECTION 02658

CONNECTIONS TO AND WORK ON THE EXISTING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required to maintain flow in existing drains, gravity sewers, force mains, and water lines as well as construct and maintain all temporary connections and bypasses and construct the permanent connections to the new systems as shown on the Drawings and as directed by the Engineer.

B. Furnish all labor, materials and equipment required to plug existing sections of process piping and all additional work required.

C. Should damage of any kind occur to the facilities at the Contractor's own expense and as part of the work under this Item, make repairs to the satisfaction of the Engineer.

D. Notify the Engineer immediately of any discrepancies in elevations of existing structures or process lines between those shown on the Drawings and those established during construction in order that the Engineer can make the necessary modifications.

E. All new pipe for connection shall conform to the pipe specifications in Section 02610, 02622, and 02623.

1.02 RELATED WORK

A. Construction Sequence is included in Section 01014.

B. Excavation, Backfilling, and Compaction are included in Blue Book.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 HANDLING WASTEWATER FLOWS

A. Furnish all labor, equipment and materials necessary to maintain existing flows, including temporary bypasses and all pumping of wastewater that may be required to prevent backing up of the system and immediately cart away and remove all offensive matter at Contractor's own expense.

B. Permission will not be given to overflow, bypass, pump or by any other means convey wastewater "or other process liquids" to any brook or other water course without permission of the Engineer.

C. Submit to the Engineer for approval a detailed written plan of all methods of flow maintenance ten days in advance of flow interruption.

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and design, install and remove formwork for cast-in-place concrete as shown on the Drawings and as specified herein.

B. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts and other items furnished under other Sections and required to be cast into concrete.

1.02 RELATED WORK

A. Concrete Reinforcement is included in Section 03200.

B. Concrete Joints and Joint Accessories are included in Section 03250.

C. Cast-in-Place Concrete is included in Section 03300.

D. Concrete finishes are included in Section 03350.

E. Precast, prestressed concrete is included in Section 03420.

F. Grout is included in Section 03600.

G. Modifications to Existing Concrete are included in Section 03740.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Form release agent

2. Form ties

B. Samples: Demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated or otherwise finished and will not affect the forming materials.

C. Certificates: Certify that form release agent complies with Federal, State and Local VOC limitations.

1.04 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete

2. ACI 318 - Building Code Requirements for Reinforced Concrete

3. ACI 347 - Formwork for Concrete

B. American Plywood Association (APA)

1. Material grades and designations as specified

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 DESIGN OF FORMS

A. Structural design responsibility: All forms and shoring shall be designed at the Contractor's expense by a professional engineer registered in the State of Louisiana. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 and as recommended in ACI 347 and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete.

PART 2 PRODUCTS

2.01 GENERAL

A. The usage of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configurations desired.

2.02 MATERIALS

A. Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved. All forms shall be designed and constructed to provide a uniform concrete surface requiring minimal finishing or repairs.

B. Wall Forms

1. Forms for all exposed exterior and interior concrete walls shall be new and unused "Plyform" exterior grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group, or equal acceptable to the Engineer. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding.

2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging outward or creating surface patterns.

3. Forms for circular structures shall conform to the circular shape of the structure. Straight panels may not be substituted for circular panels.

C. Column Forms

1. Rectangular columns shall be formed as specified for wall forms. All corners shall have a 3/4-in chamfer unless otherwise noted on the Drawings.

2. Circular columns shall be formed with steel, fiberglass reinforced plastic, or seamless cardboard column forms. The forms shall be continuous for the height of the column between construction joints indicated on the Drawings unless otherwise approved by the Engineer.

D. Rustications shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

E. Form Release Agent: Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water based, bond-breaking form coating unless otherwise noted.

F. Form Ties

1. Form ties encased in concrete other than those specified in the following paragraphs shall be designed so that, after removal of the projecting part, no metal shall remain within 1-1/2-in of the face of the concrete. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a wood or metal cone at least 1/2-in diameter and 1-1/2-in long. Form ties in concrete exposed to view shall be the cone-washer type.

2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.

3. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1-1/2-in and sufficient dimensions to permit proper patching of the tie hole.

4. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie.

5. Common wire shall not be used for form ties.

6. Alternate form ties consisting of tapered through-bolts at least 1-in in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain Engineer's acceptance of system and spacing of ties prior to ordering or purchase of forming. Clean, fill and seal form tie hole with non-shrink cement grout. The Contractor shall be responsible for watertightness of the form ties and any repairs needed.

PART 3 EXECUTION

3.01 GENERAL

A. Forms shall be used for all cast-in-place concrete including sides of footings. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions and appearance indicated on the Drawings.

B. Forms for walls shall have removable panels at the bottom for cleaning, inspection and joint surface preparation. Forms for walls of considerable height shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, prevent segregation and prevent the accumulation of hardened concrete on the forms above the fresh concrete.

C. Molding, bevels, or other types of chamfer strips shall be placed to produce blockouts, rustications, or chamfers as shown on the Drawings or as specified herein. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a 3/4-in chamfer. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealants manufacturer's recommendations.

D. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.

E. Before form material is re-used, all surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn and all protrusions smoothed. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

3.02 FORM TOLERANCES

A. Forms shall be surfaced, designed and constructed in accordance with the recommendations of ACI 347 and shall meet the following additional requirements for the specified finishes.

B. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/32-in and forms for plane surfaces shall be such that the concrete will be plane within 1/16-in in 4-ft. Forms shall be tight to prevent the passage of mortar, water and grout. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-in from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.

C. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.

D. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1-in.

E. Formed concrete Surfaces to Receive Paint: Surface deflections shall be limited to 1/32-in at any point and the variation in wall deflection shall not exceed 1/16-in per 4-ft. The maximum deviation

of the finish wall surface at any point shall not exceed 1/4-in from the intended surface as shown on the Drawings.

3.03 FORM PREPARATION

A. Wood forms in contact with the concrete shall be coated with an effective release agent prior to form installation.

B. Clean, repair, remove projecting nails, fill holes, and smooth protrusions or all forms surfaces to be in contact with concrete before reuse. Do not reuse forms for exposed concrete unless a "like new" condition of the form is maintained that will produce surfaces equivalent in smoothness and appearance to those produced by new plywood panels.

C. Steel forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those utilized for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

3.04 REMOVAL OF FORMS

A. The Contractor shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347. Form removal shall conform to the requirements specified in Section 03300.

3.05 INSPECTION

A. The Engineer shall be notified when the forms are complete and ready for inspection at least 6 hours prior to the proposed concrete placement.

B. Failure of the forms to comply with the requirements specified herein, or to produce concrete complying with requirements of this Section, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair for replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all concrete reinforcement complete as shown on the Drawings and as specified herein.

B. Furnish only all the deformed steel reinforcement required to be entirely built into the concrete masonry unit construction.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Joint and Joint Accessories are included in Section 03250.

C. Cast-in-place Concrete is included in Section 03300.

D. Grout is included in Section 03600.

E. Concrete Electrical Duct Encasement is included in Section 03800.

F. Masonry is included in Blue Book.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Reinforcing steel. Placement drawings shall conform to the recommendations of ACI 315. All reinforcement in a concrete placement shall be included on a single placement drawing or cross-referenced to the main pertinent placement drawing. This drawing shall include the additional reinforcement (around openings, at corners, etc) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.

2. Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.

B. If requested by the ENGINEER, submit two samples of each type of mechanical reinforcing steel connectors.

C. Submit Test Reports, in accordance with Section 01300, of each of the following items.

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.

2. Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement required.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

3. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

6. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

7. ASTM A616 - Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

8. ASTM A617 - Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

9. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

10. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

11. ASTM A775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

12. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

B. American Concrete Institute (ACI)

1. ACI 301 - Specifications for Structural Concrete for Buildings

2. ACI 315 - Details and Detailing of Concrete Reinforcement.

3. ACI 318 - Building Code Requirements for Reinforced Concrete

4. SP-66 (ACI 315) ACI Detailing Manual

C. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice

D. American Welding Society (AWS)

1. AWS D1.4 - Structural Welding Code Reinforcing Steel

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 DELIVERY, HANDLING AND STORAGE

A. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

B. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placing Drawings.

C. Reinforcing steel shall be stored off the ground, protected from moisture and kept free from dirt, oil, or other injurious contaminants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be new, of domestic manufacture and shall comply with the following material specifications.

B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.

C. Concrete Reinforcing Bars required on the Drawings to be Field Bent or Welded: ASTM A706.

1. ASTM A615, Grade 60 for hot-rolled plain or deformed bars.

2. ASTM A82 for cold-drawn wire.

D. Welded Steel Wire Fabric: ASTM A185.

E. Welded Deformed Steel Wire Fabric: ASTM A497.

F. Welded Plain Bar Mats: ASTM A704 and ASTM A615 Grade 60 plain bars.

G. Fabricated Deformed Steel Bar Mats: ASTM A184 and ASTM A615 Grade 60 deformed bars.

H. The following alternate materials are allowed:

1. ASTM A615 Grade 60 may be used for ASTM A706 provided the following requirements are satisfied:

a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3000 psi.

b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.

c. The carbon equivalency (CE) of ASTM A615 bars shall be 0.55 or less.

I. Reinforcing Steel Accessories

1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 - Maximum Protection.

2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 - Moderate Protection.

3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks. Blocks shall have equal or greater strength than the surrounding concrete.

J. Tie Wire: Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire.

K. Mechanical reinforcing steel butt splices may be used if approved by the ENGINEER. These shall be positive connecting taper threaded type employing a hexagonal coupler such as Lenton rebar splices as manufactured by Erico Products Inc., Solon, OH or equal. They shall meet all ACI 318 Building Code requirements. Bar ends must be taper threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement. Bar couplers shall be torqued to manufacturer's recommended value.

1. Unless otherwise noted on the Drawings, mechanical tension splices shall be designed to produce a splice strength in tension or compression of not less than 125 percent of the ASTM specified minimum yield strength of the rebar.

2. Compression type mechanical splices shall provide concentric bearing from one bar to the other bar and shall be capable of developing the ultimate strength of the rebar in compression.

2.02 FABRICATION

A. Fabrication of reinforcement shall be in compliance with the CRSI Manual of Standard Practice.

B. Bars shall be cold bent. Bars shall not be straightened or rebent.

C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the CRSI.

D. Bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded, shall have the applicable end(s) saw-cut. Such ends shall terminate in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

E. Spirals

1. Provide a minimum of 1-1/2 finishing turns at the top and bottom.

2. Splices shall be tension lap splices at least 48 bar diameters, but not less than 12-in. in length. Welded splices shall only be used where specifically approved by the Engineer.

3. Provide spacers as recommended by the CRSI.

PART 3 EXECUTION

3.01 INSTALLATION

A. Surface condition, bending, spacing and tolerances of placement of reinforcement shall comply with the CRSI Manual of Standard Practice. The Contractor shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.

B. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.

C. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified herein, or unless prior written approval has been obtained from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.

D. Reinforcing steel interfering with the location of other reinforcing steel, conduits or embedded items, may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference, shall only be made with the approval of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the Engineer.

E. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.

F. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the Engineer. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld or otherwise repair as directed by the Engineer. Do not bend reinforcement after it is embedded in concrete.

3.02 REINFORCEMENT AROUND OPENINGS

A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.03 SPLICING OF REINFORCEMENT

A. Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30 bar diameters, but not less than 12-in. The lap splice length for column vertical bars shall be based on the bar size in the column above.

B. Tension lap splices shall be provided at all laps in compliance with ACI 318. Splices in adjacent bars shall be staggered. Class A splices may be used when 50 percent or less of the bars are spliced within the required lap length. Class B splices shall be used at all other locations.

C. Except as otherwise indicated on the Drawings, splices in circumferential reinforcement in circular walls shall be Class B tension splices and shall be staggered. Adjacent bars shall not be spliced within the required lap length.

D. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125 percent of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class C splice.

E. Install wire fabric in as long lengths as practicable. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI-318 but not less than 12-in. The spliced fabrics shall be tied together with wire ties spaced not more than 24-in on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.

F. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings and approved by the ENGINEER. Splices in adjacent bars shall be offset by at least 30 bar diameters. Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the Engineer.

G. After installation of mechanical splicers, on zinc-coated or epoxy-coated reinforcement, coating damage shall be repaired in accordance with the applicable ASTM standard. All parts of mechanical connectors used on coated bars including steel splice sleeves, bolts and/or nuts shall be coated with the same material used for the repair of coating damage.

3.04 ACCESSORIES

A. Determine, provide and install accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.

B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.

C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified herein.

D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

3.05 INSPECTION

A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been observed by the Engineer and the Engineer's release to proceed with the concreting has been obtained. The Engineer shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his/her observations of the reinforcing steel.

END OF SECTION

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SECTION 03250

CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Cast-In-Place Concrete is included in Section 03300.

D. Concrete Finishes are included in Section 03350.

E. Grout is included in Section 03600.

F. Modifications to Existing Concrete are included in Section 03740.

G. Miscellaneous Metals are included in Section 05500.

H. Sealants and Caulking are included in Section 07920.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data. Submittals shall include at least the following:

1. Waterstops: Product data including catalogue cut, technical data, storage requirements, splicing methods and conformity to ASTM standards.

2. Premolded joint fillers: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

3. Bond breaker: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

4. Expansion joint dowels: Product data on the complete assembly including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements and conformity to ASTM standards.

5. Compressible joint filler: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

6. Bonding agents: Product data including catalogue cut, technical data, storage requirements, product life, application requirements and conformity to ASTM standards.

B. Certifications

1. Certification that all materials used within the joint system are compatible with each other.

2. Certify that sealant is acceptable for intended use.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

2. ASTM B127 - Standard Specification for Nickel-Copper Alloy (UNS NO4400) Plate, Sheet and Strip.

3. ASTM B164 - Standard Specification for Nickel-Copper Alloy Rod, Bar and Wire.

4. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

5. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

6. ASTM D1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types).

7. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. U.S. Army Corps of Engineers (CRD).

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

C. Federal Specifications

1. FS SS-S-210A - Sealing Compound for Expansion Joints.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Provide services of a manufacturer's field representative of the sealant who has performed at least five projects of similar size and complexity within the last 5 years. The field representative shall be present at the work site prior to any mixing of components to instruct on mixing, application and inspection procedures and to inspect the finish of the prepared surfaces prior to application of the sealant.

B. The manufacturer's field representative shall make at least one additional visit to the site as the work progresses and shall report on each visit to the Contractor and the Engineer, advising as to whether the application is being performed in accordance with this Section and the Manufacturer's printed instructions.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original, unopened containers displaying the manufacturer's label showing manufacturer name, product identification, and batch number.

B. Store products as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

2.02 MATERIALS

A. Injected Tube Waterstops - Non-expansion joint. The permeable injection tubes shall be composed of a reinforcing spiral covered with an inner and outer protective membranes. The injected material shall be a polyurethane grout with an accelerator system. The accelerator shall be capable of controlling the reaction time up to one hour. After reaction, the polyurethane grout shall form a flexible closed cell polyurethane foam. The system shall be INJECTO with Flex LV resin by DeNeef America, Inc.; ULTRA SEAL System with AKWASEAL grout by Colloid Environmental Technologies Co., Arlington Heights, IL, or equal.

B. Premolded Joint Filler

1. Premolded joint filler - structures. Self-expanding cork, premolded joint filler shall conform to ASTM D1752, Type II. The thickness shall be 3/4-in unless shown otherwise on the Drawings.

2. Premolded joint filler - sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings. The joint filler shall be asphalt-impregnated fiber board conforming to ASTM D1751. Thickness shall be 3/4-in unless otherwise shown on the Drawings.

C. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.

2. Except where tape is specifically called for on the drawings, bond breaker for concrete shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors Inc.; Silcoseal 77, by SCA Construction Supply Division, Superior Concrete Accessories or equal.

D. Expansion Joint Dowels

1. Dowels shall be smooth steel conforming to ASTM A675, Grade 70. Dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04-in on the diameter of the dowel and extends no more than 0.04-in from the end. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end. Caps shall allow for at least 1-1/2-in of expansion.

2. Expansion Dowel Caps: No. 87 dowel caps by Heckmann Building Products, Inc.; type F-46 dowel caps by the Dayton Superior Corporation; DT-8 Dowel Bar Expansion Tube by Meadow Steel Products, Inc., or equal.

E. Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881. The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of Lyndhurst, N.J.; Concresive Liquid (LPL) by Master Builders of Cleveland, OH or equal.

F. Sealant: Provide sealant for joints in horizontal surfaces conforming to ASTM C920, Type S or M, Grade P or NS, Class 25. Provide sealant for joints in sloping and vertical surfaces conforming to ASTM C920, Type S or M, Grade NS, Class 25. Provide Use T sealant in pedestrian and vehicular traffic areas and Use NT in non-traffic areas.

G. Neoprene Bearing Pads: Neoprene Bearing Pads: 50 durometer conforming to AASHTO Standard Specifications for Highway Bridges.

PART 3 EXECUTION

3.01 INSTALLATION

A. Waterstops

1. Install waterstops for all joints where shown on the Drawings. Provide waterstops continuous around all corners and intersections so that a continuous seal is provided. Make splices in accordance with the manufacturer's recommendations. Use only manufacturer's special approved tools.

2. Secure waterstops in wall joints before concrete is placed.

3. Provide a minimum number of splices in waterstop.

4. Injected tube waterstops shall be installed in conformity with the manufactures recommendations. Injection ports shall not be spaced greater than 25 feet. The joint surfaces shall be wire brushed and scraped as necessary to expose an uncontaminated surface. The joint shall then be cleaned with pressurized air to remove all residue and debris. Immediately prior to resin injection, the injection tubes shall be flushed with water to clean and moisten the full length of the tube. Resin injection shall be in accordance with the manufacturer's recommendations. The injection tube shall be sealed and injection commenced on the next adjacent tube prior to the setting of the resin.

B. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor, must be submitted to the Engineer for written approval.

2. Additional or relocated joints should be located where they least impair strength of the member. In general, locate joints within the middle third of spans of slabs, beams and girders. However, if a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.

3. All joints shall be perpendicular to main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. When joints in beams are allowed, provide a shear key and inclined dowels as approved by the Engineer.

4. Provide sealant grooves for joint sealant where indicated on the Drawings.

5. At all construction joints and at concrete joints designated on the Drawings to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points or side to side) of approximately 1/4-in to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding. At least 2 hours before and again shortly before the new concrete is deposited, the joints and adjacent concrete surfaces to at least 12-in past the joint shall be saturated with water. After glistening water disappears, the joints shall be given a thorough coating of neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-in thick, well scrubbed-in by means of stiff bristle brushes whenever possible. Horizontal wall joints with no access to the earlier concrete placement surface shall have the roughened surface thoroughly coated with a neat cement slurry of pouring consistency. New concrete shall be deposited before the neat cement dries.

6. In lieu of the above method for bonding plastic concrete to hardened concrete, the following optional method may be used. Concrete must be allowed to set a minimum of 28 days. Use an epoxy bonding agent applied to roughened and cleaned surfaces of set concrete in strict accordance with manufacturer's recommendations and as specified in Section 03740 with respect to preparation of surfaces and applications of bonding agent.

7. Provide waterstops in all wall and slab construction joints in liquid containment structures and at other locations shown on the Drawings.

8. Keyways shall not be used in construction joints unless specifically shown on the Drawings or approved by the Engineer.

D. Expansion Joints

1. Make expansion joints at locations indicated on drawings. Do not eliminate expansion joints.

2. Do not extend through expansion joints, reinforcement or other embedded metal items that are continuously bonded to concrete on each side of joint.

3. Position premolded joint filler material accurately. Secure the joint filler against displacement during concrete placement and compaction. Place joint filler over the face of the joint, allowing for sealant grooves as detailed on the Drawings. Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as shown on the Drawings.

4. Expansion joints shall be 1-in in width unless otherwise noted on the Drawings.

5. Where indicated on Drawings, install smooth dowels at right angles to expansion joints. Align dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the Drawings, apply oil or grease to one end of all dowels through expansion joints. Provide plastic expansion caps on the lubricated ends of expansion dowels.

6. Provide center bulb type waterstops in all wall and slab expansion joints in liquid containment structures and at other locations shown on the Drawings.

E. Control Joints

1. Make control joints at locations shown on the drawings. Do not eliminate control joints.

2. Provide sealant grooves, sealants and waterstops at control joints in slabs on grade or walls as detailed. Provide waterstops at all wall and slab control joints in water containment structures and at other locations shown on the Drawings.

3. Extend every other bar of reinforcing steel through control joints or as indicated on the Drawings. Where specifically noted on the Drawings, coat the concrete surface with a bond breaker prior to placing new concrete against it. Avoid coating reinforcement or waterstops with bond breaker at these locations.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.

B. Furnish all sampling and testing of products and materials by an independent testing laboratory acceptable to the Engineer but engaged by and at the expense of the Contractor.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joint Accessories are included in Section 03250.

D. Concrete Finishes are included in Section 03350.

E. Grout is included in Section 03600.

F. Concrete Electrical Duct Encasement is included in Section 03800.

G. Moisture Protection is included in Division 7.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data shall include the following:

1. Sources of cement and aggregates.

2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.

3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

4. Water reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

5. High range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature

considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.

6. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.

7. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM standards. Identify proposed locations of use.

B. Samples: Fine and coarse aggregates if requested for examination by the Engineer.

C. Test Reports

1. Sieve analysis, mechanical properties and deleterious substance content for coarse and fine aggregate.

2. Chemical analysis and physical tests of each type of cement.

3. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water cementitious ratio, concrete slump, type and manufacturer of cement.

   a. Standard deviation data for each proposed concrete mix based on statistical records.

   b. Water cementitious ratio curve for concrete mixes based on laboratory tests. Give average cylinder strength test results at 28 days for laboratory concrete mix designs. Provide results of 7 and 14 day tests if available.

D. Certifications

1. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

2. Certify admixtures are suitable for use in contact with potable water after 30 days of concrete curing.

3. Certify curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

4. Certify the Contractor is not associated with the independent testing laboratory nor does the Contractor or its officers have a beneficial interest in the laboratory.

5. Shrinkage test reports.

E. Qualifications: Independent testing laboratory: Name, address and qualifications. Laboratories affiliated with the Contractor or in which the Contractor or its officers have a beneficial interest are not acceptable.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete
7. ASTM C150 - Standard Specification for Portland Cement
8. ASTM C157 -Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
9. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
14. ASTM C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
15. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
16. ASTM C596 - Standard Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
17. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

B. American Concrete Institute (ACI).

1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

2. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.

3. ACI 304.2R - Placing Concrete by Pumping Methods.

4. ACI 305R - Hot Weather Concreting.

5. ACI 306R - Cold Weather Concreting.

6. ACI 318 - Building Code Requirements for Reinforced Concrete.

7. ACI 350R - Environmental Engineering Concrete Structures.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Only one source of cement and aggregates shall be used. Concrete shall be uniform in color and appearance.

B. Well in advance of placing concrete, discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops and curing. Propose methods of hot and cold weather concreting as required.

C. Concrete Conference

1. A meeting to review the detailed requirements of the CONTRACTOR's proposed concrete design mixes and to determine the procedures for producing proper concrete construction shall be held no later than 14 days after the notice to proceed.

2. All parties involved in the concrete work shall attend the conference, including but not limited to the following:

CONTRACTOR's representative
Testing laboratory representative
Concrete subcontractor
Reinforcing steel subcontractor and detailer
Concrete supplier
Admixture manufacturer's representative

3. The conference shall be held at a mutually agreed upon time and place. The ENGINEER shall be notified no less than 5 days prior to the date of the conference.

D. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at the Contractor's expense.

E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at his/her expense, make new acceptance tests of aggregates and establish new design mixes. Such testing and design shall be accomplished with the assistance of an independent testing laboratory acceptable to the Engineer.

F. Reinforced concrete shall comply with ACI 318, the recommendations of ACI 350R and other stated requirements, codes and standards.

G. All field testing and inspection services required will be provided by the Owner. The cost of such work, except as specifically stated otherwise, shall be paid for by the Owner. Methods of testing will comply with the latest applicable ASTM methods.

H. Samples of constituents and of concrete as-placed will be subjected to laboratory tests. All materials incorporated in the work shall conform to accepted samples.

1.06 DELIVERY, STORAGE AND HANDLING

A. Cement: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.

B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3-ft in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.

D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

E. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.

F. Liquid Curing Compounds: Store in closed containers.

1.07 CONSTRUCTION TOLERANCES

A. The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.

1. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown: All tolerances must comply with manufacturers requirements. The elevation of the aeration basins and clarifiers top of wall cannot vary more than 1/4-inch throughout the entire circumference.

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch; In 20 feet or more: -inch
Variation from the level or from the grades shown.	In 10 feet: 1/4-inch In 20 feet or more: -inch
Variation from the plumb.	In 10 feet: 1/4-inch In 20 feet or more: -inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus -inch
Variation in the locations and sizes of slabs and wall openings.	Plus or minus 1/4-inch

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

A. Materials shall comply with this Section and any applicable State or local requirements.

B. Cement: Domestic portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the Engineer and one brand shall be used throughout the Work. The following cement type(s) shall be used:

1. Class A & B Concrete - Type I

2. Class D Concrete - Type II

C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.

D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 1 herein.

E. Water: Potable water free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall

be from the same manufacturer. Admixtures shall be compatible with the concrete mix including other admixtures and shall be suitable for use in contact with potable water after 30 days of concrete curing.

1. Air Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

2. Water Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

3. High-Range Water Reducer (Plasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water reducing or high range water reducing admixtures.

G. Flyash shall not be used.

H. Sheet Curing Materials. Waterproof paper, polyethylene film or white burlap-polyethylene sheeting all complying with ASTM C171.

I. Liquid Curing Compound. Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compound shall be approved for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

2.03 MIXES

A. Development of mix designs and testing shall be by an independent testing laboratory acceptable to the Engineer engaged by and at the expense of the Contractor.

B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.

C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if not available, be developed by laboratory tests. Water content of the concrete shall be based on a curve showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the compressive strengths specified, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to

strengths 16 percent greater than the required design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.

D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the compression strength requirements in conformity with the provisions of ACI 318.

E. Shrinkage Tests: Perform shrinkage tests on the design mix for Class D concrete. The tests shall conform to ASTM C157 as modified by ASTM C596. Concrete and not mortar specimens shall be used. The average shrinkage at 28 days of air storage shall not exceed 0.036 percent.

F. Entrained air, as measured by ASTM C231, shall be as shown in Table 1. If the air entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal required under Paragraph 1.03 above.

G. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1. If plasticizer is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.

H. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 1

Class	Design Strength (1)	Fine Cement (2)	Coarse Aggregate (2)	Cementitious Aggregate (3)	Content (4)
A	2500	C150 Type I	C33	57	440
B	3000	C150 Type I	C33	57	480
D	4000	C150 Type II	C33	57	560

Class	W/C Ratio (5)	AE Range (6)	WR (7)	HRWR (8)	Slump Range (in.)
A	0.60 max.	3.5 to 5	Yes	No	1-4
B	0.50 max.	3.5 to 5	Yes	No	1-3
D	0.45 max.	3.5 to 5	Yes	No	3-4

NOTES:
(1) Minimum compressive strength in psi at 28 days
(2) ASTM designation
(3) Size Number in ASTM C33
(4) Minimum cementitious content in lbs/cu yd
(5) W/C is Water Cementitious ratio by weight
(6) AE is percent air entrainment
(7) WR is water reducing admixture
(8) HRWR is high range water reducer

PART 3 EXECUTION

3.01 MEASURING MATERIALS

A. Concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant.

B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Scales shall have been certified by the local Sealer of Weights and Measures within 1 year of use.

C. Measure the amount of free water in fine aggregates within 0.3 of a percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.

D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.

1. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.

2. Inject multiple admixtures separately during the batching sequence.

3.02 MIXING AND TRANSPORTING

A. Concrete shall be ready-mixed concrete produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.

B. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.

C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

D. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.

E. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.

F. Retempering of concrete or mortar which has partially hardened (that is, mixing with or without additional cement, aggregate, or water) will not be permitted.

G. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

H. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of transit mix truck.

I. Temperature and Mixing Time Control

1. In cold weather (see Paragraph 3.06D below) maintain the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms as indicated in Table 2.

2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.

3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.

4. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the following:

TABLE 2

AIR OR CONCRETE TEMPERATURE (WHICHEVER IS HIGHER)	***MAXIMUM TIME***
(27 Degree C) 80 to 90 Degree F	(32 Degree C)...45 minutes
(21 Degree C) 70 to 79 Degree F	(26 Degree C)...60 minutes
(5 Degree C) 40 to 69 Degree F	(20 Degree C)...90 minutes

If an approved high range water reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

3.03 INSPECTION AND COORDINATION

A. The batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing

and the alignment, cleanliness and tightness of formwork. No placement shall be made without the inspection and acceptance of the Engineer.

3.04 CONCRETE APPEARANCE

A. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:

1. The gradation of aggregate.

2. The proportion of fine and coarse aggregate.

3. The percentage of entrained air, within the allowable limits.

B. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete when viewed in good lighting from 10-ft away shall be pleasing in appearance, and at 20-ft shall show no visible defects.

3.05 PLACING AND COMPACTING

A. Placing

1. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the pour who can assure that reinforcement and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.

3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.

4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.

5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.

6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.

7. Slabs

   a. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edgeform, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.

   b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

   c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

   a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottom of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12 to 24-in lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7-ft and the maximum free fall of concrete shall not exceed 15-ft.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading, etc, shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.

2. All concrete shall be placed and compacted with mechanical vibrators. The number, type and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.

3. A minimum frequency of 7000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30-in apart. At each insertion, vibrate sufficiently to

consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8-in thick shall be consolidated with vibrating screeds; slabs 8 to 12-in thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.

5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. The vibrators shall be inserted vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:

   a. Frequency returns to normal.

   b. Surface appears liquefied, flattened and glistening.

   c. Trapped air ceases to rise.

   d. Coarse aggregate has blended into surface, but has not disappeared.

3.06 CURING AND PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Curing Methods

1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:

   a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.

   b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.

   c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is

visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.

2. Specified applications of curing methods.

   a. Slabs for Water Containment Structures: Water curing only.

   b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.

   c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.

   d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.

   e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.

   f. Concrete Joints: Water cured or sheet material cured.

C. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

D. Cold Weather Concreting:

1. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.

2. Concrete placed during cold weather shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 306R and the additional requirements specified herein.

3. Discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.

4. The minimum temperature of concrete immediately after placement and during the protection period shall be as indicated in Table 3. The temperature of the concrete in place and during the protection period shall not exceed these values by more than 20 degrees F. Prevent overheating and non-uniform heating of the concrete.

TABLE 3

Concrete Temperatures Minimum Dimension of Section

	≤ 12-in	12 to 36-in
Min. conc temp:	55 Degree F	50 Degree F

5. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.

   a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (eg: 5 days at an average 70 degrees F = 350 degree-days).

   b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.

6. Salt, manure or other chemicals shall not be used for protection.

7. At the end of the protection period, allow the concrete to cool gradually to the ambient temperature. If water curing has been used, the concrete shall not be exposed to temperatures below those shown in Table 3 until at least 24 hours after water curing has been terminated.

8. During periods not defined as cold weather, but when freezing temperatures are expected or occur, protect concrete surfaces from freezing for the first 24 hours after placing.

E. Hot Weather Concreting

1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation as estimated in ACI 305R, approaching or exceeding 0.2 lbs/sq ft/hr).

2. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R and the additional requirements specified herein.

   a. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.

   b. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the job and to provide vibration immediately after placement.

   c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.

3. Discuss with the Engineer a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

3.07 REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 30 percent of its specified design strength, nor before reaching the following number of day-degrees of curing (whichever is the longer):

TABLE 4

Forms for	*Degree Days*
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of degree-days in Paragraph 3.06D above).

B. Shores shall not be removed until the concrete has attained at least 60 percent of its specified design strength and also sufficient strength to support safely its own weight and the construction live loads upon it.

3.08 FIELD TESTS

A. Sets of field control cylinder specimens will be taken by the Engineer (or inspector) during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than once a day, nor less than once for each 150 cu yds of concrete nor less than once for each 5,000 sq ft of surface area for slabs or walls.

1. A "set" of test cylinders consists of four cylinders: one to be broken at 7 days and two to be broken and their strengths averaged at 28 days. The fourth may be used for a special break at 3 days or to verify strength after 28 days if 28 day breaks are low.

2. When the average 28 day compressive strength of the cylinders in any set falls below the required compressive strength or below proportional minimum 7 day strengths (where proper relation between seven and 28 day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.

B. Cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations and furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner. Curing boxes shall be acceptable to the Engineer.

C. Slump tests will be made in the field immediately prior to placing the concrete. Such tests shall be made in accordance with ASTM C143. If the slump is greater the specified range, the concrete shall be rejected.

D. Air Content: Test for air content shall be made on a fresh concrete sample. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173. If lightweight aggregates or aggregates with high absorptions are used, the latter test method shall be used.

3.09 FIELD CONTROL

A. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.

B. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

3.10 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.

B. When the tests on control specimens of concrete fall below the required strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In case of failure of the cores, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Test need not be made until concrete has aged 60 days.

C. Should the strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

3.11 PATCHING

A. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface

defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.

B. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100. Holes are then to be promptly filled upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

C. When patching exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.12 REPAIRS

A. It is the intent of this Section to require quality work including adequate forming, proper mixture and placement of concrete and curing so completed concrete surfaces will require no patching.

3.13 SCHEDULE

A. The following (Table 5) are the general applications for the various concrete classes and design strengths:

TABLE 5

Class	***(psi)***	***Design Strength Description***
A	2,500	Concrete fill
B	3,000	Concrete overlay slabs and pavements
D	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams and all other structural concrete

END OF SECTION

SECTION 03350

CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and finish cast-in-place concrete surfaces as specified herein.

B. Sandblasting the sample structure concrete to an approved texture is included in the work of this Section.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Patching and repair of defective and honeycombed concrete is included in Section 03300.

C. Cast-in-Place concrete is included in Section 03300.

D. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings, the metallic and chemical hardener and surface retarder manufacturers' surface preparation and application procedures.

1.04 SCHEDULE OF FINISHES

A. Concrete for the project shall be finished in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section.

B. Finishes to the base concrete for the following conditions shall be finished as noted and as further specified herein:

1. Exterior concrete excluding slabs and walking surfaces and exposed interior concrete - Rubbed finish. Light sandblast as approved. Sandblast open tanks to 1-ft below normal water line. Rub all exterior vertical walls of concrete tanks to 1-ft below finished earth grades. Rub all interior vertical surfaces of concrete tanks to 1-ft below specified water levels.

2. Exposed interior concrete including underside slabs, beams and stairs and sides of openings, beams and stairs - Rubbed finish.

3. Concrete for exterior on walks, stairs and other horizontal areas not receiving exposed aggregate finish - Heavy broomed finish, non-slip.

4. Concrete on which sewage flows - Steel troweled finish.

5. Concrete not exposed in the finished work and not scheduled to receive an additional applied finish or material - Off-form finish at vertical surfaces, consolidate and screed to grade at horizontal surfaces.

6. Concrete to receive paint - Rubbed finish. (Where rubbed finish is used for non-painted surfaces, match cement and color of parent concrete.)

7. Concrete to receive roof insulation - Consolidate, screed and wood float to required grades.

8. Concrete to receive resilient tile, rubber tile, carpet and cleavage plane for ceramic and quarry tile bed - Steel trowel finish.

9. Tops of curbs and pads - Steel trowel finish.

10. Concrete to receive cementitious finish - Off-form finish.

1.05 SITE MOCK-UPS

A. Before proceeding with finishing of a complete slab or wall area, provide a 10 sq ft minimum area with the proposed finish for the approval of the Engineer. Provide 48 hours notification for the Engineer to have the proper personnel at the site for evaluation during actual finishing of the mock-up.

B. Modify techniques and equipment as required to achieve an approved finish.

C. When approved, the area will be recorded on Drawings and will become the standard of acceptance for that finish for the project.

D. Provide simular procedures for each finish as directed.

1.06 RESPONSIBILITY FOR CHANGING FINISHES

A. The surface finishes specified for concrete to receive additional applied finishes or materials are the finishes required for the proper application of the actual products specified under other Sections. Where different products are approved for use, it shall be the Contractor's responsibility to determine if changes in finishes are required and to provide the proper finishes to receive these products.

B. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for approval.

1.07 MANUFACTURER'S SUPERVISION

A. The manufacturer of surface retarder shall make available at no cost, upon 72 hours notification, the services of a qualified field representative to make clear to the user the application of the product under prevailing job conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cementitious and component materials required for finishing with the concrete surfaces shall be as specified in Section 03300.

B. Chemical hardener shall be Lapidolith by Sonneborn; Hornolith by A.C. Horn; Penalith by W.R. Meadows or equal fluosilicate base material.

PART 3 EXECUTION

3.01 FORMED SURFACES

A. Forms shall not be stripped before the concrete has been cured and attained strength all as specified in Section 03300.

B. Care shall be exercised to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or doing any other work adjacent thereto.

C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the Engineer.

D. Off-Form Finish - Fins and other projections shall be removed and tie cones and defects filled as specified under Section 03300.

E. Rubbed Finish

1. Immediately upon stripping forms and before concrete has changed in color, all fins shall be carefully removed with a hammer. While the wall is still damp apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within all pits, air holes or blemishes in the parent concrete; avoid coating large areas of the finished surface with this slurry.

2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout consisting of 1 volume cement to 1-1/2 volumes of clean masonry sand having a fineness modulus of approximately 2.25 and complying with the gradation requirements of the ASTM for such a material. Grout shall be uniformly applied by means of damp (neither dripping wet nor dry) pads of coarse burlap approximately 6-in square used as a float. Grout shall be well scrubbed into the pits and air holes to provide a dense mortar in the imperfections to be patched.

3. Allow the mortar to partially harden for one or two hours depending upon the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the perpendicular edge of a steel trowel without damaging the grout in the small pits or holes, cut off all that can be removed with a trowel. Grout allowed to remain on the wall too long will get too hard and will be difficult to remove.

4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout should remain after this rubbing. The entire

cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cut with the trowel so it can be wiped off clean with the burlap.

5. On the day following the repair of pits, air holes and blemishes, the walls again shall be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such is present a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without working up a lather or mortar or change the texture of the concrete.

6. A thorough wash-down with stiff bristle brushes shall follow the final bagging or stoning operation in order that no extraneous materials remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

3.02 FLOORS AND SLABS

A. Floors and slabs shall be compacted with internal vibrators as specified in Section 03300 and screeded to the established grades. Floors and slabs shall be level with a tolerance of 1/8-in when checked with a 12-ft straightedge, except where drains occur, in which case floors shall be pitched to drains as indicated. Failure to meet either of above shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Following screeding as specified above, float the slabs as approved by the Engineer. The floating operation shall be continued until sufficient mortar is brought to the surface to fill all voids. The surfaces shall be tested with a straightedge to detect high and low spots which shall be eliminated. Excessive floating shall be avoided.

C. The excessive use of "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate away from the surface and allowing a layer of mortar to accumulate will not be permitted on any slab finish. The dusting of surfaces with dry materials will not be permitted. All edges of slabs and tops of walls shall be rounded off with a steel edging tool. Steel edging tool radius shall be 1/4-in for all slabs subject to wheeled traffic.

1. Steel Trowel Finish

   a. Finish by screeding and floating with straightedges to bring the surfaces to the required elevations. While the concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, the surface shall be wood floated to a true, even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface. After surface moisture has disappeared, the concrete shall be hand steel troweled to produce a smooth, impervious surface, free from trowel marks. An additional troweling shall be given the surface for the purpose of burnishing. The final troweling shall produce a ringing sound from the trowel. Dry cement or additional water shall not be used in troweling, nor will excessive troweling be permitted.

   b. The slab finish tolerances and slope tolerances and/or repairs shall be as specified herein. Floor flatness measurements will be made the day after a concrete floor is finished and before the shoring is removed, in order to eliminate any effects of shrinkage, curling and

deflection. A 12-ft long straightedge shall be supported at each end with steel gauge blocks whose thickness are equal to tolerance specified. Floor surface shall not have crowns so high as to prevent 12-ft straightedge from resting on the two end blocks, nor low spots so low that a third block of twice the tolerance in thickness can easily pass under the supported straightedge.

c. Compliance with the designated limits in four of five consecutive measurements will be considered satisfactory by the Engineer, unless obvious faults are observed. A check for adequate slope and drainage will also be made to confirm compliance with Project requirements.

2. Wood Float Finish: Slabs shall be finished by screeding with straightedges to bring the surface to the required finish plane. Slab shall be wood floated to compact and seal surface. All laitance shall be removed and the surface left clean.

3. Heavy Broomed Finish: Steel trowel finish the concrete as specified above, except that the final troweling shall be omitted and while the concrete is still soft enough, the surface shall be finished by a steel wire broom or a stiff coarse fiber broom to produce the pattern and depth of scoring as approved by the Engineer.

4. Sidewalk Finish: Walks adjacent to structures shall slope down 1/4-in/ft away from structures, unless otherwise shown. The surface shall be struck off by means of a strike board and floated with a wood or cork float to a true plane, then flat steel troweled before brooming. The surface shall be broomed at right angles to the direction of traffic. Sidewalk surfaces shall be laid out in blocks as shown or as directed.

5. Power Machine Finish: In lieu of hand steel trowel finishing, an approved power machine for finishing concrete floors and slabs may be used in accordance with the directions of the machine manufacturer and as approved by the Engineer. The use of a power machine will not be allowed when the concrete has not attained the necessary set to allow finishing without introducing high and low spots in the slab. Hand steel trowel the areas of slabs not accessible to power equipment. A final steel troweling shall be done by hand over all areas.

D. Concrete Sealer

1. Aged Concrete: Restore surface soundness by patching, grouting, filling cracks and holes, etc. Surface must also be free of any dust, dirt and other foreign matter. Use power tools and/or strippers to remove any incompatible sealers or coatings. Cleanse as required, following the procedure indicated under cured concrete.

2. Methods: Apply sealer so as to form a continuous, uniform film by spray, soft-bristel pushbroom, long-nap roller or lambswool applicator. Ordinary garden-type sprayers, using neoprene hose, are recommended for best results.

3. Applications: For curing only, apply first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 sq.ft. per gallon. Apply second coat when all trades are completed and structure is ready for occupancy at the rate of 400 to 600 sq.ft. per gallon.

4. To meet guarantee and to seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full-strength. On aged concrete, when renovating, dustproofing and

sealing, the first coat should be thinned 10 to 15 percent with reducer per manufacturer's directions.

5. Prepare and seal surfaces indicated on the room finish schedule to receive a sealer as follows:

   a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule in Paragraph 3.05 below.

   b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application-ready when it is damp but not "wet" and can no longer be marred by walking workman.

   c. Newly-Cured Bare Concrete: Level and spots gouged out by trades. Remove all dirt, dust, droppage, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry so that surface is no more than damp, and not wet.

3.03 CONCRETE RECEIVING CHEMICAL HARDENER

A. After 28 days, minimum, concrete cure, apply chemical hardener in three applications to a minimum total coverage of the undiluted chemical of 100 sq ft per gallon and in accordance with manufacturer's recommendations as reviewed.

3.04 APPROVAL OF FINISHES

A. All concrete surfaces, when finished, will be inspected by the Engineer.

B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked until approved by the Engineer.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install grout complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Grout for Auger-cast plies is included in Blue Book.

B. Formwork is included in Section 03100.

C. Concrete Reinforcement is included in Section 03200.

D. Concrete Joints and Joint Accessories are included in Section 03250.

E. Cast-in-Place Concrete is included in Section 03300.

F. Modifications to Existing Concrete are included in Section 03740.

G. Grout for reinforced masonry is included in Division 4.

H. Miscellaneous Metals are included in Section 05500.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Commercially manufactured nonshrink cementitous grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.

B. Samples

1. Samples of commercially manufactured grout products when requested by the Engineer.

2. Aggregates for use in concrete grout when requested by the Engineer.

C. Laboratory Test Reports: Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.

D. Qualifications: Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts, which they will supply.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

2. ASTM C579 - Standard Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

3. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

4. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

B. U.S. Army Corps of Engineers Standard (CRD)

1. CRD C-621 - Corps of Engineers Specification for Nonshrink Grout

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications: Grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

B. Pre-installation Conference: Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days prior to its scheduled date.

C. Services of Manufacturer's Representative: A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required, to correct installation problems.

D. Field Testing: The field testing of Concrete Grout shall be as specified for concrete in Section 03300.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.

B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

1.07 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.

B. Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.

a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp. or equal.

b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp. or equal.

B. Nonshrink Epoxy Grout: Nonshrink epoxy-based grout shall be a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30 x 10^{-6} when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co. or equal.

C. Cement Grout: Cement grouts shall be a mixture of one part portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 03300 except as specified herein. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 2900 psi at 28 days, or 2500 psi nominal strength. Coarse aggregate size shall be 1/2-in maximum. Slump should not exceed 5-in and should be as low as practical yet still retain sufficient workability.

2. Synthetic reinforcing fibers as specified in Section 03200 shall be added to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water: Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

A. Grout shall be placed over cured concrete that has attained its full design strength unless otherwise approved by the Engineer.

B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may effect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the airline to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.

1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION - GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.

F. Reflect all existing underlying expansion, control and construction joints through the grout.

3.03 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3-in in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION - NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

1. General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.

2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.

3. Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.

4. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.

END OF SECTION

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SECTION 03740

MODIFICATIONS AND REPAIR TO CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and cut, remove, repair or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

B. In general, work under this Section will be performed as a remedy for improperly placed or poorly placed concrete. Such work shall be performed only after receiving written directions from the Engineer.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joints and Accessories are included in Section 03250.

D. Cast-in-Place Concrete is included in Section 03300.

E. Grout is included in Section 03600.

F. Structural Steel is included in Section 05120.

G. Miscellaneous Metals are included in Section 05500.

H. Sealants and Caulking are included in Section 07920.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, a Schedule of Demolition and the detailed methods of demolition to be used at each location.

B. Submit manufacturer's technical literature on all product brands proposed for use, to the Engineer for review. The submittal shall include the manufacturer's installation and/or application instructions.

C. When substitutions for acceptable brands of materials specified herein are proposed, submit brochures and technical data of the proposed substitutions to the Engineer for approval before delivery to the project.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

2. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.

3. ASTM C883 - Standard Test Method for Effective Shrinkage of Epoxy-Resin Systems Used with Concrete.

4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

6. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

7. ASTM D732 - Standard Test Method for Shear Strength of Plastics by Punch Tool.

8. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until authorization is given by the Engineer.

B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring and bracing and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust and to prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown or specified, line drilling will be required in cutting existing concrete.

C. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years experience in the manufacture of such products and shall have an ongoing program of training, certifying and technically supporting the Contractor's personnel.

D. Contractor Qualifications: Should excessive bonding and cracking exist, Contractors shall complete a program of instruction in the application of the approved manufacturer's material specified in this Section and provide certification from the manufacturer attesting to their training and status as an approved applicator.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Materials shall comply with this Section and any state or local regulations.

B. Epoxy Bonding Agent The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type II and the additional requirements specified herein.

1. Material

a. Properties of the cured material:

1) Compressive Strength (ASTM D695): 8500 psi minimum at 28 days.

2) Tensile Strength (ASTM D638): 4000 psi minimum at 14 days.

3) Flexural Strength (ASTM D790 - Modulus of Rupture): 6,300 psi minimum at 14 days.

4) Shear Strength (ASTM D732): 5000 psi minimum at 14 days.

5) Water Absorption (ASTM D570 - 2 hour boil): One percent maximum at 14 days.

6) Bond Strength (ASTM C882) Hardened to Plastic: 1500 psi minimum at 14 days moist cure.

7) Effective Shrinkage (ASTM C883): Passes Test.

8) Color: Gray.

2. Approved manufacturer's include: Sika Corporation, Lyndhurst, NJ - Sikadur 32, Hi-Mod; Master Builder's, Cleveland, OH - Concresive Liquid (LPL) or equal.

C. Epoxy Paste

1. General: Epoxy Paste shall be a two-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts and all-threads into hardened concrete and shall comply with the requirements of ASTM C881, Type I, Grade 3 and the additional requirements specified herein. {It may also be used to patch existing surfaces where the glue line is 1/8-in or less.}.

2. Material

a. Properties of the cured material:

1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.

2) Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at Break - 0.3 percent minimum.

3) Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at 14 days.

4) Shear Strength (ASTM D732): 2,800 psi minimum at 14 days.

5) Water Absorption (ASTM D570): 1.0 percent maximum at 7 days.

6) Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure.

7) Color: Concrete gray.

3. Approved manufacturer's include:

a. Overhead applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-mod LV 31; Master Builders, Inc., Cleveland, OH - Concresive 1438 or equal.

b. Sika Corporation, Lyndhurst, N.J. - Sikadur Hi-mod LV 32; Master Builders, Inc., Cleveland, OH - Concresive 1438 or equal.

D. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink Epoxy Grout and Polymer Modified mortar are included in Section 03600.

E. Adhesive capsule type anchor system shall be equal to Molly parabond two part stud and capsule system by Emhart, Temple, PA or the HVA adhesive Anchoring System by Hilti Fastening Systems, Tulsa, OK. The capsule shall consist of a sealed glass capsule containing premeasured amounts of a polyester or vinylester resin, quartz sand aggregate and a hardener contained in a separate vial within the capsule.

F. Acrylic Latex Bonding Agent

G. Crack Repair Epoxy Adhesive

1. General

a. Crack Repair Epoxy Adhesive shall be a two-component, solvent-free, moisture insensitive epoxy resin material suitable for crack grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.

b. All concrete surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system shall be coated with an acceptable epoxy coating approved by the FDA for use in contact with potable water.

2. Material

a. Properties of the cured material

1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.

2) Tensile Strength (ASTM D638): 5,300 psi minimum at 14 days. Elongation at Break - 2 to 5 percent.

3) Flexural Strength (ASTM D790 - Modulus of Rupture): 12,000 psi minimum at 14 days (gravity); 4,600 psi minimum at 14 days (injection)

4) Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.

5) Water Absorption (ASTM D570 - 2 hour boil): 1.5 percent maximum at 7 days.

6) Bond Strength (ASTM C882): 2,400 psi at 2 days dry; 2,000 psi at 14 days dry plus 12 days moist.

7) Effective Shrinkage (ASTM 883): Passes Test.

3 Approved manufacturer's include:

a. For standard applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod; Master Builders Inc., Cleveland, OH - Concressive 1380 or equal.

b. For very thin applications; Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod LV; Master Builders Inc., Cleveland, OH - Concressive 1468 or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc, are specified in respective Sections. All work shall comply with other requirements of this of Section and as shown on the Drawings.

B. All commercial products specified in this Section shall be stored, mixed and applied in strict compliance with the manufacturer's recommendations.

C. In all cases where concrete is repaired in the vicinity of an expansion joint or control joint the repairs shall be made to preserve the isolation between components on either side of the joint.

D. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the Engineer. Where possible, rebar locations shall be identified prior to drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

3.02 CONCRETE REMOVAL

A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer, shall be done by line drilling at limits followed by chipping or jack-hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged. Sawcutting at limits of concrete to be removed shall only be done if indicated on the Drawings, or after obtaining written approval from the Engineer.

B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4-in.

C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1-in deep saw cut on each exposed surface of the existing concrete.

D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the Engineer.

E. The Engineer may from time to time direct the Contractor to make additional repairs to existing concrete. These repairs shall be made as specified or by such other methods as may be appropriate.

3.03 CONNECTION SURFACE PREPARATION

A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs or modifications as shown on the Drawings, specified herein, or as directed by the Engineer.

B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e. - sandblasting, grinding, etc, as approved by the Engineer. Be sure the areas are not less than 1/2-in in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.

C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc, as approved by the Engineer. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2-in. Reinforcing to be saved shall not be damaged during the demolition operation.

D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent or lapped to new reinforcing as shown on the Drawings and provided with 1-in minimum cover all around.

E. The following are specific concrete surface preparation "methods" to be used where called for on the Drawings, specified herein or as directed by the Engineer.

1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water. Brush on a 1/16-in layer of cement and water mixed to the consistency of a heavy paste. Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.

2. Method B: After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface. The field preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.

3. Method C: Drill a hole 1/4-in larger than the diameter of the dowel. The hole shall be blown clear of loose particles and dust just prior to installing epoxy. The drilled hole shall first be filled with epoxy paste, then dowels/bolts shall be buttered with paste then inserted by tapping. Unless otherwise shown on the Drawings, deformed bars shall be drilled and set to a depth of ten bar diameters and smooth bars shall be drilled and set to a depth of fifteen bar diameters. If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.

4. Method D: Combination of Method B and C.

5. Method E: Capsule anchor system shall be set in existing concrete by drilling holes to the required depth to develop the full tensile and shear strengths of the anchor material being used. The anchor bolts system shall be installed per the manufacturer's recommendation in holes sized as required. The anchor stud bolt, rebar or other embedment item shall be tipped with a double 45 degree chamfered point, securely fastened into the chuck of all rotary percussion hammer drill and drilled into the capsule filled hole. The anchor may be installed in horizontal, vertical and overhead positions.

3.04 GROUTING

A. Grouting shall be as specified in Section 03600.

3.05 CRACK REPAIR

A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks per manufacturer's recommendations. If cracks are less than 1/16-in in thickness they shall be pressure injected.

B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant through valves sealed to surface with crack repair epoxy adhesive per manufacturer's recommendations.

3.06 WATERSTOPS SET INTO EXISTING CONCRETE

A. Where waterstops are required to be set into existing concrete, reglets shall be cut as shown on the Drawings. Thoroughly clean the surface of all debris and apply epoxy bonding agent to the existing surface of the reglet. Embed the waterstop in the reglet with Non-Shrink Cement Grout prior to placing the new concrete. Where waterstops are called to be placed laying flat against existing concrete, the concrete surface shall be thoroughly cleaned of all debris and the waterstop bonded to the concrete using an approved epoxy bonding agent.

END OF SECTION

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SECTION 03800

CONCRETE ELECTRICAL RACEWAY ENCASEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install concrete encasement around underground electrical raceways as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Excavation, backfilling, fill and grading are included in Division 2.

B. Concrete formwork is included in Section 03100.

C. Concrete joints and joint accessories are included in Section 03250.

D. Cast in place concrete is included in Section 03300.

E. Modifications to existing concrete are included in Section 03740.

F. Furnishing and installing electrical conduit is included in Division 16.

G. Furnishing and placing polyethylene warning tape in the backfill above encasement is included in Division 16.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement, lime, aggregate and all other concrete components shall be as specified in Section 03300 except that aggregate size shall not exceed 3/8-in. Concrete shall have a minimum compressive strength at 28 days of 4000 psi.

PART 3 EXECUTION

3.01 GENERAL

A. Concrete shall conform to the requirements Section 03300 and as specified herein.

B. Provide not less than 4-in of concrete between the outside of a raceway and the earth. Provide not less than 2-in of concrete between adjacent raceways. Form as specified in Section 03100 for buried concrete.

C. All raceway concrete placements shall be continuous between manholes or handholes and between

manholes or handholes and structures.

D. Where raceways pass through concrete walls, concrete encasement shall be extended through the finished flush with inside surfaces. Watertight construction joints with waterstops conforming to Section 03250 shall be provided.

E. Encasements shall be reinforced as and where indicated on the Drawings.

F. Encasements shall be laid in trenches on mats of screened gravel not less than 6-in thick.

G. The minimum cover for raceway banks shall be 24-in.

H. All concrete electrical raceway encasement shall be colored as approved and/or directed by the Engineer.

END OF SECTION

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Painting is included in Division 9.

B. Pipe hangers and sleeves are included in Division 15.

C. Equipment anchor bolts are included in the respective Sections of Divisions 11, 14 and 15.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for all items included in Part 2 of this Section.

B. Design Data: Submit manufacturer's load and deflection tables for grating.

C. Certificates: Certify that welders have been qualified under AWS, within the previous 12 months, to perform the welds required under this Section.

1.04 REFERENCE STANDARDS

A. Aluminum Association (AA)

1. AA M31C22A41

a. M31: Mechanical Finish, Fine Satin

b. C22: Finish, Medium Matte

c. A41: Clear Anodic Coating, Class I

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A48 - Standard Specification for Gray Iron Castings.

3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.

5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

7. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

8. ASTM A276 - Standard Specification for Stainless Steel and Heat-Resisting Steel Bars and Shapes.

9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.

10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

11. ASTM A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

14. ASTM A536 - Standard Specification for Ductile Iron Castings.

15. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

16. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

17. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

18. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

C. American Iron and Steel Institute (AISI).

1. Specification for Structural Steel Buildings.

D. American Welding Society (AWS)

1. AWS D1.1 - Structural Welding Code Steel.

2. AWS D1.2 - Structural Welding Code Aluminum.

E. Federal Specifications

1. FS-FF-B-575C - Bolts, Hexagonal and Square

F. Occupational Safety and Health Administration (OSHA)

G. Southern Building Code Congress International, (SBCCI)

1. Standard Building Code (SBC)

H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Repair items which have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1.	Structural Steel	ASTM A572
2.	Structural Plates, Angles, Rods, & Bars	ASTM A36
3.	Structural Steel Tubing	ASTM A500, Grade B
4.	Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
5.	Steel Sheets	ASTM A366
6.	Gray Iron Castings	ASTM A48, Class 35
7.	Ductile Iron Castings	ASTM A536, Grade 65-45-12
8.	Aluminum Extruded Pipe	ASTM B429, Alloy 6063 T6
9.	Aluminum Extruded Shapes	ASTM B221, Alloy 6061 T6
10.	Aluminum Sheet and Plate	ASTM B209, Alloy 6061 T6
11.	Stainless Steel Plates, Sheets, and Structural Shapes	
	a. Exterior, Submerged or Industrial Use	ASTM A167, Type 316 (Type 316L for welded)
	b. Interior and Architectural Use	ASTM A167, Type 304
12.	Stainless Steel Bolts, Nuts, and Washers	ASTM A276, Type 316
13.	Carbon Steel Bolts and Studs	ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
14.	High Strength Steel Bolts, Nuts and washers	ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
	a. Elevated Temperature Exposure	Type I

	b. General Application	Type I or Type II
15.	Galvanizing	ASTM A123, Zn w/0.5 percent minimum Ni
16.	Galvanizing, hardware	ASTM A153, Zn w/0.5 percent minimum Ni

2.03 ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchor bolt material shall be ASTM A276, Type 316 unless otherwise noted.

B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts.

C. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwick-bolt II; ITW Ramset; Redhead trubolt, or equal.

D. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti, HVA Adhesive Anchor; Molly, Parabond; Rawlplug, Rawl Chem-Stud or equal.

E. Adhesive anchors, for fastening to hollow concrete block or brick, shall be a three-part stud, screen and chemical dispenser anchoring system. Adhesive cartridges shall contain premeasured amounts of resin and hardener which are mixed and deposited in a screen tube by a dispenser. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Anchors shall be Hilti, HIT C-20 System or equal.

F. Automatic end welded headed anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors, Nelson, S3L Shear Connectors] or equal.

G. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

I. Toggle bolts shall be Hilti, Toggler Bolt or equal.

2.04 MISCELLANEOUS ALUMINUM

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects

impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.

E. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8 in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 316 stainless steel. Plates shall have a mill finish.

F. Aluminum nosing at concrete stairs shall be Wooster Products, Inc.; Alumogrit Treads, Type 116; similar by Barry Pattern and Foundry Co.; Andco or equal. Furnish with wing type anchors and flat head stainless steel machine screws, 12-in on center. Nosing shall also be used at concrete ladder openings. Nosing shall a single piece for each step extending to within 3-in at each side of stair or full ladder width. Set nosing flush with stair tread finish at concrete stairs. Furnish treads with heavy duty protective tape cover.

2.05 MISCELLANEOUS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous steel items shall include: beams, angles, lintels, metal stairs, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.

D. Structural steel angle and channel door frames shall be galvanized. Frames shall be fabricated with not less than three anchors on each jamb.

E. Steel pipe pieces for sleeves, lifting attachments and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe, shall have welded circumferential steel waterstops at mid-length.

F. Lintels, relief angles or other steel supporting masonry or embedded in masonry shall be galvanized.

G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall be omitted within 3-in of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.

H. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 oz/sq ft of surface.

2.06 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

2.07 CASTINGS

A. Casting shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the Engineer. All matching surfaces shall be machined to a true plane surface to allow contact surfaces to seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from dimensions. The Contractor shall provide facilities for weighing castings in the presence of the Engineer.

B. Frames, covers, cast grates and trench drains shall be gray iron castings except as otherwise specified or indicated on the Drawings. Sizes shall be as shown on the Drawings. Covers

shall have letters "WATER," "SANITARY SEWER," or DRAIN," as applicable, embossed on top.

C. Frames and covers for installation in slabs shall be heavy duty, [R-6013-R-6099] Series as manufactured by Neenah Foundry Co., or equal.

D. Electrical and telephone manhole and handhole frames and covers shall be ductile iron castings. The covers shall be watertight. Covers shall have the word "ELECTRIC," "HIGH VOLTAGE," "LOW VOLTAGE," "SIGNAL," "TELEPHONE," as applicable, embossed on or cast into the top in letters 2-in high. The clear opening shall be 36-in unless otherwise indicated on the Drawings.

E. Trench drains shall be of the length shown on the Drawings and shall be heavy duty, Series with a "Type A" cover as manufactured by Neenah Foundry Co. or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.

C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

D. Specialty products shall be installed in accordance with the manufacturer's recommendations.

E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.

F. Install adhesive capsule anchors using manufacture's recommended drive units and adapters and in compliance with the manufacturer's recommendations.

G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.

H. All railings shall be erected to line and plumb.

I. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

J. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

K. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

L. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

M. Between aluminum grating, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4-in thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

END OF SECTION

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SECTION 05510

PREFABRICATED ALUMINUM STAIRS WITH RAILING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary and install aluminum stairs complete with anchors and brackets, including integral handrails and posts when applicable, as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete is included in Division 3.

B. Miscellaneous Metal is included in Section 05500.

C. Handrailing is included in Section 05520.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, complete shop drawings and calculations. Calculations and Shop Drawings shall be sealed by a licensed professional engineer. Submittals shall indicate construction details, sizes, of metal sections, thicknesses of metal, profiles, attachments, dimensions and field joints, method of support from structure, work to be built-in or provided by other sections and finishes to conform to the Drawings and this Section. Indicate welded connections, both shop and field, using standard AWS welding symbols. Indicate net weld lengths. Submittals shall include the following:

1. Two samples, each 8-in square in area, of each type finished material.

2. Manufacturer's certification that materials meet specification requirements.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

B. Aluminum Association (AA)

1. AA 6061-T6 - Aluminum Extrusions, Sheet and Plate.

C. American Welding Society (AWS)

1. AWS D1.2 - Structural Welding Code - Aluminum.

D. American National Standards Institute (ANSI)

1. ANSI A202.1 - Metal Bar Grating Manual for Steel and Aluminum Gratings and Stair Treads.

E. International Building Code (IBC) 2000

F. Occupation Safety and Health Administration (OSHA)

G. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle prefabricated components, and other manufactured items so they will not be damaged or deformed.

B. All parts shall be properly protected so no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Attention is directed to Section 01600 for additional storage provisions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum: ASTM B221, Alloy 6061-T6, Finish AA-C22A31.

2.02 MANUFACTURED COMPONENETS

A. Treads: Extruded or cast aluminum with integral nosing to form a one piece structural unit. Abrasive areas or serrations on the entire walking surface and open holes for drainage. 11-1/16-in wide tread shall be I-Bar Grating by Borden Metal Products Co.; Intertec Corp. or equal.
B. Landings: Use the same design as treads.

2.03 GENERAL DESIGN

A. Design of the aluminum members shall conform to the current edition of the Aluminum Association Specifications and Guidelines for Aluminum Structures. The design and drawings shall be signed and sealed by a registered professional engineer.

PART 3 EXECUTION

3.01 GENERAL FABRICATION

A. Verify dimensions on site prior to shop fabrication. Detail stair risers, treads and landings to conform with the requirements of OSHA latest edition and IBC.

B. Fabricate stairs, landings, and component connections to support live loads of minimum 100 lb/sq ft with deflection of stairs and landings not exceeding 1/360 of span. Stairs exceeding height of 10-ft shall have landings.

C. Fabricate railing supports and component connections capable of resisting a lateral force of minimum 200 lbs at any single point, without permanent set or damage and loads indicated in the IBC.

D. Shop assemble sections in largest practical sizes, easily handled through building openings.

E. Accurately form and fit components and connections. Grind exposed edges and welds smooth and flush.

F. Accurately form components required for proper anchorage of stairs and landings to each other and to building structure.

G. Aluminum welding shall be performed by experienced, certified operators.

3.02 ERECTION

A. Erect stairs square, level, plumb and free from distortion or defects detrimental to appearance and performance.

B. Provide necessary anchors, plates, angles, hangers and struts as required for connecting stairs to the structure.

C. Ensure alignment with adjacent construction. Coordinate with related work to ensure no interruption in installation.

D. Perform necessary cutting and altering for the installation of work of other Sections. Do not perform any other additional cutting without review of the Engineer.

E. Field bolt and weld to match standard of shop bolting and welding. Hide bolts and screws whenever possible. Where not hidden, use flush countersunk fastenings, unless indicated otherwise. Make mechanically fastened joints flush hairline butted. Grind welds smooth and flush.

F. Properly secure treads to stringers with minimum 3/8-in stainless steel bolts and washers. All other fasteners are to also be stainless steel.

END OF SECTION

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A. Aluminum Association (AA)

1. Standard Specifications as referenced.

B. Occupational Safety and Health Administration (OSHA).

C. International Conference of Building Officials (ICBO)

1. Uniform Building Code (UBC)

D. Building Officials and Code Administrations Congress, Inc. (BOCA)

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The railing assembly including rails, posts, attachments and anchors shall be adequate to resist the following forces without damages or permanent set. Apply each load so as to produce the maximum stress in each of the railing components.

1. Handrails

a. A concentrated load of 200 lbs applied at any point and in any direction.

b. A uniform load of 50 lbs/ft applied at any point and in any direction.

2. Guardrails

a. A concentrated load of 300 lbs applied at any point and in any direction along the top railing member.

b. A uniform load of 100 lbs/ft applied in any direction along the top railing member.

c. Infill area of guardrail system (including intermediate rails): A horizontal load of 200 lbs applied on a 1 sq ft area anywhere in the system.

1.06 PROJECT/SITE REQUIREMENTS

A. Fully coordinate the work of this Section with that of other Sections. Verify at the site the dimensions and work of other trades adjoining or supporting the work of this Section prior to fabrication and installation.

B. Take field measurements at the site to confirm and/or supplement indicated dimensions and to ensure proper fit of all components.

C. Furnish to the appropriate trades all items specified under this Section and installed under other Sections.

specified in Paragraph 1.05 above. Shorter spacing may be used at ends of lines of railing when required to maintain uniform spacing along the line. Posts shall be provided at all ends and corners of runs when toeboards are provided.

C. Railings shall be fabricated as a sub-assembled system. Posts shall be completely assembled except for the top fitting which may be field attached to the top rail.

D. Field splices and expansion joints shall have internal sleeves. Accurately form components to each other and to the structure with tightly fitted joints providing smooth transitions.

E. Make provision for thermal movements of the rails and toeboards as noted on the Drawings. Provide expansion joints in at not more than 24-ft O.C. unless the manufacturer recommends a closer spacing.

F. Make provisions for removable railing sections where shown on the Drawings.

G. Pipe cuts shall be square and without burrs. Joints shall be neat and with minimum gap between adjoining segments. All fastener holes shall be unobtrusively located, drilled and countersunk to provide fasteners flush with the surface of the rail.

H. Provide 3/16-in weep holes located 1/4-in to 3/4-in above the grout line for posts set in grout or concrete.

I. Supply components required to anchor fabrications to the structures. Support handrails from structural members using approved sockets, flanges, brackets, or other means which provide neat and substantial support.

J. All railing surfaces and anchorage systems in contact with concrete or dissimilar metals shall receive one applied coat of zinc chronate to a dry film thickness of 10 mils.

K. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush and hairline. Ease exposed edges to small uniform radius.

L. Continuously seal joined pieces by continuous welds.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work prior to commencing installation.

3.02 PREPARATION

A. Supply items required to be cast into concrete, embedded in masonry, and/or placed in partitions with setting templates, to appropriate trades for installation under other Sections.

B. Clean and strip primed steel items to bare metal where site welding is required.

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Hot-Dip Galvanized Coatings.

10. ASTM B6 - Standard Specification for Zinc.

11. ASTM D2092 - Standard Practice for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting.

C. Certification: Furnish Certificates of Compliance with ASTM Specifications and Standards specified herein. Each certificate to be signed by Contractor and Galvanizer certifying that steel materials, bolts, nuts, washers and items of iron and steel hardware conform with specified requirements.

D. Inspections and Tests: Inspections, tests and samples to conform with ASTM Specifications and Standards. Inspections rights and privileges, procedures and acceptance or rejection of galvanized steel materials to conform with ASTM A123 or A153, as applicable. Inspections and tests include the following:

1. Visual examination of samples and finished products.

2. Tests to determine weight or mass of zinc of coating per square foot of metal surface.

3. Tests to determine distribution and uniformity of zinc coating.

1.03 SUBMITTALS

A. Furnish Certificates of Compliance with certified original and two copies forwarded to the Engineer.

1.04 DELIVERY, STORAGE AND HANDLING

A. Packaging: Of type to prevent damage to galvanized surfaces and distortion of steel materials and components.

B. Handling and Storage: Handle and protect galvanized materials from damage to zinc coating. To avoid humid storage stain, space surfaces of galvanized materials to permit free circulation of air.

C. Damaged Material: Repair material showing evidence of damage to zinc coating. If not repairable, material with damaged coating will be subject to rejection.

PART 2: PRODUCTS

2.01 STEEL MATERIALS

A. Material for galvanizing to be geometrically suitable for galvanizing as specified in ASTM A384 and A385. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, fabrications and assemblies.

B. Material to be chemically suitable for galvanizing.

2.02 IRON AND STEEL HARDWARE

A. Bolts, nuts, washers and items of iron and steel hardware furnished or galvanized to be suitable for hot dip galvanizing.

B. Inspect iron and steel hardware before galvanizing and ascertain whether suitable for

requirements of ADHGA, consisting of visual inspection.

3.03 TOUCH UP AND REPAIR

A. Repair damaged galvanized surfaces in accordance with ASTM A780.

B. Dry film thickness of applied repair materials to be not less than galvanized coating thickness required by ASTM A53, A123 or A153, as applicable.

C. Touch up prime-painted surface with same galvanized primer applied in shop. Clean damaged surfaces first to assure proper paint adhesion.

END OF SECTION

PART 2: PRODUCTS

2.01 UNTREATED LUMBER

A. Grading: Lumber shall be graded in accordance with the rules of one of the following associations: "Grading Rules for Southern Pine Lumber" of the Southern Pine Inspection Bureau (SPIB); "Standard Grading and Dressing Rules No. 16" of the West Coast Lumber Inspection Bureau (WCLIB); or "Grading Rules for Western Lumber" published by Western Wood Products Association (WWPA).

B. Grade Marking: Each piece of lumber shall bear the official grade mark of one of the above-mentioned grading rules. The Association standards for grading and grade marking of the lumber shall be acceptable to the Engineer.

C. Size Dressing: All lumber, except as otherwise specified or shown, shall be dressed to size in accordance with the standards of the association under which the lumber is graded. All lumber shall be S4S unless otherwise specified.

D. Drying: All lumber incorporated in the work, except where otherwise specified, shall be air or kiln dried to a moisture content of not more than 19 percent and not less than one percent.

E. Minimum Design Valves:

Minimum design values for lumber shall be:

1. Extreme fiber street in bending:

   - single: 1500 psi
   - repetitive: 1750 psi

2. Tension parallel to grain: 1000 psi

3. Horizontal shear: 95 psi

4. Compression:

   - perpendicular to grain: 385 psi
   - 1250-1500 psi

5. Modulus of elasticity: 1,800,000

6. Hidden exterior wood trim shall be pressure treated with a wood preservative

2.02 TREATED LUMBER

A. Marking: Each piece of treated lumber shall bear the approval mark of an approved testing agency.

B. Kiln Drying: Kiln-dried lumber shall be treated with a water-borne preservative and shall have a maximum moisture content of 15 percent after treatment.

PART 3: PRODUCTS

3.01 GENERAL

A. Preliminaries: Rough carpentry shall be as specified, shown, and as necessary for complete work. The Contractor shall verify drawing dimensions with actual field conditions and shall inspect related work and adjacent surfaces, and shall report to the Engineer all conditions which could prevent proper execution of this work.

B. Work Coordination and Performance: The Contractor shall coordinate all the work and cooperate with the subcontractors and the trades doing related work. All work of construction shall be carefully planned and laid out. All work shall be performed under the direction of a capable, experienced supervisor.

C. Rough Hardware: All rough hardware not otherwise specified and which is necessary for the satisfactory execution of framing, including nails, spikes, dowels, fasteners, and similar incidentals shall be provided and installed by the Contractor. Rough hardware shall be coordinated, furnished, installed, and embedded as shown and as required for a complete work.

D. Framing: Framing members and assemblies shall be closely fitted, accurately set, and rigidly secured to required lines, levels, and arrangements shown. Framing shall be accurately and neatly cut and shall be securely nailed, screwed, or otherwise fastened in place in a workmanlike manner.

3.02 FASTENERS AND FRAMING DEVICES

A. Nailing: Where nail spacing is not otherwise regulated by the Building Code, nails shall not be driven closer together than 1/2 their length unless driven in drilled holes, nor driven closer to the edge of a member than 1/4 of their length. When necessary to prevent splitting, holes shall be drilled slightly smaller than nail diameters. The nails shall penetrate the second or farther member not less than 1/2 the nail length. Common nails shall be used unless otherwise specified or shown.

B. Bolts and Nuts: Malleable or cut-steel washers shall be provided under bolt heads and nuts except where bearing on steel plates or other steel attachments or where flat-head countersunk bolts are shown. Bolt holes shall be drilled 1/32-inch to 1/16-inch larger diameter than the bolts they are to accommodate, and shall be bored true-to-line. Members shall be clamped together and bolts shall be driven in place and nuts drawn up tightly. Bolts shall be drawn tight again immediately prior to enclosing with finish or, if left exposed, upon completion of other work. Holes at anchor bolts embedded in concrete may be 1/16-inch larger than bolt diameter.

C. Screws: Lag and wood screws shall be screwed, not driven, into place. Holes to receive lag screws shall be bored first of the same diameter and depth as shank, then continued to depth equal to length of screw with diameter equal to the base of the screw thread. Screws shall penetrate into the farther member a distance equal to a least 7 times the diameter of the screw shank. Washers shall be installed under each lag screw head bearing on wood.

D. Metal Framing Devices: Metal framing devices shall be furnished and installed where shown. Nails for the framing devices shall be as furnished or recommended by the manufacturer of

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B. Storage: All materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2: PRODUCTS

2.01 SEALANTS AND CAULKING MATERIALS

A. All caulking and sealing materials shall conform to the following requirements:

1. Sealant for exterior and/or interior use shall be 2-part polyurethane, gun grade, as manufactured by Tremco "Dymeric Plus"; Products Research Corp. "210"; Progress Unlimited "Iso-Flex 2000"; or equal. Sealant for interior use may be 1-part acrylic terpolymer sealant, as manufactured by Tremco's "Mono"; Dap "One-Part Acrylic"; or equal.

2. The sealants used with aluminum doors, windows, storefronts, and frames shall be silicone sealant conforming to Federal Specifications TT-S-001543A (Class A) and TT-S-00230C(2) (Type II, Class A), as manufactured by Tremco "Spectrem 2", or equal.

3. Acoustic caulking compound shall be nonskinning synthetic polymer as manufactured by Tremco; Presstite "579.64"; Lowry "Acoustical Sealer"; or equal.

4. Fire-resistant penetration sealant shall be a medium density fire-resistant foam that retains form and stability at high temperature and meets UL test requirement for fire rating required at location used. Fire-resistant sealant shall be Dow-Corning Corporation's "3-6548 Silicone RTV" foam; 3M Corporation's "Fire Barrier Caulk CP 25" and "Putty Corporation's "Fire Barrier Caulk CP 25" and "Putty 303"; or equal.

5. Caulking tapes shall be of the butyl-base, vulcanized type.

6. Primers shall be as recommended in the manufacturers printed instructions for caulking and sealants.

7. Cleaning and cleanup solvents shall be as recommended in the manufacturer's printed instructions for caulking and sealants.

2.02 EXPANSION AND RELATED CONTROL JOINT FILLERS

A. The Contractor shall furnish all the materials for expansion joints and fillers, and control joints and seals in all concrete floor slabs and masonry walls as indicated on the Drawings.

B. At the locations indicated on the Drawings, expansion joints and fillers (1/2 inch wide) are called for in the concrete floor slabs.

C. Both types of joints (expansion and control) shall be sealed with a two-part epoxy caulk sealant, Para-Caulk 2405 by Parawaz Company or similar by Tremco, in accordance with the manufacturer's recommendations.

2.03 PREFORMED EXPANDING FOAM SEALANT

A. The Contractor shall furnish at all expansion and control joints in masonry walls impregnated

surfaces, excess sealant shall be removed per sealant or caulking manufacturer's printed instructions.

3.03 ACOUSTIC CAULKING

A. Preparation: Joints and surfaces to be sealed shall be clean, dry, and free of loose materials.

B. Concealed Joints: Concealed joints in acoustic partitions including perimeters and intersections of walls and penetrations through finish work and at conduit ends with boxes shall be sealed with acoustic caulking compound. Backs of electrical boxes shall be sealed with acoustic sheet caulking, covering all holes and knock-outs.

3.04 PREFORMED EXPANDING FOAM SEALANT

A. The Contractor shall install preformed foam sealant in vertical control joints in exterior masonry cavity walls (mean joint size 3/8" to 1/2") using Emseal Greyflex; joint shall be watertight requiring foam sealant compressed to 20% of original uncompressed dimension.

B. Install preformed foam sealant in joints at all locations where shown on Drawings or specified herein, for buildings erected under this contract. Use Emseal, joints shall require foam sealant compressed to 25% of original uncompressed dimension.

C. See details on Drawings for additional information regarding joint locations, dimensions, and use of other sealant when preformed foam sealant is to be used as a backup material.

D. Follow manufacturer's instructions for cleaning of joints, joint preparation, depth dimension of seal related to mean joint width, and general installation procedures.

3.05 EXPANSION AND RELATED CONTROL JOINT FILLERS

A. The filler for the expansion joints shall be placed so that ends are tightly butted and so that the top of the filler is level with the top of the concrete slab. Fillers shall be firmly anchored to avoid displacement. Joints, not completely filled with filler material and those with displaced or faulty fillers, shall be redone by the Contractor subject to final approval by the Engineer. In no case shall concrete bridge the gap of the expansion joint space. The joint shall be sealed.

B. Control joints (1/8 inch wide) shall be cut with a power carborundum circular saw in concrete slabs at locations as indicated on the Drawings; such joints shall be cut 1 inch deep maximum. Saw cuts shall run through to 1/2 inch expansion joints (w/fillers) and as close to vertical surfaces as possible, so each resulting area of concrete surface is isolated from all other areas. Immediately before sealing, the control joints shall be cleared of dust and debris with compressed air. Control joints in floors shall be filled and sealed to completely fill the joints. Excess sealant shall be removed from all adjacent floor and other surfaces. Top of seal shall be level with top of concrete floor surface.

END OF SECTION

2. SSPC-SP-6 - Commercial Blast Cleaning

3. SSPC-SP-10 - Near-White Blast Cleaning

B. National Sanitation Foundation (NSF)

1. NSF-61

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 PRODUCTS

2.01 MATERIALS

A. All shop priming materials shall be fully equal to those manufactured by Ameron International, the Tnemec Company, the Kop-Coat Company, Sherwin-Williams, or International Protective Coatings. This specification has been prepared on the basis of Ameron, Tnemec, Kop-Coat, Sherwin-Williams, and International Protective Coatings products and recommendations for applications. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each application, together with sufficient data substantiated by certified tests to demonstrate its equality to the paint(s) named, is submitted in writing to the Engineer for approval. The type and number of tests performed shall be subject to the Engineer's approval and shall be made at no additional cost to the Owner.

B. Shop prime coatings shall be guaranteed by the manufacturer to be compatible with the finish coatings to be used and shall be supplied by the same manufacturer as the finish coating, unless otherwise approved by the Engineer. Refer to Section 09902, Field Painting.

C. Coatings used for potable water service shall be certified in accordance with NSF-61.

2.02 PRIME PAINT SYSTEMS

A. The following surfaces shall have the types of prime paint scheduled below, applied at the dry film thickness (DFT) in mils per coat as noted. The maximum thickness shall be 150 percent of the minimum specified, i.e. 5 mils DFT may be 7.5 mils maximum.

1. Ferrous metals, submerged or subject to splashing.

a. Ameron

1 Coat: Amerlock 2 Epoxy (3.5 - 4.5 DFT)

b. Tnemec

1 Coat: 20-1211 Pota-Pox Epoxy (3.5 - 4.5 DFT)

c. Kop-Coat

1 Coat: Higard Epoxy Primer (3.5 - 4.5 DFT)

1 Coat: Interseal 670 HS (3.5 - 4.5 DFT)

4. Galvanized metals, where noted to be painted:

a. Ameron

1 Coat: Amerlock 2 Epoxy (3.0 - 5.0 DFT)

b. Tnemec

1 Coat: 66-1211 Epoxoline Primer (3.0 - 5.0 DFT)

c. Kop-Coat

1 Coat: Higard Epoxy Primer (3.5 - 4.5 DFT)

d. Sherwin-Williams

1 Coat: Macropoxy 646 (3.5 - 4.5 DFT)

e. International Protective Coatings

1 Coat: Interseal 670 HS (3.0 – 5.0 DFT)

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Sharp edges shall be rounded to a radius of 1/8 inch, including rolled steel sections such as angles or wide flanges.

B. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-10 immediately prior to priming.

C. Nonsubmerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-6, immediately prior to priming.

D. Surfaces to be prime painted shall be dry and free of dust, oil, grease, dirt, rust, loose mill scale and other foreign material before priming.

E. Nonprimed surfaces:

1. Gears, bearings surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

3.02 APPLICATION

A. Apply shop prime coats in accordance with approved paint manufacturer's recommendations.

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1.02 RELATED WORK

A. Concrete finishes are specified in Division 3.

B. Waterproofing is included in Division 7.

C. Shop priming and surface preparation of ferrous metals are specified in Section 09901 and included in the respective Section with the item to be primed.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings, working drawings and product data including manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness.

B. Submit, in accordance with Section 01300, color cards, including standard and special colors, for initial color selections.

C. Submit three sets of 8-inch by 8-inch samples on 1/4-inch hardboard, of all colors required for all types of paint to be used. Resubmit until approved.

D. Schedule of Painting Operations: Submit for review, within 90 days after the Notice to Proceed, a complete Schedule of Painting Operations. This Schedule is imperative so that the various fabricators may be notified of the proper shop prime coat to apply. Properly notify and coordinate the fabricators' surface preparation and painting operations with these Specifications. This Schedule shall include for each surface to be painted, the brand name, the percent volume of solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness, and color charts. When the Schedule has been approved, apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges shall be made available to the Engineer to verify the proper application while work is in progress.

1.04 REFERENCES STANDARDS

A. The work herein specified shall be performed in a legally acceptable manner and it shall be the responsibility of the Contractor to obtain any and all licenses, permits and legal approvals required to perform the work specified.

B. American Society for Testing and Materials (ASTM)

1. ASTM D4417 - Standard Method for Field Measurement of Surface Profile of Blast Cleaned Steel.

2. ASTM D4258 - Surface Cleaning Concrete for Coating.

3. ASTM D4259 - Abrading Concrete.

4. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

C. A written record of the meeting shall be submitted to the Engineer by the Contractor.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in factory sealed containers with manufacturer's labels intact and legible. Date of manufacture shall be clearly marked on each container. Product Data Sheets and Material Safety Data Sheets shall accompany all shipments of paint and related materials.

B. Store materials in a protected area capable of maintaining the paint materials at a temperature between 35 degrees F and 110 degrees F. Coatings must be stored to conform with local, state, and federal safety codes for flammable materials.

C. Storage areas shall be isolated from other buildings with all weather access. Keep area free of weeds and extraneous combustible materials. Open flames and smoking shall not be permitted in the storage area.

D. Provide protected area with provisions to allow paint materials to reach a minimum temperature of 60 degrees F immediately prior to mixing and application.

PART 2: PRODUCTS

2.01 MATERIALS

A. All painting materials shall be fully equal to those manufactured by Ameron International, the Tnemec Company Inc., the Kop-Coat Company, Inc, Carboline, or International Protective Coatings. The painting schedule has been prepared on the basis of Ameron International, Tnemec, Kop-Coat and Carboline products and recommendations for applications. No brand other than those named will be considered for approval unless the brand and type of paint proposed for each item in the following schedule together with sufficient data substantiated by certified tests conducted at no expense to the Owner, to demonstrate its equality to the paint(s) named, is submitted in writing to the Engineer for approval within 30 days after the signing of the Notice to Proceed. The type and number of tests performed shall be subject to the Engineer's approval.

B. All painting materials shall be delivered to the mixing area in unbroken containers, bearing the manufacturer's brand, date of manufacture and name. They shall be used without adulteration and mixed, thinned, and applied in strict accordance with manufacturer's directions for the applicable materials and surface and with the Engineer's approval before using.

C. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish paints to be used. Refer to Section 09901 for special primers.

D. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil.

E. Work areas will be designated by the Engineer for storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for painting wastes and no plumbing fixture shall be used for this purpose.

F. All recommendations of the paint manufacturer in regard to the health and safety of workmen shall be followed.

c. Kop-Coat
2 Coats: Kop-Coat 600 Interior/Exterior-Acrylic Emulsion (2 DFT per coat)
2 Coats: 1600 Acrylic Industrial Coating (2 DFT per coat)

d. Carboline
1 Coat: Carbocrylic 120 (1 DFT)
2 Coats: Carboguard 3359 (2 DFT per coat)

e. International Protective Coatings
1 Coat: Intercryl 530 (1 DFT)
2 Coats: Intercryl 530 (2 DFT)

f. Sherwin-Williams
1 Coat: PrepRite 400 Latex Wall Primer (1.1 DFT)
2 Coat: ProMar 400 Latex Egg Shell Enamel (1.3 DFT)

3. Interior and exterior Exposed Masonry (above grade and interior partitions) or Concrete Wall and Ceilings (scheduled to be painted):

a. Ameron
1 Coat: Amerlock 400 Block Filler (60-80 sq, ft. per gallon)
2 Coats: Amerlock 2 (6 DFT per coat)

b. Tnemec
1 Coat: 54-561 Modified Epoxy Polyamide Masonry Filler (60-80 sq ft per gal.)
2 Coats: 66-Color Hi-Build Epoxoline (6 DFT per coat)

c. Kop-Coat
1 Coat: Epoxy Block Filler (60-80 sq ft/gal.)
2 Coats: Higard Epoxy (6 DFT per coat)

d. Carboline
1 Coat: Carboguard 890 (60-80 sq ft/gal.)
2 Coats: Carboguard 954 HB (6 DFT per coat)

e. International Protective Coatings
1 Coat: Intercryl 320 (60 to 80 square feet per gallon evenly spread)
2 Coats: Interseal 670 HS (6 DFT per coat)

f. Sherwin-Williams
1 Coat: Kem Cati-Coat HS, B42-400 Series (60-80 sq ft/gal)
2 Coats: Macropoxy HS Epoxy B58-400 Series (3-6 DFT per coat)

4. Ferrous metals and ductile iron pipe (not coated) submerged or subject to splashing:

Note: Brush apply a "striped coat" over all welded joints prior to the first coat.

a. Ameron
1 Coat: Amerlock 2 (7 DFT)
2 Coats: Amerlock 2 (8 DFT)

6. Interior nonsubmerged ferrous metals and ductile iron pipe (not coated):

   Note: Brush apply a "striped coat" over all welded joints prior to the first coat.

   a. Ameron
      1 Coat: Amerlock 2 (5 DFT)
      1 Coat: Amerlock 2 (6 DFT)

   b. Tnemec
      1 Coat: 66-1211 Hi-Build Epoxoline (5 DFT)
      1 Coat: 66-Color Hi-Build Epoxoline (6 DFT)

   c. Kop-Coat
      1 Coat: Higard-Gray Epoxy (5 DFT)
      1 Coat: Higard-Color Epoxy (6 DFT)

   d. Carboline
      1 Coat: Carboguard 890 (5 DFT)
      1 Coat: Carboguard 890 HB (5 DFT)

   e. International Protective Coatings
      1 Coat: Interseal 670 HS (5 DFT)
      1 Coat: Interseal 670 HS (6 DFT)

   f. Sherwin-Williams
      1 Coat: Dura-Plate 235 B67-235 Series (4-8 mils DFT)
      1 Coat: Macropoxy HS Epoxy, B58-400 Series (3-6 DFT)

7. Exterior galvanized, and non-ferrous metal (Obtain Engineer's approval before painting over galvanized):

   a. Ameron
      1 Coat: Amerlock 2 (4 DFT)
      1 Coat: Amercoat 450 HS (2.5 DFT)

   b. Tnemec
      1 Coat: 66-Color Hi-Build Epoxoline (4 DFT)
      1 Coat: 71-Color Endura-Shield (2.5 DFT)

   c. Kop-Coat
      1 Coat: Higard Epoxy (4 DFT)
      1 Coat: 133 HB (2.5 DFT)

   d. Carboline
      1 Coat: Carboguard 890 (4 DFT)
      1 Coat: Carboguard 133 HB (2.5 DFT)

   e. International Protective Coatings
      1 Coat: Interseal 670 HS (4 DFT)
      1 Coat: Interthane 990 HS (2.5 DFT)

e. International Protective Coatings
1 Coat: Interseal 670 HS (4 DFT)
1 Coat: Interseal 670 HS (5 DFT)

f. Sherwin-Williams
2 Coats: Dura-Plate 235 Epoxy B67-235 Series (4-8 mils DFT per coat)

10. Metal surfaces exposed to temperatures above 250 degrees F (e.g. generator mufflers):

a. Ameron
2 Coats: Amercoat 878 Silicone Aluminum (1 DFT per coat)

b. Tnemec
2 Coats: 39-1061 Silicone Aluminum (1.5 DFT)

c. Kop-Coat
2 Coats: 4631 Silicon Aluminum (1.5 DFT)

d. Carboline
2 Coats: Thermaline 4900 Silicone Aluminum (1.5 DFT)

e. International Protective Coatings
2 Coats: Intertherm 875 (1.5 DFT per coat)

f. Sherwin-Williams
2 Coats: Silver Brite Aluminum Paint, S59S11 (1.0-1.5 mils DFT per coat)

11. Insulated Pipe:

a. Ameron
2 Coats: Amercoat 220 (3 DFT per coat)

b. Tnemec
2 Coats: 6-Color Tneme-cryl (3 DFT per coat)

c. Kop-Coat
2 Coats: Kop-Coat 600 Acrylic (3 DFT per coat)

d. Carboline
2 Coats: Carbocrylic 3359 (3 DFT per coat)

e. International Protective Coatings
2 Coats: Intertherm 228 (3 DFT)

f. Sherwin-Williams
2 Coats: DTM Acrylic Gloss or SemiGloss B66 Series (2.5 to 4 DFT per coat)

c. Kop-Coat
1 Coat: Higard Epoxy (4 DFT)
1 Coat: 133 HB (3 DFT)

d. Carboline
1 Coat: Carboguard 890 (4 DFT)
1 Coat: Carbothane 133HB (2.5 DFT)

e. International Protective Coatings
2 Coats: Interseal 670 HS (4 DFT per coat)

f. Sherwin-Williams
1 Coat: Dura-Plate 235 Epoxy B67-235 Series (4-8 mils DFT)

15. Exterior masonry or all concrete walls and roofs (nonsubmerged or not subject to splashing and scheduled for painting):

a. Ameron
1 Coat: Amerlock 2 (8 DFT)

b. Tnemec
1 Coat: 52 or 55 Color (10 DFT)

c. Kop-Coat
1 Coat: Flexxide Elastomeric Coating System (10 DFT)

d. Carboline
1 Coat: Carbocrylic 120 (1 DFT)
1 Coat: Carbocrylic 3359 (3 DFT)

e. International Protective Coatings
2 Coats: Interseal 670 HS (5 DFT per coat)

f. Sherwin-Williams
2 Coats: Conflex XL Elastomeric Coating (9.4 to 11 mils DFT per coat)

16. Interior exposed masonry and interior concrete walls and ceilings (where scheduled to be painted):

a. Ameron
1 Coat: Amerlock 400 Block Filler (60-80 sq. ft. per gal.)
1 Coat: Amerlock 2 (6 DFT per coat)

b. Tnemec
1 Coat: 54-561 Modified Epoxy Polyamide Masonry Filler (60-80 sq ft per gal.)
2 Coats: 66-Color Hi-Build Epoxoline (6 DFT per coat)

c. Kop-Coat
1 Coat: Epoxy Block Filler (60-80 sq ft gal.)
1 Coats: Higard Epoxy (6 DFT per coat)

B. New Ferrous Metal (Not Galvanized):

1. Carbon steel surfaces shall be ground smooth and clear of all sharp edges, rough welds, pinholes, burrs, weld splatter, laminations, etc. The profile on the steel shall be restored if grinding is done after abrasive blasting.

2. Surfaces which are to be submerged shall be abrasive blasted in accordance with SSPC-SP-10. Nonsubmerged surfaces shall be abrasive blasted in accordance with SSPC-SP-6.

3. Anchor profile shall be measured in accordance with Method C of ASTM D4417. Anchor profile shall be as specified by the coating manufacturer. In the absence of such requirements, the following shall be used:

   Minimum Anchor profile: 1.5 mils.
   Maximum Anchor profile: 2.5 mils.

4. Grease, oil, foreign matter, dust, etc., shall be removed before blasting or painting. The method of removal must be approved by the Engineer.

5. Cleaning shall cease each day to allow work to be primed. Primer shall be applied within 6 hours after blasting or before flash rusting. If rusting occurs, surface shall be re-blasted.

6. Permission shall be required for blasting if relative humidity exceeds 85 percent of if temperature of the surface is within 5 degrees F of the dew point.

7. Dry blasting shall not be carried out on surfaces that will be wet before painting.

8. All blasting equipment shall be in accordance with OSHA, Plant and Local Safety requirements.

9. Equipment shall have automatic moisture traps and drains.

10. Air fed hoods shall be used and have appropriate filters and carbon monoxide monitors on air line.

11. "DEAD MAN HANDLES" shall be used.

12. Pressure vessel wall thicknesses shall be checked at least annually.

13. Hoses shall be static dissipating.

14. Blasting pots shall be grounded

C. Concrete block surface shall be smooth and cleaned of all mortar flash, dust, efflorescence, chalk, loose mortar, dirt, grease, oil, tar and other foreign matter.

D. All plastic PVC and other surfaces shall be lightly sanded before painting.

E. Wood surfaces shall be dry. Sand to obtain a smooth surface. All encrustations shall be removed.

followed by two coats. The finish coat shall be feathered from the ground to the plane of the surface and sanded as necessary to provide a flat, smooth surface ready for decoration.

L. Mildew:

1. Remove muldew by scrubbing with solution of trisodium phosphate and bleach.

2. Rinse with clean water and allow surface to dry.

3.02 PAINTING SCHEDULE

A. All colors will be selected by the Owner and Engineer based on the Color Schedule herein.

B. The following items will not require coatings unless specifically called for by the manufacturer.

1. PVC Pipe

2. FRP Items

3. Galvanized steel

4. Aluminum (except where in contact with concrete/grout)

5. Stainless Steel

3.03 WORKMANSHIP

A. General

1. Primer (spot) and paint used for a particular surface shall, in general, be as scheduled for that type of new surface. Confirm with the paint manufacturer that the paint proposed for a particular repaint condition will be compatible with the existing painted surface. Sample repainted areas on the actual site will be required to ensure this compatibility. Finished repainted areas shall be covered by the same guarantee specified for remainder of work.

2. At the request of the Engineer, samples of the finished work prepared in strict accordance with these Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the Engineer where standard chart colors are not satisfactory.

3. Protection of furniture and other movable objects, equipment, fittings and accessories shall be provided throughout the painting operations. Canopies of lighting fixtures shall be loosened and removed from contact with surface, covered and protected and reset upon completion. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery name plates and all machined parts not receiving a paint finish. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

4. On metal surfaces apply each coat of paint at the rate specified by the manufacture to achieve

C. Field Painting

1. All painting at the site shall be designated as Field Painting and shall be under the direct and complete control of the Engineer and only skilled painters and specialists, where required, shall be used on the work.

2. All paint shall be at room temperature before applying and no painting shall be done when the temperature is below 50 degrees F or above 100 degrees F, in dust-laden air, when rain or snow is falling, or until all traces of moisture have completely disappeared from the surface to be painted. Coatings shall not be applied unless the temperature of the surface being coated is, and remains, at least 5 degrees F above the dew point until the coating is dry "to touch". Relative humidity shall be less than 85 percent during application. Coatings shall not be applied when exposed to wind velocities above 15 miles per hour. Coatings shall be protected from freezing until dry.

3. Corners, sharp edges and welds shall be stripped (an additional coat by brush) prior to application of the specified coat. Coating used for striping shall be the same as that specified for the coat to be applied.

4. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.

5. Finish surfaces shall not show brush marks, lap marks or roller marks, or other irregularities. Undercoats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted and all exterior trim shall be back-primed before installation.

6. Film thickness shall be monitored with a wet film thickness gage as the work progresses.

7. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. All exterior concrete and masonry painting shall be performed in one continuous manner structure by structure. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

8. All materials shall be applied by spray unless otherwise directed by the Engineer. The Contractor shall be responsible for all damage caused by overspray or drifting. On concrete or masonry, back-rolling after spraying shall be undertaken immediately following each coat to assure that all voids and holes are wet out and fully coated. Back-rolling may be deleted from the final coat if the test panel indicates that the prior coats followed by back-rolling is sufficient to provide a continuous coating without pinholes.

9. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be removed and repainted in accordance with the Engineer's directions.

10. Coating integrity shall be determined in accordance with NACE RP-0188-88 using the low voltage wet sponge test method. All holidays will be clearly marked for repair.

11. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and

B. Titles shall identify the contents by complete name. Identification title locations shall be determined by the Engineer but in general they shall be placed where the view is unobstructed and on the two lower quarters of pipe or covering where they are overhead. Titles should be clearly visible from operating positions, especially those adjacent to control valves.

C. Titles on equipment shall be applied at eye level on machines where possible or at the upper most broad vertical surface of low equipment. Where more than one piece of the equipment item to be titled exists, the items shall be numbered consecutively as indicated on the mechanical drawings or as directed by the Engineer, for example Pump No. 1; Pump No. 2, etc. Titles shall be composed and justified on the left hand side. Titles of equipment shall be coordinated with the Owner to ensure they are consistent with the titles provided to the SCADA system.

D. Application of titles.

1. The color of the titles shall be black or white, as approved, to best contrast with the color of the pipes and equipment and shall be stencil applied.

2. Numbers and letters shall be die-cut from 3.5 mils vinyl film and prespaced on carrier tape. Adhesive and finish surface shall be protected with one piece removable liners. Color shall be white or black as approved depending on substrate color.

3. The system for preparation and application of letters shall be Type B a.s.i./2 by ASI Sign Systems; Architectural Graphics Inc. or equal. Letter type shall be Optima Bold, upper case. Grid 2 spacing shall be employed. Arrow shall match as approved, letter type and size. The instructions of the manufacturer shall be followed in respect to storage, surface preparation and application of letters.

4. Exposed Ductile Iron Pipe:

   At the Contractor's option, he may either provide exposed DI pipe without bituminous coating or with bituminous coating. If bituminous coating is provided, then the painting system must be compatible with the bituminous coating.

5. Letter sizes.

Size of Legend Letters (in.)	*Outside Diameter of Pipe or Covering (in.)*
to 1-1/4	1/21-1/2 to 2
3/4	2-1/2 to 6
1-1\4	8 to 10
2-1/2	More than 10
3	

6. Equipment titles are to be two inches high.

7. Arrow sizes. Where "a" is equal to 3/4 of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrow head shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6-in.

8. When using direction arrows, point arrowhead away from pipe markers and in direction of

B. The completed work shall be inspected visually by the Engineer for skips, holidays, hiding, uniform color and appearance, and other imperfections. All defective work shall be corrected by the Contractor or applicator at no cost to the Owner.

C. Coating thickness on steel shall be determined in accordance with SSPC-PA-2. The number of readings will be a minimum of that stated in SSPC-PA-2.

D. Coating integrity for coatings in immersion areas or subjected to splash and spillage shall be determined in accordance with NACE RP0188-88 "Standard Recommended Practice for Discontinuity (Holiday) Testing of Protective Coatings" using the low voltage wet sponge test method. All holidays will be clearly marked for repair.

E. The Contractor shall furnish to the job site and use for coating application and inspection and make available to the Engineer the following test equipment:

1. Wet film thickness gauge.

2. Dry film thickness gauge (with certified thickness calibrator) equal to Mikrotest III, Elcometer Inspector III, or Positest.

3. Surface Temperature Gauge.

4. Holiday Detector. Low voltage type such as Tinker & Rasor Model M-1, Series 9533.

5. SSPC VIS-1-67T Pictorial Surface Preparation Standard.

6. Keane-Tator Surface Comparator Number 372 or equal.

7. NBS Certified Coating Thickness Standards.

8. Sling Psychrometer with barometric charts.

9. Surface moisture metering device equal to Delmhors Model DB.

3.08 CLEANUP

A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials and all rubbish from and about the buildings and leave work "broom clean" unless more exactly specified.

B. Upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the work ready for inspection.

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PART 2 PRODUCTS

2.01 GENERAL

A. The following equipment is specified by model number and manufacturer for convenience of description only. Equipment proposed by a different manufacturer shall be equal in all respects to that specified.

B. Location of equipment shall be as directed by the OWNER.

2.02 MISCELLANEOUS EQUIPMENT

A. Floor crane (S-16) shall be a 6000 lb capacity unit. The unit shall include the following:

1. Manual telescopic boom.

2. Hand pump hydraulic boom lift with double action pump for high and low speed lift.

3. Three position adjustable width telescopic legs.

4. Pneumatic wheels.

5. Battery operated cable lift.

6. Capable of disassembly.

7. The crane shall be Model HM-6000-A-P16 by Air Technical Industries or equal by Husky-Master.

8. The floor crane shall be set up in the Secondary Clarifier Gallery, near the Secondary Scum Well.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the respective manufacturer's instructions and recommendations. Installation shall include delivery and assembly of all items where applicable, attachment to substrate or to other items, where required and furnishing all oil and grease for initial operation where applicable.

B. The mounting and preparing of all equipment required for completely assembled and safe operating units shall be in strict accordance with the manufacturer's instructions and recommendations. The preparation shall include furnishing the required lubricants and performing the required adjustments for initial operation.

C. Equipment shall be delivered to the plant when directed by the Engineer, assembled as required, and placed or attached where directed by the Engineer.

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materials and details of construction, to indicate full compliance with these specifications.

4. Certified dimensional drawings of each item of equipment and auxiliary apparatus to be furnished.

5. Manufacturer's certified rating curves showing pump characteristics of head, brake horsepower, discharge, efficiency, and required net positive suction head. Catalog sheets showing a family of curves will not be acceptable.

6. Schematic electrical wiring diagrams and other data as required for completion of each pump installation.

B. Design Data

1. The weight of each item, carton or piece of equipment shipped with the item number and weight on the submitted list to correspond to the number on shipped item.

2. Data on the characteristics and performance of the recirculation/mixing chopper pumps and motors. Data on the pumps shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for capacity, pressure, and horsepower within 5 percent of nominal rating. Curves shall be submitted on 8-1/2-in by 11-in sheets. Data shall include BHP required, speed, efficiency and all other pertinent data.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Structural Steel

B. American Welding Society (AWS)

1. AWS D1.1 - Structural Welding Code - Steel

C. Steel Structures Painting Council (SSPC)

1. SSPC SP-5 - Surface Preparation Specification No. 5 White Metal Blast Cleaning

2. SSPC SP-6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning

3. SSPC SP-10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning

D. Anti-Friction Bearing Manufacturers Association Standards (AFBMA)

E. National Electrical Manufacturers Association (NEMA)

F. American Institute of Steel Construction (AISC)

criteria of the South Wastewater Treatment Plant in Baton Rouge, LA and that their O&M costs are equal to or lower than the specified equipment.

1.06 SYSTEM DESCRIPTION

A. This project entails the construction and equipping, ready for full service, the retrofitting of Digester No. 3 and No. 4 for the purpose of anaerobic digestion of wastewater solids residuals. This tank is to be fitted with equipment to mix the tank contents by recirculating digester sludge.

B. The contractor shall furnish and install two (2) mixing systems, each consisting of three (3) rotatable mixing nozzles or (3) double nozzle mixing assemblies, and two (2) recirculation/chopper pumps. The nozzles shall be located as recommended by the Manufacturer. Each pump shall provide a minimum of 2,400 gpm @ 40 feet TDH. The equipment shall be provided as a complete system by the mixing system manufacturer. Each equipment item shall be constructed as hereinafter specified. Mixing assemblies that utilize a fixed double nozzle design shall not be required to rotate.

C. The chopper-type recirculating pump shall be part of the scope of supply of the mixing system Manufacturer. The pump performance, design and operating characteristics shall be the responsibility of the mixing system Manufacturer. The pump shall be designed to prevent nozzle clogging in the specified application. Pumps shall be of a centrifugal chopper design, of heavy-duty construction, intended for services requiring a combined chopping and pumping action on fluids with entrained solids. Chopper Pumps shall be manufactured by Vaughan Company, Inc. or the Hayward Gordon Chopx brand.

D. Systems using single nozzle mixing assemblies shall be rotatable in order to create a rotating toroidal pattern. The pattern shall also include a helical flow pattern following the surface of the toroid, rising along the tank wall and descending in the middle of the tank to effectively sweep solids from the center of the tank. Rotatable nozzles shall be used to allow adjustment of the mixing pattern and to permit initial removal of heavy solids from the tank floor.

E. Systems using a fixed double nozzle assembly design shall not be required to rotate. The nozzles shall be designed to produce a rotational mixing pattern within the tank, while also producing flow across the middle portion of the tank thereby preventing solids from migrating toward the center. Solids are effectively drafted by the nozzles to the outer 30% of the tank where the peripheral rotation will create a homogeneous state throughout the entire tank volume.

F. The digester mixing system shall positively and continuously mix the entire contents of the digester. The variation in total solids throughout the digester shall not vary more than a 10% standard deviation from the mean total solids for the digester when the mean total solids concentration in the digester is between 2% and 4.5% solids by weight.

G. The complete sludge mixing system for the digester shall consist of a centrifugal recirculation chopper pumps, safety and operating equipment, electrical controls, valves, suction piping and all appurtenances required for sequentially discharging the sludge from the recirculation chopper pumps to achieve complete mixing of the digester contents. The performance characteristics of the pumps shall be as follows:

1.	Number of Pumps	4
2.	Configuration	As shown on Drawings
3.	Process Fluid	Anaerobically Digested Sludge
4.	Design Capacity	2400 gpm minimum at 40-ft. TDH

C. Structural steel used in the fabrication of the gas mixer and appurtenances shall conform to the requirements of ASTM A36 Design and fabricate structural steel members in accordance with the latest AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings." Welding shall be shielded arc welding and shall conform to the latest Standards of the American Welding Society. All steel plates that are part of the gas mixers shall be at least 1/4-in thick.

2.02 APPURTENANCES

A. Appurtenances as described hereinafter shall be included for each digester.

1. Sludge Mixing pumps and associated controls

2. Sludge Mixing Equipment within each digester.

3. All associated piping, valves and appurtenances.

4. Suction and discharge piping pressure gauges shall be supplied and mounted in close proximity to the recirculating pump. Gauges are to be 0-60 psi range with diaphragm protectors.

B. Seal Water Flushing Station (if required): Seal water flushing panel shall be supplied for each mixing pump for the purpose of cooling and lubricating the pump seal. All the components of the flushing system to include pressure gage, flow control valve with rotameter (rated for 0-6 gph), "y" strainer, pressure regulator and gate valve, all the be mounted and pre-piped on a 24"x24" polypropylene board, predrilled and ready for wall mounting. Mounting location shall be as agreed to with the Owner in the field. Flushing system is suitable for the trickle flush seal requirement. Pumps built specifically with flushless mechanical seals do not require a flush water station.

2.03 PUMPS

A. The pumps shall be mounted in the digester control building basement level as shown on the contract drawings and shall comprise of centrifugal chopper pumps with all safety and operational controls taking suction from the digesters and sequentially discharging through necessary piping and appurtenances to allow for complete independent mixing of each of the two digesters contents.

B. The pump performance, design and operating characteristics shall be the responsibility of the mixing system manufacturer. The pump shall be designed to prevent nozzle clogging in the specified application. Pumps shall be of a centrifugal chopper design, of heavy-duty construction, intended for services requiring a combined chopping and pumping action on fluids with entrained solids. Complete equipment shall be similar and equal in all respects to the sludge recirculation/mixing system as manufactured by Liquid Dynamics, Vaughn, or prior approved equal.

C. Pump and Motor Base: The pump and motor base shall be fabricated from steel, designed to provide rigid support of the pump and motor. Each base shall be furnished with suitable bolt and grout holes to facilitate mounting at site. Units shall be provided with V-Belts and sheaves to provide the required pump speed to meet performance conditions. Suitable OSHA guards are required.

M. Bearing Frame: The bearing frame shall be cast iron and should be fitted with grease nipples for grease lubrication or with a constant level oiler and vent and drain plugs for oil lubrication. The axial thrust bearing shall be contained in a separate housing mounted within the power frame to allow for external axial adjustment of the impeller clearance. Radial bearings shall be cylindrical roller type to withstand high radial loads during chopping. Axial thrust in both directions shall be taken up by a double row angular contact thrust bearings on pumps with less than 14" diameter impellers or by higher capacity double row tapered roller bearings for pumps with 14" diameter or larger impellers. The bearing lives are to be rated for a minimum of 100,000 hrs based on calculated loads due to hydraulic thrust encountered at the duty point, as well as other mechanical loading due to belt drives or shaft and impeller weight.

N. Stuffing Box/Seal Housing: The stuffing box will be constructed of A48 Class 30 cast iron designed to accommodate either:

1. Graphite acrylic braided packing with a Teflon lantern ring, retained by a bronze, split adjustable gland plate and lubricated with a clean water flush.

2. Single or double mechanical seal with clean water flush.

O. Any leakage will be retained by a drainable reservoir, integral with the bearing housing. A 0.75" NPT hole will be provided to connect seal water drainage piping.

P. Mechanical Seal: The pump seal shall be a John Crane type 1A seal, water flushed, with a lip seal to provide isolation between the bearings and seal area. The pump seal system shall consist of double mechanical Chesterton seals. Alternatively, the pumps may be supplied with a flushless mechanical seal which has been specifically designed to require no seal water flush through the elimination of the stuffing box. The seal shall be a cartridge type with tungsten carbide faces. The seal shall be pre-assembled and tested so that no seal settings or adjustments are required. Springs used to push the seal faces together must be shielded from the pumpage. The seal faces shall be lubricated and cooled by a separate oil chamber. The oil chamber shall include a 10 psi pressure relief valve. The area between the seal oil chamber and bearing oil chamber shall be vented and drained to prevent contamination of the bearings. Flushless mechanical seals do not require a seal water flushing station specified elsewhere in this specification.

2.04 Pump Control Panel

A. The Control Panel shall be supplied and installed as shown on the plans. The panel components include:

1. One (1) Lightning arrestor, 1 phase, 1 - Surge arrestor 120 volt, 1 phase,

2. One (1) Control circuit breaker, 1 pole 125 volt, 1 to 3 H-O-A three-position switch,

3. One (1) Pilot light, press-to-test type: "RUNNING", 1 - Elapsed time run counter,

4. One (1) lot corrosion inhibitor, terminal blocks, amp overload as required, all mounted inside a 24" x 30" x 8" NEMA 4X enclosure.

B. Pump Emergency Stop Panel: The emergency E-Stop panel shall be provided on the main control

system capable of 60-psi pressure. The bearings shall be permanently grease lubricated, requiring no periodic maintenance.

2. The gearbox shall be anchored to the tank floor using stainless steel anchor bolts. Anchor bolts shall be 5/8-inch diameter, and of sufficient length to support thrust loads from nozzles. Anchor bolts shall be Type 316 stainless steel. Connection of the feed pipe to each gearbox base shall be by a 150 lb standard ANSI flange connection. The remote station shall be connected to the base by means of a black iron crank rod housed within a separate galvanized steel carrier pipe.

3. A remote handwheel shall be provided with the mixer nozzle to position the mixer in any direction. The hand wheel shall be mounted on the outside of the tank wall and shall incorporate a chain and/or gearing connection to the crank rod to elevate the hand wheel to an operating position. The remote housing shall be made of 3/16-inch aluminum with Type 304 stainless steel shafts and self-lubricating bearings. The chain shall be nickel-plated and shall be self-lubricated. The housing shall incorporate a geared indicator with reference guide to show the position of the mixer nozzle in the tank.

4. Fixed double nozzle systems do not require gearboxes or controls.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, level, align, and lubricate mixing system. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery

B. Erect and install the digester mixing equipment in accordance with the following:

1. Installation shall be in strict accordance with the manufacturer's instructions and recommendations.

2. Field welding shall be shielded arc welding in conformance with the latest standards of the American Welding Society for gas-tight welding. Field welding shall be performed by certified welders according to AWS D1.1.

C. Installation shall include furnishing the grease and oil required for initial operation. The grease and oil shall be in accordance with the respective equipment manufacturer's recommendations.

D. All piping connections are to be tight and leak free. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on system piping. Install and secure all service lines as required.

E. All piping connections are to be tight and leak free. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on system piping. Install and secure all service lines as required.

F. Cleaning: Prior to acceptance, areas around recirculation pump and nozzles shall be inspected for dirt, splashed material, damaged paint or coating, and cleaned or repaired accordingly.

3. After construction debris and foreign material has been removed from the tank, Contractor shall supply adequate water volume to operate pump and mixing nozzles. Contractor shall observe and record operation of pumps, suction and discharge gauge readings, ampere draw, and pump controls. Check all equipment, test manual control, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

4. Following test with water, fill digester with sludge (seed from existing) to the maximum level. Feeding of fresh sludge to the digester shall be discontinued. Following eight hours of continuous sludge mixing system operation, temperature and total suspended solids measurements will be made from each of the sampling wells at eight elevations in each well to within two feet of the floor of the digester. Temperature measurements shall be made by positioning the temperature probe of a thermocouple type temperature-measuring device at the desired elevation and allowing it to stay at each sampling point long enough for the device to accurately measure the temperature of the digester contents at that point. The Engineer shall witness the temperature measurements. The Mixing System Manufacturer shall supervise sample collection as well as provide the interpretation of the sample analysis report. The Mixing System shall be considered as passing the Performance Test if 90% of all like sample points are within +/- 10% of the average value of that group of samples. The mixing system shall be designed to re-suspend solids from a quiescent condition that can last for periods of six months duration. The resultant mixture shall have a uniform concentration with the solids content varying by no more than ±10%.

5. All temperature readings shall be 1.0°F standard deviation of the mean value of all temperature readings within a single digester.

6. The variation in total solids throughout the digester shall not vary more than a 10% standard deviation from the mean total solids for the digester when the mean total solids concentration in the digester is between 2% and 4.5% solids by weight

E. Test data shall be furnished to the engineer 30 days prior to acceptance of the proposed equipment. All costs for sampling and analysis shall be borne by the Contractor. If the equipment performance test requirements cannot be satisfied, the mixing system for that digester will not be approved. The Contractor shall be required, at his expense and in a manner acceptable to the Engineer, to improve the mixing characteristics of the system until the requirements can be satisfied.

F. The Engineer shall be notified at least 10 days in advance of the actual test data. A qualified representative of the equipment supplier shall direct the equipment test, analyze data, and certify the equipment performance during the test. The Engineer shall observe all tests.

G. If, in the opinion of the Engineer, the equipment meets the requirements specified herein, the equipment shall be classed as conforming. If, in the opinion of the Engineer, the equipment test performance results do not meet the requirements specified herein, the equipment shall be classed as nonconforming.

H. In the case of nonconforming equipment, the Engineer shall reject the equipment as nonconforming to the contract documents; the Contractor/Equipment Manufacturer shall then either fix the equipment so it conforms to the specifications, or replace it with equipment that meets the specifications at no additional cost to the Owner.

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2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. The total weight of the equipment, cover with appurtenances including the weight of the single largest item and the weight of each item of equipment.

4. Calculations on ballast requirements.

5. Stress analysis for loadings given in Paragraph 2.02 below, showing stresses on all structural members including roller guide extensions. Calculations shall include unbalanced loadings imposed by live load and wind. Separate calculations shall be submitted based on the cover resting on the corbels and floating, with the ballast ring unsubmerged.

6. A complete total bill of materials for all equipment.

7. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc, on the list. List bearings by the bearing manufacturer's numbers only.

8. All information required by Division 16.

9. Complete master wiring diagrams, elementary or control schematic of all controllers, control panels, control devices and operators stations furnished under this section and suitable outline drawings of control panels and power feed cable supporting systems shall be furnished.

B. Operating and Maintenance Data

1. Copies of an operating and maintenance manual shall be furnished as provided for in Section 01730.

2. A factory representative who has complete knowledge of proper operation and maintenance shall be provided for two trips at 3 days each to instruct representatives of the Owner and the Engineer on mechanical equipment start-up and proper operation and maintenance. This work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the Owner.

C. In the event that it is impossible to conform with certain details of this Section due to different manufacturing techniques, describe completely all nonconforming aspects.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A714 - Standard Specification for High-Strength, Low-Alloy Welded and Seamless Steel Pipe.

C. The digester floating cover shall meet the following design and performance criteria:

1. New Duo Deck Floating Covers for Digesters Number Three (3) and Four (4)

a.	Tank diameter	65-ft-0-in inside diameter
b.	Steel Cover weight (no ballast)	95,900 pounds
c.	Normal Operation Liquid Level	See drawings
d.	Maximum cover travel	See drawings
e.	Max Tank side water depth Min Tank side water depth	41.00' Elevation 31.63' Elevation
f.	Overall cover skirt length	3-ft
g.	Minimum number of guides	2

D. Cover position indicators shall be furnished as specified herein.

1.07 MAINTENANCE

A. Tools and Spare Parts

1. One set of all special tools required for normal operation and maintenance shall be furnished for each digester as provided in Section 01730.

2. The following spare parts shall be provided for each digester:

a. Two sets of all gaskets and similar seals.

b. Two sets of spare parts, including flame elements, diaphragms, discs, seats, etc, for each pressure relief/vacuum breaker/flame arrester assembly.

c. Two rollers for each duo deck floating cover.

B. All spare parts shall be properly packed and clearly identified as provided in Section 01730.

PART 2 PRODUCTS

2.01 GENERAL

A. This Section is intended to give a general description of what is required, but does not cover all details which may vary in accordance with the exact requirements of the equipment as offered. It is, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in this Section, or shown on the Drawings shall be furnished and installed.

F. The gas holder floating cover shall consist of steel truss assemblies which plate sections and rim plate assemblies are attached. A gas dome assembly shall be located at the center of the cover for collection of gases in the tank.

1. Ceiling plate shall cover the surface of the tank and shall slope radially upward from the rim plates to the gas dome located in the center of the tanks. The ceiling plate shall be integrally welded to the lower cord plate of the trusses. All welds shall be watertight and gastight.

2. Radial trusses shall extend from the rim plates to the gas dome, which shall be provided with heavy ring plates to carry the reactions from the top and bottom cords of the trusses. The trusses shall be located above the ceiling plate. To assure proper alignment and to aid in welding fit-up, the trusses shall have bolted connection at the gas dome and rim skirt. Each truss shall comprise a lower and upper chord from the gas dome connection to the rim plate and include the required supporting interconnecting members in the vertical plane. There shall be an attic space between the upper chord and lower chord of the trusses for the full radius of the cover.

3. Roof plates shall be welded to the top cords of the radial trusses. All welds shall be watertight and gas tight. The air space between the roof plate and the ceiling plate shall be completely gas tight.

4. The rim plate shall be provided with flanged vertical seams for rigidity and ease in field assembly and shall extend both above and below the ceiling plate. The rim plate shall be designed to provide proper flotation under all conditions, to deflect gases to the center of the tank and to prevent the escape of gases through the clearance between the cover and the tank wall. All rim sections shall be provided with splice bars to aid in the erection of the cover rim plates and to provide additional stiffness to the rim.

5. Gas domes shall be of the dimensions shown on the Drawings. Each gas dome shall be provided with a removable, gasketed, top plate bolted to the top of the dome. The gas dome shall be gastight.

G. Digester Cover Guides

1. Two (2) sets of 3" x 2" x ¼" steel angle wall guides, with suitable wall anchors and extending the full range of cover travel, shall be provided to prevent cover rotation.

2.03 APPURTENANCES FOR DUO DECK FLOATING COVER

A. The gas dome assembly shall include the following:

1. A 24-in diameter gas pipe housing, with height as shown on the Drawings, located in the center of the gas dome such that it will telescope over the vertical gas piping as the cover rises and falls. An 8-in diameter handhole with a removable, gasketed, gastight cover plate with lifting handle shall be bolted to the top of the gas pipe housing to allow access to the gas piping. The bottom of the gas pipe housing shall have a mounting flange which shall be bolted to the gas dome. A suitable gasket shall be provided at the connection. The complete gas pipe housing shall be gas tight.

E. Drain sumps shall be provided in four bays at the low point in the ceiling plate near the rim plate. Drain sumps shall be approximately 8-in in diameter by 6-in deep and shall be constructed of welded steel plate. The top of the drain wells shall be welded to the ceiling plate. All welds shall be watertight and gas tight. A 3-in diameter threaded nozzle shall be welded to the roof directly above each drain well.

F. The Contractor shall furnish and install fixed piping from the gas withdrawal point along the digester roof to the edge of the floating cover including support as recommended by the roof manufacturer and in accordance with Division 15. At the edge of the digester floating cover, the Contractor shall furnish and install flexible piping/hose to bridge the gap between the digester wall and the point of reconnection to the existing rigid fixed pipe on the Control Building roof. The hose shall be of adequate length to allow full range of digester cover travel.

2.04 COVER POSITION INDICATORS

A. Cover position indicators shall be installed on the standard floating cover.

B. Each indicator shall have a local reading dial with scale calibrated in increments of feet and inches for the full travel of the cover. Dial and mechanism shall be enclosed in a water and moisture tight case of cast aluminum construction and shall be of the remote reading type.

C. Each indicator shall be actuated by a sonic pulse transmitter. Each indicator shall be provided with a signal converting transmitter emitting a 4-20 mA signal and constructed for explosion-proof Class 1, Division 1, Group D location. Calibration shall be with the 4-mA signal at the cover and sludge low position and the 20-mA signal at the gas and cover high position as indicated on the drawings.

E. In addition to the cover position indication provided by the Manufacturer, the Contractor shall furnish and install a physical level indication for each cover on the exterior of the digester at a location agreed to by the Owner. The physical level indication shall consist of connection of stainless steel chain to the digester roof and over the digester wall through a pulley or roller bar. This shall allow free movement of the chain with upward and downward movement of the digester cover. The stainless steel chain shall extend to the ground when the cover is at the highest point. The chain shall be weighted with a 10 pound weight and laced through stainless steel clamps/pipe supports spaced no more than 5 feet apart and to within 15 feet of the ground. The Contractor shall mark gradations on the side of the digester to indicate digester roof cover elevation from low point of resting on the corbels to the highest digester cover point. The location of the gradation shall be as determined by the Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

B. Installation shall include furnishing the grease and oil required for initial operation. The grease and oil shall be in accordance with the respective equipment manufacturer's recommendations.

E. All labor, power, equipment, water and incidentals required for the field tests shall be furnished by the Contractor.

F. After the plant is in operation, a full operating test shall be conducted in the presence of the Engineer. During the test, the digester cover operation and the gas recirculation system operation shall be observed to ensure that the equipment complies with this Section.

G. A written report covering the representative's findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

H. If the equipment fails to meet the requirements specified, corrective measures shall be taken and the equipment retested. If the equipment is still unable to meet the requirements, replace the equipment at no additional cost to the Owner and the above test procedures shall be repeated until satisfactory results are obtained.

END OF SECTION

B. Operating and maintenance instructions shall be furnished to the Engineer as provided in Section 01730. The instructions shall be prepared specifically for this installation and shall include required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Material (ASTM)

1. ASTM A48 - Gray Iron Castings

2. ASTM B584 - Standard Specification for Copper Alloy Sand Casting for General Applications

B. American Society of Mechanical Engineers (ASME)

C. Anti-Friction Bearing Manufacturers Association (AFBMA)

D. American National Standards Institute (ANSI)

E. American Iron and Steel Institute (AISI)

F. Instrument Society of America (ISA)

1.05 QUALITY ASSURANCE

A. The manufacturer shall certify to have not less than ten years of experience in the application, design, and manufacture of digester heating systems in wastewater treatment plants and shall submit a list of not less than twenty-five operating installations as evidence of meeting the experience requirement. The list shall include a contact and phone number.

B. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration of the required item. Products of other unnamed manufacturers will be considered in accordance with the General Conditions.

C. One supplier/equipment manufacturer to be responsible for the complete digester heating system described in Paragraph 1.06. This one supplier/equipment manufacturer shall be made responsible for the satisfactory operation of components of the system.

D. A manufacturer's factory representative for the equipment specified shall be present at the jobsite and classroom as designated by the Owner for a minimum of two days for combination heater and heat exchanger.

E. The heat exchangers shall be a self contained complete heating system. The combination heater and heat exchangers shall be as manufactured by Envirex, Inc. or prior approved equal.

1.06 SYSTEM DESCRIPTION

1.08 WARRANTY

A. The complete unit shall operate at a minimum efficiency of 80.0 percent while operating on natural gas. The test results shall be certified to the Engineer by the combination heater and heat exchanger manufacturer in a report which shall contain supporting data and calculations. Failure to meet the above efficiency shall be just cause for refusal of acceptance of the unit by the Engineer. Further, the combination heater and heat exchanger manufacturer shall warrant that if within five years after shipment of the heater and heat exchanger, the tube sheets, combustion chambers, controls, rear doors, and refractory at the rear of the boiler, fail under normal use, he will repair and/or replace the parts, placing the unit in full operating condition, without cost to the Owner.

B. The flow sensing device shall be provided with a 30-day trial period commencing when the system is placed into service. If the flow sensing device does not operate as intended, a full credit shall be provided to the Owner.

PART 2: PRODUCTS

2.01 GENERAL

A. These Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation, and field testing of materials, equipment, and apparatus as required. Additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications, or shown on the Drawings, shall be furnished and installed.

B. Lifting rings or lugs shall be provided on each unit. The lifting lugs shall be positioned and of adequate strength to allow lifting of the entire unit safely and without damage to the equipment.

C. Necessary foundation bolts, plates, nuts, and washers shall be furnished. It shall be the responsibility of the equipment manufacturer to determine the number, size, and location of anchor bolts.

D. Brass or stainless steel nameplates giving the name of the manufacturer, model number, serial number, capacity, pressure, and any other pertinent data shall be attached to each item of equipment.

2.02 COMBINATION HEATER AND HEAT EXCHANGER

A. The sludge tubes shall be standard weight steel pipe held in position by multiple gasket joints so arranged that leakage will be exposed to atmospheric pressure and detected by telltale holes in the gasket following ring, positively preventing contamination of the heating water by any material circulated through the sludge tubes. The sludge return bends, gasket following rings, and flanged connections shall be of cast iron construction. Sludge tubes and return bends shall be 4 inches diameter or greater. Flanged sludge and water connections shall be standard 125 pound. Sludge tubes shall be completely removable for inspection, cleaning or replacement. Return bends and flanged sludge inlet and outlet connections shall be removable for inspection and cleaning of the interior surface of the sludge tubes without draining the water. A manufacturer's Data Report for all types of boilers, form H-2, per ASME Code. ASME Code Rules shall be furnished to the

C. The induced draft fan shall be belt driven to permit field adjustment of the air capacity. The drive belts and open drip proof motor shall be enclosed in a removable housing. An air proving switch shall be provided to shut down the boiler in the event of fan failure.

2.04 CONTROL PANEL

A. The electrical control panel containing burner controller, branch circuit breaker and magnetic starter for the induced draft fan motor, controls for water bath circulation pump, and digester temperature controls shall be mounted and wired with rigid conduit and flexible watertight connectors in accordance with NEC. The electrical control panel shall be mounted on the side of the unit so as not to interfere with access to the burner, return breech, sludge tubes, or gas piping. Burner mounted controls will not be acceptable. The control panel shall be a NEMA 4X Enclosure with dual swing-out doors. The doors shall be lockable with disconnect switch and handle to insure the doors are closed during operation.

B. Starters and circuit breakers for digester recirculation pumps shall be provided in the heater and heat exchanger control panel.

C. A 480V to 120V control power transformer sized for all 120V loads shall be provided in the heater control panel.

D. The following switches and indicating lamps shall be provided on control panel doors:

1. Sludge Heater (manual/off/auto) switch

2. Constant Water Bath (on/off) switch

3. Exhaust fan (continuous/intermittent) switch

4. Sludge recirculation pump (continuous/intermittent) switch

5. Low boiler water indicator lamp

6. Flame failure alarm horn, alarm horn silencer, and flame failure indicator lamp.

E. Tagged outlets shall be provided to the main power 460 volt, 3 phase, 60 Hertz, AC.

F. Control panels shall have provisions for remote permissive run contact from a flow sensing device at the heater inlet so that heaters shall not operate without flow in the suction line.

G. All devices installed in the NEMA 4X enclosure "as installed" shall be maintained within their rated temperature limits based on the internal enclosure temperature to be experienced with the panel installed and operating in a 105 degrees F ambient outdoor location with the panel in direct sunlight. The manufacturer/supplier shall perform a temperature analysis to determine the maximum internal cabinet temperature to be experienced under the above conditions. This analysis shall take into account all external environmental temperature factors as well as the heat generated by all internal devices. The manufacturer/supplier shall be required to provide cooling through use of an accepted air conditioner that maintains the NEMA rating of the control panel to keep all panel components within their rated temperature limits under the above conditions. The cooling

1. Operating temperature thermostat (sensor and indicator) with high/low set points.

2. High temperature thermostat (sensor and indicator) with manual reset for high temperature limit safety shut down.

3. ASME pressure relief valve for both the boiler and heat exchanger set at 30 psi.

4. Low water cutoff switch.

5. Boiler temperature gage and pressure gage.

2.09 FLOW SENSING DEVICE

A. The feed line to each sludge heater shall be provided with a flow sensing device Model DFS-II as manufactured by Greyline or prior approved equal. The flow sensor shall provide a control contact closure to the heater control panel to allow the heater to operate only when there is a flow in the feed pipe.

PART 3 EXECUTION

3.01 PREPARATION

A. The completed heater and heat exchanger shall be shop fired and tested prior to shipment to insure proper operation and to adjust air and fuel flows. A report of the results of this test shall be submitted to the Engineer at his request. This report shall include the following information:

1. Manometer readings at the main gas regulator, pilot gas regulator, burner inlet, burner, and furnace.

2. Amps drawn by motors.

3. Voltage of pilot and main flame controller signal.

4. Flue gas reads including percent oxygen, percent carbon dioxide, temperature and efficiency.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's recommendations and instructions in the locations shown on the Drawings. Anchor bolts shall be set as required by the certified shop drawings.

B. Piping connections shall be made after the heat exchangers are bolted in place. Pipe connections shall be made so that stresses are not transmitted to the heat exchanger piping, providing and installing flexible couplings or sleeves, if necessary.

C. After field inspection is complete and the heat exchangers are ready for start-up, the Contractor and manufacturer's representative, in the presence of the Engineer, shall make a final field inspection of heat exchangers and their installation. Work shall be to the complete satisfaction of the Engineer. The Contractor shall require the manufacturer to certify, in writing and signed by the factory

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1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts.

2. ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.

3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

4. ASTM A536 - Standard Specification for Ductile Iron Castings

5. ASTM A714 - Standard Specification for High-Strength Low-Alloy Welded and Seamless Steel Pipe

B. American Water Works Association (AWWA)

1. AWWA C203 - Coal-Tar Protective Coatings and Lining for Steel Water Pipelines - Enamel and Tape-Hot-Applied.

C. American National Standards Institute (ANSI)

1. ANSI B2.1 - American Standard for Tapered Pipe Threads.

2. ANSI B16.5 - Pipe Flanges and Flanged Fittings.

3. ANSI B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.

4. ANSI B36.10 - Welded and Seamless Wrought Steel Pipe.

D. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

1. SP-59

E. Steel Structures Painting Council (SSPC)

1. SSPC SP-6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.

F. American Welding Society, Inc. (AWS).

G. National Electrical Manufacturers Assoc. (NEMA).

H. Where reference is made to one of the above standards, the revisions in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Like items and/or models of equipment provided hereunder shall be the products of one

drip traps are not required.

B. Each drip trap shall be the manually operated rotating disc type. Inlet and outlet connections shall be 1-in diameter. Unless otherwise specified or indicated on the Drawings, storage capacity shall be at least four quarts. Ports shall be sealed with O-rings or gaskets. The escape of gas shall not be possible while draining or when revolving the operation handle to open the drain line. Construction shall be of aluminum or cast iron except for stainless steel shaft and spring. Outlets shall be piped to floor drains where practicable.

C. All drip traps shall be suitable for gas pressures up to 25 psig.

D. Piping to each drip trap shall include a 1-in diameter pipe, a shutoff valve and union to isolate the drip trap. Pipe and valves shall be as specified under Division 15.

E. Drip traps shall be as manufactured by Envirex, Inc.; Varec, or prior approved equal.

2.02 FLAME TRAPS

A. Flame traps shall be equipped with thermal shutoff valves and shall be installed in the gas lines to the compressors. The flame traps shall be 6" as shown on the Drawings.

B. Flame traps shall have connections, capacity and head loss as follows:

Size	*Connection*	*Capacity, SCFH*	*Head Loss (in. W.C.)*
6-inch	Flange	10,000	0.5

C. The thermal valve portion shall be a fusible element released and spring operated plug type shut-off valve. Construction shall be cast aluminum or cast iron throughout except for stainless steel plug stem.

D. Flame trap portion shall have a housing constructed of cast aluminum ends and cast iron side and cover plates. The bank assembly shall be all aluminum and shall be arranged for easy removal from the housing to facilitate inspection and cleaning. Net free area through the bank assembly shall be not less than four times that of the corresponding size standard pipe. All grids of bank shall be individual corrugate stamped and rectangular shaped sheets and shall be arranged for individual removal. The flame trap portion shall be provided with a plugged drain connection.

E. Equipment shall be as manufactured by Envirex, Inc.; Varec, or equal.

2.03 PRESSURE-VACUUM RELIEF VALVES

A. One pressure-vacuum relief valve with flame trap shall be furnished and installed on the new digester cover. The valve shall provide a relief opening of not less than 4-in. in diameter. The pressure- vacuum relief valve with flame trap shall have a full sized plug valve in the pipe nozzle to allow removal of the pressure-vacuum relief valve without loss of gas or depressurizing the cover.

B. The main body shall be of cast iron construction. The pressure-relief valve shall be provided by a

E. Gages shall be provided with brass or stainless steel nameplates such as Digester, Waste Gas and Boiler.

F. Gages shall be as manufactured by Ashcroft, Division of Dresser Industries, Inc.; U.S. Gage; Crosby-Ashton, or prior approved equal.

2.06 GAS PIPE AND FITTINGS FOR DIGESTER GAS

A. All digester gas piping shall be 316L Stainless Steel.

B. Pipe fittings shall be of seamless steel of the same material as the pipe. Fittings shall be of the welding type standard wall thickness conforming to ANSI B36.10. Fitting dimensions shall conform to ANSI B16.9, except that 90 degree elbows shall be short radius type conforming to MSS SP-59. Fittings shall be furnished with threaded ends in conformance with ANSI B2.1.

C. Where flanged ends are required for connection to flanged valves and appurtenances, they shall be made using welding neck or slip-on type flanges. Flanges shall be of the same material as the pipe. Flanges shall be 150 lb, raised face type, conforming to ANSI B16.5. Flanges shall be faced, drilled and spot faced on the back. Flanges shall be bored to match pipe and fittings specified above. Welding neck flanges shall have beveled end for welding. Slip-on flanges shall be welded at both the flanges hub and at the pipe end.

D. Flange bolts and nuts shall conform to ASTM A307, Grade B.

E. Gaskets shall be of approved composition, suitable for the intended service.

F. Pipe for use with mechanical type couplings shall have radius grooved ends. Groove dimensions and tolerances shall fully conform to the coupling manufacturer's specifications.

G. Wherever raised face flanges are connected to flat face flanges, a suitable FRP filler ring of the same thickness as the raised face shall be provided to provide a suitable flat face matting surface. Alternately, the flange on the steel pipe may be of the flat face type.

H. All steel pipe, fittings, specials and appurtenances shall be prepared, primed, coated and lined as specified herein below:

1. Exterior surfaces of all steel pipe, fittings, specials, flanges, anchors and pipe supports exposed in above ground or interior locations shall be thoroughly cleaned in the shop by blasting with grit, shot or sand to SSPC SP6. One coat of primer shall be applied to the cleaned dry surface in a proper workmanship like manner and as recommended by the primer manufacturer. The primer shall be subject to approval of the Engineer and compatible to the finish coat as specified in Division 9 of the Specifications. Field painting of the installed system shall be as specified in Division 9.

2. Interior surfaces of all steel pipe, fittings and specials, which are to be installed exposed above ground or in interior locations shall be thoroughly cleaned in the shop by blasting with grit, shot or sand to SSPC SP6. Two coats of paint shall be applied to the interior of the pipe at the shop. The paint coats shall be Koppers Bitumastic Super Tank Solution or equal applied at a minimum of 8 mils DFT per coat.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment specified herein shall be installed true to alignment and rigidly supported. Installation shall be as shown on the Drawings and in accordance with the manufacturer's instructions and recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

B. Drip traps, flame traps, pressure relief valves, check valves, pressure vacuum relief valves and other items to be installed in the gas pipelines shall be installed as shown on the Drawing. Piping connections shall be gas-tight and made up so as not to place undue stress on these items. The pipeline shall provide support.

C. Pipe Installation

1. Steel piping and fittings shall be installed true to alignment and rigidly supported. All field welding shall be in accordance with the American Welding Society Standards. The strength of the field weld shall develop the strength of the pipe. When cutting of the pipe is required, the cutting shall be done by machine in a neat, workmanlike manner. Cut ends shall be smooth and at right angles to the axis of the pipe. Pipe ends for welding to fittings shall have beveled ends. All joints shall be gas-tight.

2. All threads shall be clean, machine cut and all pipe shall be reamed before erection. Screwed joints shall be made up with good quality thread compound and applied to the male thread only. After having been set up, a joint shall not be backed off unless the joint is completely broken, the threads cleaned and new compound applied. All joints shall be air-tight.

3. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before installation.

4. All pressure control lines and vent lines (to atmosphere), including fittings and valves, required for a complete installation shall be furnished and installed in accordance with the manufacturer's recommendations and approved shop drawings.

5. Sleeves of the proper size shall be installed for pipes passing through floors and walls as indicated on the Drawings. Sleeves shall be given a prime coat of rust inhibitive primer such as Koppers No. 621, or equal.

3.02 FIELD TESTING

A. Prior to testing and adjustment of valve settings the Contractor, in the presence of the Engineer, shall make a thorough inspection of the gas piping and gas handling and safety equipment checking for proper installation of the equipment. Any errors found or questions arising from this inspection shall be resolved to the satisfaction of the Engineer prior to proceeding with testing and adjustment.

B. Prior to the adjustment of relief valves in the gas piping system, the Contractor shall perform a pressure test on the gas piping system. Valves shall be closed to exclude the digester gas piping,

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(8) oversee and certify installation

(9) oversee, document, and certify loop testing

(10) oversee, document, and certify system commissioning

(11) conduct the performance test

(12) prepare Owner's Manuals

(133) prepare record drawings

b. Integration of the Process Control and Instrumentation System with instrumentation and control devices being provided under other sections;

(1) Develop all requisite loop drawings and record loop drawings associated with equipment provided under other Divisions of these Specifications and Owner furnished and existing equipment.

(2) Resolve signal, power, or functional incompatibilities between the Process Control and Instrumentation System and interfacing devices.

E. Summary of Work: The scope-of-work shall include all instrumentation and control system work required to provide additions of new control and monitoring systems for the South Wastewater Treatment Plant. The work shall include furnishing, installing, commissioning and placing into service all control systems, control system components and appurtenances required for a complete and fully functional instrumentation and control system as herein defined, as specified under other sections of these specifications and as shown on the Plans. This work shall include, but not necessarily be limited to: (1) Provide miscellaneous instrumentation, (2) provide interface to MCCs, (3) provide new/existing process equipment controls and interfacing (4) provide SCADA system components as required, and (4) provide modification of existing control systems' hardware/software as required for integration with the control system.

1. The general areas of responsibility are as follows:

a. Provide install and place into service hardware, software and appurtenances required for implementation of the new control and monitoring systems logic, as shown on the "P & ID(s)," as shown on the instrumentation loop drawings as defined in Division 13 and as required to provide fully integrated equipment control and monitoring systems. Further definition is included in, but not limited to, Section 13440 - IPC-Based Control Systems Hardware and Section 13450 - IPC-Based Control Systems Software.

b. Install all instrumentation and controls as shown on the P&ID, on the instrumentation loop drawings, as defined in Division 13 and as required to provide fully integrated equipment control and monitoring systems, complete with all wiring, conduit and appurtenances required to connect all control system components.

c. Modify the existing control system hardware to support modifications to the existing process equipment and additions of new process equipment. The modifications shall be

c. Shop drawing information shall be bound in standard size, 3 ring, looseleaf, vinyl plastic, hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 3 inches.

d. Interfaces between instruments, motor starters, control valves, variable speed drives, flow meters, chemical feeders and other equipment shall be included in the shop drawing submittal.

2. Analog Hardware Submittal: The Contractor shall submit an analog hardware submittal as a complete bound package at one time within 60 calendar days after the commencement date stated in the Notice to Proceed, including:

a. A complete index which lists each device by tag number, type, and Manufacturer. A separate technical brochure or bulletin shall be included with each instrument data sheet. The data sheets shall be indexed in the submittal by systems or loops, as a separate group for each system or loop. If, within a single system or loop, a single instrument is employed more than once, one data sheet with one brochure or bulletin may cover all identical uses of that instrument in that system. Each brochure or bulletin shall include a list of tag numbers for which it applies. System groups shall be separated by labeled tags.

b. Fully executed data sheets according to ISA-S20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves, for each component, together with a technical product brochure or bulletin. The technical product brochures shall be complete enough to verify conformance to all Contract Document requirements. The data sheets, as a minimum, shall show:

(1) Component functional description used in the Contract Documents

(2) Manufacturer's model number or other product designation

(3) Project tag number used in the Contract Documents

(4) Project system or loop of which the component is a part

(5) Project location or assembly at which the component is to be installed

(6) Input and output characteristics

(7) Scale, range, units, and multiplier (if any)

(8) Requirements for electric supply (if any)

(9) Requirements for air supply (if any)

(10) Materials of component parts to be in contact with or otherwise exposed to process media and corrosive ambient air

(11) Special requirements or features

a. A complete index in the front of each bound volume. The loop drawings shall be indexed by systems or process areas. All loops shall be tagged in a manner consistent with the Contract Documents. Loop drawings shall be submitted for every analog and discrete monitoring and control loop.

b. Drawings showing definitive diagrams for every instrumentation loop system. These diagrams shall show and identify each component of each loop or system using legend and symbols from ANSI/ISA S5.4 - Instrument Loop Drawings, extending the format as shown on Drawing I-1 and as defined by the most recent revision in ISA. Each system or loop diagram shall be drawn on a separate drawing sheet. Loop drawings shall be developed for loops in equipment vendor supplied packages, equipment provided under Division 13, and Owner furnished equipment. The loop drawings shall also show all software modules and linkages. In addition to the expanded ISA S5.4 requirements the loop diagrams shall also show the following details:

(1) Functional name of each loop

(2) Reference name, drawing, and loop diagram numbers for any signal continuing off the loop diagram sheet.

(3) MCC panel, circuit, and breaker numbers for all power feeds to the loops and instrumentation.

(4) Designation, and if appropriate, terminal assignments associated with every manhole, pullbox, junction box, conduit, and panel through which the loop circuits pass.

(5) Vendor panel, instrument panel, conduit, junction boxes, equipment and SCADA terminations, termination identification wire numbers and colors, power circuits, and ground identifications.

c. Itemized instrument summary. The summary shall be prepared with Excel software and shall be submitted on 3 1/2-inch floppy disks and hard copy. The instrument summary shall list all of the key attributes of each instrument provided under this Contract. As a minimum, attributes shall include:

(1) Tag number

(2) Manufacturer

(3) Model number

(4) Service

(5) Area location

(6) Calibrated range

(7) Loop drawing number

point-to-point diagrams with cable, wire, tube and termination numbers. These drawings shall include all instruments and instrument elements. One set of drawings electronically formatted in the latest addition of AUTOCAD and 2 hard copies shall be submitted after completion of all Precommissioning tasks but prior to Performance Testing. All such drawings shall be submitted for review prior to acceptance of the completed Work by the Owner.

1.05 SYSTEM INTEGRATION / INSTRUMENTATION / CONTROL / ALARM SYSTEMS DOCUMENTATION / REPAIR / CALIBRATION

A. The control system work may require revisions of the existing control systems for proper system functionality. Therefore, the Process Control System Programmer (PCSP) shall carefully inspect all field conditions associated with systems integration prior to bid. All programming and components required for a complete and fully functional control and monitoring system shall be provided even if not specifically called for on the plans or in the specifications.

B. The contractor shall provide detailed "as installed" record information and diagrammatic documentation. The contractor shall also provide calibration and repair of existing systems components, which are utilized in connecting to new instruments and instrumentation systems as further described below. The Contractor shall provide written proof of certification for (1) the new instrumentation and instrumentation systems and (2) the control and alarm systems provided under this project as shown on the drawings, as indicated on the P&ID, herein noted and as further described and below.

C. Information for the existing systems when available can be accessed from the Owner by the Contractor during construction to facilitate integration of the modifications into the existing alarm and monitoring systems. Any information on existing systems referenced on the plans or within the specifications was compiled from as built information supplied by previous construction contractors, or from contract drawings. The use of referenced information or previous drawings, when available, is intended to indicate the major components of existing systems and not intended to be an exact representation of all components or system requirements. The documentation and drawings that depict the existing conditions are neither complete nor always correct. Existing documentation will be made available to the Contractor where possible. It shall be the responsibility of the Contractor to verify all existing conditions, to make all drawings and sketches of existing circuits as necessary to insure the new controls are properly wired, work in accordance with the specifications, and have sufficient detail to provide for complete final system documentation. The contractor shall carefully examine existing conditions and all components required for a complete working system shall be provided and included in the final documentation even if not specifically called for on the plans or in the specifications.

D. Upon completion of all calibration and repair Work the contractor shall provide complete detailed record information for all systems supplied under this project. Diagrams shall show all components, actual field conditions and point to point connections.

E. Calibration/repair of existing systems connected to under this project shall include, but not be limited to:

1. Incidental small repairs, calibration, tuning, verification, cleaning/greasing, replacement

H. Any Work done on the above listed systems, including but not limited to repairs and calibration, shall be done in strict compliance with the manufacturer's recommendations and procedures for repairs and calibration.

I. All system Work including but not limited to repairs and calibration shall be formatted in writing and approved by the Owner prior to actual performance of any Work. Work to be performed may be presented in the form of the actual calibration and discrepancy reports provided sufficient detailing of required actions are provided.

J. All Work shall be scheduled with, approved by and preformed at the convenience of the Owner so as not to unnecessarily interrupt plant processes.

K. Scheduling of Work shall be done by formal presentation and Owner's approval of the written procedures as outlined in item H above. Completion of each calibration/repair shall be documented by the contractor and approved by the Owner's representative. This shall be done upon completion of each system repair. Copies of documentation shall be provided to the Owner at the time of approval and in the final system documentation as outlined above.

L. All Work shall be subject to testing / verification by and at the discretion of the Owner at the time of notification of completion of each scheduled item by the contractor. Any work found not to be in compliance with specification performance (percent error shall not exceed manufacturer's specifications) shall be corrected by the contractor and testing repeated to the satisfaction of the Owner.

1.06 SPECIAL WARRANTY REQUIREMENTS

A. Contractor shall obtain from each Supplier a Year 2000 warranty stating that all information technology components, including, but not limited to hardware, software, accessories and peripherals, tools and utilities (collectively, "components") furnished to the Contractor or installed in the Work are Year 2000 compliant. "Year 2000 compliant" means that such components will accurately process date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000, and leap year calculations. Furthermore, Year 2000 compliant components, when used in combination with other components, shall accurately process date/time data if the other components properly exchange date/time data with it. This warranty shall survive for the full term of the applicable statute of limitations.

B. Period for Correction of Defects: Contractor shall correct all defects in the PCIS upon notification from the Owner within one (1) year from the date of Substantial Completion. Corrections shall be completed within 5 days after notification.

1.07 WARRANTY

A. Contractor shall provide warranty coverage for the PCIS system for a period of twelve months from the system substantial completion date. Such warranty coverage will obligate the Contractor to repair or replace any defect or nonconformity in the system equipment provided that such defect or nonconformity is not a result of use of the system equipment contrary to the system supplier's instructions or in a manner not reasonably contemplated by the intended application.

1.10 CONTROL LOOP DESCRIPTIONS

A. Loop Descriptions: The loop descriptions are a general representation of the quantity of I/O points and a general representation of the programming concepts. The loop diagrams and loop descriptions are a general representation of the SCADA system data point configurations. Requirements for the SCADA system transition are not limited to and/or may not include all indicated components and/or concepts. All components required for a fully functional control and monitoring system shall be provided, even if not specifically called for on the plans or in the specifications.

Loop # 1001: Digester Mixing Pump No. 1 – Provides local HOA selector switching locally at the pump. Control logic will be provided by the MCC. "Run", "Stop", and "Fail" alarms will be provided at the SCADA master station. Provides on/off cycle timer control capability and timer adjustment. Provides alarms for no-flow. Provides on off status at the master station.

Loop # 1002: Digester Mixing Pump No. 2 – Provides local HOA selector switching locally at the pump. Control logic will be provided by the MCC. "Run", "Stop", and "Fail" alarms will be provided at the SCADA master station. Provides on/off cycle timer control capability and timer adjustment. Provides alarms for no-flow. Provides on off status at the master station.

Loop # 1003: Digester Mixing Pump No. 3 – Provides local HOA selector switching locally at the pump. Control logic will be provided by the MCC. "Run", "Stop", and "Fail" alarms will be provided at the SCADA master station. Provides on/off cycle timer control capability and timer adjustment. Provides alarms for no-flow. Provides on off status at the master station.

Loop # 1004: Digester No. 3 level indication -

Loop # 1005: Digester No. 4 level indication -

Loop # 1006: Digester Heater No. 3 – Provides local HOA selector switching locally at the pump. Control logic will be provided by the MCC. "Run", "Stop", and "Fail" alarms will be provided at the SCADA master station

Loop # 1007: Digester Heater No. 4 – Provides local HOA selector switching locally at the pump. Control logic will be provided by the MCC. "Run", "Stop", and "Fail" alarms will be provided at the SCADA master station

PART 2 -- PRODUCTS

2.01 GENERAL

A. Code and Regulatory Compliance: All PCIS Work shall conform to or exceed the applicable requirements of the National Electrical Code.

B. Current Technology: All meters, instruments, and other components shall be the most recent field-proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise required to match existing equipment.

C. Hardware Commonality: All instruments which utilize a common measurement principle (for

example, d/p cells, pressure transmitters, level transmitters which monitor hydrostatic head) shall be furnished by a single Manufacturer. All panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be from a single Manufacturer.

D. Loop Accuracy: The accuracy of each instrumentation system or loop shall be determined as a probable maximum error; this shall be the square-root of the sum of the squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual instrument shall have a minimum accuracy of plus and minus 0.5 percent of full scale and a minimum repeatability of plus and minus 0.25 percent of full scale unless otherwise indicated. Instruments which do not conform to or improve upon these criteria are not acceptable.

E. Instrument and Loop Power: Power requirements and input/output connections for all components shall be verified. Power for transmitted signals shall, in general, originate in and be supplied by the control panel devices. The use of "2-wire" transmitters is preferred, and use of "4-wire" transmitters shall be minimized. Individual loop or redundant power supplies shall be provided as required by the Manufacturer's instrument load characteristics to ensure sufficient power to each loop component. All power supplies shall be mounted within control panels or in the field at the point of application.

F. Loop Isolators and Convertors: Signal isolators shall be provided as required to ensure adjacent component impedance match where feedback paths may be generated, or to maintain loop integrity during the removal of a loop component. Dropping precision wirewound resistors shall be installed at all field side terminations in the control panels to ensure loop integrity. Signal conditioners and converters shall be provided where required to resolve any signal level incompatibilities or provide required functions.

G. Environmental Suitability: All indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided in order to maintain all instrumentation devices 20% within the minimums and maximums of their rated environmental operating ranges. The Contractor shall provide all power wiring for these devices. Enclosures suitable for the environment shall be furnished. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.

H. Signal Levels: Analog measurements and control signals shall be as indicated herein, and unless otherwise indicated, shall vary in direct linear proportion to the measured variable. Electrical signals outside control panels shall be 4 to 20 milliamperes dc except as indicated. Signals within enclosures may be 1-5 volts dc. All electric signals shall be electrically or optically isolated from other signals. All pneumatic signals shall be 3 to 15 psig with 3 psig equal to 0% and 15 psig equal to 100%.

I. Control Panel Power Supplies: All control panels shall be provided with redundant power supplies which are configured in a fault-tolerant manner to prevent interruption of service upon failure and interruption of service necessitated by the replacement of a power supply. All power supplies shall have an excess rated capacity of 40 percent. The failure of a power supply shall be annunciated at the control panel and repeated to the main control room SCADA System.

J. Alternative Equipment and Methods: Equipment or methods requiring redesign of any project details are not acceptable without prior written approval of the Engineer through the "or equal" process of Specification Section for Products, Materials, Equipment, and Substitutions. Any proposal for approval of alternative equipment or methods shall include evidence of improved performance, operational advantage and maintenance enhancement over the equipment or method indicated, or shall include evidence that an indicated component is not available.

K. Communications Protocol: Where required or indicated on the plans, loop drawings or P&ID(s), systems communications capability to interface to popular industry standard fieldbus communications protocols such as Profibus DP or DeviceNet shall be provided.

L. The installation of electrical equipment requiring the assembly of individual electrical components not assembled by a recognized manufacturer shall be supplied by a UL recognized electrical fabrication shop and shall be UL labeled by the fabrication shop. Assemblies such as control panels, IPC system and system enclosures, control relay and control assemblies, etc. are a few but not the only examples of this requirement.

2.02 OPERATING CONDITIONS

A. The Process Control and Instrumentation System shall be designed and constructed for satisfactory operation and long, low maintenance service under the following conditions:

1. Environment - wastewater treatment facility

2. Temperature Range – 20 through 104 degrees F

3. Thermal Shock - 1 degree F per minute, max

4. Relative Humidity - 20 through 90 percent, non-condensing

2.03 SPARE PARTS AND SPECIAL TOOLS

A. The Contractor shall furnish the spare parts selected by the Engineer from the priced list of spare parts in the Analog Hardware Submittal .

B. The Contractor shall furnish a priced list of all special tools required to calibrate and maintain all of the instrumentation provided under the Contract Documents. After approval the Contractor shall furnish all listed tools.

C. All special tools and spare parts shall be submitted before startup commences, suitably wrapped and identified. This includes a digital camera and program for use with the maintenance computer.

2.04 INSTRUMENTATION (as required)

A. Transient Protector (4-20 MA Signal Surge Suppressor) all 4-20 MaDC signals supplied or modified under this project shall be provided with transient protection.

1. The protector shall be of the in line type with gas filled spark gap, an inductor, and a fast response bipolar zener diode selected to prevent damage from transients inducted by

lighting, welding equipment, heavy electrical equipment, etc. The protector housing shall be of stainless steel and the internal components shall be epoxy sealed. The protector shall be Rosemount Model 470 or prior approved equal.

B. Transient Protector (Single Phase Supply Surge Suppressor) all single phase supply input supplied or modified under this project shall be provided with a single-phase surge suppressor.

1. The protector shall be housed in a NEMA 4X (FRP) enclosure. The unit shall be UL 1449 listed, shall provide a minimum of 20 amps operating current rating (higher if required for specific application) and a minimum of 40 kA of surge current suppression. The protector shall be provided with a 5-year failure replacement warranty. The protector shall provide indicator lights showing system status. The protector shall be AEGIS+ as manufactured by Cutler-Hammer or prior approved equal.

C. Check Valve Limit Switch(s). Limit switches shall be provided for all new pump check valves supplied under this project.

1. The switch shall have sealed mercury-wetted contacts of the number and type shown on the drawings. The switch shall be mounted on an adjustable tilt bracket and housed in a NEMA 4X (Fiberglass) enclosure. The switch shall be connected, have sufficient cable length to reach an external junction box and allow for complete movement of the check valve swing arm. The switch shall be constructed to allow for mounting on the check valve swing arm and allow in place adjustment to actuate the switch at any angle of the check valve swing arm.

D. Terminal Cabinets (AJB and MAJB) Terminal cabinets shall be provide as required, as shown on the drawings and as detailed herein detailed.

1. Instrumentation Terminal Cabinets shall be of the NEMA 4X (stainless steel), wall or stand mount type. The structures shall be sized to accommodate the number of terminal blocks required for installed equipment and 25 percent spare for future. All terminal blocks shall be mounted to a sub-panel within the enclosure and spaced to allow ease of field wiring. Terminal strips shall be U. L. rated for the intended service and shall be labeled with a scheme approved by the Engineer. The Cabinets shall be as manufactured by Hoffman or prior approved equal.

2.05 MISCELLEANOUS FIELD MOUNTED INSTRUMENTS (as required)

A. Flow Relay - Zero Return Unit

1. Type:
   a. External Contact Actuated.
   b. Electronic Output.
   c. NEMA 4X Enclosure.

2. Operation: To present a "live zero"; or 4 mA signal to the loop when actuated. Actuation shall be by a closed contact on a no flow condition.

3. Functional:
   a. Power Requirement - 120 VAC plus or minus 10 percent, 60 Hz.

b. Output - 4 mADC.
c. Input (During Flow) - 4-20 mADC.
d. Input (During No Flow) - External dry contact closure.

4. Physical:
   a. Case Type - NEMA 4X.
   b. Mounting - Wall
   c. Head Assembly - NEMA 4X.
   d. Mounting within 1/4-in bore tapered Type 316 stainless steel thermowell.

B. Flow Totalizing Indicator, Commander 150 Model ABB or equal.

1. Type:
   a. Electronic
   b. 8 Digit, Electro-Mechanical.
   c. NEMA I Case.

2. Purpose - To accept standard electronic input signal and provide a digital display of the electronically integrated value.

3. Functional:
   a. Solid State Circuitry.
   b. Input - 4-20 mADC.
   c. Totalizer - 8-Digit, electro-mechanical, non-reset type unless otherwise noted.
   d. Dropout - 0 to 10 percent adjustable.

4. Physical:
   a. Case Size - Nominal 3-in by 6-in by 20-in.
   b. General purposes enclosure, with slide tray.
   c. Mounting - Flush panel suitable for high density mounting arrangements.

5. Performance: Accuracy - plus or minus 0.5 percent of span.

C. Indicator

1. Type:
   a. Milliammeter.
   b. 4-in (nominal) glass dial window.
   c. NEMA 4X rated.

2. Operation: To accept a standard electronic input signal and provide an indication of a measured variable on a dial scale.

3. Functional:
   a. Input - 4-20 mADC, 10 ohm terminal resistance.
   b. Indication - Scale graduated in engineering units.

4. Physical:
   a. Case Size - Nominal 4 to 6-in.
   b. Mounting - Flush panel, surface or conduit as shown on the loop diagrams.

5. Performance:. Accuracy - Plus or minus 2.0 percent of span.

D. Pressure Indicating Transmitter

1. Type:
   a. Diaphragm.
   b. Electronic Output.
   c. NEMA 4X enclosure.

2. Operation:
   a. Purpose - To sense variations in pressure and produce a standard current output signal linear with the pressure.
   b. Sensing Element - differential-capacitance cell, bonded strain gauge, or differential pressure cell.
   c. Indicator - integrally mounted.

3. Functional:
   a. Static Pressure Limits - 200 psig (min) unless otherwise required.
   b. Power Supply - DC (from receiver over signal leads).
   c. Output - 4-20 mADC.
   d. Process Connections - 1/2-in NPT.

4. Physical:
   a. Body Material - Type 316 stainless steel.
   b. Wetted Parts - Type 316 stainless steel.
   c. Electronics Housing - NEMA 4X.

5. Performance:
   a. Accuracy - plus or minus 0.25 percent of span.
   b. Indicator Accuracy - plus or minus 2.0 percent of span.

E. Diaphragm Seal

1. Type:
   a. Thread Attached.
   b. Welded Metal Diaphragm.
   c. Exposed Surfaces - Type 316 stainless steel.

2. Operation:
   a. Purpose - To protect instruments or gauges from the process medium.
   b. Operating Principal - A flexible diaphragm separates process medium and instrument element. Space on instrument side of diaphragm to be completely filled with a suitable silicone or instrument oil. The process pressure is transmitted by the liquid filled system to the instrument element.

3. Functional:
   a. Filling Screw - Include on all units.
   b. Pressure Limits - 1,000 psi.
   c. Flushing Connection - Include on all units.

d. Capillary tubing as required.

4. Physical:

a. Top Housing - Carbon Steel, Cadmium plated.

b. Diaphragm - Type 316 ELC Stainless Steel.

c. Exposed Surfaces - Type 316 stainless steel.

d. Bolts, Nuts and Plugs - Type 18-8 stainless steel or Type 316 stainless steel.

e. Capillary - 1/4-in stainless steel armor shielded.

F. Level Switch (Float Type)

1. Type:

a. Tilting float actuation.

b. SPDT mercury switch.

c. Polypropylene casing.

2. Operation:

a. Function - To produce a contact output at a predetermined liquid level.

b. Operating Principle - A sealed mercury switch encased in a weighted float freely suspended from a cable is actuated by the tilting motion of the float when it is displaced by the liquid level.

3. Functional:

a. Output - Form C (SPDT) hermetically sealed mercury switch, rated 6 Amps at 250 VAC.

4. Physical:

a. Float - Hermetically sealed, molded polypropylene casing.

b. Cable - Three-conductor No. 19 AWG PVC-jacketed.

c. Mounting - Cable suspended by waterproof compression connector.

5. Performance:

a. Angular Operating Differential - 20 degrees.

b. Vertical Operating Differential - 1/2-in.

6. Manufacturer:

   a. Float switch shall be Flygt Corporation, 3- or 4-wire, type ENH-10 or equal.

7. Accessories:

   a. Support bracket with adjustable clamp for setting switch height.

   b. NEMA 4X junction box.

   c. An intrinsically safe relay shall be provided between each level switch and control cabinet for hazardous area applications. Relay shall be GEM Safe-Pak Division of Delaval; Cutler Hammer Type MX or equal.

G. Pressure Gauge

1. Type - Bourdon Tube

2. Operation: To measure pressure of the process and indicate locally in psi.

3. Process:
   a. Fluid - water
   b. Maximum Pressure - 150 psig
   c. Maximum Temperature - 200 degrees F

4. Physical:
   a. Dial Size - 4-1/2-in, white with black engraving.
   b. Lens - Shatterproof glass, screwed ring or snap ring retainer.
   c. Movement - Manufacturers best.
   d. Over-range - 1.3 times maximum range without damage.
   e. Process Connection - 1/4-in NPT
   f. Case:
      1) Material - phenolic
      2) Blowout back.
      3) Bottom connected for pipe mounted gauges and back connected for flush mounted.
      4) Suitable for liquid fill.

   g. Tube, socket, tip material - bronze.
   h. Pulsation dampeners as required.
   i. Diaphragm seals as required.

5. Performance:
   a. Range - Reference Drawings.
   b. Accuracy - 1/2 of 1 percent of span.

H. Inline Fluid Detector

1. Type

a. Empty pipe detector
b. Radio Frequency
c. Flange-mounted
d. Remote-mounted electronics

2. Operation
   a. Power: 120 VAC
   b. Ambient Temperature: -40C to 60C
   c. Level Output: DPDT
   d. Contract Rating: 120 VAC 5A non-inductive
   e. Time Delay: adjustable 0-120 seconds
   f. Fail Safe
   g. Built-on RFI protection

3. Enclosure: NEMA 1-5 and 12, Explosion proof for Class I Groups A, B, C, D Division 1 and 2, Class II Groups E, F, G, Division 1 and 2

4. Sensor
   a. Process Temperature 340 F Max
   b. Process wetted parts, 316L SS and Teflon
   c. NEMA 1-5 and 12, Explosion proof for Class I Groups A, B, C, D, Division 1 and 2, Class II Groups E, F, G, Division 1 and 2.

5. Manufacturer
   a. Drexelbrook Engineering Company, Model 506-7032 Series or equal

2.06 MISCELLANEOUS PANEL MOUNTED INSTRUMENTS (as required)

A. Flow Totalizing Indicator

1. Type:

   a. Electronic.

   b. 8 Digit, Electro-Mechanical.
   c. NEMA I Case.

2. Operation: Purpose - To accept standard electronic input signal and provide a digital display of the electronically integrated value.

3. Functional:
   a. Solid State Circuitry.
   b. Input - 4-20 mADC.
   c. Totalizer - 8-Digit, electro-mechanical, non-reset type unless otherwise noted.
   d. Dropout - 0 to 10 percent adjustable.

4. Physical:
   a. Case Size - Nominal 3-in by 6-in by 20-in.
   b. General purposes enclosure, with slide tray.
   c. Mounting - Flush panel suitable for high density mounting arrangements.

5. Performance: Accuracy - plus or minus 0.5 percent of span.

B. Indicator

1. Type:
   a. Electronic.
   b. 1-in high characters (nominal)
   c. NEMA I Case.

2. Operation:
   a. To accept standard electronic input signal(s) and provide an indication of the measured variable(s) on a LED digital display.
   b. Pointer Actuation - Potentiometer or Servo positioner.
   c. Circuitry - Solid State.

3. Functional:
   a. Input(s) - 4-20 mADC into 250 ohms (maximum).
   b. Indication - 1-in LED, 4-1/2 digit, graduated in engineering units.

4. Physical:
   a. Case Size - Nominal 3-in by 6-in.
   b. Case Type - NEMA I
   c. Mounting - Flush panel suitable for high density mounting arrangements.

5. Performance: Accuracy - plus or minus 0.5 percent of span.

6. Manufacturer: Action Instruments or equal.

C. Relay (Signal Converter)

1. Type:
   a. Current or Voltage signal input.
   b. Current output.
   c. NEMA I, Rack Mounting.

2. Operation: To accept an analog current or voltage input signal and provide a DC current output with increased impedance capability and provide loop isolation. Also, capable of field adjustment of input/output scaling, where required (EXAMPLE: 12-20 mA of input to equal 4-20 mA output).

3. Functional:
   a. Solid State Circuitry.
   b. Inputs - Vary with application such as 4-20 mA, 10-50 mA, 0 to 10 volts.
   c. Output - Isolated 4-20 mADC into 750 ohms (maximum).

4. Physical:
   a. Case Material - Aluminum.
   b. General purpose enclosure.
   c. Mounting - Rear panel rack mounting.

5. Performance: Accuracy - plus or minus 0.25 percent of span.

D. Relay (Add-Subtract)

1. Type:
   a. Current inputs.
   b. Current output.
   c. NEMA I, rack mounted.

2. Operation:
   a. To accept two or more input signals and provide a process output signal proportional to the sum and/or difference of the inputs.
   b. Solid state circuitry with isolation between input, output and power.

3. Functional:
   a. Inputs - 4-20 mADC.
   b. Output - 4-20 mADC into 750 ohms (maximum).
   c. Individual adjustable scaling of each input and output.
   d. RFI protection.

4. Physical: General purpose enclosure.

5. Performance: Accuracy - plus or minus 0.5 percent of input span.

E. Relay (Current Trip)

1. Type:
   a. Current input.
   b. Relay outputs SPDT.
   c. NEMA I, rack mounting.

2. Operation:
   a. The relay shall accept an analog current or voltage input signal and provide dual alarm outputs (high and low).
   b. Circuit isolation between input and output.

3. Functional:
   a. Dual Alarms with two independent set points adjustable 0 to 100 percent by 10 turn pots.
   b. Input - 4-20 mA.
   c. Output dual relay, 5 Amps.

4. Physical:
   a. Rack mounted general purpose enclosure.
   b. Die cast aluminum.

5. Performance:
   a. Set point dial accuracy plus or minus 2.0 percent of span.
   b. Repeatability - 0.1 percent of span.

F. Relay (Rate Multiplier)

1. Type:
   a. Voltage pulse input.
   b. Voltage, 30 ms pulse output.
   c. NEMA 1, rack mounting.

2. Operation: To power and accept an input pulse from a three wire pulse device and produce a scaled output pulse for counter indication.

3. Functional:
   a. Input and output pulses varies with application.
   b. 4 decade (min) scaling (multiplication factor).
   c. Excitation for 3 wire sensor.

4. Physical: Rack mounted general purpose enclosure.

5. Performance:
   a. Calibration capability.
   b. Plus 1 input pulse.

H. Quantity Indicator - Subtractive Counter & Probe Controls

1. Type:
   a. Subtractive counter.
   b. Cycle start/stop controls and operating light to match quantity element (Automatic Sounding Probe) specified.

2. Operation: To initiate probe sounding and indicate quantity of material remaining in the bin or silo.

3. Functional:
   a. Power requirement 120 VAC, 60 Hz.
   b. Indicator: 4 digit, subtractive, predetermined, electro-mechanical counter, scaled to provide volume remaining in cubic feet.

I. Quantity Indicator - Counter

1. Type:
   a. Electromechanical.
   b. AC or DC input as required to match other instruments in loop.

2. Operation: To accept a contact closure input to count and indicate a total quantity.

3. Functional: DC, AC Voltage variation (percent) plus 10 plus 10 Residual ripple/frequency (percent/Hz) 48 50..60 Count speed (Imp/s) 25 10 Min. On/Off time (ms) 20/20 50/50 Power consumption (w/VA) 2.75 4 Duty cycle (percent) 100 100

4. Physical:

a. Corrosion-proof (atmospheric humidity) mechanical mechanism.
b. 0.080 by 0.160/N white on black digits.

J. Indicating Controller

1. Type:
   a. Electronic Analog.
   b. Solid State Circuitry.
   c. 3-in by 6-in NEMA 1 Case.

2. Operation: To produce a standard electronic output signal based on the deviation between a measured variable input signal, and a manually or automatically adjusted set point signal.

3. Functional:
   a. Measured Variable Input - 4-20 mADC into 250 ohms (maximum).
   b. Remote Set Point Input - 4-20 mADC into 250 ohms (maximum).
   c. Input Indication - 4-in vertical scale(s) for measured variable and setpoint.
   d. Output Indication - 2.5-in horizontal scale.
   e. Control Mode - proportional (3 to 500 percent).
   f. Manual Station - Auto-manual switch, local-remote switch, and thumbwheels for manual adjustment.
   g. Auxiliary 2 Amp output contacts to indicate switch status.
   h. Batch control where required to prevent windup.
   i. Balanceless, bumpless transfer.

4. Physical:
   a. Case Size - Nominal 3-in by 6-in by 20-in.
   b. Case Type - General purpose enclosure with slide tray.
   c. Mounting - Flush panel suitable for high density mounting arrangements.

5. Performance: Accuracy - plus or minus 0.5 percent of span.

2.07 MISCELLANEOUS PANEL COMPONENTS (as required)

A. All components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Components mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices. All internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with the Drawings, specifications, and supplier's data.

1. Push buttons: The push buttons shall be heavy-duty, oil tight, with momentary contacts. Switches shall be supplied with the number of poles required for the application, an escutcheon plate, and contacts rated for 10 Amps at 120 VAC.

2. Relays: Relays shall be double pole, double throw, octal plug in type with a transparent

dust cover. The relay shall be equipped with an indicating light to indicate when its coil is energized. The relays shall have 5 Amps, 120 VAC contacts. The mechanical life of the relay shall be 10,000,000 operations minimum.

3. Timers: Timers shall be plug in type with a dust and moisture resistance case. The timers shall be of the multirange/analog or digital type with selectable ranges, between 1 second and 10 hours full scale. The output contacts shall be rated at 2.5 Amps, 120 VAC minimum. The timer shall have a "timing in progress" indication. The mechanical life shall be 10,000,000 operations minimum.

4. Hand Switches: 2-in Square Type - Selector switches shall be of the illuminated multiple-lamp, oiltight type with square-shape display windows and removable contact blocks. The units shall be approximately 2-1/2-in square, and shall be divided into as many as four separate lightable quadrants. The lights shall be equipped with reduced voltage transformers or resistors depending on primary power source and lamps with a 15,000 hour minimum life. Contact blocks shall be heavy-duty with fine silver, butting-type contacts. Contact rating shall be 10 Amps continuous current at 120 VAC. Contact blocks for electronic duty shall contain sliding gold contacts for solid-state millivolt and milliamp dry circuits. Contact rating shall be 1 Amp resistive load at 28 VDC.

5. Except where the 2-in square type are specifically required the following type shall be provided. Rotary selector switches shall be heavy duty oil resistant, with the number of poles and number of positions as required. Switches shall have a pistol grip handle and be of the maintained contact type rated for 10 Amps at 120 VAC. The switches required for "electronic duty" shall have low, stable, contact resistance and gold contacts. Provide make-before-break bridging contacts where required.

6. Pilot Lights: Compact multilight indicating lights shall be provided as shown on the graphic and cabinets. Units shall be approximately 1-in diameter with a minimum of three colors. Bulbs shall be of the reduced voltage type to have a life exceeding 10,000 hours and allow relamping from the front. Lens shall be engraved per the Drawings and have the appropriate colors. Amber lights shall be alarm and be activated from the separately mounted annunciator system.

7. Clock: Provide a digital 24 hour clock mounted on panels as shown. The clock shall have a 2-in LCD Display.

8. Time Delay Relay:

   a. The time delay relays shall be of the pneumatic type with time delay and instantaneous contacts. The time delay relays shall be set for sixty seconds but be adjustable from 0 to 90 seconds.

PART 3 – EXECUTION

3.01 PRODUCT HANDLING

A. Shipping Precautions: After completion of shop assembly, factory test, and approval, all

equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weight shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

B. Special Instructions: Special instructions for proper field handling, storage, and installation required by the Manufacturer shall be securely attached to each piece of equipment prior to packaging and shipment.

C. Tagging: Each component shall be tagged to identify its location, instrument tag number, and function in the system. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment in the PCIS. Identification shall be prominently displayed on the outside of the package.

D. Storage: Equipment shall not be stored outdoors. Equipment shall be stored in dry permanent shelters, including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the Contractor at no additional cost to the Owner. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through tests as directed by the Engineer. Such tests shall be at no additional cost to the Owner, and if the equipment fails the tests, it shall be replaced at no additional cost to the Owner.

3.2 MANUFACTURER'S SERVICES

A. The Contractor shall furnish the following Manufacturer's services for the instrumentation listed below:

1. Perform bench calibration
2. Oversee installation
3. Verify installation of installed instrument
4. Certify installation and reconfirm Manufacturer's accuracy statement
5. Oversee loop testing, prepare loop validation sheets, and certify loop testing
6. Oversee precommissioning, prepare precommissioning validation sheets, and certify precommissioning

B. Manufacturer's services shall be furnished all equipment covered herein and supplied under this contract:

3.03 INSTALLATION

A. General:

1. All instrumentation, including instrumentation furnished under other Divisions, shall be installed under Division 13 and the manufacturers' instructions.

2. Equipment Locations: The monitoring and control system configurations indicated are diagrammatic. The locations of equipment are approximate. The exact locations and

routing of wiring and cables shall be governed by structural conditions and physical interferences and by the location of electrical terminations on equipment. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. Where job conditions require reasonable changes in approximated locations and arrangements, or when the Owner exercises the right to require changes in location of equipment which do not impact material quantities or cause material reWork, the Contractor shall make such changes without additional cost to the Owner.

B. Conduit, Cables, and Field Wiring

1. All conduit shall be provided under Division 16 without delay to the Work of Division 13.

2. All 4-20 mA signal circuits, process equipment control wiring, signal wiring to field instruments, PLC input and output wiring and other field wiring and cables shall be provided under Division 16.

3. All PLC equipment cables, data highway shall be provided under Division 13.

4. All terminations and wire identification at PCIS equipment furnished under this or any other Division shall be provided under Division 13.

C. Instrumentation Tie-Downs: All instruments, control panels, and equipment shall be anchored by methods which comply with seismic requirements which apply to the site.

D. Existing Instrumentation: Each existing instrument to be removed and reinstalled shall be cleaned, reconditioned and recalibrated by an authorized service facility of the instrument Manufacturer. The Contractor shall provide certification of this Work prior to reinstallation of each instrument.

E. Ancillary Devices: The Contract Documents show all necessary conduit and instruments required to make a complete instrumentation system. The Contractor shall be responsible for providing any additional or different type connections as required by the instruments and specific installation requirements at no additional cost to the Owner. All such additions and all such changes, including the proposed method of installation, shall be submitted to the Engineer for approval prior to commencing the Work. Such changes shall not be a basis of claims for extra Work or delay.

F. Installation Criteria and Validation: All field-mounted components and assemblies shall be installed and connected according to the requirements below:

1. Installation personnel have been instructed on installation requirements of the Contract Documents.

2. Technical assistance is available to installation personnel at least by telephone.

3. Installation personnel have at least one copy of the approved shop drawings and data.

4. Instrument process sensing lines shall be installed similar to conduit specified under Electrical General Provisions. Individual tubes shall run parallel and near the surfaces from

which they are supported. Supports shall be used at intervals of not more than 3 feet of rigid tubing.

5. Bends shall be formed to uniform radii with the proper tool without deforming or thinning the walls of the tubing. Plastic clips shall be used to hold individual plastic tubes parallel. Ends of tubing shall be square-cut and cleaned before being inserted in the fittings. Bulkhead fittings shall be provided at all panels requiring pipe or tubing entries.

6. All differential pressure elements shall have three valve manifolds.

7. All flexible cables and capillary tubing shall be installed in flexible conduits. The lengths shall be sufficient to withdraw the element for periodic maintenance.

8. All power and signal wires shall be terminated with crimped type lugs.

9. All connectors shall be, as a minimum, water tight.

10. All wires shall be mounted clearly with an identification tag that is of a permanent and reusable nature.

11. All wire and cable shall be arranged in a neat manner and securely supported in cable groups and connected from terminal to terminal without splices unless specifically approved by the Engineer. All wiring shall be protected from sharp edges and corners.

12. All mounting stands and bracket materials and Workmanship shall comply with requirements of the Contract Documents.

13. Verify the correctness of each installation, including polarity of electric power and signal connections, and making sure all process connections are free of leaks. The Contractor shall certify in writing that for each loop or system checked out, all discrepancies have been corrected.

14. The Owner will not be responsible for any additional cost of reWork attributable to actions of the Contractor or the Instrumentation Supplier.

3.04 CALIBRATION

A. General: All devices provided under Division 13 shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.

B. Calibration Points: Each instrument shall be calibrated at 20,40,60, 80 and 100% of span using test instruments to simulate inputs. The test instruments shall have accuracies traceable to National Institute of Testing Standards.

C. Bench Calibration: Instruments which have been bench-calibrated shall be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, shall be made only after consultation with the Engineer.

D. Field Calibration: Instruments which were not bench-calibrated shall be calibrated in the field to

insure proper operation in accordance with the instrument loop diagrams or specification data sheets.

E. Analyzer Calibration: Each analyzer system shall be calibrated and tested as a Workable system after installation. Testing procedures shall be directed by the manufacturers' technical representatives. All samples and sample gases shall be furnished by the manufacturers.

F. Calibration Sheets: Each instrument calibration sheet shall provide the following information and a space for sign-off on individual items and on the completed unit:

1. Project name
2. Loop number
3. Tag number
4. Manufacturer
5. Model number
6. Serial number
7. Calibration range
8. Calibration data: Input, output, and error at 10 percent, 50 percent and 90 percent of span
9. Switch setting, contact action, and deadband for discrete elements
10. Space for comments
11. Space for sign-off by Instrumentation Supplier and date
12. Test equipment used and associated serial numbers

G. Calibration Tags: A calibration and testing tag shall be attached to each piece of equipment or system at a location determined by the Engineer. The Contractor shall have the Instrumentation Supplier sign the tag when calibration is complete. The Engineer will sign the tag when the calibration and testing has been accepted.

3.05 LOOP TESTING

A. General: Individual instrument loop diagrams per ISA Standard S5.4 - Instrument Loop Diagrams, expanded format, shall be submitted to the Engineer for review prior to the loop tests. The Contractor shall notify the Engineer of scheduled tests a minimum of 30 days prior to the estimated completion date of installation and wiring of the PCIS. After the Engineer'S review of the submitted loop diagrams for correctness and compliance with the specifications, loop testing shall proceed. The loop check shall be witnessed by the Engineer.

B. Control Valve Tests: All control valves, cylinders, drives and connecting linkages shall be stroked from the operator interface units as well as local control devices and adjusted to verify proper control action, hand switch action, limit switch settings, torque settings, remote control actions, and remote feedback of valve status and position. Control valve actions and positioner settings shall be checked with the valves in place to insure that no changes have occurred since the bench calibration.

C. Interlocks: All hardware and software interlocks between the instrumentation and the motor control circuits, control circuits of variable-speed controllers and packaged equipment controls shall be checked to the maximum extent possible.

D. Instrument and Instrument Component Validation: Each instrument shall be field tested, inspected, and adjusted to its indicated performance requirement in accordance its

Manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or, in the absence of a Contract requirement, any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer at no additional cost to the Owner.

E. Loop Validation: Controllers and electronic function modules shall be field tested and exercised to demonstrate correct operation. All control loops shall be checked under simulated operating conditions by impressing input signals at the primary control elements and observing appropriate responses of the respective control and monitoring elements, final control elements, and the graphic displays associated with the SCADA and PLC. Actual signals shall be used wherever available. Following any necessary corrections, the loops shall be retested. Specified accuracy tolerances for each analog netWork are defined as the root-mean-square-summation of individual component accuracy requirements. Individual component accuracy requirements shall be as indicated by Contract requirements or by published manufacturer accuracy specifications, whenever Contract accuracy requirements are not indicated. Each analog netWork shall be tested by applying simulated analog or discrete inputs to the first element of an analog netWork. For netWorks which incorporate analog elements, simulated sensor inputs corresponding to 20, 40, 60, 80 and 100% of span shall be applied, and the resulting element outputs monitored to verify compliance to calculated root-mean-square-summation accuracy tolerance requirements. Continuously variable analog inputs shall be applied to verify the proper operation and setting of discrete devices. Provisional settings shall be made on controllers and alarms during analog loop tests. All analog loop test data shall be recorded on test forms attached at the end of this section which include calculated root-mean-square-summation system accuracy tolerance requirements for each output.

F. Loop Validation Sheets: The Contractor shall prepare loop confirmation sheets for each loop covering each active instrumentation and control device except simple hand switches and lights. Loop confirmation sheets shall form the basis for operational tests and documentation. Each loop confirmation sheet shall cite the following information and shall provide spaces for sign-off on individual items and on the complete loop by the Instrumentation Supplier:

1. Project name
2. Loop number
3. Tag number, description, manufacturer and model number for each element
4. Installation bulletin number
5. Specification sheet number
6. Loop description number
7. Adjustment check
8. Space for comments
9. Space for loop sign-off by Instrumentation Supplier and date
10. Space for Engineer witness signature and date

G. Loop Certifications: When installation tests have been successfully completed for all individual instruments and all separate analog control netWorks, a certified copy of all test forms signed by the Engineer or the Engineer's representative as a witness, with test data entered, shall be submitted to the Engineer together with a clear and unequivocal statement that all instrumentation has been successfully calibrated, inspected, and tested.

3.06 PRECOMMISSIONING

A. General: Precommissioning shall commence after acceptance of all wire test, calibration tests and loop tests, and all inspections have demonstrated that the instrumentation and control system complies with all Contract requirements. Precommissioning shall demonstrate proper operation of all systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible.

B. Precommissioning Procedures and Documentation: All precommissioning and test activities shall follow detailed test procedures and check lists accepted by the Engineer. All test data shall be acquired using equipment as required and shall be recorded on test forms accepted by the Engineer, which include calculated tolerance limits for each step. Completion of all system precommissioning and test activities shall be documented by a certified report, including all test forms with test data entered, delivered to the Engineer with a clear and unequivocal statement that all system precommissioning and test requirements have been satisfied.

C. Operational Validation: Where feasible, system precommissioning activities shall include the use of water to establish service conditions that simulate, to the greatest extent possible, normal final control element operating conditions in terms of applied process loads, operating ranges, and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using motor control center and local field mounted control circuits. All hardwired and software control circuit interlocks and alarms shall be operational. The control of final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits. The stable steady-state operation of final control elements running under the control of field mounted automatic analog controllers or software based controllers shall be assured by adjusting the controllers as required to eliminate oscillatory final control element operation. The transient stability of final control elements operating under the control of field mounted, and software based automatic analog controllers shall be verified by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments as required to eliminate excessive oscillatory amplitudes and decay rates.

D. Loop Tuning: All electronic control stations incorporating proportional, integral or differential control circuits shall be optimally tuned, experimentally, by applying control signal disturbances and adjusting the gain, reset, or rate settings as required to achieve a proper response. Measured final control element variable position/speed setpoint settings shall be compared to measured final control element position/speed values at 20, 40, 60, 80 and 100% of span and the results checked against indicated accuracy tolerances.

E. Precommissioning Validation Sheets: Precommissioning shall be documented on one of two types of test forms as follows:

1. For functions which can be demonstrated on a loop-by-loop basis, the form shall include:

   a. Project name
   b. Loop number
   c. Loop description
   d. Tag number, description, manufacturer and data sheet number for each component.
   e. Space for sign-off and date by both the Instrumentation Supplier and Engineer.

2. For functions which cannot be demonstrated on a loop-by-loop basis, the test form shall be

a listing of the specific tests to be conducted. With each test description the following information shall be included:

a. Specification page and paragraph of function demonstrated
b. Description of function
c. Space for sign-off and date by both the Instrumentation Supplier and Engineer

F. Precommissioning Certification: The Contractor shall submit an instrumentation and control system precommissioning completion report which shall state that all Contract requirements have been met and shall include a listing of all instrumentation and control system maintenance and repair activities conducted during the precommissioning testing. Acceptance of the instrumentation and control system precommissioning testing must be provided in writing by the Engineer before the performance testing may begin. Final acceptance of the control system shall be based upon plant completion as stated in the General Conditions.

3.08 PERFORMANCE TEST

A. The entire PCIS shall operate for 30 days without failure.

B. The Contractor shall furnish all necessary support staff as required to operate the system and to satisfy the repair or replacement requirements.

C. If any component fails during the performance test, it shall be repaired or replaced and the PCIS shall be restarted on another 30 day period.

D. Prior to completion of the 30 day testing the Contractor shall demonstrate to the satisfaction of the Engineer that all systems and components are year 2000 compliant as required above.

3.10 ACCEPTANCE

A. For the purpose of this Section, the following conditions shall be fulfilled before the work is considered substantially complete:

1. All submittals have been completed and approved.
2. The PCIS has been calibrated, loop tested and pre-commissioned.
3. All required spare parts and expendable supplies and test equipment have been delivered to the Engineer.
4. The performance test has been successfully completed.
5. All punch-list items have been corrected.
6. All record drawings, in both hard copy and electronic format, have been submitted.
7. Revisions to the Owner's Manuals that may have resulted from the field tests have been made and reviewed.
8. All debris associated with installation of instrumentation has been removed.
9. All probes, elements, sample lines, transmitters, tubing, and enclosures have been cleaned and are in like-new condition.

END OF SECTION

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SECTION 13410

CONTROL PANELS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. General: The Contractor shall provide control panels, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 13400 - Process Control and Instrumentation Systems apply to this Section.

C. The provisions of this Section apply to local panels provided in equipment systems specified in other sections unless indicated otherwise in those sections.

D. The requirements of Section 01179-Control Panel apply to this Section.

1.02 CONTRACTOR SUBMITTALS

A. General: Submittals shall be furnished in accordance with Section 01300 - Contractor Submittals.

B. Control Panel Engineering Submittal: The Contractor shall submit a control panel Engineering submittal (CPES) for each control panel and enclosure being provided under Division 13. The CPES shall completely define and document the construction, finish, layout, power circuits, signal and safety grounding circuits, fuses, circuit breakers, signal circuits, internally mounted instrumentation and SCADA system components, face plate mounted instrumentation components, internal panel arrangements, and external panel arrangements. All panel drawings shall, as a minimum, be "B" size with all data sheets and manufacturer specification sheets being "A" size. The submittal shall be in conformance with ISA-S20, Standard Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves, shall be submitted as a singular complete bound volume or multi-volume package within 120 calendar days after Notice to Proceed and shall have the following contents.

1. A complete index shall appear in the front of each bound volume. All drawings and data sheets associated with a panel shall be grouped together with the panels being indexed by systems or process areas. All panel tagging and nameplate nomenclature shall be consistent with the requirements of the Contract Documents.

2. Scale construction drawings which define and quantify the type and gauge of steel to be used for panel fabrication, the ASTM grade to be used for structural shapes and straps, panel door locks and hinge mechanisms, type of bolts and bolt locations for section joining and anchoring, details and proposed locations on the utilization of "UNISTRUT" members, stiffener materials and locations, electrical terminal box and outlet locations, electrical access locations, print pocket locations, writing board locations, and lifting lug material and locations.

3. Scaled physical arrangement drawings drawn to scale which define and quantify the physical groupings comprising control panel sections, auxiliary panels, subpanels, and racks. Cutout locations with nameplate identifications shall be shown.

4. Front of panel layouts for all control panels.

5. Schematic/elementary diagrams shall depict all control devices and circuits and their functions.

6. Wiring/connection diagrams shall locate and identify electrical devices, terminals, and interconnecting wiring. These diagrams shall show interconnecting wiring by lines, designate terminal assignments, and show the physical location of all electrical and control devices.

7. Interconnection diagrams shall locate and identify all external connections between the control panel/control panel devices and associated equipment. These diagrams shall show interconnecting wiring by lines, designate terminal assignments, and show the physical location of all panel ingress and egress points.

8. Control sequence diagrams to portray the contact positions or connections required to be made for each successive step of the control action. Written descriptions explaining the control sequence diagrams and system operation shall be furnished.

9. Completed ISA-S20 data sheets for all instrumentation devices associated with each control panel supplemented with manufacturer specification sheets which verify conformance to the requirements of the Contract Documents.

10. A bill of material which enumerates all devices associated with the control panel.

11. A priced listing of analog spare parts in conformance with Section 13400.

1.03 EXTENDED PERIOD FOR CORRECTION OF DEFECTS

A. The Contractor shall correct all defects in accordance with Section 13400.

PART 2 – PRODUCTS

2.01 GENERAL

A. Environmental Suitability: All indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided in order to maintain all instrumentation devices 20 percent within the minimums and maximums of their rated environmental operating ranges. The Contractor shall provide all power wiring for these devices. Enclosures suitable for the environment shall be provided. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.

B. The control panel controls shall be 120 VAC. Where the electrical power supply to the control panel is 240 VAC single phase or 480 VAC 3-phase, as indicated, the control panel shall be provided with a control panel transformer. Control conductors shall be provided in accordance with the indicated requirements.

C. The control panel shall be the source of power for any 120 VAC solenoid valves interconnected with the control panel. All equipment associated with the control panel shall be ready for service after connection of conductors to equipment, controls, and control panel.

D. The main feeder disconnect shall have a door-mounted handle unless otherwise indicated.

E. Control panels shall be housed in NEMA 4X 316 SS enclosures unless otherwise indicated. Control panels shall be either freestanding, pedestal-mounted or equipment skid-mounted, as indicated. Internal control components shall be mounted on an internal back-panel or side-panel as required.

F. Each source of foreign voltage shall be isolated by providing disconnecting or pull-apart terminal blocks or a disconnect operable from the control panel front. Each control panel shall be provided with identified terminal strips for the connection of all external conductors. The Contractor shall provide sufficient terminal blocks to connect 25 percent additional conductors for future use.

G. Motor starters, where required, shall be in accordance with Section 16484 - Low Voltage Motor Control Center modifications. Each motor starter shall be provided with contact closures for motor overload, local indication, and remote alarm. All electrical components shall be of standard American manufacture.

H. Discrete outputs from the control panel shall be provided by electrically isolated contacts rated for 5 amps at 120 VAC. Analog inputs and outputs shall be isolated 4-20 mA, 2-wire signals with power supply.

I. Programmable Logic Controllers (PLCs) may be supplied in lieu of relays, provided the programmable logic controllers match the PLCs provided under Section 13440 - PLC-Based Control Systems Hardware.

J. All control panel mounted devices shall be mounted a minimum of 3 feet above finished floor elevation. Provide all combination motor starters not furnished in a MCC but specified in Section 11000 - Equipment General Provisions.

K. Painting: Control panels shall be thoroughly cleaned and sand blasted per Steel Structures Painting Council Specification SSPC-SP-6 (Commercial Blast) after which surfaces shall receive a prime coat Amercoat 185 or equal, 3-mils DFT, for a total thickness of the prime plus finish system of 6 mils. The finished color of the outside surfaces shall be selected by the Engineer, unless otherwise indicated. Interior of the control panel, back-panel, and side-panels shall have a white finish coat.

2.02 CONTROL PANELS

A. Materials

1. Panel section faces shall be No. 10 gauge minimum thickness steel for free standing panels and No. 14 gauge minimum thickness steel for wall mounted or pedestal mounted panels. All materials shall be selected for levelness and smoothness.

2. Relay rack high density type panels shall utilize standard relay racks with No. 14 gauge steel frame and supports.

3. Structural shapes and strap steel shall comply with ASTM A 283 - Low and Intermediate Tensile Strength Carbon Steel Plates, Grade C.

   a. Bolting Material: Commercial quality carbon steel bolts, nuts, and washers shall be 1/2-inch diameter with UNC threads. Carriage bolts shall be used for attaching end plates. All other bolts shall be hex end machine bolts. All nuts shall be hot pressed hex, American Standard, heavy. Standard wrought washers shall be used for foundation bolts and attachments to building structures. All other bolted joints shall have SAE standard lock washers.

4. Construction: Dimensions shall be in accordance with vendor's requirements. Elevations and horizontal spacing shall be subject to Engineer's approval.

B. Fabrication

1. End plates, top plates, and top closure panels (to hung ceiling) shall be provided when required by the material requisition. End plates, top plates, and top closure panels shall be removable with countersunk bolts to match panels. Top closure panels shall be furnished in lengths which match the widths of standard panels, except that one top closure panel may extend across two 4-feet 6-inches wide or five 2-feet wide standard panels. The vertical joints of these panels shall align with the vertical joints of the standard panels.

2. End closure or rear closure doors shall be provided where required. Such doors shall be flush fitting, gasketed, and be of the hinged lift-off type with lockable door handles. A common key shall be provided for all doors on one panel assembly. Removable access panels shall be provided with dished handle fasteners. Screw driver 1/4 turn or Dzus type fasteners are not acceptable.

   a. The flanged edges of all panels shall be straight and smooth. Corners shall be welded and ground smooth.

   b. The face of the panel shall be true and level after flanging.

   c. All panel cut-outs and holes may be cut or drilled by any standard method that does not cause deformation. Burrs shall be ground smooth.

   d. Adjacent panels shall assemble with faces flush. Gaps or cracks shall not be visible from the front of the assembled instrument board.

e. Stiffeners shall be welded to the back of panels, as required to prevent panel deformation due to the weight of face mounted instruments.

f. Panels shall be self-supporting as defined below.

C. Framework and Supports

1. The rear of each panel section shall have a steel framework assembled to it for supporting conduit, wireways, switches, piping, and all instrument accessory items such as relay or terminal enclosures, transducers, pressure switches, valves, and air relays. The main frame Work shall be constructed of standard structural shapes. Special shapes such as "Unistrut" may be used for secondary supports. Framework must neither interfere with instrument connections nor interfere with access needed for maintenance or adjustments.

2. Steel framework shall extend 2-feet 4-inches back from the panel face or as indicated in the material requisition. Where indicated, individual adjustable leg supports shall be provided at the back of the framework so that the entire panel is self-supporting.

D. Preparation of Panel Surface

1. The following requirements apply to the front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all holes or cut-outs.

a. All high spots, burrs, and rough spots shall be ground smooth.

b. The surfaces shall be sanded or sandblasted to a smooth, clean bright finish.

c. All traces of oil shall be removed with a solvent.

d. The first coat of primer shall be applied immediately.

E. Panel Finishing

1. A thin coat primer surface shall be applied over the entire panel surface.

2. Wet sand, dry, then quick glaze spot putty on the front of the panel only. Dry, then wet sand again and dry.

3. A primer surface shall be applied on the front of the panel only.

4. Wet sand to smooth clear finish, then dry.

5. At least 2 coats of air-dry, satin finish, lacquer enamel shall be applied over the entire surface. Color to be as approved by Engineer.

6. Contractor shall supply 2 one-pint containers of air drying, matching paint for field touch-up of the panel face.

F. Instrument Finishing: The final coats applied to painted surface of instrument cases, doors, or bezels which are visible from the front of panels shall be manufacturer's standard unless otherwise indicated.

G. Mounting of Instruments

1. The panel vendor shall provide cut-outs, and shall mount all instrument items indicated to be panel mounted, including any instruments indicated to be furnished by other vendors but installed in panel.

2. The panel vendor shall also mount behind the panels other instrument accessory items as required for functionality or as indicated.

3. Equipment mounted at the rear of panel shall be installed to allow for commissioning adjustments, servicing requirements, and cover removal.

4. Spare space shall be kept clear of wiring, etc., to give maximum space for future additions.

H. Electrical Requirements

1. The Contractor shall provide conduit, wireways, switches, wire, and electrical fittings for all 115 volt circuits to instruments and other electrical devices as required for a complete and operable installation.

2. Conduit, wireways, junction boxes and fittings shall be provided for all signal wire, thermocouple, or resistance thermometer lead wire. Conduit or wireway runs shall include those required between temperature sensors and temperature transmitters and between the thermocouple wireway or junction box and instruments.

3. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. All wiring shall be identified with stamped tubular wire end markers.

4. Freestanding panels shall be provided with switched 100-watt incandescent back-of-panel lights. One light shall be provided for every 4-feet of panel width and shall be mounted inside and in the top of the back-of-panel area.

5. Freestanding panels shall be provided with a 15-amp, 120-volt, service outlet circuit within the back-of-panel area. The circuit shall be provided with 3-wire, 120-volt, 15-ampere, duplex receptacles one for every 4 feet of panel width (one minimum per panel), spaced evenly along the back-of-panel area.

6. Wall mounted or pedestal mounted panels shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel.

7. Wall mounted or pedestal mounted panels mounted outside or in unshaded areas shall be provided with thermostatically controlled heaters that maintain inside temperature above 40°F.

8. Provide a hand switch controlled 100-watt incandescent light and a breaker protected

120-volt, 15-amp duplex receptacle within each wall mounted or pedestal mounted panel.

9. Wiring Methods: Wiring methods and materials for all panels shall be in accordance with the N.E.C. requirements for General Purpose (no open wiring) unless otherwise indicated.

10. Signal and Control Circuit Wiring

    a. Wire type and sizes: Conductor shall be flexible stranded copper machine tool wire, UL listed Type MTW, and shall be rated 600-volts. Wires for instrument signal circuits and alarm input circuits shall be No. 14 AWG. All other wires, including shielded cables, shall be No. 16 AWG minimum.

    b. Wire Insulation Colors: Conductors supplying 120 VAC power on the line side of a disconnecting switch shall have a black insulation for the ungrounded conductor. Grounded circuit conductors shall have white insulation. Insulation for ungrounded 120V AC control circuit conductors shall be red. All wires energized by a voltage source external to the control panels shall have yellow insulation. Insulation for all DC conductors shall be blue.

    c. Wire Marking: Wire numbers shall be marked using white numbered wire markers made from plastic-coated cloth, Brady Type B-500 or equal, or shall be heat-shrink plastic.

    d. Flexible conduit is not acceptable except when specifically approved by the Engineer in writing.

    e. Conduit fittings shall be Crouse-Hinds cast fittings or equal.

    f. Splicing of wires in conduits shall be allowed but all splices shall be soldered or pressure type crimped.

    g. For case grounding, panels shall be provided with a 1/4-inch by 1-inch copper ground bus complete with solderless connector for one No. 4 AWG bare stranded copper cable. The copper cable shall be provided by the Contractor and be connected to a system ground loop.

11. Electrical Locations:

    a. When Contract Documents call for thermocouple actuated instruments, the thermocouple lead wire shall be installed, without junction, by the Contractor. The panel vendor shall provide dedicated empty conduits or wireways running from the instrument(s) to the top or bottom of the panel as called for in the material specifications or as otherwise required. Sizing of the conduit or wireway shall be in accordance with the capacity of the instrument(s).

    b. Single case (no remote logic) annunciator units shall be installed at the top of panel and may be considered as a terminal box when top of panel wire entry is indicated. If bottom of panel entry is indicated, a terminal box shall be provided at the bottom of the panel and be wired to the annunciator unit. Terminals shall be identified with plastic

marker strips.

c. Terminal boxes for incoming and outgoing signal leads shall be located at the top or bottom of the panel as indicated in the material specification, or as otherwise required.

12. Power Supply Wiring:

a. Unless otherwise indicated, all instruments, alarm systems, and motor controls shall operate on 115 volt, 60 Hz circuits.

b. At a location near the top of the panel (or bottom), the panel fabricator shall provide terminal box connections for the main power supply entry.

c. Power supply switches for alarm units shall be 3 pole type, arranged to open both power circuits and alarm circuits. Each annunciator unit shall be equipped with a separate switch.

d. Instruments located on the same panel section and serving the same process unit may be connected to a common branch circuit from the power supply. The number of circuits depends on the circuit load as noted herein. A 15 amp, 2 pole circuit breaker shall be provided in each branch circuit. The circuit load shall not exceed 10 amp. Different panel sections or different process units must not use common branch circuits. When instruments do not come equipped with integral fuses, provide fuses as required for the protection of individual instruments against fault currents. Fuses shall be mounted on the back of the panel in a fuse holder, and each fuse shall be identified by a service name tag. Fuses shall be as manufactured by Bussmann Manufacturing Division, Type KAW TRON or equal.

e. Each potentiometer type instrument, electronic transducer, controller, or analyzer shall have an individual disconnect switch. Disconnect switches shall have metal or plastic tags indicating instrument tag numbers. Individual plug and cord set power supply connections may be used without switches when indicated in the material specification.

f. Where alarm units are single unit types, one switch may be used to disconnect not more than 6 alarm units located on the same or adjacent panels.

13. Alarm Wiring: The panel vendor shall install and wire all alarms including light cabinets, audible signal units, test and acknowledge switches, and remote logic units as indicated. Interconnecting wiring to panel mounted initiating devices shall also be wired by the panel vendor. The wiring from external initiating devices shall be provided by the installing Contractor. Where plug and cord sets are provided for component interconnection, the panel vendor shall harness and support the cables in neat and orderly fashion. Where separate wire is required, panel vendor shall install No. 16 AWG with THWN or THHN insulation between all components.

14. Signal Wiring:

a. Signal Wire - Non Computer Use

(1) Signal wire shall be twisted pair or triads in conduit or troughs. Cable shall be constructed of No. 16 AWG copper signal wires with THWN or THHN insulation.

(2) Multiconductor cables where indicated shall consist of No. 16 AWG copper signal wires twisted in pairs, with 90-C, 600 V fault insulation. A copper drain wire shall be provided for the bundle with a wrap of aluminum polyester shield. The overall bundle jacket shall be PVC.

b. Signal Wire - Computer Use

(1) Signal wires shall be similar to those for non-computer use but each pair shall be triplexed with a copper drain wire and aluminum polyester tape shall be applied over the triplexed group. All cable shields, including thermocouple extension leads shall be terminated in the central control room at the computer system grounding bus. Continuity of the shield shall be maintained throughout the cable runs.

c. Multi-conductor cables, wireways and conduit shall be sized to allow for 10 percent spare signal wire.

I. Labor and Workmanship: All panels shall be fabricated, piped, and wired by fully qualified Workmen who are properly trained, experienced, and supervised.

2.03 CONTROL SYSTEM ENCLOSURES

A. Each control system programmable controller and corresponding housing, I/O modules, power supply modules, communication interface devices, and peripheral equipment shall be mounted inside a NEMA 4X enclosure. Each SCADA system remote I/O system and corresponding housing, I/O modules, power supply modules, communication interface devices, and peripheral equipment shall be mounted inside a NEMA 4X enclosure. All I/O wiring from the field to the remote I/O system shall be terminated on terminal blocks in the lower portion of the enclosure. A nameplate shall be mounted on the outside of the door of the enclosure and be engraved with "PLC-X" or "RIO-X" where "X" is the number as shown on the Drawings. Where indicated, programmable controllers mounted in free standing enclosures shall be 84-inches tall by 26-inches wide by 24-inches deep, minimum. Where indicated, programmable controllers mounted in wall or pedestal mounted enclosures shall be 36-inches tall by 24-inches wide by 24-inches deep, minimum. Enclosures shall be as manufactured by Hoffman, or equal.

B. All devices installed in the NEMA 4 X enclosure "as installed" shall be maintained within their rated temperature limits based on the internal enclosure temperature to be experienced with the panel installed and operating in a 105 degree F ambient temperature. The manufacturer / supplier shall perform a temperature analysis to determine the maximum internal cabinet temperature to be experienced under the above conditions. This analysis shall take into account all external environmental temperature factors as well as the heat generated by all internal devices. The manufacturer/supplier shall be required to provide heat-exchanger forced air ventilation (if necessary or if called for on the plans or in the specifications) to keep all panel components within their rated temperature limits under the above conditions. If forced air-cooling is required or called for on the plans or in the specifications, duplex fans with alternation and failure protection shall be provided. The forced air ventilation system shall be approved by the Engineer and shall be mounted outside the control panel. All

openings shall be comply with the NEMA 4X rating requirements.

2.04 SPARE PARTS AND SPECIAL TOOLS

A. Control panel spare parts selected by the Engineer and special tools shall be furnished in accordance with Section 13400.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Preparation for Shipment and Shipping:

1. All panels are to be crated for shipment using a heavy framework and skids. The panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. All instruments which are shipped with the panel shall further have suitable shipping stops and cushioning material installed to protect parts which could be damaged due to mechanical shock. Each separate panel unit shall be provided with removable lifting lugs to facilitate handling.

2. All shipments shall be by air ride van, unless otherwise indicated.

3. All control panel testing and inspection shall be performed prior to shipping.

B. Control panel shall be installed in accordance with Section 13400.

3.02 CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

A. Wiring Installation: All wires shall be run in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, (3) wiring from components on a swing-out panel to components on a part of the fixed structure, and (4) wiring to panel-mounted components. Wiring run from components on a swing-out panel to other components on a fixed panel shall be made up in tied bundles. These bundles shall be tied with nylon wire ties and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.

B. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon wire ties and be secured to the inside face of the panel using adhesive mounts.

C. Wiring to rear terminals on panel-mount instruments shall be in plastic wireways secured to horizontal brackets above or below the instruments in about the same plane as the rear of the instruments.

D. Shop drawings shall show conformance to the above wiring installation requirements.

E. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal.

3.03 CALIBRATION, TESTING, AND INSTRUCTION

A. General: Calibration, testing, and instruction shall be performed in accordance with Section 13400.

B. Inspection and Approval:

1. Panel fabricator shall conduct the following tests prior to arrival of the Engineer and before shipment, if the Engineer chooses not to witness factory testing.

   a. All alarm circuits rung out to determine their operability.

   b. All electrical circuits checked for continuity and where applicable, operability.

   c. All nameplates checked for correct spelling and size of letters.

   d. Any other test required to place the panel in an operating condition.

2. It shall be the responsibility of the Contractor to furnish all necessary testing devices and sufficient manpower to perform the tests required by the Engineer.

3. If the above tests have not been performed prior to the arrival of the Engineer, the Contractor shall be liable to the Owner for costs of the Engineer for the extra time required for inspection services.

4. Field testing: Each control panel shall be tested again for functional operation in the field after the connection of external conductors, and prior to equipment startup.

END OF SECTION

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SECTION 15051

PIPING - TESTING & GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the basic administrative and testing requirements for piping. Specific piping materials, systems and related installation and testing requirements are specified in other Sections of Division 2 and 15.

1.02 RELATED WORK

A. Piping materials and systems are included in other Sections of Division 2 and 15.

B. Valves are included in Section 15100.

C. Pipe insulation is included in Section 15250.

1.03 SUBMITTALS

A. General submittals for piping and piping systems are listed below. Submittals shall be in accordance with Section 01300. It is not intended that all submittals listed below be provided for all piping materials and systems. Refer to individual System or Piping Sections for specific submittals.

B. Shop Drawings and Product Data

1. Piping layouts in full detail.

2. Location of pipe hangers and supports.

3. Location and type of backup block or device to prevent joint separation.

4. Large scale details of wall penetrations and fabricated fittings.

5. Schedules of all pipe, fittings, special castings, couplings, expansion joints and other appurtenances.

6. Catalog cuts of joints, couplings, harnesses, expansion joints, gaskets, fasteners and other accessories.

7. Brochures and technical data on coatings and linings and proposed method for application and repair.

C. Test Reports

1. Eight copies of certified shop tests showing compliance with appropriate standard.

2. Eight copies of all field test reports signed by Contractor and Engineer.

D. Certificates

1. Copies of certification for all welders performing work in accordance with ANSI B31.1.

E. Manufacturers Installation (or application) instructions.

F. Statement of Qualifications

G. Manufacturers Field Report

H. Project Record Document

I. Operation and Maintenance Data in accordance with Section 01730.

J. Warranties

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

B. American National Standards Institute (ANSI)

1. ANSI B16.5 - Pipe Flanges and Flange Fittings

2. ANSI B31.1 - Power Piping

C. American Welding Society (AWS)

1. AWS B2.1 - Welding Procedure and Performance Qualifications

D. American Water Works Association (AWWA)

1. AWWA Manual M11 - Steel Pipe - A Guide for Design and Installation

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All materials shall be new and unused.

B. Install piping to meet requirements of local codes.

C. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified. Reference to standards such as ASTM and ANSI shall apply to those versions in effect at the time of bid opening.

D. Coordinate dimensions and drilling of flanges with flanges for valves, pumps and other equipment to be installed in piping systems. Bolt holes in flanges to straddle vertical centerline.

E. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner and acid solder.

F. Pipe-joint compound, for pipe carrying flammable or toxic gas, must bear approval of Underwriters' Laboratories or Factory Mutual Engineering Division.

G. Unless otherwise specified, pressures referred to in all Piping Sections are expressed in pounds per square in gage above atmospheric pressure, PSIG and all temperature are expressed in degrees Fahrenheit.

1.06 DELIVERY, STORAGE AND HANDLING

A. During loading, transportation and unloading, take care to prevent damage to pipes and coating. Carefully load and unload each pipe under control at all times. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation to ensure no injury to pipe and lining.

PART 2 PRODUCTS

2.01 MATERIALS

A. Specific piping materials and appurtenances are specified in the respective Piping or System Sections.

B. General installation materials shall be as specified below.

1. Unions shall be brass or bronze unions for joining nonferrous pipe; malleable brass or bronze-seated iron or steel unions for joining ferrous pipe; PVC unions for joining PVC pipe; CPVC unions for joining CPVC pipe.

2. Flanged Joints. Bolt and nuts, Type 304 stainless steel, bolt number and size same as flange standard; studs - same quality as machine bolts; 1/16-in. thick rubber gaskets with cloth insertions; rust-resistant coatings.

3. Temporary Plugs shall be standard plugs or caps which are suitable for permanent service.

4. Wall Sleeve Seals shall be a specified in Section 01170.

5. Flexible Connections shall be flanged spool type, 180 degree F maximum service, single filted arch with synthetic rubber tube and cover, steel-ring reinforced synthetic fiber carcass, with flanges drilled to 150-lb ANSI B16.5 Standard. Steel retaining rings, control rods and compression sleeves shall be provided where shown and as required for the working pressure of the system in which the joint is installed. All flexible joints shall be rated for the working pressure of the system in which they are installed.

PART 3 EXECUTION

3.01 GENERAL

A. All dirt, scale, weld splatter, water and other foreign matter shall be removed from the inside and outside of all pipe and sub-assemblies prior to installing.

B. All pipe joints and connections to equipment shall be made in such a manner as to produce a minimum of strain at the joint.

C. Install piping in a neat manner with lines straight and parallel or at right angles to walls or column lines and with risers plumb. Run piping so as to avoid passing through ductwork or directly under electric light outlets and/or interference with other lines [or extending beyond furring lines as determined by Architectural Drawings]. All work shall be accomplished using recognized methods

and procedures of pipe fabrication and in accordance with the latest revision of applicable ANSI Standards, ASME Codes and Pipe Fabrication Institute Standards.

1. Use full length of pipe except where cut lengths are necessary. Do not spring or deform piping to make up joints.

2. Pipe shall be cut square, not upset, undersize or out of round. Ends shall be carefully reamed and cleaned before being installed. Bending of pipe is not permitted. Use fittings for all changes in direction.

3. Do not use bushings except where specifically approved by the Engineer. Reducers shall be eccentric to provide for drainage from all liquid-bearing lines and facilitate air removal from water lines.

4. Verify the locations and elevations of any existing piping and manholes before proceeding with work on any system. Any discrepancies between the information shown on the Drawings and the actual conditions found in the field shall be reported at once to the Engineer. No claim for extra payment will be considered if the above provision has not been complied with.

5. Where lines of lower service rating tie into services or equipment of higher service rating the isolation valve between the two shall conform to the higher rating.

6. Mitering of pipe to form elbow is not permitted.

7. All piping interiors shall be thoroughly cleaned after installation and kept clean by approved temporary closures on all openings until the system is put in service. Closures should be suitable to withstand the hydrostatic test.

8. End caps on pre-cleaned pipe shall not be removed until immediately before assembly. All open ends shall be capped immediately after completion of installation.

D. Test Connections

1. Provide 1/2-in. female N.P.T. test connection equipped with 1/2-in. brass plug on all pump suction and discharge lines. Where indicated on the Drawings, test connections should be equipped with bar stock valve and gage. Provide test connections at all steam traps. The connection shall be located on the discharge side of the trap between the trap and the first valve. It shall consist of a 1/2-in. branch connection terminated with a gate valve.

E. Unions

1. Unions (screwed or flanged) shall be provided where indicated and in the following locations even if not indicated.

   a. In long runs of piping to permit convenient disassembly for alterations or repairs.

   b. In by-passes around equipment.

   c. In connections to tanks, pumps and other equipment between the shut-off valve and the equipment.

   d. In connections on both sides of traps, controls and automatic control valves.

F. Vents and Drains

1. Provide vents and drains in the following places:

a. Water Lines - Vents at high points and drains at low points.

b. Air Lines - Drains at low points.

3.02 UNIONS

A. Use unions to allow dismantling of pipe, valves and equipment.

3.03 WELDING

A. Welding in accordance with ANSI Standard B31 and AWS B3.0.

B. Install welding fittings on all welded lines. Make changes in direction and intersection of lines with welding fittings. Do not miter pipes to form elbows or notching of straight runs to form tees, or any similar construction. Do not employ welder who has not been fully qualified in above specified procedure and so certified by approved welding bureau or similar locally recognized testing authority.

3.04 FLANGED JOINTS

A. Make flanged joints with bolts, bolt studs with nut on each end, or studs with nuts where one flange is tapped. Use number and size of bolts conforming to same ANSI Standard as flanges. Before flanges pieces are assembled, remove rust resistant coating from machined surfaces, clean gaskets and smooth all burrs and other defects. Make up flanged joints tight, care being taken to prevent undue strain upon valves or other pieces of equipment.

3.05 SLEEVE COUPLINGS

A. Install tierods, pipe clamps or bridles when sleeve type couplings or fittings are used in piping system where indicated, and at changes in direction or other places as necessary, to prevent joints from pulling apart under pressure. Use bridles and tierods at least 3/4-in. in diameter except where tierods replace flange bolts of smaller size in which case fit with nut on each side of pair of flanges. Joint harnessing shall conform, as a minimum, to the requirements for the bolts and tie bolt lugs as set forth in AWWA Manual M11.

3.06 WALL SLEEVE SEALS

A. Use expandable rubber segmented sealing device with corrosion- resistant fasteners to make watertight the annular space between pipe and sleeve. Determined the required inside diameter of each individual wall opening or sleeve to fit the pipe and seal to assure a watertight joint as recommended by the manufacturer, before ordering, fabricating or installing. Install pipe concentrically through wall sleeve. Install and tighten seal per manufacturer's instructions.

3.07 TESTING

A. Test all pipelines for water/gas tightness as specified in the Piping or System sections. Furnish all labor, testing plugs or caps, pressure pumps, pipe connections, gages and all other equipment required. Testing shall be performed in accordance with one or more of the testing procedures appended to this Section and/or as specified in each Piping or System Section. All testing shall be performed in the presence of the Engineer.

B. Repair faulty joints or remove defective pipe and fittings and replace as approved by the Engineer. Retest.

3.08 DISINFECTION

A. After satisfactory testing, all potable water lines shall be thoroughly disinfected with a solution of not less than 50 parts per million of available chlorine. The disinfecting solution shall be allowed to remain in the system for a period of three hours after which time all valves and faucets shall be opened and the system shall be flushed with clean water.

B. Water being flushed from structures or pipelines after disinfection with a chlorine residue of 2 mg/l or greater, shall be treated with a dechlorination solution, in a method approved by the Engineer, prior to discharge.

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HYDROSTATIC TEST

SCOPE: This test specification shall be used to hydrostatically test piping systems for structural integrity and leaks. The test shall be performed at ambient temperature unless otherwise specified.

1.0 TEST FLUID

1.1 Water should be used as the test fluid whenever possible. In those systems where water cannot be used the test fluid may be either the one to be used in the system or the one agreed upon by the Engineer and the Contractor.

2.0 TEST EQUIPMENT

2.1 Water - Of sufficient capacity to deliver the required test pressure.

2.2 Strainer - On inlet side of the pump to prevent foreign matter from entering the system.

2.3 Valves - Shall be provided on the suction and discharge side of the pump.

2.4 Heater - To allow heating of the test fluid when elevated temperatures are required for test.

2.5 Relief Valve - Set at a pressure to relieve at 20 to 25 percent above the required test pressure.

2.6 Pressure Gage(s) - Capable of reaching 50 percent over the test pressure. These should be located at the pump discharge and any other place deemed convenient by the Contractor.

2.7 Pressure gages and relief valves shall be checked for accuracy before use in test procedures.

3.0 PREPARATION FOR TEST

3.1 Determine the fluid to be used for the test, and, if other than ambient temperature is required, what the test temperature will be.

3.2 When a fluid other than water is used for a test, the equipment used for the test shall be of a material compatible with the test fluid. Normally this would be equal to the piping material.

3.3 Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.

3.4 Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc that shall not be subjected to the test pressure.

3.5 All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.

3.6 Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.

3.7 All joints, including welds, are to be left uninsulated and exposed for examination during test.

3.8 A joint previously tested in accordance with this specification may be covered or insulated.

3.9 Piping designed for vapor or gas shall be provided with additional temporary supports, if necessary, to support the weight of the test liquid.

3.10 Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.

3.11 Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.

4.0 TEST PRESSURE

4.1 The hydrostatic test pressure shall be 1-1/2 times the design pressure, not to exceed 75 psi, unless otherwise specified in the System Specification Section.

5.0 TEST PROCEDURE

5.1 Allow the test fluid to enter the system. Open vents to allow displacement of all entrapped air. For all pipelines exceeding 500-ft in length, the maximum rate of filling shall be limited to that which produces a maximum nominal flow velocity of one foot per second in the pipe to be tested.

5.2 Close vents and restrict personnel in the test area to those involved in the test.

5.3 Raise the pressure slowly with the pump until the predetermined test pressure is reached. Maintain pressure for duration of time specified in System Specification Section, keeping personnel at a safe distance.

5.4 Reduce the pressure about 20 percent and hold it at that point while the entire system is carefully inspected for leaks, cracks, or other signs of defects.

5.5 If defects are found, the pressure shall be released, the system drained, the defects corrected and the test repeated.

5.6 After a satisfactory test has been completed, the line shall be drained.

6.0 FLUSHING

6.1 Lines tested with water shall be completely drained.

6.2 Lines shall be flushed, after test.

7.0 TEST RECORDS

7.1 Records shall be maintained of all tests performed.

7.2 Test records shall include:

A. Date of Testing

B. Identification of Piping Tested

C. Test Fluid

D. Test Pressure

E. Signatures of Contractor and Engineer

7.3 If leaks are found, they shall be noted, on the record. After correction, retesting as specified for original test.

7.4 Records of test shall be maintained by the Contractor and 8 copies furnished to the Engineer.

SERVICE PRESSURE TEST

SCOPE: This test specification shall be used to test piping systems using service pressure and the fluid for which the system is used.

It shall not be used to test piping systems conveying combustible or flammable liquids or systems that comply with ANSI B31 codes.

1.0 TEST FLUID

1.1 The fluid for which the system is designed shall be the test fluid.

2.0 TEST EQUIPMENT

2.1 A pressure gage capable of registering 25 psi over the design pressure shall be installed down-stream from the supply shut-off valve if one is not included in the system.

3.0 PREPARATION FOR TEST

3.1 Insulated lines shall have all joints left exposed until completion of the test.

4.0 TEST PRESSURE

4.1 The test pressure shall be equal to the maximum pressure that the line will be subjected to under normal operating conditions as determined by the Engineer.

5.0 TEST PROCEDURE

5.1 Liquids

5.1.1 See that all personnel not involved in the test vacate the area.

5.1.2 Allow the system fluid to enter the system slowly while venting the air at the extreme far and uppermost points. For all pipelines exceeding 500-ft in length, the maximum rate of filling shall be limited to that which produces a maximum nominal flow velocity of one foot per second in the pipe to be tested.

5.1.3 When the system is full and all air is vented, close the vents.

5.1.4 Allow the pressure in the system to build up to the full line pressure.

5.1.5 Inspect entire system for leaks.

5.2 Gas or Vapor (Including Compressed Air and Steam)

5.2.1 See that all personnel not involved in the test vacate the area.

5.2.2 In systems that do not have a pressure gage near the main shut-off valve, a gage shall be installed.

5.2.3 Allow the system fluid to enter the system slowly until the full operating pressure is reached.

5.2.4 Shut off main supply valve. Observe the gage for 15 minutes. The pressure gage shall not drop during this time.

5.2.5 If the gage drops, indicating the presence of leaks, the systems shall be inspected visually and, if necessary, with soap suds or commercially available leak detectors to locate the leak(s).

5.3 If leaks are found, the lines shall be relieved of pressure, purged if necessary, and repaired. Tests shall be

repeated for repaired sections.

6.0 TEST RECORDS

6.1 Records shall be maintained of all tests performed.

6.2 Test records shall include:

A. Date of Testing

B. Identification of Piping Tested

C. Test Fluid

D. Test Pressure

E. Signatures of Contractor and Engineer

6.3 If leaks are found, they shall be noted on the record. After correction, retesting is required.

6.4 Test records shall be maintained by the Contractor and 8 copies furnished to the Engineer.

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PNEUMATIC TEST

SCOPE: This procedure for a pneumatic test of piping systems shall be used when water, or other liquid, cannot be introduced into the line, or as a supplement to a hydrostatic test.

IT SHALL NOT BE USED TO TEST NON-METALLIC (PLASTIC) PIPE.

1.0 GENERAL

1.1 There is a hazard in using gases for test fluids because of their compressibility.

1.2 Gases shall never be used unless there is ample justification and always in a safe manner. See Section 3.0.

2.0 TEST GASES & PRESSURES

2.1 Compressed air shall normally be used. Other gases may be used when specified or directed by the Engineer.

2.2 Test pressures shall be 110 percent of the anticipated maximum operating pressure, but not exceeding 100 psig and not less than 5 psig at the highest point in the system.

3.0 SAFETY

3.1 All pneumatic tests shall be done under the supervision of Contractor and in the presence of the Engineer.

3.2 New Construction: The Engineer's permission shall be secured before testing.

3.3 Renovation Projects: The Owner representative and the Engineer must be informed and their permission secured before testing.

3.4 Only those people actively participating in the test shall be allowed in the test area.

3.5 Safety glasses and hard-hats must be worn.

4.0 EQUIPMENT

4.1 Building supply air to deliver the required test pressure if available, or Contractor shall provide a compressor capable of the required test pressure.

4.2 Valves shall be provided on the discharge side of the pump.

4.3 Relief valve to relieve at 10 to 15 percent over the test pressure.

4.4 Pressure Gage(s) capable of reaching 50 percent over the test pressure. A gage shall be located on the pump discharge and other location as required.

5.0 TEST PROCEDURE

5.1 Increase the pressure in the line gradually, in steps, to the specified pressure. Checks shall be made at 25 psig intervals until the test pressure is reached using sound, soap solution or a drop in indicated pressure.

5.2 When the specified pressure for the test is reached, shut off the valve in the supply line from the pump.

5.3 Maintain the test pressure long enough to visually inspect all joints or a minimum of 10 minutes. There shall be no drop in the test pressure in this time.

5.4 Leaks shall be repaired and the line retested. All leaks shall be noted on the Test Record form.

5.5 After satisfactory completion of the test, vent the line and allow it to return to atmospheric pressure. Connection can then be made to the supply line.

6.0 TEST RECORDS

6.1 Records shall be maintained of all tests performed.

6.2 Test records shall include:

A. Date of Testing

B. Identification of Piping Tested

C. Test Fluid

D. Test Pressure

E. Signatures of Contractor and Engineer

6.3 If leaks are found, they shall be noted on the record. After correction, retesting is required.

6.4 Test records shall be maintained by the Contractor and 8 copies furnished to the Engineer.

END OF SECTION

SECTION 15064

PLASTIC PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install 1/8-in. to 6-in. plastic piping and appurtenances as shown on the Drawings and as specified herein.

B. Refer to Section 15051 for additional general piping requirements.

1.02 RELATED WORK

A. Buried force main piping is included under Division 2.

B. Concrete work is included in Division 3.

C. Painting is included in Section 09902.

D. Valves are included in Section 15100.

E. Pipe hangers and supports are included in Section 15094.

1.03 SUBMITTALS

A. Shop drawings and product data, in accordance with Section 01300, shall include the following:

1. Shop drawings including piping layouts and schedules shall be submitted to the Engineer and shall include dimensioning, fittings, locations of valves and appurtenances, joint details, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished.

2. Shop drawing submittals for piping under this Section shall include all data and information required for the complete piping systems. All dimensions shall be based on the actual equipment to be furnished. Types and locations of pipe hangers and/or supports shall be shown on the piping layout for each piping submittal.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM).

1. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

2. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

3. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

4. ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

5. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

6. ASTM D2467 - Standard Specification for Socket - Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

7. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

8. ASTM D2657 - Standard Practice for Heat-Joining Polyolefin Pipe and Fittings.

9. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.

10. ASTM D2855 - Standard Practice for Making Solvent - Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

11. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

12. ASTM D3311 - Standard Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns.

13. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.

14. ASTM F594 - Standard Specification for Stainless Steel Nuts.

B. Plastic Pipe Institute (PPI)

1. PPI TR31 - Underground Installation of Polyolefin Piping.

C. American National Standard Institute

1. ANSI B16.5 Pipe Flanges and Flanged Fittings.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All plastic pipe and fittings of each type shall be furnished by a single manufacturer who is experienced in the manufacture of the items to be furnished; however, it shall not be a requirement that the pipe and fittings be manufactured by the same manufacturer, provided that the pipe and fittings are compatible in both compounding and size. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall be suitable for the intended service.

1.06 SYSTEM DESCRIPTION

A. Piping shall be installed in those locations as shown on the Drawings.

B. The equipment and materials specified herein are intended to be standard types of plastic pipe and fittings for use in transporting wastewater, water, air and chemicals.

C. Plastic piping systems shall be designed for the following conditions:

System	*Material*	*Fluids*	*Normal Operation Pressure (psi)*
Non-Potable Water System	PVC	Non-Potable Water	120
Belt Filter Press Polymer Feed	PVC	Polymer & Polymer Solution	80
Potable Water	PVC	Potable Water	80

PART 2 PRODUCTS

2.01 MATERIALS

A. Poly Vinyl Chloride Pipe and Fittings - PVC

1. Pipe shall be manufactured from PVC compounds meeting ASTM D1784, Class 12454-B in accordance with ASTM D1785, PVC 1120. The pipe shall have a minimum hydrostatic design stress of 2,000 psi at 73 degrees F and shall be suitable for field cutting and solvent welding. Pipe shall be of the sizes as shown on the Drawings and shall be Schedule 80 unless otherwise shown.

2. Fittings shall be the socket type for solvent welded joints conforming to ASTM D2467 or ASTM D2466 where Schedule 40 pipe is shown on the Drawings. Fittings shall be manufactured from PVC compound meeting ASTM D1784, Class 12454-B. Solvent cement shall be as specified in ASTM D2564.

3. Pipe, fittings and solvent for use with potable water shall be certified by the National Sanitation Foundation in accordance with NSF Standard No. 14 and the seal shall be included on the pipe.

B. Poly (Vinyl Chloride) Pipe and Fittings for Drain, Waste and Vent Service (DWV).

1. Pipe shall be manufactured from PVC compounds meeting ASTM D1784, Class 12454-B in accordance with ASTM D2665. The patterns, dimensions and laying lengths of fittings including adapters shall meet the requirements of ASTM D3311. Solvent cement for joining DWV pipe and fittings shall be as specified in ASTM D2564.

C. Threaded joints shall be as specified under the applicable ASTM standard for the pipe and fittings being used. Thread sealer shall be thread tape which shall be standard industrial quality Teflon, Type 1.

D. Flanged Joints

1. Where flanged joints are shown on the Drawings, they shall be supplied with 1/8-in. thick full-faced Viton-N gaskets or equal.

2. Flange bolt spacing, number and dimensions shall conform to the requirements of ANSI B16.5. PVC flanges shall be single piece, suitable for solvent cementing to the pipe and shall be suitable for a minimum pressure of 150 psi. Two piece sleeved flanges (Van Stone type) shall not be acceptable.
3. Bolts, nuts and washers for flanged joints shall be for corrosive service conditions and shall be ASTM F593 and F594, Type 316 stainless steel. Antisieze compound for stainless steel bolts and nuts shall be of a molybdenum disulfide base such as Molycoat-G or equal.

E. Fittings, specials, unions and flanges shall be of the same schedule number and manufactured of the same materials as the pipe. Whenever unions are called out on the Drawings, flanged connections may be substituted, provided that dimensional controls do not preclude use of flanges.

F. Expansion joints for PVC sizes 2-in to 6-in shall be telescoping type as manufactured by Plastinetics, Inc.; ASAHI/America or equal. Expansion in pipes smaller than 2-in shall be accommodated with expansion loops.

2.02 SURFACE PREPARATION AND SHOP COATING

A. All PVC piping and fittings exposed to view shall have its surface prepared and be shop painted as specified in Section 09901. Surface preparation and shop priming are a part of the work of this Section. Field finish painting is included in Section 09902. The Contractor shall assist as required in identifying pipe contents, direction of flow and all else required for proper finish painting and marking of pipe.

PART 3 EXECUTION

3.01 INSTALLATION

A. The installation of plastic pipe shall be strictly in accordance with the manufacturer's technical data and printed instructions.

B. Joints for PVC pipe shall be solvent cemented unless flanged or threaded are otherwise shown on the Drawings or are specified as other types herein. In making solvent cemented connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth to remove any shoulder or burrs created by cutting of the pipe. Solvent cement joints shall be made in accordance with ASTM D2855. Primer shall be used whenever recommended by the pipe, fitting, or cement manufacturer and in all cases for joints on pipe systems four inches in diameter or larger. Making solvent cement joints shall not be performed and the work shall stop when the temperature, measured in the shade, is 40 degrees F and falling.

C. Joints between PVC drain, waste and vent pipe and cast-iron soil pipe shall be made with approved mechanical compression joints designed for such use.

D. Installation of valves and fittings shall be in accordance with manufacturer's instructions. Particular care shall be taken not to overstress threaded connections. In making solvent cement connections, the solvent cement or primer shall not be spilled on valves. Any cement allowed to run from joints shall be cleaned from the pipe and fittings immediately.

E. All piping shall have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the Engineer. PVC pipe shall be installed with at least one expansion joint or loop near the center of each straight run of pipe which is 50 feet or longer with the maximum spacing between expansion joints or loops being 150 feet.

F. All plastic pipe to metal pipe connections shall be made using flanged connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings nor shall plastic piping be threaded into metal valves, fittings or couplings. Only socket to thread adaptors shall be used for threaded plastic pipe connections to other threaded devices.

G. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify these locations from approved piping layout drawings and the structural drawings. Pipe hangers and supports are specified in Section 15094.

3.02 FIELD TESTING

A. All pipelines shall remain undisturbed for the minimum curing or cooling time specified for each type of pipe material but no less than 8 hours to develop full curing and complete strength at all joints. All pipe systems shall be flushed clean and then subjected to a hydrostatic pressure test for 12 hours at a test pressure and temperature specified below. Testing procedures shall be as specified below and in Section 15051. Should the temperature not be attainable under hydrostatic conditions, the test may be performed under hydro-dynamic conditions provided that accurate measurements for loss of the test fluid can be made or the pressure shall be proportionally increased to simulate the stresses of the higher temperature in relation to the lowest system temperature that is expected during the duration of the test. The proportionally higher test pressures shall be determined in accordance with the accepted temperature versus strength properties as published by the pipe manufacturer, Plastic Pipe Institute or other pipe material standards organization. Allowance for expansion of polyethylene pipe during the test shall be made in accordance with PPI Technical Report TR31.

B. The test pressures and temperatures for the various pipe lines shall be as follows:

1.	Chemical feed piping:	150 psi at 100 degrees F.
2.	Drain piping:	15 psi at ambient temperature
3.	Vent piping:	15 psi at ambient temperature
4.	Potable/Non-potable Water:	150 psi at ambient temperature

C. The test shall be performed by slowly filling the piping system, expelling entrapped air from all high points. The fill rate shall be controlled so that the fluid velocity within the pipe system is less than two fps. Upon completion of the filling process, the system shall be brought up to the specified test temperature as applicable, holding the system pressure to less than ten percent of the test pressure. Once the system has been stabilized at the specified test temperature, the pipe should be slowly brought up to the test pressure in such a manner so as to not create shock, surge or water hammer in the pipe system. The test duration time limit shall not begin until the full pressure specified above has been reached and the system has been stabilized to within five percent of the test temperature. The system pressure and temperature shall be maintained to within one-half

percent but no more than five percent of the specified value for the temperature and within five psi of the specified value for the pressure. These tolerances shall be held for the entire duration of the test. Upon completion of the test, the pressure shall be slowly removed by opening a valve or other pressure relieving device at a location remote to the location of the pressure/temperature monitoring equipment.

D. The pressure test shall be monitored by a recording type pressure gage for tests not requiring temperature control or a dual pen pressure/temperature recording gage when temperature control is required. The entire test process shall be recorded, including the initial temperature stabilization and pressurization of the piping system. The record shall be continuous through the system test and shall show the final de-pressurization of the pipe system.

E. All visible leaks detected during the pressure test shall be repaired and the pressure/temperature test rerun. A successful test shall be a test in which no visible leaks are detected and the pipe system pressure can be maintained within one-half percent but no more than five psi of the specified value.

F. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during the tests.

3.03 PAINTING

A. All PVC pipe and fittings exposed to the direct sunlight shall be field painted to provide additional UV protection. This painting shall be required whether or not marking is required and shall be in accordance with Section 09901.

END OF SECTION

SECTION 15066

STAINLESS STEEL PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install, test, complete and ready for operation all stainless steel pipe as shown on the Drawings and as specified herein.

B. Where the word pipe is used it shall refer to pipe, fittings, hangers, supports and appurtenances unless otherwise noted.

C. The work includes, but is not necessarily limited to furnishing and installing interior, above grade, stainless steel pipe, fittings and specials with screwed, butt welded, or flanged and plain ends.

1.02 RELATED WORK

A. Buried piping is included in Division 2.

B. Field painting is included in Section 09902.

C. Valves and appurtenances are included in Section 15100.

D. Piping specialties are included in Section 15120.

E. Pipe hangers and supports are included in Section 15094.

F. Thermal insulation is included in Section 15250.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, the following:

1. Within 30 calendar days following effective date of the Agreement, submit the name of the pipe, fitting and appurtenances manufacturers and a list of the material to be furnished by each manufacturer.

2. Shop drawings including piping layouts and schedules, including dimensioning, fittings, expansion joints, locations of valves and appurtenances, joint details, wall penetration details, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished. Shop drawings shall include all data and information required for the complete piping systems. All dimensions shall be based on the actual equipment to be furnished. Types and locations of pipe hangers and/or supports shall be shown on the piping layouts for each pipe submittal. Not all dimensions will be checked by the Engineer, nor will detailed review be performed. Contractor shall be responsible for accurate dimensioning of piping systems.

3. Proposed cleaning method, including precleaning, descaling, chemicals to be used, or mechanical descaling method and final cleaning/passivation

4. Certifications that welders are qualified, in accordance with ANSI B31.1, Paragraph 127.5 for shop and project site welding of pipe work.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.

2. ASTM A530 - Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.

3. ASTM A778 - Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

B. American National Standards Institute (ANSI)

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

2. ANSI B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.

3. ANSI B36.19 - Stainless Steel Pipe

C. American Water Works Association (AWWA)

1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

D. American Society of Mechanical Engineers (ASME)

1. ASME B31.1 - Power Piping.

E. American Welding Society (AWS)

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Stainless steel pipe and fittings shall be furnished by a single manufacturer who is fully experienced, reputable, qualified and regularly engaged for the last 5 years in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with this Section.

1.06 SYSTEM DESCRIPTION

A. Piping shall be installed in those locations as shown on the Drawings.

B. The equipment and materials specified herein are intended to be standard types of stainless steel pipe and fittings for use in transporting air.

1.07 DELIVERY, STORAGE AND HANDLING

A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe and fittings. Pipe and fittings shall not be dropped. Pipe and fittings shall be examined before installation and no piece shall be installed which is found to be defective.

B. In handling the pipe, wide cushioned slings or other devices and methods acceptable to the Engineer shall be used. No uncushioned ropes, chairs, wedges or levers shall be used in handling the pipe, fittings and couplings.

C. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe by the Contractor, at the Contractor's own expense. All pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until they are put into service.

PART 2 PRODUCTS

2.01 MATERIALS

A. All stainless steel pipe and fittings shall be fabricated from stainless steel sheet and conform to ASTM A312 Type 316L. Carbon content of Type 316L material shall be 0.03 percent maximum. Finish shall be No. 1 or No. 2B.

B. Pipe shall be die-formed or rolled true to dimension and round. Tolerances for length, inside and outside diameter and straightness shall conform to ASTM A530. The two edges of sheet shall be brought to line so as not to leave a shoulder on the inside of the pipe. Ends of pipe and fittings shall be perpendicular to the longitudinal axis. Longitudinal seams on pipe and fittings shall be welded by either the tungsten gas or the metallic-gas method. The interior welds shall be smooth, even and shall not have an internal bead higher than 1/16-in. All pieces shall be marked with gauge and type of stainless steel and with the initials of the inspector marked on the inside of each piece, at each end.

C. Pipe and fittings shall be supplied with the following minimum wall thicknesses:

Diameter (Inches)	***Gauge***	***Inches***
Less than 10	16	0.064
12 to 16	12	0.109
18 and larger	10	0.138

D. Fittings shall be smooth curve type up to 18-in diameter and mitered type 20-in diameter and greater. Fittings shall conform to ANSI B16.9.

E. Flanges for pipe 4-in and smaller shall be of the type of stainless steel as the pipeline, and shall be welded directly to the pipe end, and shall be drilled to the 125 lb ANSI B16.1 standard. Flanges for pipe larger than 4-in shall have stub ends or rolled angle rings of the type of stainless steel as the pipeline welded to the pipe end, with suitable gaskets between the mating surfaces and joined through the use of 125 lb rated back-up flanges, drilled to ANSI B16.1, and made of Type 316 stainless steel. Where the pipe stub is to pass through a sleeve during installation, a split-type back

up flange shall be used. Bolts, washers, nuts and other hardware for flange bolting shall be Type 316 stainless steel.

F. Gaskets for flanged connections shall be a minimum of 1/16-in thick and shall be rubber.

G. Shop fabricated multiple output headers may be used in lieu of individual flanged fittings.

H. Wall pipes shall have integral shop welded wall stops.

I. All stainless steel pipe and fittings shall be pickled at the point of manufacture, scrubbed and washed until all discoloration is removed in accordance with ASTM A380.

J. Pipe ends shall be prepared for couplings or other type ends where required by transport and handling limitations, where required by the support layout requirements and where noted on the Drawings. Plain end pipe may be coupled with Pressfit-style connectors, for pipe/tubing sizes 1-1/2-in and smaller, manufactured by the Victaulic Co. or by the use of grooved end couplings. Grooving (or built-up ends for Schedule 5s or 10s pipe) shall be of the coupling manufacturers standard type. Contractor is responsible for ensuring rigidity of joints where required. All normal pipe joints at valves, bends, etc, shall be flanged, drilling per ANSI B16.1, Class 125.

K. Shop welding of fabrications shall be done according to the procedures and by welders certified per ASME Section IX. Welds shall be by an inert gas shielding process using only extra low carbon filler metals. Welds shall have a bead height of no more than 1/16-in. Butt welds shall have 100 percent penetration to the interior or backside of the weld joint. Cross-sectional thickness of welds shall be equal or greater than that of the parent metal.

L. Where shown on the Drawings or where approved by the Engineer, plain end pipe shall be joined by all stainless steel flexible couplings. Sleeve type couplings shall be of the Type 316L stainless steel and shall be Style 38 as manufactured by Dresser Manufacturing Division of Dresser Industries; coupling 411 as manufactured by Smith Blair, Inc. or equivalent couplings manufactured by Depend-O-Lok Co.

M. Where shown on the Drawings or where approved by the Engineer, flanged coupling adaptors shall be used to connect plain end pipe to equipment, fittings and valves. Flanged coupling adaptors shall be of the Type 316L stainless steel and shall comply with AWWA C207. Flanged coupling adapters shall be manufactured by Dresser Manufacturing Division of Dresser Industries; Smith Blair, Inc. or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. All pipe and fittings shall be installed true to grade and alignment and pipe anchorage and/or restraint shall be provided where required. Manufacturer's instructions shall be strictly followed.

B. All pipe and fittings shall be protected from dirt, dust, oil, grease and other foreign matter during installation to prevent damage to pipe and to assure no foreign matter is left in the piping.

C. To assemble the joints in the field, thoroughly clean all joint surfaces and gaskets, if any, with soapy water before assembly. Bolts shall be tightened alternately, evenly to the manufacturer's

specified torques. Under no condition shall extension wrenches or pipe-over-handle ratchet wrenches be used to secure greater leverage. All electrical bonding or insulation shall be installed as joints are made up.

D. Fittings, in addition to those shown on the Drawings, shall be provided if required. Due consideration shall be given to thermal expansion/contraction over a temperature range of 200 degrees F.

E. When cutting of pipe is required, the cutting shall be done by machine neatly, without damage to the pipe. Cut ends shall be smooth and at right angles to the axis of the pipe.

F. After installation, stainless steel pipe lines shall be washed clean with steam or hot water to remove any foreign material picked up during transport.

3.02 JOINING MECHANICAL AND RESTRAINED JOINTS

A. Mechanical joints shall be in accordance with the ANotes on Methods of Installation under AWWA C111 and the instructions of the manufacturer.

B. Restrained joint pipe and fittings shall be installed in the locations shown on the Drawings and as acceptable to the Engineer.

3.03 JOINING FLANGED JOINTS

A. Flanged joints shall be made with gasket, bolts and nut bolts stud with a nut on each end, or studs with nuts where the pipe is tapped. The number and size of bolts shall conform to the same standard requirements as the flange.

3.04 FIELD WELDING

A. Welding in the field shall be done only if approved by the Engineer. Field welds shall be made by welders certified under ASME Section IX and be equal in all respects to shop welds. After field welding has been done, all joints shall be thoroughly cleaned and buffed using deburring and finishing wheels.

3.05 FIELD PAINTING

A. Final field painting is included in Section 09902 except that for all stainless steel pipe, only bands, labels and arrows rather than full pipe painting will be required.

3.06 DISINFECTION AND CLEANUP

A. After installation, completed lines shall be cleaned with Oakite deoxidizer or similar deoxidizer as recommended by the manufacturer to remove all foreign matter, construction stains or shop markings. Cleaned lines shall be rinsed clear with steam or hot water.

3.07 FIELD TESTING

A. All pipe lines shall be tested for compliance with the Specifications. If leaks are discovered, they shall be repaired under this Section and approved by the Engineer. Pressure and leakage tests will be required. The test pressure for the low pressure air piping shall be 15 psi.

END OF SECTION

SECTION 15072

DUCTILE IRON PIPE AND FITTINGS
(Flanged and Process Piping)

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required, install, and test ductile iron pipe and fittings for plant mechanical piping as shown on the Drawings and as specified herein.

B. Mechanical piping shall include all piping and fittings installed above grade, in utility tunnel or gallery and shall exclude pipe in valve vaults, manholes, cleanouts and similar yard structures.

C. Mechanical piping shall be installed as shown on the Drawings. Provide pipe supports, hangers and couplings as required to achieve a complete pipe system.

D. Where the word "pipe" is used, it shall refer to pipe, fittings, or appurtenances unless otherwise noted.

1.02 QUALIFICATIONS

A. All ductile iron pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the material to be furnished. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications. Pipe manufacturer must have 5 years experience in manufacturing ductile iron pipe of largest diameter to be furnished. All ductile iron pipe must be supplied by one manufacture.

1.03 RELATED WORK

A. General Piping Requirements are included in Section 15051.

B. Ductile Iron Yard Piping is included are Section 02610.

C. Pipe Hangers and Supports are included in Section 15094.

D. Valves and Appurtenances are included in Section 15100.

E. Painting is included in Division 9.

1.03 SUBMITTALS

A. The Contractor shall submit to the Engineer, within 30 days after receipt of Notice to Proceed, a list of materials to be furnished, and the names of the suppliers and the date of delivery of materials to the site.

B. Submit shop drawings to the Engineer for review in accordance with Section 01300, showing the complete laying plan of all pipe, including all fittings, adapters, valves, and specials along with the manufacturer's drawings and specifications indicating complete details of all items. The pipe

details shall include a pipe class laying schedule which specifies pipe class, class coding, joints, station limits, and transition stations, and a list of abbreviated terms with their full meaning. The Contractor shall provide details of fittings to be furnished. The above shall be submitted to the Engineer for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated on the Drawings. In most cases, a certain amount of flexibility in the positioning of pipes will be allowed. Horizontal and vertical deflections may require beveled, special deflection or short pipes. The deflections at joints shall not exceed 75 percent of that recommended by the manufacturer or, if the manufacturer uses a safety factor, shall not exceed the manufacturer's recommendation. The manufacturer shall provide of statement of the safety factor.

C. Prior to shipment of pipe, submit a certified affidavit of compliance from the pipe manufacturer stating that the pipe, fittings, and gaskets, lining and exterior coatings for this project have been manfuactured and tested in accordance with ANSI/AWWA and ASTM standards and requirements specified herein.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A377 - Standard Index for Specification for Ductile-Iron Pressure Pipe

2. ASTM C150 - Standard Specification for Portland Cement.

B. American National Standards Institute (ANSI)

1. ANSI B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form).

2. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

3. ANSI B18.2 - Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.

C. American Water Works Association (AWWA)

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-In Through 48-In (75mm Through 1200mm) for Water and Other Liquids.

3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

4. AWWA C115 - Flanged Ductile-Iron Pipe with Threaded Flanges.

5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.

6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids.

7. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

8. AWWA C606 - Grooved and Shouldered Joints.

9. AWWA C651 - Disinfecting Water Mains.

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Each length of ductile iron pipe supplied for the project shall be hydrostatically tested at the point of manufacture to 500 psi for duration of 10 seconds per AWWA C151. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture of the pipe wall. Certified test results shall be furnished in duplicate to the Engineer prior to time of shipment.

B. All ductile-iron pipe and fittings to be installed under this project shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the Engineer sworn certificates of such tests and their results prior to the shipment of the pipe.

C. All pipe and fittings to be installed under this Contract may be inspected at the plant for compliance with these Specifications by an independent testing laboratory selected by the Owner, at the Owner's expense.

D. Inspection of the pipe and fittings will also be made by the Engineer or representative of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job.

E. All pipe and fittings shall be permanently marked with the following information:

1. Manufacturer, date.

2. Size, type, class, or wall thickness.

3. Standard produced to (ANSI/AWWA, ASTM, etc).

1.06 DELIVERY, STORAGE AND HANDLING

A. See Section 01600 for general requirements.

B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Under no circumstances shall the pipe be dropped or skidded against each other. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or internal lining of the pipe.

C. Materials, if stored, shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times.

D. Pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Stacking shall conform to manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe

1. Ductile iron pipe shall conform to AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, latest revisions. Flanged pipe shall be Class 53 as per AWWA C150.

2. Pipe shall be supplied in standard lengths as much as possible.

3. Ductile iron pipe shall be as manufactured by U.S. Pipe and Foundry Company, Inc.; American Cast Iron Pipe Company, Clow, McWayne, Griffin, or prior approved equal.

4. Pipe manufacturer must have 5 years experience in manufacturing ductile iron pipe of largest diameter to be furnished. All ductile iron pipe must be of one manufacturer.

B. Joints

1. Ductile iron pipe shall have flanged joints. Flange shall be flat face type, unless otherwise noted, meeting ANSI B16.1 Class 125 requirements.

2. Bolts, gaskets and installation shall be in accordance with AWWA C115, Appendix A requirements. Flange gasket shall be full face type per AWWA C111 to provide positive sealing for the flanged ductile iron joints. Thickness shall be 1/8-in unless otherwise indicated. Gaskets shall be compatible with fluids to be transported through the pipe and with all temperature requirements. Gaskets for ductile iron pipe must not have the larger inside diameters provided by the requirements of ANSI B16.21.

3. Assembly bolts shall be square headed carbon steel machine bolts with hexagon nuts per ANSI B18.2. Thread shall conform to ANSI B1.1. Bolt length shall be such that after joints are assembled, the bolts shall protrude through the nuts, but not more than 2-in.

4. Grooved joints shall conform to AWWA C606 standard rigid couplings and shall be Style 31 couplings as manufactured by Victaulic Company of America or equal.

5. Sleeve type couplings shall be Dresser Style 38 or 138 as manufactured by Dresser Industries or equal.

6. Flanged coupling adapters shall be Smith-Blair Type 913 or equal.

C. Fittings

1. Pipe fittings shall be ductile iron with a pressure rating of 250 psi. Fittings shall meet the requirements of AWWA C110 as applicable. Fittings shall have the same pressure rating, as a minimum, of the connecting pipe.

D. Interior Lining

1. Ductile iron pipe and fittings shall have the same type of lining as specified or indicated on the Drawings.

2. All raw wastewater, sludge, and scum piping pipe shall have a ceramic epoxy liner on the inside. The lining material shall be Protecto 401 as manufactured by the Vulcan Group. The lining material shall be applied evenly without "holidays" to a total thickness of the dray coating a nominal of 40 mils in accordance with the manufacturer's recommendations and as specified herein.

3. Application of lining: the lining shall be applied by a competent firm with at least a five year history of applying linings to the interior of ductile iron pipe and fittings.

    a. Surface Preparation: Prior to abrasive blasting, the entire area that will receive the protective compound shall be inspected for oil, grease, etc. Any area where oil, grease or any substance which can be removed by solvent is present, shall be solvent cleaned using the guidelines outlined in SSPC-SP-1 Solvent Cleaning. After the surface has been made free of grease, oil, or other substances, all areas that are to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The blast media shall strike 100 percent of the surface area with sufficient force to remove rust and oxides. The entire surface to be lined shall be struck with the blast media so that all rust, loose material, oxides, etc. are removed from the surface. Only slight stains and specs of tightly adhering oxides may be left on the surface. Any areas where rust appears before coating must be reblasted to remove all rust.

    b. Lining: After surface preparation and within 8 hours of surface preparation of the barrel of the pipe from the inside shoulder of the gasket groove to the end of the interior spigot shall receive a nominal coating of 40 mils dry film thickness of the protective lining. If flange fittings or pipe is included in the project, the linings must not be used on the face of the flange: however, full-face gaskets must be used to protect the end of the pipe. Push-on type fittings shall be lined from the gasket groove to the gasket groove. The 40 mils system shall not be applied in the gasket grooves.

    c. Coating of gasket groove and spigot ends: Due to the tolerances involved, the gasket groove and spigot end up to 6 inches back from the end of the spigot end must be coating with 10 mils (maximum) dry film thickness of Protector Joint compound or equal. This coating shall be applied by brush to ensure coverage. Care should be taken to ensure that the coating is smooth without excess buildup in the gasket or on the spigot end. All materials for the gasket groove and spigot end shall be applied after the application of the lining.

    d. Number of coats: The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall the material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The time between coats shall never exceed that time recommended by the lining material manufacturer. In the event that recoating or repair to the lining is required, the pipe shall be returned to the manufacturer for recoating.

4. Inspection

    a. All pipe shall be checked for thickness using a magnetic film thickness gage. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Testing.

    b. The barrel of all pipe and fittings shall be pinhole-detected with a non-destructive

2,500 volt test. Any defects found shall be repaired prior to shipment.

c. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on that date and records maintained by the applicator of his work.

5. Certification: the pipe or fitting manufacturer must supply a certificate attesting to the fact that the Applicator met the requirements of this specification, that the material used was as specified, and that the material was applied as required by these specifications.

6. Repair: all pinholes and damaged lined areas shall be repaired in accordance with written repair procedures for the lining material furnished by the manufacturer so that the repaired area is equal to performance of the undamaged lining areas. Any pipe found to have damaged lining prior to installation shall be returned to the pipe manufacturer for repair.

7. Ductile iron pipe and fittings for the grit system shall have glass lining. Glass lining shal be a smooth, continuous glass coating with an average thickness of 10 mils and a minimum thickness of 8 mils. Surface hardness shall be greater than 5 on the MOHS scale and minimum densite of lining shall be 2.5 grams/cc.

The lining shall have a weight loose of not more than 3 mils per square inch when tested in a range of 500 degree F in accordance with US Bureau of Standards, Standard T Section Thermal Shock Tests and lining shall have a minimum compressive strength of 30,000 psi. Certified test reports shall be furnished to the Engineer.

The furnished lining shall be free of pinholes, crazing or fish scales. Lining shall be as manufactured by Vitco Co. of Erie PA or equal. Lining thickness will be measured magnetic thickness gage. Continuity of lining will be verified by means of an approved "holiday" detector of low voltage, wet sponge, transistorized type.

E. Exterior Corrosion Protection

1. The exterior surfaces of all pipe and fittings that will be exposed in interior locations shall be shop primed on the outside with one coat of KopCoat No. 622 Rust Inhibitive Primer, Wasser "FerroClad P" moisture cured urethane, TENMEC 37H77 or equal, and painted in accordance with Section 09901. Flange faces shall be coated with rust-preventative compound. Rust-Preventative Compound shall be Houghton ARust Veto 344" or Rust-Oleum AR-9". Exterior surfaces of all other ductile iron pipes shall be asphaltic coated in accordance with current AWWA Standard C151.

2. Buried pipe shall be installed with polyethylene encasement conforming to AWWA C105. The polyethylene sheet shall be 8 mils thick minimum.

3. Buried sleeve-type couplings shall have a protective wrapping of "Denso" material as manufactured by DENSO Inc. of Texas, or equal. Where "Denso" material is used, the joint shall be packed up with "Densylmatic" to give an even contour for wrapping with "Densopol" tape. A 1.5 mm thick coating of "Denso" paste shall be applied following by 100 mm or more wide "Densopol" tape wound spirally round the joint with at least 50 percent overlap.

F. Pipe Hangers and Supports

1. Pipe hangers and supports shall be provided at suitable distance along the pipeline regardless whether or not they are shown on the Drawings.

2. Pipe hangers and supports shall be as specified in Section 15094.

PART 3 - EXECUTION

3.01 PIPE INSTALLATION

A. General

1. All piping and fittings shall be installed true to alignment and rigidly supported. Anchorage shall be provided where required. Any damage to linings shall be repaired to the satisfaction of the Engineer before the pipe is installed. Each length of pipe shall be cleaned out before installation. Installation shall be in compliance with all the manufacturer's recommendations.

2. The deflection at joints shall not exceed that recommended by the pipe manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in areas where conflict exists with the existing facilities.

3. When pipe cutting is acceptable to the Engineer, the cutting shall be done by abrasive saw, leaving a smooth cut at right angles to the axis of the pipe. Any damage to the lining shall be repaired to the satisfaction of the Engineer. Field cut ends shall be sealed with Protecto 401 (or for potable water, approved epoxy) in accordance with manufacturer's instructions.

4. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA C600 modified.

B. Jointing

1. Flanged joints shall be made using gaskets, bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.

2. Bolts in flanged joints or mechanical joints shall be tightened alternately and evenly.

3. Sleeve type couplings and grooved joints using split ring couplings shall be installed in accordance with the procedures recommended by their respective manufacturers.

C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit a certification stating that such requirements have been complied with.

D. Sleeves of proper size shall be installed for all pipes passing through floors or walls. Sleeves shall be installed as shown on the Drawings. Where indicated on the Drawings or required for liquid or gas-tightness, the pipe shall be sealed with a mechanical seal equal to Link-Seal as manufactured by Thunderline Corporation, or equal.

E. Sleeves and wall pipes shall have thrust collar located at the mid-depth of wall.

F. Concrete inserts for hangers and supports shall be furnished and installed as recommended by the manufacturer or as specified herein or as shown on the Drawings. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify their locations from approved piping layout drawings and the structural drawings

G. Pipelines supported by pipe hangers from the ceiling, or otherwise supported where lateral displacement of pipe is probable, shall be seismically braced laterally, and braced longitudinally and laterally as required for the specific piping system, and at 90 degree bends. The seismic bracing, as a minimum, shall consist of 3/8-in steel plate welded to pipe hanger, 2-in diameter all threaded rod, 2-in diameter flexible connector and eye rod inserted in the ceiling. Submit seismic loading and calculations for Engineer's review.

3.02 CLEANING

A. Clean all of the pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. All debris shall be removed from the pipeline. The lowest segment outlet shall be flushed last to assure debris removal.

B. For potable water lines, the Contractor shall disinfect the water lines and flush in accordance with City requirements and a procedure approved by the Engineer.

3.03 PIPE MARKING

A. All exposed piping, exterior and interior, shall be identified by painted legend markers, directional arrow markers and number markers as required. Pipe marking colors shall contrast with pipe color for ease of visibility. Pipe marking shall match the existing markings. Letters and markers 1-1/8-in in width shall be installed on pipes under 3-in in diameter. Markers 2-1/2-in in width shall be installed on pipes 3-in in diameter and larger. Legend markers, directional arrow markers and number markers shall be placed as directed by the Engineer. Markers shall be located where pipes pass through walls or floors, at piping intersections and maximum 15-ft spacing on piping runs.

B. Pipe marker letter legend shall be as given on the G sheets of the Drawings and as approved by the Engineer

END OF SECTION

SECTION 15094

PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish labor, materials, equipment and incidentals and install pipe hangers, supports, beam clamps, hanger rods, friction clamps, concrete inserts, and anchor bolts including all hanging and supporting devices for supporting non-buried piping as shown on the Drawings and as specified herein. PLEASE NOTE: NOT ALL PIPE SUPPORTS, HANGERS, ANCHORAGES, OR EXPANSION JOINTS ARE SHOWN ON THE DRAWINGS.

B. Unless otherwise noted, wherever the word "support" is used herein, it shall mean any overhead hangers, wall bracket, supports from the floor, friction clamps and attendant beam clamps, concrete inserts, pipe guides, rods, supports pipes and other necessary equipment for supporting and/or anchoring any pipes, tubing, or appurtenances. Where the word pipe is used it shall mean pipe, appurtenances and/or tubing.

1.02 RELATED WORK

A. Concrete is included in Division 3.

B. Miscellaneous metal fabrication is included in Section 05500.

C. Field painting is included in Section 09900.

D. Pipe and fittings are included in Division 15.

E. Valves are included in Section 15100.

F. Piping specialties are included in Section 15120.

1.03 SUBMITTALS

A. Submit to the Engineer as provided in Section 01300, complete sets of shop drawings of all items to be furnished under this Section. Submittals shall include complete layouts, schedules, location plans and complete total bill of materials for all pipe support systems.

B. Submittals shall include a representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers and/or supports are not suitable, submit detailed drawings showing materials and details of construction for each type of special hanger and/or support.

C. Submittals shall include complete piping drawings indicating type of hanger and/or support, location, magnitude of load transmitted to the structure and type of anchor, guide and other pipe supporting appurtenances. Submittals shall use detail numbers as shown on the Drawings to indicate type of support proposed wherever possible.

D. Type and locations of pipe hangers and/or supports shall also be shown on the piping layouts for each piping submittal as specified in the respective Division 13 and 15 pipe specifications.

E. Submit complete design data for support systems to show conformance with this Specification.

1.04 QUALIFICATIONS

A. Hangers, supports and appurtenances shall conform to the latest applicable requirements of ANSI 31.1.0, except as supplemented or modified by the requirements of this Specification.

B. Hangers, supports and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10-ft of water filled pipe being supported.

C. Pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit certification stating that such requirements have been complied with.

D. The supports specified under this section shall be furnished by a Manufacturer who is fully experienced, reputable, qualified and has been regularly engaged in the design of complete pipe support systems and the manufacture (or fabrication) of the items to be furnished for at least ten (10) years.

E. It is a requirement of these Specifications and Drawings to have the piping supports and anchorages (including location of guides and expansion joints) designed and supplied, as much as practical, as an integral system, by a single manufacturer, rather than have selection and supply of these items by a number of different manufacturers or distributors. The Pipe Support Manufacturer shall certify through the Contractor to the Engineer that the supports and/or anchorage have been designed as a system.

F. Design calculations for pipe supports and anchorage systems (including guides and expansion joints) shall be submitted, along with the pipe system drawings. Calculations shall be stamped by a licensed Professional Engineer who is regularly engaged in pipe support system design.

G. Nothing in these Contract Documents, however, shall modify the requirements that THE CONTRACTOR SHALL HAVE THE FINAL RESPONSIBILITY FOR PROPER PERMANENT SUPPORT AND ANCHORAGE OF ALL PIPING SYSTEMS.

1.05 DESCRIPTION OF SYSTEM

A. All pipe and tubing shall be supported and anchored as required to prevent significant stresses in the pipe or tubing material, valves, fittings and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports and anchorage shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact.

B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit certification stating that such requirements have been complied with.

C. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.

D. The minimum working factor of safety for all supporting equipment, with the exception of springs and anchorage, shall be five (5) times the ultimate tensile strength of the material, assuming a supported weight of a length of water filled pipe and equal to half the distance to the next supports. Valves and other concentrated loads shall be accounted for.

E. The minimum factor of safety for thrust anchorage design shall be 1.5. Thrust design shall utilize: working pressure plus water hammer; or 1.5 times working pressure; or test pressure whichever is highest or as noted on the Drawings and as acceptable to the Engineer.

F. All support of the same type shall be identical, varying only with size, and the product of one manufacturer or fabricator. Supports shall be provided where indicated on the Drawings, where required, and where acceptable to the Engineer to form a complete workable system. If types of pipe supports other than those shown on the Drawings or specified are required, they shall be as acceptable to the Engineer.

G. All air piping shall be designed for a maximum operating temperature of 200°F from 50°F ambient.

1.06 REFERENCE STANDARDS

A. Manufacturer's Standardization Society (MSS):

1. MSS SP-58 - Pipe Hangers and Supports - Materials and Design.

2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

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

1. ASTM A36 - Structural Steel.

2. ASTM A307 - Carbon Steel Externally and Internally Threaded Standard Fasteners.

C. American National Standards Institute (ANSI):

PART 2 PRODUCTS

2.01 GENERAL

A. The equipment specified herein is intended to support the various types of pipe and piping systems. The details shown on the Drawings are intended to indicate the generally desired methods of

support under normal conditions. It shall be the responsibility of the Contractor to develop final details and any details associated with special conditions not already covered to meet the system conditions specified in the respective Division 13 and 15 pipe specifications.

B. Pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. Supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 05500 and shall be furnished and installed under this Section.

C. Hangers and supports shall be spaced in accordance with ANSI B31.1 except that the maximum unsupported spans shall not exceed 10 feet unless otherwise specified herein.

D. Where flexible couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc., shall be rigidly supported. All sleeve couplings and expansion joints shall be supported on both sides.

E. Pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

F. Rods, clamps, hangers, inserts, anchor bolts, brackets, and components for interior pipe supports shall be furnished with galvanized finish, hot dipped or elector-galvanized coated, except where field welding is required. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-in. plastic coating. Rods, clamps, hangers, inserts, anchor bolts, brackets, and components for exterior pipe, submerged piping, pipe subject to splashing and pipe within outdoor structures shall be of Type 316 stainless steel.

G. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports. No visible sagging is permitted.

H. Uninsulated non-metallic piping such as PVC, CPVC, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the Engineer. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360 degree arc support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18 gauge minimum thickness, not be less than 12-in. in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than 2-in. wide.

I. Insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide galvanized protection shields as specified in Paragraph 2.01H above at each location.

J. Where pipe hangers and supports come in contact with copper piping provide protection from galvanic corrosion by, wrapping pipe with 1/16-in. thick neoprene sheet material and galvanized protection shield, isolators similar to Elcen figure number 228, or copper plated or PVC coated hangers and supports.

K. Pipe supports shall be provided as follows:

1. Cast iron and ductile iron piping shall be supported at a maximum support spacing of 20 feet with a minimum of one support per pipe section at the joints.

2. Support spacing for steel and stainless steel piping two inch and smaller diameter and copper tubing shall not exceed five feet.

3. Supports for multiple PVC plastic piping shall be continuous wherever possible. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support-spacing shall not exceed three feet. Multiple, suspended, horizontal plastic PVC pipe runs, where possible, shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy, the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of mild steel construction. Rung spacing shall be 12-in. Tray width shall be approximately 6-in for single runs and 12-in. for double runs. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc. required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model m-CAC, Husky-Burndy Model SCR or equal. Spacing between clamps shall not exceed 5-ft. The cable trays shall provide continuous support along the length of the pipe. Individual claps, hangers, and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

4. Vertical pipes shall be supported at each floor or at intervals of not more than twelve feet by approved pipe collars, clamps, brackets, or wall rests, and at points necessary to insure rigid construction.

5. Pipe supports shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.

6. Supports shall be provided at changes in direction or specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Engineer.

7. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

8. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

L. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by Grinnel Co., Inc., Providence, RI, Carpenter & Patterson, Inc., Woburn, MA, F & S Central, Brooklyn, NY, Elcen Metal Products Co., Franklin Park, IL, and Unistrut Northeast, Cambridge, MA, or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance shall be considered as equal.

M. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes, concrete and anchor hardware similar to items previously specified herein and shall be subject to the approval of the Engineer.

N. Anchor bolts shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, Minnesota or Wej-it manufactured by Wej-it Expansion Products, Inc., Broomfield, Colorado. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1-in behind the steel reinforcement. Expansion type anchors shall not be used in locations where the normal loading will be direct tension.

O. Horizontal piping buried in earth under lowest floor slabs or buried within the concrete material shall be supported similar to that as detailed on the drawings or as acceptable to the Engineer. Provide all necessary temporary support for this piping until slabs are poured; care shall be taken during pouring procedure to ensure proper alignments. For pipes larger than 8-inches in diameter, blocking or other methods may be substituted, as acceptable to the Engineer.

P. Cast-in-place anchor bolts for interior supports shall meet the requirements of ASTM A307. All anchor bolts, nuts and washers shall be hot dip galvanized or cadmium plated, except where pipe supports are submerged or within one foot above liquid levels, all bolts, nuts, washers and hardware shall be Type 316 stainless steel.

2.02 SINGLE PIPE HANGERS

A. Single pipes shall be supported by hangers suspended by galvanized steel rods from structural steel members, concrete ceilings and beams, bottom of trapeze hangers and wall mounted steel angle brackets.

B. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication. The strength of the rod shall be based on its root diameter.

C. Except as otherwise specified herein, pipe hangers shall be adjustable clevis type similar to Grinnel Figure Numbers 65, 260 and 590 as required. Hangers shall be carbon steel with a galvanized finish.

D. Steam cleaning piping shall be supported by adjustable type pipe roller supports. Roller support shall have cast iron roll and sockets, steel roll rod and continuous threaded galvanized rods and hex nuts similar to Grinnel Figure Number 177.

E. Hanger rods shall be attached to concrete structures using concrete inserts similar to F & S Figures 180, 571 or 150. Inserts shall be malleable iron, or steel with galvanized finish. Beam clamps, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members. Where necessary and approved by the Engineer, double expansion shields shall be used for attaching to concrete structures.

F. Where pipes are near walls, beams, columns etc. and located an excessive distance from ceilings or underside of beams, welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-68, 84 or 139 shall be used for hanging pipe. Brackets shall be galvanized. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.03 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns or structural steel support members as required to meet the intent of this

specification. Channel shall be similar to F & S Figure 710, rods, concrete inserts, "C" Clamps, beam clamps, welded beam attachments, and expansion shields shall be a specified in Paragraph 2.02 Single Pipe Hangers above.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to F & S Figures 158, 419, 160A, 160B as required. Material of construction shall be galvanized steel. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

2.04 SINGLE AND MULTIPLE PIPE SUPPORTS

A. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods specified herein or as shown on the Drawings.

B. Pipes 3-in. in diameter and larger shall be supported by adjustable stanchions similar to F & S Figure 427, constructed of galvanized steel. Stanchions shall provide at least 4-in. adjustment and be flange mounted to floor.

C. Pipes less than 3-in. in diameter shall be held in position by supports fabricated from steel "C" channel, welded post base similar to Unistrut Figure P2072A and pipe clamps similar to Unistrut Figures P1109 thru P1126. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected together by horizontal member of sufficient load capacity to support pipe. Wherever possible supports shall be fastened to nearby walls or other structural member to provide horizontal nearby walls or other structural member to provide horizontal rigidity. More than one pipe may be supported from a common fabricated support. Supports unless specified elsewhere shall be galvanized.

D. Where shown on the Drawings, pipe shall be supported using concrete anchor posts the pipe shall be securely fastened to concrete anchor posts using suitable metal straps as required and approved by the Engineer.

2.05 WALL SUPPORTED PIPES

A. Single or multiple pipes located adjacent to walls, columns or other structural members, whenever deemed necessary, shall be supported using welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-78, 84, or 134; or "C" Channel with steel brackets similar to Unistrut pipe clamps. All members shall be securely fastened to wall, column, etc. using double expansion shields or other method as approved by the Engineer. Additional wall bearing plates shall be provided where required.

B. Pipe shall be attached to supports using methods herein before specified to meet the intent of this Specification.

C. Supports shall be galvanized.

2.06 BASE ANCHOR SUPPORT

A. Where pipes change direction from horizontal to vertical via a bend, a weld or cast base anchor support shall be installed at the bend to carry the load. The bend anchor shall be fastened to the floor and double expansion shields or other method as approved by the Engineer.

B. Where pipe are to bends shall be supported using concrete anchor posts, pipes shall be securely fastened to concrete supports with suitable metal bands as required and approved by the Engineer.

2.07 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut system as specified in Paragraph 2.08, they shall be supported in one of the following methods.

1. For pipes 1/4-in. to 2-in. in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported. The hanger ring shall be galvanized steel or PVC clad depending on the supported pipe. The hanger ring shall be equal to Carpenter & Paterson Fig. No. 81 or 81CT. The anchor flange shall be galvanized malleable iron similar to Carpenter and Patterson Figure No. 85.

2. For pipes equal to or greater than 1/2-in. in diameter extended pipe clamps similar to Carpenter and Patterson Figure No. 268 may be used. The hanger shall be attached to concrete structures using double expansion shields or to steel support members using welding lugs similar to Carpenter and Patterson Figure No. 220.

3. Pipe riser clamps shall be used to support vertical pipes extending through floor slabs. Riser clamps shall be galvanized steel similar to Carpenter and Patterson Figure No. 126. Copper clad or PVC coating clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamp.

4. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding twelve feet shall be supported by approved pipe collars, clamps, brackets or wall rests at all points required to insure a rigid installation.

2.08 SPECIAL SUPPORTS

A. Pipe supports shall be provided for closely spaced vertical piping systems as required to provide a rigid installation. The support system shall consist of a framework suitably anchored to floors, ceilings and walls and be as manufactured by the Unistrut Corporation, Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsu, or equal.

B. Vertical and horizontal supporting members shall be U shaped channels similar to Unistrut Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps equal to Unistrut Series P1100M and Series P2558. Components shall be of mild steel.

C. The assemblies shall be furnished complete with nuts, bolts, and fittings required for a complete assembly including end caps for all members.

D. The design of each individual framing system shall be the responsibility of the Contractor. Shop drawings, as specified above shall be submitted and shall show all details of the installation, including dimensions and types of supports. In all instances the completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached.

E. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes in accordance with applicable

provisions of Section 05500, have anchor hardware similar to items previously specified herein, shall meet the minimum requirements listed below and be subject to the approval of the Engineer.

1. Pipe support systems shall meet all requirements of this Section and all related Sections of this Specification.

2. Complete design details of the entire pipe support system shall be provided for review by the Engineer in the submittals specified in subsection 1.03

3. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.09 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. Surfaces shall be prepared and shop painted as part of the work of this Section. Surface preparation and shop painting shall be specified in Section 09901.

PART 3 EXECUTION

3.01 COATING

A. After fabrication and before installation, all metal surfaces of pipe supports, hangers, anchors, rods, support pipes, brackets, nuts, bolts, washers and other metal used, shall be either galvanized (except cast or ductile iron and stainless steel), coated with two heavy coats of bituminous pain or receive the coating (if any) as specified in Section 09902.

3.02 SHIPPING, HANDLING, DELIVERY AND STORAGE

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

3.03 PREPARATION

A. Locate hangers, supports and accessories to support piping, valves and at all concentrated loads.

B. Locate hangers, supports and accessories within maximum span lengths specified to support continuous pipeline runs.

C. Locate hangers and supports to prevent vibration or swaying and to provide for expansion and contraction.

D. Install items to be embedded before concrete placement.

E. Fasten embedded items securely to prevent movement during concrete placement.

F. Install hanger and support units on piping systems as recommended by manufacturer.

G. Adjust hangers and supports and place grout for concrete supports to bring pipelines to specified elevations.

H. Ferrous pipes shall be supported by galvanized steel pipe attachment.

I. Copper piping shall be supported by plastic-coated or copper-plated steel pipe attachments.

J. Plastic piping shall be supported by plastic-coated steel pipe attachments

K. Stainless steel pipe shall be supported by plastic-coated steel pipe attachments.

3.04 INSTALLATION

A. Supports and Hangers for Horizontal Pipes.

1. Space supports and hangers for all piping no farther apart than indicated below unless otherwise shown.

a. Copper Tube:
(1) 2-in. and Smaller: 6-ft.
(2) 2-1/2-in. and Larger: 8-ft.

b. Steel Pipe:
(1) 1-in. and Smaller: 6-ft.
(2) 1-1/2-in. and Larger: 10-ft.

c. Stainless Steel Pipe:
(1) 2-in. and Smaller: 6-ft.
(2) 2-1/2-in. and Larger: 8-ft.

d. Plastic Pipe:
(1) Maximum support spacing for plastic pipe at ambient temperature shall be one-half the above values specified for steel pipe.

e. Ductile Iron Pipe:
(1) Two supports per length.

2. Additional supports shall be placed immediately adjacent to any change in piping direction, and on both sides of valves and couplings.

3. Accurately locate inserts for hanger rods in forms before concrete is placed.

4. Use expansion anchors only to support rods, hangers and brackets for piping 2-in. and smaller and only if the expansion anchors are designed to carry 100 percent of the full load, hangers and/or bracket and pipe load.

B. Supports for Vertical Piping.

1. Provide riser clamp placed under hub, fitting or coupling with approved solid bearing on steel sleeve at each floor level.

2. Where riser clamps are used with plastic piping they shall be modified so as not to exert any compressive forces on the pipe.

3. For the 30" diameter pipe in the vertidal runs, the pipe shall be strapped to the support structure (trickling filter splitter box or structural pipe bridge) at every pipe support and at least every 20 feet using stainless steel straps.

3.05 ACCEPTANCE AND SERVICE

A. Pipe systems shall be brought to operating pressures and temperatures. Systems shall be cycled to duplicate operating conditions. If any part of the piping support system proves to be defective or inadequate, it shall be repaired or augmented under this section to the satisfaction of the Engineer and at no additional cost to the Owner. Contractor shall furnish labor and materials to readjust and correct faults with hangers and supports for the piping systems.

END OF SECTION

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SECTION 15100

VALVES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation and test all non-buried valves as shown on the Drawings and as specified herein.

B. The equipment may include, but not be limited to, the following. However all items specified herein may not be included in this project.

1. Valve Actuators - General
2. Plug Valves
3. Check Valves
4. Corporation Stop and Stop and Waste Valves
5. Air and/or Air/Vacuum Valves for Sewage Use
6. Air Release Valves
7. Air and Vacuum Valves
8. Gate Valves
9. Ball Valves
10. Water Pressure Regulators
11. Solenoid Valves
12. Pressure Relief Valves
13. Butterfly Valves
14. Plastic Valves
15. Globe Valves
16. Resilient Seated Gate Valves

1.02 RELATED WORK

A. Piping and disinfection for potable water systems is included in the respective Sections of Divisions 15 and 2.

B. Pipe hangers, supports and anchorage are included in Section 15094.

C. Instrumentation and Electrical, not specified herein, are included in Divisions 13 and 16.

D. Painting is included in Section 09902.

E. Certain appurtenances for individual types of pipe or systems are specified with the specific type of pipe or system. However, additional items are specified in this Section.

F. Certain items similar to those specified in this Section may be specified to be furnished and installed with individual equipment or systems. In case of a conflict, those individual equipment or system requirements shall govern.

1.03 SUBMITTALS

A. Submit materials required to establish compliance with these Specifications in accordance with Section 01300. Submittals shall include the following:

1. Certified drawings showing all important details of construction and dimensions.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. The total weight of each item.

4. A complete bill of materials.

5. Additional submittal data, where noted with individual pieces of equipment.

B. Test Reports

1. Provide certified hydrostatic test data, per manufacturers standard procedure or MSS-SP-61 for all valves.

C. Certificates

1. For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

D. Manufacturer's Installation and Application Data

E. Operating and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Engineer as provided in Section 01730. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and other information required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Standard Specification for Gray Iron Castings.

2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

3. ASTM A159 - Standard Specification for Automotive Gray Iron Castings.

4. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.

5. ASTM A276 - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

6. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings.

7. ASTM A536 - Standard Specification for Ductile Iron Castings.

8. ASTM B30 - Standard Specification for Copper-Base Alloys in Ingot Form.

9. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings

B. American Water Works Association (AWWA)

1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

2. AWWA C500 - Metal-Seated Gate Valves Supply Service

3. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-in (50mm Through 24-in (600mm) NPS

4. AWWA C509 - Resilient-Seated Gate Valves for Water and Supply Service

5. AWWA C540 - Power-Actuating Devices for Valves and Sluice Gates

6. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants

7. AWWA C800 - Underground Service Line Valves and Fittings

C. American National Standards Institute (ANSI)

1. ANSI B2.1 - Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads (except dry seals).

2. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

3. ANSI B16.10 - Face-to-Face and End-to-End Dimensions of Valves

D. American Iron and Steel Institute (AISI)

E. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS-SP-61 - Pressure Testing of Steel Valves.

2. MSS-SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

3. MSS-SP-71 - Cast Iron Swing Check Valves, Flanges and Threaded Ends.

4. MSS-SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Services.

5. MSS-SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

6. MSS-SP-80 - Bronze Gate, Globe, Angle and Check Valves.

7. MSS-SP-82 - Valve Pressure Testing Methods

8. MSS-SP-98 - Protective Epoxy Coatings for the Interior of Valves and Hydrants.

F. National Electrical Manufacturers Association (NEMA)

G. Underwriters Laboratories (UL)

H. Factory Mutual (FM)

I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Valves and appurtenances shall be products of well established firms who are fully experienced, minimum 10 years, reputable and qualified in the manufacture of the particular equipment to be furnished.

2. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

3. All units of the same type shall be the product of one manufacturer. All actuators shall be the product of the same manufacturer.

B. Certifications

1. The manufacturers shall furnish an affidavit of compliance with Standards referred to herein as specified in Paragraph 1.03C. Refer to PART 3 for testing required for certain items in addition to that required by referenced standards.

C. Provide the services of a qualified and factory-trained service representative of the manufacturer to provide operational and maintenance instruction, for a one-day, eight hour period for:

1. Pressure regulating valves

2. Air release, air and vacuum valves

D. Inspection of the units may also be made by the Engineer or other representative of the Owner after delivery. The equipment shall be subject to rejection at any due to failure to meet any of the Specification requirements, even though submittal data may have been accepted previously. Equipment rejected after delivery shall be marked for identification and shall be removed from the job site at once.

1.06 SYSTEM DESCRIPTION

A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater, sludges, air and chemicals, raw, filtered and finished water as noted on the Drawings.

B. Valves, appurtenances and miscellaneous items shall be installed as shown on the Drawings and as specified, so as to form complete workable systems.

C. Unless otherwise noted all powered valve operators shall have:

1. Valves larger than 3-in.: electric operators 460 volt, 3 phase, 60 hz.

2. Solenoid valves: 120 volt, single phase, 60 hz, NEMA 4 enclosure, continuous duty Class F coils and manual operator.

3. See other paragraphs for additional requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Reference is made to Section 01600 for additional information.

B. Packing and Shipping

1. Care shall be taken in loading, transporting and unloading to prevent injury to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the Engineer.

2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until after installation and connecting piping is completed.

a. All valves 3-in. and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.

b. Valves smaller than 3-in. shall be shipped and stored as above except that heavy cardboard covers may be used on the openings.

c. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until the valve is installed and put into use.

d. Any corrosion in evidence at the time of acceptance by the Owner shall be removed, or the valve shall be removed and replaced.

C. Storage and Protection

1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual piping specifications and manufacturer's information for further requirements.

1.08 MAINTENANCE

A. Special tools and the manufacturer's standard spare parts, if required for normal operation and maintenance, shall be supplied with the equipment in accordance with Section 01730 and where noted, as specified herein.

B. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

C. Provide to the Owner a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for a period of not less than one year after start-up and final acceptance.

1.09 WARRANTY

A. The Manufacturer of the valve/gate motor operators shall provide a two (2) year warranty on the equipment. The Manufacturer shall guarantee that the equipment furnished is free from defects of design, material and workmanship. In the event the equipment fails to perform as specified, the Manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner (including handling and shipment costs). Normal wear and tear shall be excluded and shall be as identified in the Operations and Maintenance Manuals submitted by the Manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT - GENERAL

A. Reference is made to Division 1 for additional requirements, including nameplates, provisions for temporary pressure gages, protection against electrolysis and anchor bolts.

B. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

C. Valves and appurtenances shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.

D. Valves and appurtenances shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard referenced, cast in raised letters or indelibly marked upon some appropriate part of the body.

E. Unless otherwise noted, items shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher and suitable for the pressures noted where they are installed.

F. Joints, size and material - unless otherwise noted or required by the Engineer:

1. Except where noted, all joints referred to herein shall be of the same type, nominal diameter, material and with a minimum rating equal to the pipe or fittings they are connected to.

2. Valves and appurtenances shall be of the same nominal diameter as the pipe or fittings they are connected to.

3. All valves exposed to view, or in vaults.

a. 3-in. and smaller - threaded ends

b. 4-in. and larger flanged ends.

G. Provide all special adaptors as required to ensure compatibility between valves, appurtenances and adjacent pipe.

H. Valves and actuators located outdoors but not within a building; within maximum 2-ft above liquid; in vaults; or where otherwise noted shall be especially designed for submerged service where water may completely submerge the valve and operator. All other units shall be as a minimum weather tight.

2.02 VALVE ACTUATORS - GENERAL

A. See the Paragraph 2.01H for submergence requirements.

B. The valve manufacturer shall supply and integrally, rigidly mount all actuators, including any type of manual or powered actuators, on valves at the factory. The valves and their individual actuators shall be shipped as a unit.

C. Unless otherwise noted, valves shall be manually actuated; non-buried valves shall have an operating wheel, handle or lever mounted on the operator; buried valves and those with operating nuts shall have a non-rising stem with an AWWA 2-in. nut. At least two tee handles shall be provided for all operating nuts.

D. Except as otherwise shown on the Drawings or specified herein, all valves 3-in. diameter or larger, with the valve center line located 7-ft or more above the operating floor, shall be provided with chain wheel operators complete with chain guides and hot dipped galvanized steel chain, which loop within 4-ft of the operating floor.

E. All actuators shall be capable of moving the valve from the full open to full close position and in reverse and holding the valve at any position part way between full open or closed. Stops shall be provided for all valves as required.

F. Each operating device shall have cast on it the word "OPEN" and an arrow indicating the direction of operation.

G. Floor boxes for operating nuts recessed in concrete shall be standard cast iron type, cast-in-place, with fastening top by Clow or equal.

H. Stem guides shall be of the adjustable wall bracket type, bronze bushed, with maximum spacing of

10-ft as manufactured by Clow; Rodney Hunt or equal. Extended operating nuts and/or stems shall have universal joints and pin couplings, if longer than 10-ft and a rating of at least five times the maximum operating torque. Stem adaptors shall be provided.

I. Where required by the installation, or as specified, provide the following: extended stem; floor stand and handwheel; position indicator and etched or cast arrow to show direction of rotation to open the valve; resilient, moisture-resistant seal around stem penetration of slab.

J. Gear Actuators

1. Unless otherwise noted, gear actuators shall be provided for the following: all valves of larger than 8-in. nominal diameter; all buried valves with operating shaft mounted horizontally (butterfly, plug, etc); where specified and/or indicated on the Drawings; where manual operator effort is greater than 80 ft-lbs rim pull.

2. Gear actuators shall be of the worm or helical gear type with output shaft perpendicular to valve shaft, having a removable hand wheel mounted on the output shaft. Unless noted they shall conform to AWWA C504, but except with butterfly valves, need not be certified.

3. Actuators shall be capable of being removed from the valve without dismantling the valve or removing the valve from the line.

4. Gearing shall be machine-cut steel designed for smooth operation. Bearings shall be permanently lubricated, with bronze bearing bushings provided to take all thrusts and seals and to contain lubricants. Housings shall be sealed to exclude moisture and dirt, allow the reduction mechanisms to operate in lubricant and be of the same material as the valve body.

5. Manual operator input effort to the handwheel shall be a maximum of 40 ft-lbs for operating the valve from full open to full close, under any conditions. Gear actuators shall indicate valve position and have adjustable stops. Maximum handwheel size shall be 24-in diameter.

K. Additional valve actuators are included with the individual valve types and as noted in Paragraph 1.02.

L. All position indication and direction of opening arrows shall be embossed, stamped, engraved, etched or raised decals.

M. Unless otherwise noted, all valves larger than 3-in. nominal diameter shall be provided with position indicators at the point of operation.

2.03 GATE VALVES (2-1/2-IN. AND SMALLER)

A. Gate valves 2-1/2-in. diameter and smaller shall have flanged, screwed, or solder ends as required and shall be brass, or bronze, or Type 304 stainless steel solid wedge, union bonnet, rising-stem gate valves such as Figures 47 and 48 as manufactured by Jenkins Brothers or equal products as manufactured by Crane; Fairbanks; Kennedy Valve Manufacturing Co.; Lukenhiemer or equal.

B. All water valves 2-1/2-in. and 3-in. unless noted otherwise, shall be brass body gates and shall be Jenkins No. 1240, or Hammond 1B-647.

2.04 GATE VALVES (3-IN. AND LARGER)

A. General Requirements

1. Unless otherwise specified below, these requirements shall apply to all gate valves.

2. Gate valves shall meet the requirements of AWWA C500 and AWWA C509 as applicable to the type of valve specified.
3. Buried and submerged valves shall be furnished with mechanical joints and stainless steel hardware; non-rising stem design.

4. Exposed valves shall be furnished with Class 125 flanged ends; provide valves with outside screw and yoke.

5. All-metal valves shall be manufactured of ASTM A126 Cast Iron, Class B, with bronze mounting design.

6. Rising stem valves shall be sealed with adjustable and replaceable packing; valve design must permit packing replacement under operating system pressures with only moderate leakage.

7. Non-rising stem valves shall use a double O-ring stem seal, except that packing shall be used where geared operators are required.

8. Except as otherwise specified, valves shall be rated for the following working water pressures:

Valve Size	***Pressure (psig)***
3-in. to 12-in.	200
14-in. to 20-in.	150
24-in. and greater	50

9. Flanged valves to have face-to-face dimensions per ANSI B16.1 and flanges per ANSI B16.10.

10. Exposed valves 16-in. and larger to have valve by-pass.

11. All bonnet and packing gland bolts shall be zinc or cadmium electroplated steel; packing gland bolts shall have bronze nuts.

12. Exposed valves 16-in. and greater indicated for horizontal stem installation shall be furnished with rollers, tracks and scrapers and enclosed bevel gear grease case.

13. Provide geared operator and chainwheel, chain and chain guides for valves with handwheel centerline more than 7-ft above operating level.

14. All valves shall be marked per AWWA Standards, including name of manufacturer, valve size and working pressure and year of manufacture.
15. Unless otherwise indicated, valves 12-in. and smaller shall be capable of installation in the vertical or horizontal position, and sealing in both directions at the rated pressure.

16. Valve operation shall be counterclockwise for potable water; clockwise for wastewater and other non-potable waters. Provide permanent label showing "OPEN" and arrows.

17. Metal-seated valves shall be coated internally and externally with an asphaltic varnish, per AWWA C500. Resilient seated valves shall be coated, interior and exterior, with fusion bonded epoxy per AWWA C550.

B. Valve Applications

1. Valves for Potable Water Service.

a. Double disc design manufactured by American-Darling Valve; Kennedy Valve; M&H Valve Company or prior approved equal.

b. Double revolving disc manufactured by American-Darling Valve.

2. Valves for Wastewater Service

a. Resilient seated design manufactured by American-Darling Valve; Kennedy Valve; M&H Valve; Clow Corp; or prior approved equal.

3. At the Contractor's option and unless otherwise indicated, any of the listed valve styles may be used at no additional cost to the Owner.

C. Valve Requirements

1. Resilient Seated Gate Valves

a. Gate valves with 4" - 12" diameters shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 of latest revision and in accordance with the following specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

b. The valves are to be non-rising stem with the stem made of cast, forged, or rolled bronze shown in AWWA C509. Two stem seals shall be provided and shall be of the o-ring type, one above and one below the thrust collar. The stem nut, also made of bronze, must be independent of the gate.

c. The sealing mechanism shall consist of a cast iron gate having a vulcanized synthetic rubber coating. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

d. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surface inside and outside shall have a fusion-bonded epoxy coating. A handwheel or wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with WAWA C509.

e. Valves shall be equal to those as manufactured by American, Dresser, Mueller, Clow or prior approved equal.

D. Tapping Valves and Sleeves

1. Tapping valves shall comply with the same requirements as solid wedge or double disc gate valves except they shall have the flanged end and port opening modified for tapping service. Valves shall be capable of passing a full nominal sized cutter without damage to the valve.

The tapping sleeve shall be gray cast iron or ductile iron mechanical joint type with the outlet flange conforming to MSS-SP-60.

2. All water valves, 4-in. and larger, shall be iron body gates, bronze trim, flanged ends, O.S.&Y. pattern, solid wedge, rising spindle, Jenkins No. 651, or Hammond IR-1140.

2.05 PLUG VALVES

A. Plug valves shall be of the offset disc type, 1/4 turn, non-lubricated, serviceable (able to be repacked) under full line pressure and capable of sealing in both directions at the rated pressure. The disc shall be completely out of the flow path when open. Plug valves specified herein shall be by Milliken (for valves less than 24" diameter) or prior approved equal. All manufacturers, named or otherwise, must comply completely with this Specification.

1. For clean liquid or screened sewage, all size plug valves shall have a rectangular port with a minimum port area of 80 percent.

2. All valves 24-in. and larger shall have a minimum 100 percent open port area regardless of published CV factors.

3. All plug valves for what ever service, shall be capable of passing "pigging" cleaning equipment (using a Girard or similar cleaning pig of full nominal pipeline diameter) in either direction and manufacturer shall so certify that this may be done without the use of special equipment.

B. Valves shall be rated at minimum 175 psi W.O.G. (Water, Oil and Gas) working pressure for sizes 4-in. to 12-in. inclusive and at minimum 150 psi W.O.G. working pressure for sizes 14-in. and larger.

1. All plug valves under this paragraph shall be performance, leakage and hydrostatically tested in accordance with WAWA C504, except as herein modified.

2. At the above rated minimum working pressures, the valves shall be certified by the manufacturer as permitting zero leakage for a period of at least five minutes with pressure applied in either direction.

3. At the direction of the Engineer, the valve manufacturer may be requested to perform a valve seat leakage test witnessed by the Engineer to prove compliance with these Specifications.

C. Valve bodies shall be of cast iron, 30,000 psi tensile strength, ASTM A126, Grade B, or of ductile iron, ASTM A536 and of the top entry, bolted bonnet design, cast with integral flanges conforming to the connecting piping. All exposed bolts, nuts and washers shall be zinc or cadmium-plated, except for buried or submerged valves, which shall have Type 316 stainless steel hardware.

D. The valve disc shall:

1. Be cast iron ASTM A126, Grade B, or ductile iron, ASTM A536, Grade 65-45-12.

2. Be removable without removing the valve from the line.

3. Have an integral upper and lower shaft which shall have seals on the upper and lower journals

to prevent entrance of solids into the journals.

4. Be one piece for valves up to 14-in. and maximum two piece for larger valves.

E. Shaft bearings shall be permanently lubricated, rigidly backed TFE, stainless steel or bronze at both upper and lower stem journals. The operator shaft shall have easily replaceable seals, which shall be externally adjustable and repackable without removing the bonnet from the valve, or shall have self-adjusting packing.

F. The valve seating surface shall provide full 360 degree seating by contact of a resilient seating material on the disc mating with welded-in high 90% nickel content overlay seating surface in the body.

1. The seating design shall be resilient and of the continuous interface type having consistent opening and closing torques and shall be non-jamming in the closed position. Screw-in seats shall not be acceptable.

2. Discs shall have a full resilient facing of neoprene or Buna-N.

G. The methods of mounting the actuator to the valve shall provide an air gap between the two. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel. Hardware on actuators shall be of the same materials as the valves.

H. Unless otherwise required, due to location or operation, each valve 6-in. and smaller shall be provided with its own securely attached lever. Provide adjustable limit stops for both opening and closing and a clearly marked position indicator.

I. Plug valves shall be installed so that the direction of flow through the valve and the shaft orientation is in accordance with the manufacturer's recommendations. Unless otherwise noted, shaft shall be horizontal, with plug opening up.

2.05 CHECK VALVES

A. Check valves for metallic lines of 2-in. to 24-in. diameter shall be swing type and shall meet the requirements of AWWA C508. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, nonshock and hydrostatically tested at 300 psi.

1. When there is no flow through the line, the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

2. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.

3. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. The position of the weight shall be adjustable. Various weights shall be provided and installation approved by the Engineer. Lever shall be installed to the horizontal in the closed position, for both horizontal and vertical pipeline installations.

4. The discharge check valves shall have two weighted arms, one located at each end of the

pivot arm. Each arm shall be equally weighted. The valve shall be for heavy duty service that requires very rapid closure. In addition, these valves shall incorporate a hydro-viscous damping system to cushion the final closure of the valve. The damper(s) shall be installed either on each valve arm or internally adjacent to the valve seating surface.

5. Check valves shall be American-Darling; M&H; GA Industries; Clow; Mueller; Milliken; or equal.

B. Check valves 2-in. and smaller for installation in copper and steel pipes shall be bronze, swing type, 125 lb with solder or screwed ends.

C. All check valves 3-in. and smaller shall be similar to Hammond 1B-940, or Jenkins No. 92A. Check valves 4-in. and larger shall be flanged and similar to Hammond 1R-1124 or Jenkins No. 624.

2.06 PLASTIC VALVES

A. General

1. All valves shall be certified as completely compatible with the intended and specified service; compatibility shall apply to the material of the valve and internal components, including all seals, gaskets, O-rings and washers; solvents and primers used in valve joint make-up shall be specifically in conformance with the written instructions of the valve supplier. Service chemicals and service conditions are shown in the piping specifications in Division 15.

2. Except as otherwise specified valve ends shall be socket-type designed for solvent welding. The valve manufacturer shall provide specific recommendations for solvent and primer.

3. Valve material shall be the same as the piping service except as specified.

   a. PVC shall be Type 1, Grade 1, per ASTM D1784, classification, made from unplasticized polymer, and generally suitable for service to 120 degrees F.

   b. CPVC shall be Type 4, Grade 1, per ASTM D 1784, classification generally suitable for service to 180 degrees F.

   c. Polypropylene (PP) shall conform to the material requirements of ASTM D4101 for copolymer polypropylene.

   d. PVDF (poylvinylidned fluoride) shall be manufactured from high molecular weight polymers of vinylidene fluoride.

   e. The manufacturer of the valves shall retain material source quality documentation and shall furnish it to the Engineer upon request.

4. Unless otherwise specified:

   a. O-rings, valve seats and stem seals shall be Teflon, or Teflon encapsulated elastomer. Alternative materials may not be substituted without complete documentation provide to the Engineer of service suitability.

b. Gaskets shall be made from PTFE-bonded sheet material, GORE-TEX manufactured by W.L. Gore & Associates, AV Low-Torque gaskets by Asahi of America, or equal.

c. Valve external hardware shall be Type 316 stainless steel. No internal metallic components shall be exposed to the service fluid.

d. No factory or field coatings shall be applied to the valves.

5. All valves, except butterfly valves shall have a non-shock service pressure rating of not less than 120 psig at 70 degrees F.

6. All valves shall be given hydrostatic and pressure and leakage tests at the factory. Provide certified copy of test results.

7. Valves shall be the standard, catalogued products of the following manufacturers:

a. Chemtrol

b. Asahi/America

c. Plast-O-Matic

d. Hayward

8. Valves specified as furnished with equipment or equipment systems shall comply with these requirements.

B. Ball Valves

1. Ball valves shall be the socket-ended type, unless otherwise specified, with full-port opening.

1. Provide quarter-turn manual valve operator and valve seat adjustability.

3. Plastic valves in sodium hypochlorite service shall have the ball drilled to permit venting of pressure and gas from the confined ball cavity, when the valve is closed. The drilling shall vent to the upstream end of the valve. The drilling shall be 1/8-in. opening, de-burred.

C. Butterfly Valves

1. Ball valves shall have PVC body and PP disc with Teflon seat and Teflon O-ring shaft seals fully isolating a Type 316 or Type 403 stainless steel stem.

2. The valves shall be of the lug or wafer style suitable for dead-end service.

3. Each valve shall be furnished with a lever actuator.

D. Diaphragm Valves

1. Valves shall have socket or spigot or threaded ends.

2. Valve body and bonnet shall be of solid PVC or CPVC.

3. Diaphragms shall be Teflon, EPDM, Buna-N, Butyl, Hypalon, Neoprene, or Natural Rubber as applicable for the chemical service.

4. The valve shall have a full-width weir, designed for throttling, and complete bubble-tight closure.

5. Provide a handwheel valve operator with a stainless steel stem, a cast stem sleeve and a clear plastic stem cover with a position indicator. Provide an adjustable limit stop to prevent overtravel.

E. Needle Valves shall be designed for close control of flow throttling with a multi-turn valve handle.

F. Check Valves

1. Ball check valves shall be double-union style with socket ends, solid and completely spherical ball and capable of either horizontal or vertical mounting.

2. Swing Check valves shall be flanged, full-ported, with top entry access for disc inspection and removal. Furnish with outside lever and weight, with weight position along lever arm adjustable.

G. Backpressure Regulating/Control Valves

1. Spring-loaded diaphragm design, fully-adjustable pressure setting, set to assure continuous positive pressure at the pump discharge.

2. Furnish with Teflon diaphragms and elastomer-coated springs.

2.07 SOLENOID VALVES

A. Solenoid valves shall be packless piston type direct acting for sizes less than 1-in. and internal pilot operated for sizes 1-in. and larger, 2-way or 3-way valves, and shall be ASCO Valve: Red Hat as manufactured by Automatic Switch Co., equal by Atkomatic Valve Co., or prior approved equal for air and water service.

B. Valves shall be energized to open, except for valves on water seal lines to pumps that shall be energize to close unless otherwise specified in the pump specifications.

C. Valves shall have forged brass bodies, NPT end connections of the connected piping Type 304 series stainless internal parts, and Buna-N or Ethylene Propylene valve seats. Valves shall have a minimum 150 psig safe working pressure and zero minimum operating pressure differential. Connections shall be threaded. Except as otherwise specified herein, valves shall be as noted in PART 1 of this Specification.

D. Solenoid valves on bypass piping shall be installed whether shown or not.

E. Note that solenoid valves may be shown on Electrical and/or Mechanical Drawings or may only be specified.

2.08 AIR AND/OR AIR/VACUUM VALVES - SEWAGE USE

A. This general section applies to all air release, air/vacuum, hydraulically operated air/vacuum valves, vacuum relief, combination air and air/vacuum or vacuum relief or similar valves.

B. Valves shall be supplied with shutoff gate or ball valves with operator handle or lever removed. Valves shall be properly vented and piped to drain.

C. Attention is directed to the requirement that valve's pressure rating be at least equal to the attached pipe's rating.

D. For service on sewage, sludge (of any type) and non-screened water, the valves shall be of the special sewage type, performing similar functions for specific type of valve as noted for water.

1. The valves shall have Type 316 stainless steel trim and float with an adjustable viton seat and be supplied with backwash accessories.

2. A valved outlet with hose connections for flushing water connection (where flushing accessories are required) shall be provided within a distance that hoses, supplied with the valve, may reach. Proper cross connection prevention shall be provided.

3. Valves shall be APCO Series 400 SAVV or prior approved equal. Size will be as noted on the drawings.

2.09 AIR RELEASE VALVES

A. Air release valves shall be installed to release any small accumulations of air, which may collect while pipe is in operation and under pressure.

B. The small orifice assembly air release valve shall automatically release air accumulations from the pipe while under positive pressure. When the valve body fills with air, the float ball shall fall to open the small orifice and exhaust the air to atmosphere. When the air has been exhausted, the float ball shall be buoyed up and tightly close the small orifice.

C. The small orifice assembly shall be furnished with cast iron body and cover (ASTM A126-B). The float ball shall be constructed of stainless steel and attached to a stainless steel level mechanism. A resilient, Buna-N seat shall be attached to the lever mechanism for drop-tight closure.

D. Separate air release valves shall be manufactured by APCO; Val-Matic; Crispin or prior approved equal of the special type for use with non-clean water.

2.10 WATER PRESSURE REGULATORS (PRV)

A. PRVs shall be Watts Muesco Regulator Co. Series 115 or equal for 1-1/4-in. and larger and Model 223-S or equal for units smaller than 1-1/4 in. Valves shall be provided with strainer and of size noted on the Drawing. Valves shall be diaphragm type, pressure reducing globe valves.

B. Provide a three valve full size bypass around each PRV.

C. Provide strainers of the same material as the PRV ahead of each PRV with pressure gauges on high and low side.

D. Smaller PRV shall have pressure setting 10 psi less than main valve.

E. Pressure regulators and components shall be securely anchored to wall or floor at a height as directed by Engineer.

F. Provide an adjustable pressure relief valve downstream of each PRV station.

2.11 SURFACE PREPARATION AND SHOP COATINGS

A. Not withstanding any of these Specifications, all coatings and lubricants in contact with potable water shall be certified as acceptable for use with that fluid.

B. If not specified herein, coatings shall comply with the requirements of Section 09901. In case of a conflict, the requirements of this Section govern.

C. If the manufacturer's requirement is not to require finished coating on any interior surfaces, then manufacturer shall so state and no interior finish coating will be required, if acceptable to the Engineer.

D. The exterior surface of various parts of valves, operators, floor-stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter and thereafter one shop coat of an approved rust-inhibitive primer as specified in Section 09901 shall be applied in accordance with the instructions of the paint manufacturer or other primer compatible with the finish coat provided.

E. Unless otherwise noted, interior ferrous surfaces of all valves shall be given a shop finish of an asphalt varnish conforming to WAWA C509, (except mounting faces/surfaces) or epoxy WAWA C550 with a minimum thickness of 4 mil.

F. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating. Mounting surfaces shall be especially coated with a rust preventative.

G. Special care shall be taken to protect uncoated items and plastic items, especially from environmental damage.

2.12 FACTORY INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

A. Factory inspection, testing and correction of deficiencies shall be done in accordance with the referenced Standards and as noted herein.

B. See Division 1 for additional requirements. Also refer to PART 1 of this Section, especially for required submission of test data to the Engineer.

C. In addition to all tests required by the referenced Standards, the following shall also be factory tested:

1. Pressure regulating valves shall be factory tested at the specified pressures and flows.

2. The non-cavitating butterfly valves, to demonstrate its non-cavitating capabilities.

3. All types of air and vacuum valves.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. All valves and appurtenances shall be installed per the manufacturer's instructions in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings, or otherwise required. Before setting these items, check all Drawings and figures that have a direct bearing on their location. The Contractor shall be responsible for the proper location of valves and appurtenances during the construction of the Work.

C. All materials shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc. All valve flange covers shall remain in place until connected piping is in place. All operating mechanisms shall be operated to check their proper functioning and all nuts and bolts checked for tightness. Valves and other equipment that do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.

D. Where installation is covered by a Referenced Standard, installation shall be in accordance with that Standard, except as herein modified, and the Contractor shall certify such. Also note additional requirements in other parts of this Specification.

E. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint and all valves and other items shall be installed in the proper position as recommended by the manufacturer. Contractor shall be responsible for verifying manufacturers' torquing requirements for all valves.

3.02 INSTALLATION OF MANUAL OPERATIONAL DEVICES

A. Unless otherwise noted, all operational devices shall be installed with the units of the factory, as shown on the Drawings or as acceptable to the Engineer to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.

B. For manually operated valves 3-in. in diameter and smaller, valve operators and indicators shall be rotated to display toward normal operation locations.

C. Floor boxes, valve boxes, extension stems and low floor stands shall be installed vertically centered over the operating nut, with couplings as required and the elevation of the box top shall be adjusted to conform with the elevation of the finished floor surface or grade at the completion of the Contract. Boxes and stem guides shall be adequately supported during concrete pouring to maintain vertical alignment.

3.03 INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

A. See also Division 1. Take care not to over pressure valves or appurtenances during pipe testing. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the Engineer.

B. Functional Test: Prior to plant startup, all items shall be inspected for proper alignment, quiet operation, proper connection and satisfactory performance. All units shall be operated continuously while connected to the attached piping for at least 24 hours, without vibration, jamming, leakage, or overheating and perform the specified function.

A. The various pipe lines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer.

D. Various regulating valves, strainers, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the Engineer.

3.04 CLEANING AND DISINFECTION

A. All items (including valve interiors) shall be cleaned prior to installation, testing, disinfection (if required) and final acceptance.

B. Disinfection of valves and appurtenances on all potable water lines and where otherwise noted, shall be as noted in the Section referenced in Paragraph 1.02.

END OF SECTION

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SECTION 15120

PIPING SPECIALTIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section specifies the basic administrative and testing requirements for piping. Specific piping materials, systems and related installation and testing requirements are shown on the Drawings and specified in the individual pipe specifications.

B. The items shall include the following:

1. Unions
2. Flanged Joints
3. Dielectric Connectors
4. Plugs and Caps
5. Miscellaneous Adaptors
6. Vents and Drains
7. Shock Absorbers (Water Hammer Arrestor)
8. Line Strainers
9. Service Clamps
10. Cleanouts
11. Floor Drains
12. Quick Connect Couplings
13. Mechanical Sleeve Seals
14. Flexible Connectors
    a. Sleeve Couplings
    b. Split or Grooved Couplings
    c. Flange Adapters
    d. Pump and Equipment Flexible Connectors
    e. Flexible Connectors

15. Expansion Joints

    a. Single- and Multiple- Arch Type

    b. Bellows Style

    c. Flexible Metal Hose

16. Harnessing and Restraints

17. Pressure Gauges

18. Diaphragm Seals for Gages

19. Thermometers

20. Rotameters and Flow Indicators

21. Ball Sight Flow Meters

22. Chemical Diffusers

23. Diffuser Sockets

24. Appurtenances and Miscellaneous Items

1.02 RELATED WORK

A. Piping materials and systems are included in other Sections of Divisions 2 and 15.

B. Valves are included in Section 15100.

C. Pipe insulation is included in Section 15250.

1.03 SUBMITTALS

A. General submittals for piping, piping systems and pipeline appurtenances are listed below. Submittals shall be in accordance with Section 01300. It is not intended that all submittals listed below be provided for all piping materials and systems. Refer to individual System or Piping Sections for specific submittals.

B. Shop Drawings and Product Data

1. Piping layouts in full detail.

2. Location of pipe hangers and supports.

3. Location and type of backup block or device to prevent joint separation.

4. Large scale details of wall penetrations and fabricated fittings.

5. Schedules of all pipe, fittings, special castings, couplings, expansion joints and other appurtenances.

6. Catalog cuts of joints, couplings, harnesses, expansion joints, gaskets, fasteners and other accessories.

7. Catalog cuts of all pipeline appurtenances specified herein.

8. Brochures and technical data on coatings and linings and proposed method for application and repair.

C. Samples

D. Design Data

E Test Reports

1. Six copies of certified shop tests showing compliance with appropriate standard.

2. Six copies of all field test reports, signed by Contractor.

F. Certificates

1. Copies of certification for all welders performing work in accordance with ANSI B31.1.

G. Manufacturers Installation (or application) instructions.

H. Statement of Qualifications

I. Manufacturers Field Report

J. Project Record Document

K. Operation and Maintenance Data in accordance with Section 01730.

L. Warranties

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Structural Steel.

2. ASTM A126 - Gray Iron Casting for Valves, Flanges and Pipe Fittings.

3. ASTM A183 - Carbon Steel Track Bolts and Nuts.

4. ASTM A278 - Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 Degree F.

5. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

6. ASTM A325 - Standard Specification for High-Strength Bolts for Structural Steel Joints.

7. ASTM A536 - Ductile Iron Castings

8. ASTM A575 - Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grade.

9. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

10. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

B. American National Standards Institute (ANSI)

1. ANSI A13.1 - Scheme for the Identification of Piping Systems.

2. ANSI B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form)

3. ANSI B2.1 - Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads (except dry seals).

4. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

5. ANSI B16.5 - Pipe Flanges and Flange Fittings

6. ANSI B18.2 - Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.

7. ANSI B31 - Code for Pressure Piping, B31 Interpretation.

8. ANSI B31.1 - Power Piping

C. American Welding Society (AWS)

1. AWS B3.0 - Welding Procedure and Performance Qualifications

D. American Water Works Association (AWWA)

1. AWWA C-110 - Ductile-Iron and Gray-Iron Fittings 3-in Through 48-in, for Water and Other Liquids.

2. AWWA C-111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

3. AWWA C-201 -

4. AWWA C-206 - Grooved and Shouldered Type Joints.

5. AWWA Manual M11 - Steel Pipe - A Guide for Design and Installation.

E. Plumbing and Drainage Institute (PDI)

1. WH 201 - Water Hammer Arrestors

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. See Section 15051 - Piping - Testing and General Requirements

B. All materials shall be new and unused.

C. Install piping to meet requirements of local codes.

D. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified. Reference to standards such as ASTM and ANSI shall apply to those versions in effect at the time of bid opening.

E. Coordinate dimensions and drilling of flanges with flanges for valves, pumps and other equipment to be installed in piping systems. Bolt holes in flanges to straddle vertical centerline.

F. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner and acid solder.

G. Pipe-joint compound, for pipe carrying flammable or toxic gas, must bear approval of Underwriters' Laboratories or Factory Mutual Engineering Division.

H. Unless otherwise specified, pressures referred to in all Piping Sections are expressed in pounds per square in gage above atmospheric pressure, psig and all temperature are expressed in degrees Fahrenheit.

1.06 DELIVERY, STORAGE AND HANDLING

A. During loading, transportation and unloading, take care to prevent damage to pipes and coating. Carefully load and unload each pipe under control at all times. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation to ensure no injury to pipe and lining. Cover or cap all pipe ends while pipe is in storage, until it is made a part of the work.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Specific piping materials and appurtenances are specified in the respective Piping or System Sections. The use of a manufacturer's name and/or model number is for the purpose of establishing the standard of quality and general configuration desired.

B. Equipment shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.

C. Equipment shall have the name of the maker, nominal size, flow directional arrows (if applicable), working pressure for which they are designed and standard referenced specifications cast in raised letters or indelibly marked upon some appropriate part of the body.

D. Unless otherwise noted, items shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher and suitable for the pressures noted where they are installed.

2.02 UNIONS

A. Unions shall be brass or bronze unions for joining nonferrous pipe; malleable brass or bronze-seated iron or steel unions for joining ferrous pipe; PVC unions for joining PVC pipe; CPVC unions for joining CPVC pipe.

2.03 FLANGED JOINTS

A. Flanged Joints. Bolt and nuts, Grade B, ASTM A307, bolt number and size same as flange standard; studs - same quality as machine bolts; 1/16-in. thick rubber gaskets with cloth insertions; rust-resistant coatings.

2.04 DIELECTRIC CONNECTORS

A. Dielectric pipe fittings/insulators and unions shall be used to prevent galvanic action wherever valves or piping of dissimilar metals connect. This shall be particularly the case for copper, brass and bronze piping connecting to cast iron or steel piping systems.

B. Dielectric unions shall be used for 2-in. and smaller connections. Steel union nuts shall meet ASTM A575 requirements. The steel or ductile iron connection end shall have a steel body and shall have accurately machined taper tapped pipe threads in accordance with ANSI B2.1. The copper connection end shall be a copper solder joint that meets requirements of ASTM B88. Dielectric unions shall be rated for at least 250 psi at 210 degrees F.

C. Dielectric flange unions shall be used for connections 2-1/2-in. and larger. Cast iron flanges shall meet ASTM A126; the copper solder end shall meet ASTM B62 and the pipe thread shall meet ANSI B2.1. Dielectric flange unions shall be rated for at least 175 psi at 210 degrees F.

D. Dielectric unions and flange unions shall be as manufactured by Epco Inc., Cleveland, OH or equal.

E. Flange insulating kits shall be as acceptable to the Engineer, as manufactured by PSI or equal.

F. Insulated sleeve couplings and flange adaptors shall be similar to those units as specified elsewhere.

2.05 PLUGS AND CAPS

A. Provide standard plug or cap as required for testing; plugs, caps suitable for permanent service.

B. Plug or cap or otherwise cover all piping work in progress.

2.06 MISCELLANEOUS ADAPTORS

A. Between different types of pipe and/or fittings special adapters may be required to provide proper connection. Some of these may be indicated on the Drawings or specified with individual types of pipe or equipment. However, it is the Contractor's responsibility to ensure proper connection between various types of pipe, to structures and between pipe and valves, gates, fittings and other appurtenances. The Contractor shall provide all adapters as required, whether specifically noted or not.

B. As required, these adapters shall be suitable for direct bury, with proper dielectric insulation and as a minimum, if metallic (not stainless steel or galvanized), with two coats of Coal Tar Epoxy.

2.07 VENTS AND DRAINS

A. ½-in. vents shall be provided at the high point in each system. Vent connections may be tapped, provided the tap will accept three full threads on the bronze nipple.

B. 1-1/2-in. drains shall be provided to permit drainage of each system located on the invert of the blind flange; provide hose-end valve.

2.08 SHOCK ABSORBERS (WATER HAMMER ARRESTORS)

A. Shock absorbers shall be supplied on the non-potable water piping. The shock absorbers shall be Model 1485-1 as manufactured by Josam Manufacturing Company, Michigan City, IN; similar model by J.R. Smith or Zurn Industries.

B. Arrestors shall be sized in accordance with PDI Standard WH 201 for all water systems.

C. Placement shall be in accordance with PDI WH 201 with a minimum of one shock absorber at each quick acting valve, lever operated valve, self closing valve and self closing valve/faucet; or a minimum of one for each battery of these fixtures. The water hammer arrestors shall be accessible for maintenance.

2.09 LINE STRAINERS

A. "Y" Type Strainers

1. Manual strainers furnished for pipe diameters smaller than 2-in. shall be "Y" type, capable of removing solids 0.01-in. in diameter and larger. The strainer body shall be of semi-steel construction for steel pipe and brass or bronze for copper pipe and shall conform to the latest revision of ASTM A278, Class 30. Strainer elements, including woven wire mesh, shall be constructed of stainless steel.

2. The design of the strainer body shall be such that the cleanout plug and screen may be easily removed to permit inspection and cleaning without disassembly of the inlet and outlet piping. End connections shall be ANSI screwed pipe threads.

3. Sufficient spare screen shall be furnished for replacement of all "Y" type units at least once. The strainers shall be designed for a maximum operating pressure of 150 psig. They shall be as manufactured by GA Industries Inc., Pittsburg, PA; or equal.

B. Manual Basket Strainer

1. Manual basket strainers shall be furnished for pipe diameters 2-in. in diameter and larger, as shown on the Drawings. The strainer body shall be of cast iron construction. The strainer elements, including woven wire screen, shall be constructed of Type 304 stainless steel. The design of the basket strainer body shall be such that the bolted lid and basket may be easily removed for inspection and cleaning without disassembly of the inlet and outlet piping.

2. A trap with a blow-off port shall be provided for removing any material that may settle at the bottom. The strainers shall be designed for a maximum operating pressure of 150 psig, and shall be 74-DS as manufactured by GA Industries Inc., Pittsburg, PA; or equal.

3. Proper blowoff piping with valve shall be supplied and run to nearest drain.

2.10 SERVICE CLAMPS

A. Service clamps for outlet sizes up to 4-in. shall have malleable or ductile iron bodies which extend at least 160 degrees around the circumference of the pipe and shall have neoprene gaskets cemented to the saddle body. Bodies shall be tapped for IPS. Clamps shall be of the double strap design. Service clamps shall be Style 91 as manufactured by Dresser Industries, Inc. or equal as manufactured by Smith Blair; Mueller or equal.

B. Service clamps for outlet sizes 4-in. through 12-in. where the outlet size is not greater than half the size of the main pipe shall have ductile iron bodies and a neoprene circular cross section O-ring gasket confined within the body. Outlet shall be AWWA C-110 flange or AWWA C-111 mechanical joint as required for the application. Straps shall be alloy steel, minimum 1/4-in. by 1-1/2-in. in cross section and fabricated with 3/4-in. threaded ends. Service clamps shall be Fig. A-10920 or A-30920 as manufactured by American Cast Iron Pipe Company or equal.

2.11 CLEANOUTS

A. Interior flush floor cleanouts shall consist of a coated cast iron ferrule, a tapered threaded bronze cleanout plug, adjustable housing and a scoriated round cast iron tractor cover with bronze top. Interior flush floor cleanouts shall be Type No. 56056 as manufactured by Josam Manufacturing Co., Michigan City, IN; similar models by Tyler; or equal.

B. Exterior cleanouts shall consist of a coated cast iron ferrule with cut-off sections, a tapered threaded bronze cleanout plug, [Josam 58486 or equal], with a heavy round coated cast iron access frame with anchor flanges and a gasketed cover as manufactured by Josam Type No. 58680; similar models by Tyler; or equal. Exterior cleanouts shall be installed as noted on the Drawings.

C. Cleanouts shall be located where shown on the Drawings.

D. Cleanout connections to 6-in. cast iron bell and spigot soil pipe and cleanout connections to 6-in ductile iron bell and spigot pipe shall be caulked.

2.12 FLOOR DRAINS

A. Floor drains shall have 8-in. square, adjustable, bronze top strainers and coated cast iron bodies.

B. Floor drains shall have outlet connections for 4-in. cast iron bell and spigot soil pipe except where

required by other type pipe and/or indicated on the Drawings. They shall be Series No. 30004-8S as manufactured by Josam, equal by Tyler, or equal.

2.13 QUICK CONNECT COUPLINGS

A. Couplings shall be of the cam and groove type consisting of a male adapter conforming to Specification MIL-C-27487. Male adapters shall be designed to receive a female coupler without requiring threading, bolting, or tools. Connections shall remain tight and leakproof under pressures up to 100 psig. Each adapter shall be furnished with a dust cap complete with a 18-in long security chain of corrosion resistant material. Couplings shall be as manufactured by Dover Corporation, Ever-tite, or equal. Units shall be "drip proof", providing totally dry connections and disconnections.

B. Adapters shall be furnished in accordance with the Drawings, or as required by the installation.

2.14 MECHANICAL SLEEVE SEALS

A. Mechanical sleeve seals shall be used to secure and seal the annular space around all new sleeved and core-drilled wall penetrations.

B. A single seal shall be provided for all sleeve and cores in walls up to 14-in. thick; dual sleeves shall be provided in larger walls.

C. Galvanized steel wall sleeves and concrete core diameter shall be sized sufficiently larger to accommodate the modular elements, per the manufacturers recommendations.

D. Bolts and hardware shall be carbon steel, zinc-plated. Pressure plates shall be corrosion-resistant acetal resin.

E. Mechanical sleeve seals shall consist of modular bolted, synthetic rubber sealing elements, Link Seal manufactured by Thunderline Corp. or equal.

2.15 FLEXIBLE CONNECTORS

A. Sleeve Couplings

1. Provide plain end type ends to be joined by sleeve couplings as stipulated in AWWA C201.

   a. Join welds on ends by couplings without pipe stops. Grind flush to permit slipping coupling in at least one direction to clear pipe joint.

   b. Outside diameter and out-of-round tolerances shall be within limits specified by coupling manufacturer.

   c. Provide lugs in accordance with ASTM A36.

   d. Provide hardened steel washers in accordance with ASTM A325.

   e. Plastic plugs shall be fitted in coupling to protect bolt holes.

   f. Nuts and bolts

1) Provide bolts and bolt-studs in accordance with ASTM A307 and ANSI B1.1 with hexagonal or square heads, coarse thread fit, threaded full length with ends chamfered or rounded.

2) Project ends 1/4-in. beyond surface of nuts.

3) Hexagonal nuts with dimensions in accordance with ANSI B18.2 and coarse threads in accordance with ANSI B1.1.

2. Middle ring of each mechanical coupling shall have a thickness at least equal to that specified for size of pipe on which coupling is to be used and shall not be less than 10-in. long for pipe 30-in. and larger and not less than 7-in. long for pipe under 30-in. in diameter.

   a. Omit pipe stop from inner surface of middle rings of couplings whenever necessary to permit removal of valves, flowmeters and other installed equipment.

   b. Provide pipe stops in other couplings.

3. Clean and shop prime with manufacturer's standard rust inhibitive primer.

4. Furnish gaskets of a composition suitable for exposure to the fluid service.

5. Where shown on the Drawings, anchor sleeve-coupled joints with harness bolts. Weld harness lugs to steel pipe.

   a. Joint harness bolts shall be of sufficient length, with harness lugs placed so that coupling can be slipped at least in one direction to clear joint. Provide harnesses of sufficient number and strength to withstand test pressure.

   b. Each harness shall have a minimum of two 5/8-in. diameter bolts.

6. Unless otherwise specified with the individual type of pipe, sleeve couplings (mechanical couplings) shall be ITT (formerly Smith Blair) Style 411, Dresser Style 38, similar models by Baker, or equal, with the pipe stop removed.

7. Similar insulation type couplings shall be provided at the face of buildings, between different type metals, or where otherwise noted.

8. In addition to those locations noted on the Drawings, sleeve couplings shall be provided on all piping where it connects with a structure or buried directly under a structure at the structure's expansion joints. Special treatment will be required where pipe is encased in concrete, utilizing minimum 3-in. thick styrofoam placed perpendicular to the horizontal centerline of the coupling.

B. Split or Grooved Couplings

1. Split couplings shall be cast in two or more parts. When secured together with ASTM A183 bolts and nuts, couplings shall engage grooved or shouldered pipe ends and encase an elastomeric gasket to create a pipe seal. Gasket material shall be as recommended by the manufacturer for the service required.

2. Split couplings shall be as manufactured by Victaulic Company of America; Gustin-Bacon; or equal. Numbers below refer to Victaulic Co. items for reference only.

3. Unless otherwise specified with the individual type of pipe:

   a. Flexible split ring couplings shall be:

      1) grooved ends - Style 77

      2) shouldered ends - Style 44

   b. Rigid split ring couplings shall be:

      1) Grooved ends - rigid groove with Style HP-70 couplings on ductile iron less than 18-in. diameter with sufficient wall thickness per AWWA C606, or on standard groove with Style 77 coupling on manufactured steel or other pipe.

      2) Shouldered ends - Style 44 coupling on ductile iron over 16-in. diameter or without sufficient wall thickness per AWWA C606 or on manufactured steel pipe or thin wall stainless steel pipe.

4. Ductile iron pipe for use with split-type coupling joints shall have radius grooved ends conforming to AWWA C606. Pipe shall have grooved ends to provide either a rigid joint or flexible joint as shown on the Drawings and as specified herein. Flexible joint grooving shall permit expansion and contraction, and angular deflection. Rigid joint grooving shall allow no angular or linear movement. Minimum pipe wall thickness for grooved pipe shall be the following class:

Size	***Class***
4 thru 16	53
18	54
20	55
24	56

5. Grooved couplings for steel and stainless steel piping shall have roll grooving, machine-grooving, or ring collars fully welded to the pipe or fitting.

6. Rigid split couplings may be substituted for flanges as noted on the Drawings and in the individual pipe specifications.

7. Certain minimum thickness of pipe walls are required by AWWA C606 and coupling manufacturers for use of various type split couplings with certain pipes. The Contractor shall be responsible for utilizing at least those minimum wall thicknesses required (unless a greater thickness is specified or required in the individual pipe specifications) with split couplings.

8. If minimum thicknesses are not utilized with grooving, then a shouldered end treatment with couplings as noted shall be utilized.

C. Flanged Adaptors

1. Flanged adaptor connections for grooved or shouldered end pipe compatible with split

couplings at fittings, valves and equipment shall be VIC-Flange Style 341 as manufactured by the Victaulic Company of America, or equal product as manufactured by Gustin-Bacon.

2. Flanged adaptor connections for plain end pipe at fittings, valves and equipment shall be Dresser Style 127 or 128, simular models by ITT (formerly Smith-Blair), Baker, or equal.

D. Pump and Equipment Flexible Connectors

1. The flexible connectors shall be expansion/vibration joints of the single arch type of butyl rubber construction with carcass of high grade woven cotton or suitable synthetic fiber and individual solid steel ring reinforcement. Soft rubber fillers shall be integrally cured into the arches to provide a smooth flow path to prevent settling of material into the arch. Joints shall be constructed to pipeline size and to meet working pressures and corrosive conditions similar to the line where installed. Joints shall have full faced fabric reinforced butyl flanges integral with the body.

2. Split steel or ductile iron back-up rings shall be provided to insure a good joint. Rings shall be designed for mating with ANSI Standard minimum 150 lb flanges. All joints shall be finish coated with Hypalon or equal paint.

3. Expansion/vibration joints shall be furnished with control (harness) units. Harness units shall consist of minimum two drilled plates, stretcher bolts, and rubber washers backed by metal washers. The stretcher bolts shall prevent over-elongation of the joint. Extra nuts shall be provided on the stretcher bolts on the inside of the plate to prevent overcompression. All nuts, bolts and plates shall be galvanized.

4. The manufacturer of the expansion joints shall be a member of the Rubber Expansion Joint Division of the Fluid Sealing Association. Expansion joints shall be Style 1025 filled arch as manufactured by General Rubber Corp., South Hackensack, NJ; or similar products of Mercer Rubber, Goodall Rubber, Garloc; Proco Products Inc., Stockton, CA; or equal.

5. In addition to other locations shown on the Drawings, expansion joints shall be utilized in all exposed piping, within one foot of a building expansion joint, and on the suction and discharge side of all positive displacement pumps, compressors and rotating machinery, as close to the unit as possible.

E. Flexible Connectors

1. Provide one flexible connector for the seal water connection to each pump stuffing box. Connectors shall be of hose of Buna-N or similar resilient material, with fiber reinforcement, rated minimum 150 psi with bronze or Type 304 stainless steel NPT end fittings and shall be 12-in. in length. Connectors shall be for the purpose of isolating pump vibration from the seal water piping.

2.16 EXPANSION JOINTS

A. Single- and Multiple-Arch Type

1. The expansion joints shall be of the rubber spool type, soft rubber filled with single-, double-, or triple-arch steel reinforced expansion joint, as indicated on the Drawings, suitable for 120 degrees F service, unless otherwise indicated.

2. The rubber used shall be suited for service with wastewater and/or wastewater sludge, including three-ply abrasion resistant liner.

3. Provide galvanized retaining rings to mate with adjacent pipe flanges.

4. The expansion joints shall be designed for the axial movements shown on the Drawings along with the maximum axial force required to compress the joint. The joints shall prevent axial, lateral and rotational movement and vibration from being transmitted to the piping and equipment and shall be suitable for 50 psig operating pressure unless otherwise indicated.

5. Provide guides for each expansion joint.

B. Bellows Style

1. Expansion joints shall be hydraulically formed (with dies on the outside only) and having only longitudinal seam welds. These seams shall have the same strength, physical properties and thickness as the parent metal without grinding. Expansion joints, bellow, and internal sleeves shall be made of Type 304 stainless steel with carbon steel flanges at each end. The entire inside length of the expansion joint shall be straight. Manufacturer to provide lifting lugs at each flange for ease in handling and removal sheet metal coverage for any expansion joint.

2. Expansion joints shall be designed to prevent rotational movement and vibration from being transmitted to the piping and equipment and shall be suitable for 25 psig operation pressure unless otherwise specified.

3. Expansion joints shall be suitable for continuous operating temperature range of 200°F to 300°F.

4. Hinged or Gimbal expansion joints shall be used at horizontal and vertical bends in strict accordance with the standards of the EJMA, Inc.

5. Drilling and facing of flanges shall match or be suitable for use with equipment or companion flanges.

6. Guides shall be furnished with all bellows style expansion joints.

7. Manufacturer shall warrant this product to be suitable for the proposed conditions and shall furnish drawings for approval giving materials of construction, including gauge of corrugated element, maximum test pressure force to compress joint, bellows spring rate, shear force and end moment due to calculated traverse only. Manufacturer shall also furnish evidence of completing cycle life testing for the maximum diameter to be installed and shall indicate such assured cycle life test results on material submitted for approval.

C. Flexible Metal Hose

1. Flexible metal hose shall be constructed of corrugated inner tubing of tin-bronze or Type 321 stainless steel and shall have an outer shield of wire-braid of either tin-bronze or Type 321 stainless steel.

2. The flexible hose connectors shall have a length not less than five times the nominal pipe

diameter.

3. The connectors shall have 150 psi flanged ends in all sizes and shall be suitable for pressure up to 150 psig and temperatures to 400°F.

4. Flexible hose connectors shall be manufactured by Flexonics, Metraflex, or equal.

2.17 HARNESSING AND RESTRAINT

A. Where harnessed couplings or adapters are noted, they shall conform to AWWA Manual M11 except as modified by the Drawings or this Specification.

B. Unless otherwise noted, size and material for tie rods, clamps, plates and hex nuts shall be as shown on the Drawings, or, if not shown on the Drawings, shall be as required in AWWA Manual M11. Manufactured restraining clamp assemblies shall be as manufactured by Stellar Corporation, Columbus, OH; or fabricated equal.

C. Restrained joints (such as welded, locking mechanical joints) shall be of the type specified with the individual type of pipe. If not specified, restrained (locking) mechanical joint pipe shall be of the manufacturer's standard design utilizing a locking device (ring or ears) integrally cast with the pipe.

D. For up through 18-in. diameter ductile iron pipe only, the following may be used as an alternative to other restraint system:

1. The optional mechanical joint restraints shall be incorporated in the design of a follower gland. The gland shall be manufactured of ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts as specified with the pipe.

2. The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices. When the nut is sheared off, standard hex nut shall remain.

3. The mechanical joint restraint device for ductile iron pipe shall have a working pressure of at least 250 pounds per square inch with a minimum safety factor of 2:1.

4. The mechanical joint restraint devices shall be of the type listed below or equal.

5. For Ductile Iron Pipe: EBAA Iron, Inc. Megalug 1100 series for up to 12-in. only.

E. The Contractor shall be responsible for anchorage including restraint as noted elsewhere in Division 15.

2.18 PRESSURE GAGES

A. Bosses, connections, or nipples for gages shall be provided as acceptable to the Engineer. Unbossed tappings shall not be acceptable. Where gage tappings are not available in the suction or discharge nozzle, the necessary tapping in the adjacent piping shall be made.

B. In addition to the locations shown on the Drawings, pressure gages shall be furnished and installed on the upstream and downstream sides of pressure reducing stations and in the suction and discharge nozzle of all pumps, compressors and similar equipment. Additional pressure gages shall be furnished and installed as specified with individual equipment.

C. Gages shall be furnished as part of a complete factory assembly, including gage, snubber, liquid fill, bar stock ball valve isolation valve and threaded red brass connecting piping.

D. Unless otherwise noted, gage rating shall be from 0 to at least 2.5 percent higher than the rating of the pipe it is connected to.

E. For Liquid Service

1. Pressure gages shall have a 300 series stainless steel case and shall be 4-1/2-in. nominal diameter with a full-sized Type 316 stainless steel Bourdon tube and a 300 series stainless steel movement. The gages shall be liquid filled with glycerin and shall be provided with a filler/breather cap. The socket shall be 1/4-in. NPT Type 316 stainless steel with a bottom connection and the dial shall be a white background with black markings. Gages shall be ANSI Grade A plus or minus 1 percent of scale and shall have a blow-out back design.

2. Gages for the above services shall be Model 344Y liquid filled as manufactured by Crosby Valve & Gage Co., or equal by U.S. Gage, Ashcroft or Trerice.

F. Air Service

1. Unless otherwise noted, pressure gages for low pressure air pipelines shall have a range of 0 to 25 psig.

2. Pressure gages shall have a 300 series stainless steel/aluminum case and shall be 4-1/2-in. nominal diameter with a Type 316 stainless steel Bourdon tube and a 300 series stainless steel movement. The socket shall be 1/2-in. NPT Type 316 stainless steel with a bottom connection. Gages shall have an accuracy of at least plus or minus 0.25 percent of scale. Gages shall be furnished with needle valve isolation.

3. Gages for air service shall be Model 5840 as manufactured by Marsh Instrument Co., Skokie, IL; or equal.

2.19 DIAPHRAGM SEALS FOR GAGES

A. Diaphragm seals shall be installed for all pressure gages and pressure switches, to protect pressure gages and pressure switches from contact with the fluid in the pipeline. Gages shall be furnished as part of a complete factory assembly, including gage, snubber, diaphragm seal, liquid fill, bar stock isolation valve and threaded red brass interconnecting piping. Furnish also a 1/4-in. backflushing connection and ball valve.

B. Diaphragm seals shall be minimum 2-1/2-in. diameter, or as required for the connected pressure gages. The diaphragm shall be "thread attached" to both piping and pressure switches or gages. Furnish mineral oil fill between the diaphragm seal and the gage.

1. Diaphragm seals shall have an upper housing of cadmium plated carbon steel, with the lower housing of Type 316 stainless steel with Type 304 stainless steel bolts. Diaphragms shall be

Teflon.

2. Each diaphragm seal shall be connected to its respective piping or equipment with threaded red brass pipe and fittings. Pipe size and diaphragm tap size shall match the size of the gage tap on the equipment, but shall not be less than 3/4-in. except for connections to plant water piping which shall be minimum 1/2-in. Furnish a ball valve shut-off valve between the pipeline or equipment and the diaphragm seal.

3. Each diaphragm seal shall have a minimum 1/4-in. NPT flush connection with ball valve and gage tap to match the size of the gage.

4. Furnish pulsation dampeners adequate to prevent pulsation and/or vibration of the gage indicator under all system operating conditions.

5. Suction and discharge gages shall be mounted at the same elevation. Furnish supports as required and recommended by the Manufacturer, or attach gages to the seal water assembly support (where applicable).

6. Diaphragm seals shall be Type SG by Mansfield and Green, equal by Ashcroft, or prior approved equal.

C. Where installed on chlorine lines, or lines leading to chlorine ejectors, seals shall be special chlorine-resistant type. All other materials shall be certified corrosion resistant for seal location and fluid.

D. Diaphram seals for chemical piping pressure gauges shall be Series 30 threaded-end (1/2-in. to 1-in. diameter piping) or Series 40 wafer flange (1 1/2-in. to 2-in. diameter piping) as manufactured by Red Valve or prior approved equal. Body shall be PVC or Type 304 stainless steel with PVC end caps and diaphrams shall be Hypalon.

2.20 THERMOMETERS

A. Thermometers shall be installed in the locations, and with the temperature ranges shown on the Drawings. Each thermometer shall be installed within a thermowell. The thermowell shall be designed to project sufficiently into the flow stream to assure an accurate thermometer reading. Thermowells shall be of Type 304 stainless steel, and shall have a bore suitable for a 1/4-in. thermometer stem diameter. The process piping connection shall be 1/2-in. NPT, except where flanged connections are shown.

B. Thermometers shall have a 3-in. diameter dial case with bottom connection. The case, connection and stem shall be of Type 304 stainless steel and the lens shall be of tempered glass. Thermometers shall have an external calibration reset adjustment and shall be accurate to within one percent of scale.

C. Thermometers shall be as manufactured by Helicoid Division of Bristol-Babcock, Ashcroft, or equal.

2.21 ROTAMETERS AND FLOW INDICATORS

A. Rotameters for the systems listed below shall be of the glass tube type with Borosilicate glass tubes, Type 302 stainless steel frames with slip-on covers, 10-in. detached type aluminum scales

graduated in gallons per minute, 10:1 flow range, accuracy of 2 percent of full scale and vertical screwed end connections. Tube size shall be the same size as the end connections. Pressure drop at rated capacity shall not exceed 32-in. of water.

B. Flow indicators for shaft seal/flushing water systems shall be brass body, glass or plastic tube, stainless steel float, 125 psi pressure rating. Accuracy shall be at least 5 percent of full scale. Scale range shall be as follows:

Application	*Number of Units*	*Scale Range (gpm)*
Seal Water	25	0-50

2.22 BALL SIGHT FLOW METERS

A. Ball sight flow meters (indicators) shall be vertically mounted, similar to rotameters, direct reading in gpm, with ball float, glass tube surrounded by clear exterior plastic, tube, stainless steel guide rods, PVC end fittings and shall be Type 20-1340 as manufactured by Schuttle and Koerting Division of Ametek or equal.

B. Units shall have 0-15 gpm capacity unless otherwise noted.

2.23 CHEMICAL DIFFUSERS

A. Chemical diffusers shall be provided for the purpose of dispersing dilute chemical solutions into the process flow as indicated on the Drawings. Diffusers shall be of Schedule 80 PVC or CPVC pipe and constructed to the details shown on the Drawings.

2.24 DIFFUSER SOCKETS

A. Diffuser sockets for chemical diffusers shall locate the diffuser and help hold the diffuser in place. Sockets shall be cast iron flange and flare fittings, Fig. No. F-1440 as manufactured by Clow Corp. or equal.

2.25 APPURTENANCES AND MISCELLANEOUS ITEMS

A. All gaskets, glands, bolts, nuts and other required hardware shall be provided for connection of piping and appurtenances. Bolts and nuts shall be high strength, Type 316 stainless steel if submerged, buried, or subject to splashing and corten otherwise, with tee-head and hexagon nut. All other hardware shall be of the size, type and number as required and recommended by the piping or appurtenance manufacturer and as specified herein.

B. All gaskets for flanges shall be full face and suitable for 200°F operating temperature, unless higher temperature required on individual systems and the fluids carried. See also Division 1.

C. Plugs, caps and similar accessories shall be of the same material as the pipe and of the locking type, unless otherwise noted.

D. Unions shall be of the same material as the pipe, except for dielectric connections.

E. Special protective tape shall be fabric reinforced petroleum tape as manufactured by Denso Inc., Houston, TX; or equal.

2.26 COLOR CODING AND LABELING

A. Provide a complete color coding system consisting of preprinted labels and banding as manufactured by Brady, Seton or equal. Field painting shall be specified in Section 09902. Painting and coding shall comply with the requirements of the PIPING SCHEDULE.

PART 3 EXECUTION

3.01 GENERAL

A. All dirt, scale, weld splatter, water and other foreign matter shall be removed from the inside and outside of all pipe and sub-assemblies prior to installing.

B. All pipe joints and connections to equipment shall be made in such a manner as to produce a minimum of strain at the joint.

C. Install piping in a neat manner with lines straight and parallel or at right angles to walls or column lines and with risers plumb. Run piping so as to avoid passing through ductwork or directly under electric light outlets, and/or interference with other lines. All work shall be accomplished using recognized methods and procedures of pipe fabrication and in accordance with the latest revision of applicable ANSI Standards, ASME Codes and Pipe Fabrication Institute Standards.

1. Use full length of pipe except where cut lengths are necessary. Do not spring or deform piping to make up joints.

2. Pipe shall be cut square, not upset, undersized or out of round. Ends shall be carefully reamed and cleaned before being installed. Bending of pipe is not permitted. Use fittings for all changes in direction.

3. Do not use bushings except where specifically approved by the Engineer. Reducers shall be eccentric to provide for drainage from all liquid-bearing lines and facilitate air removal from water lines.

4. Verify the locations and elevations of any existing piping and manholes before proceeding with work on any system. Any discrepancies between the information shown on the Drawings and the actual conditions found in the field shall be reported at once to the Engineer. No claim for extra payment will be considered if the above provision has not been complied with.

5. Where lines of lower service rating tie into services or equipment of higher service rating the isolation valve between the two shall conform to the higher rating.

6. Mitering of pipe to form elbow is not permitted.

7. All piping interiors shall be thoroughly cleaned after installation and kept clean by approved temporary closures on all openings until the system is put in service. Open pipe ends shall be subjected to recleaning and retesting. Closures should be suitable to withstand the hydrostatic test.

8. End caps on pre-cleaned pipe shall not be removed until immediately before assembly. All open ends shall be capped immediately after completion of installation.

9. Provide temporary strainers within the piping ahead of every piece of equipment. The strainers shall be cleaned and reinserted immediately before start-up. The strainers shall be kept in service until at least 7 days after the equipment has been put in service.

D. Test Connections

1. Provide 1/2-in. female N.P.T. test connection equipped with 1/2-in. brass plug on all pump suction and discharge lines. Where indicated on the Drawings, test connections should be equipped with bar stock valve and gage. Provide test connections at all steam traps. The connection shall be located on the discharge side of the trap between the trap and the first valve. It shall consist of a 1/2-in. branch connection terminated with a gate valve.

E. Installation of Expansion Joints and Flexible Connectors

1. Piping systems shall be aligned prior to installation of expansion fittings. Alignment shall be provided by fitting a rigid pipe spool in place of the expansion joint. Prior to testing of the piping system, the pipe spool shall be replaced with the specified expansion or flexible fitting.

2. In addition to the locations noted on the Drawings and in this Section, expansion fittings and anchors shall be located and spaced as specified by the Expansion Joint Manufacturer's Association. The expansion joints/flexible connectors shall not be installed during times of temperature extreme or in a fully compressed or fully expanded condition.

F. Installation of Sleeve Couplings

1. Unless otherwise required by the manufacturer's instructions, prior to installation of sleeve couplings, the pipe ends shall be cleaned thoroughly for a distance of at least 12-in. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6-in. from the end, the middle ring shall be placed on the already installed pipe and shall be inserted into the middle ring flair and brought to proper position in relation to the pipe already installed. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares.

2. After the bolts have been inserted and all nuts have been made up fingertight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.

3. The correct torque as indicated by a torque wrench shall not exceed 75 ft-lb for 5/8-in. bolts and 90 ft-lb for 3/4-in. bolts.

4. If a wrench other than a torque wrench is used, it should be no longer than 12-in. so that when used by the average person the above torque values shall not be exceeded.

5. To prevent sleeve couplings from pulling apart under pressure, a suitable harnessing or flange clamp assembly shall be provided and installed where shown on the Drawings, directed by the Engineer or required elsewhere under Division 15 concerning anchorage.

6. Note the additional locations required for sleeve couplings in PART 2 of this Specification.

Also note Contractor's responsibility for locating, providing and installing restraints.

G. Installation of Split Couplings

1. Prior to assembly of split couplings, grooves or shoulders of the pipe as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap, or graphite paste and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed.

2. Ensure that the joints are fully extended after the rings are in place and prior to tightening the bolts. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, as required by the manufacturer, without excessive bolt tension or strain on the pipe.

H. Installation of Pipeline Appurtenances

1. All pipeline appurtenances shall be installed as required and in accordance with the manufacturer's recommendations, as acceptable to the Engineer.

2. Gages, meters and similar in-line items shall be isolated from testing pressures in excess of the rated pressure of the assembly.

3. Use Teflon tape on all screwed fittings.

I. Installation of Unions

1. Use unions to allow dismantling of pipe, valves, and equipment.

2. Unions screwed or flanged shall be provided where indicated and in the following locations even if not indicated.

a. In long runs of piping to permit convenient disassembly for alterations or repairs.

b. In by-passes around equipment.

c. In connections to tanks, pumps and other equipment between the shut-off valve and the equipment.

d. In connections on both sides of traps, controls and automatic control valves.

J. Welding

1. Welding shall be in accordance with ANSI Standard B31 and AWS B3.0.

2. Install welding fittings on all welded lines. Make changes in direction and intersection of lines with welding fittings. Do not miter pipes to form elbows or notch straight runs to form tees, or any similar construction. Do not employ welder who has not been fully qualified in above specified procedure and so certified by approved welding bureau or similar locally recognized testing authority.

K. Installation of Flanged Joints

1. Make flanged joints with bolts; bolt studs with nut on each end; or studs with nuts where one flange is tapped. Use number and size of bolts conforming to same ANSI Standard as flanges. Before flanges pieces are assembled, remove rust resistant coating from machined surfaces, clean gaskets and smooth all burrs and other defects. Make up flanged joints tight, care being taken to prevent undue strain upon valves or other pieces of equipment.

L. Vents and Drains

1. Provide vents and drains in the following places:

a. Water Lines - Vents at high points and drains at low points.

b. Air Lines - Drains at low points.

M. Wall Sleeve Seals

1. Use expandable rubber segmented sealing device with corrosion-resistant fasteners to make watertight the annular space between pipe and sleeve. Determined the required inside diameter of each individual wall opening or sleeve to fit the pipe and seal to assure a watertight joint as recommended by the manufacturer, before ordering, fabricating or installing. Install pipe concentrically through wall sleeve. Install and tighten seal per manufacturer's instructions.

3.02 TESTING

A. Test all pipelines for water/gas tightness as specified in the Piping or System sections. Furnish all labor, testing plugs or caps, pressure pumps, pipe connections, gages and all other equipment required. Testing shall be performed in accordance with each Piping or System Section. All testing shall be performed in the presence of the Engineer.

B. Repair faulty joints or remove defective pipe and fittings and replace as approved by the Engineer. Retest.

3.03 DISINFECTION

A. After satisfactory testing, all potable and protected water collection and distribution systems shall be thoroughly disinfected with a solution of not less then 50 parts per million of available chlorine. The disinfecting solution shall be allowed to remain in the system for a period of three hours after which time valves and faucets shall be opened and the system shall be flushed with clean water.

B. Water being flushed from structures or pipelines after disinfection with a chlorine residual of 2 mg/l or greater, shall be treated with a dechlorination solution, in a method approved by the Engineer, prior to discharge.

END OF SECTION

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SECTION 15250

THERMAL INSULATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install insulation on piping, valves, fittings, ducts and equipment as shown and scheduled.

1.02 RELATED WORK

A. System application and thickness for insulation when not specified in other Sections of Division 15 are included in this Section.

1.03 SUBMITTALS

A. Submit the following, in accordance with Section 01300, for each insulation by System: manufacturer's product data showing conformance with these specifications for required insulation, jackets, covers, coatings, adhesives, fasteners, supports and appurtenances; complete manufacturer's instructions for installation of required items.

B. Material deliveries must have accompanying manufacturer's certifications attesting to satisfactory results of product testing showing conformance with these specifications.

1.04 DEFINITIONS

A. Particular terminology used under this Section is defined as follows:

1. Traffic Level and Personnel Level - Areas, including process areas, equipment rooms, boiler rooms, and other areas where insulation may be damaged by normal activity and local personnel traffic. Area extends to eight feet above floor, walkways, platforms and stairs.

2. Exposed Piping and Ductwork - Piping and ductwork visible from the floor level and includes piping and ductwork in equipment rooms, boiler rooms, etc.

3. Concealed Piping and Ductwork - Piping and ductwork not visible from the floor level and includes piping and ductwork above hung ceilings and in shaftways.

4. Outdoor Air Ductwork - Portion of ductwork which brings air from outdoors into air handling equipment for treatment.

5. Supply Air Ductwork - Ductwork carrying conditioned air suitable for delivery into a space.

6. Return Air Ductwork - Ductwork carrying air from conditioned space back to air handling equipment for treatment.

7. Exhaust Air Ductwork - Ductwork carrying air to be discharged to the outdoors.

8. Thermal Conductivity - The rate of heat flow through unit area of a homogeneous substance under the influence of unit temperature gradient in the direction perpendicular to the area.

Units-BTU per (hour) (sq.ft.) (EF temp. difference) (per inch thickness).

9. Flues/Stacks/Breeching - Ductwork carrying products of combustion to atmosphere.

10. Heated Spaces - Areas where heat is supplied to maintain a minimum temperature during the heating season.

11. Unheated Spaces - Areas where heat is not applied, and there is no minimum temperature during the heating season.

12. Mixed Air Ductwork - Ductwork capable of carrying both return air and outdoor air or a combination of both.

13. Hot Ductwork - Ductwork carrying air with a temperature above the surrounding space temperature.

14. Cold Ductwork - Ductwork carrying air with a temperature below the surrounding space temperature.

15. Hot/Cold Ductwork - Ductwork carrying air with a temperature that can be either above or below the surrounding space temperature.

16. Conditioned Spaces - Areas that are provided with heating and mechanical cooling.

17. Non-Conditioned Spaces - Areas that are not provided with mechanical cooling.

18. Indoor Piping - Piping within a building that is not exposed to the weather.

19. Outdoor Piping - Piping that is not within a building and which is exposed to the weather.

PART 2 PRODUCTS

2.01 GENERAL

A. The materials supplied shall conform to all governing codes, standards, and specifications. If any departures from the specification are deemed necessary, departures shall not be made without prior written approval of Engineer.

B. Materials and integrated insulation assemblies furnished shall have flame spread ratings of not over 25 (fire resistive), smoke developed rating of not over 50, and fuel contributed rating of not over 50, as established by tests conducted in accordance with Interior Federal Standard Number 00136B, entitled "Interior Federal Standard Flame-Spread Properties for Materials" and the National Fire Code of the NFPA. The treatment of jackets or facings to impart flame and smoke safety must be permanent. (The use of water-soluble treatment is prohibited.) Exception allowed for closed cell foam insulation and PVC fitting covers.

C. The toxicity of the solvents used shall not exceed a maximum allowable concentration of 200 ppm or the latest value published by the American Conference of Governmental Industrial Hygienists and OSHA.

D. Adhesives, coatings and vapor barrier materials shall be compatible with the insulation as recommended by the insulation manufacturer. Submit a certified statement attesting to the approval of the materials by the insulation manufacturer. Adhesives and coatings shall be manufactured by Foster Div., H.B. Fuller Co. or Childers Products Co. or equal. H.P. Fuller and Childers Products Nos are listed below by adhesive/coating types.

1. Lagging adhesive: 30-40, CP50.

2. Vapor barrier coating: 30-35, CP30.

3. Vaporseal adhesive: 85-75, CP82.

4. Duct adhesive: 85-20, CP82.

5. Sealing compound adhesive: 30-45, CP70.

6. Weatherproof mastic: 35-01, CP10-1.

2.02 INSULATION FOR COLD PIPING WITH VAPOR BARRIER (TYPE I-3)

A. Cold piping systems with vapor barrier include but are not limited to miscellaneous indoor and outdoor piping as designated on the Drawings.

B. Insulation Material - Molded rigid fiberglass sectional pipe insulation rated to 500EF. The insulation shall have a minimum density of 3.5 pounds per cubic foot and a maximum "K" factor of 0.24 at 75EF mean temperature.

C. Indoor Piping - Jacket shall be kraft paper bonded to aluminum foil reinforced with fiberglass yarn and self sealing lap with maximum permeability of 0.02 perms.

D. Indoor Piping at Traffic Level - Jacket shall be kraft paper bonded to aluminum foil reinforced with fiberglass yarn and self sealing lap with a maximum permeability of 0.02 perms with field applied 0.016-in. thick aluminum jacket.

E. Outdoor Piping - Jacket shall be kraft paper bonded to aluminum foil reinforced with fiberglass yarn and self sealing lap with a maximum permeability of 0.02 perms with field applied 0.016-in. thick aluminum jacket.

F. Fittings Covers

1. Indoor Piping - Premolded one piece PVC covers.

2. Outdoor Piping - Preformed aluminum covers.

G. Acceptable manufacturers shall be Manville Corp., Certain-Teed, Owens-Corning Fiberglass, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Do not apply insulation prior to testing and acceptance of piping, ductwork and/or equipment. Clean dust, dirt, grease, and moisture from surfaces of pipe and ducts before applying insulation or insulation adhesives. Nameplates and equipment certification and data tags affixed to any piece of apparatus shall not be covered. Where two layers of insulation are used, stagger all joints both ways. Secure each layer independently. Continue insulation and jacketing through walls, partitions, floors and pipe sleeves.

B. Insulation, adhesives, coatings and vapor barrier materials shall be applied in accordance with manufacturers recommendations. Do not apply these materials when ambient temperature is above or below the maximum and minimum ambient temperature respectively, specified as limits by the manufacturer.

C. All penetrations through a vapor barrier for hangers, instruments, etc. shall be sealed to provide a complete vapor barrier. The use of staples or other fasteners that penetrate the vapor barrier is not permitted.

3.02 INSTALLATION OF PIPING INSULATION

A. Omit the specified insulation at pipe supports and substitute rigid insulation such as cellular glass, calcium silicate, or expanded silica with a protective metal shield of a thickness and length as specified in MSS bulletin SP-69 Table 4. Secure the shield with at least three 2-in. aluminum bands. Where piping is supported by roller hangers insulation saddles shall be installed.

B. Vaporseal adhesive shall be used to seal seams and to butt sections on all cold piping if self sealing laps are not provided. The use of staples or any other fastening method that would penetrate the vapor barrier will not be permitted on cold piping systems. Staples may be used on hot piping systems where there is no potential for condensation.

C. Where piping is provided with electric or steam heat tracing the insulation shall not be installed until the heat tracing has been tested and accepted. Insulation shall be sized to allow for the heat tracing line without deforming the insulation.

D. Where supports, anchors or guides are in direct contact with cold piping, insulate the item in contact a distance of four times the insulation thickness. Clamps and non-welded support devices shall be contained within the insulation.

E. On vertical risers exceeding 15 feet in height, provide intermediate support for the insulation. For carbon steel pipe, this support shall consist of angle clips or other suitable devices welded to the pipe at about 15 feet on centers and concealed by the pipe covering. On non-carbon steel piping, clamps or other non-welded devices shall be used.

F. Unless otherwise specified insulate all valves, control valves, fittings, pipe specialties and all other components that could be construed as being part of the piping system. Insulate valve bonnets to a point just below the stuffing box.

G. Bridge flanges, unions, and pipe line strainers with block or sectional insulation wired in place. Wire shall be black steel, annealed. Stop the pipe insulation a sufficient distance to allow removal

of flange bolts without disturbing the pipe insulation and extend the block, at least 2-in. over the adjacent pipe insulation. Fill voids with blanket insulation.

H. For calcium silicate insulation applied to piping, half sections shall be butted tightly together with joints staggered. Sections shall be held in place with 18 gauge black annealed wire at 9-in. intervals, with ends twisted and bent downwards to penetrate the insulation. Voids shall be filled with insulating cement.

I. Where there are lines run between two different piping systems, e.g. make up water line between potable water and chilled water, the interconnecting line shall be insulated the same as the system having the most rigid requirements. If one of the lines is not insulated the interconnecting line shall be insulated the same as the insulated line.

3.03 INSULATION FOR COLD PIPING WITH VAPOR BARRIER (TYPE I-3)

A. Installation

1. Apply insulation in thicknesses indicated. Laps and joints shall be sealed using self-sealing laps or vapor barrier tape. Lap in horizontal piping shall be at the top. Seal ends of insulation sections at flanges, valves, and fittings on 15-f. centers in straight pipe with vapor barrier coating that extends from vapor barrier jacket to the piping. All penetration of the vapor barrier shall be sealed vapor tight, including staples if used.

2. Where field applied aluminum jacket is specified the jacket shall be attached with aluminum draw bands located within three inches of each joint and 24-in. on centers maximum. Jackets on outdoor piping shall have joints arranged to shed water.

3. Fittings shall be molded fiberglass or mitered sections of pipe insulation to provide the same insulation value as required for straight piping. PVC fitting covers, where specified, shall be sealed with vaporseal adhesive. Circumferential edges shall be wrapped with vapor barrier tape. Where preformed aluminum fitting covers are specified a vapor barrier coating reinforced with glass cloth shall be applied directly to the insulation before installing the fitting cover. The vapor barrier shall be installed in accordance with the coating manufacturer's instructions. Aluminum fitting covers shall be attached with aluminum draw bands with joints located to shed water.

B. Insulation thickness for the piping schedule shall be two (2) inches, unless designated in the respective piping system section or shown on the Drawings.

END OF SECTION

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SECTION 16000

ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required and install complete and make operational, electrical and process instrumentation systems at the City of Baton Rouge South Waste Water Treatment Plant as shown on the Drawings and as specified herein.

B. The work shall include furnishing, installing and testing the equipment and materials detailed in the following Sections:

Section No.		Title
16000	-	Electrical - General Provisions
16110	-	Raceways, Boxes, Fittings and Supports
16120	-	Wires and Cables (600 Volt Maximum)
16191	-	Miscellaneous Equipment
16471	-	Panelboard Modifications
16484	-	Motor Control Center Modifications

C. The work shall include furnishing and installing the following:

1. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions.

2. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions.

3. Modifications to existing control systems including installation of auxiliary motor starter contacts, relays, switches, etc, as required to provide the control functions or inputs as shown on the Drawings. Obtain the existing equipment shop drawings from the Owner before attempting to make any modifications to the existing equipment wiring. Verify all existing wiring and connections for correctness. If record drawings are not available, trace all circuits in the field and develop the wiring diagrams necessary for completion of the work. Document all changes made to the wiring diagrams and return a marked-up set of Record Drawings to the Owner after the work is complete.

4. Coordinate the sequence of demolition with the sequence of construction to maintain plant operation. Remove and demolish equipment and materials in such a sequence that the existing and proposed plant will function properly with no disruption of treatment.

5. Modifications to existing motor control centers, switchboards, panelboards and motor controllers including installation of circuit breakers, etc, or disconnection of circuits as required to provide the power supplies to new and existing equipment to maintain the plant in operation.

6. Perform testing of the electrical equipment and make settings for the electrical protective devices.

7. Short circuit and system protective device coordination analysis.

D. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing buildings and structures in which work under this sub-bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has visited the buildings and structures and noted the locations and conditions under which the work will be performed and that he/she takes full responsibility for a complete knowledge of all factors governing his/her work.

E. Provide all electrical demolition work associated with the removal of equipment from the existing facilities, including disconnecting and removing all electrical wiring and conduit to equipment being removed under other related Sections.

F. Provide all electrical relocation work associated with the relocation of equipment for the existing and new facilities, including disconnecting all existing wiring and conduits and providing new wiring and conduit to the relocated equipment.

1.02 RELATED WORK

(NOT USED)

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings for equipment, materials and other items furnished under Division 16.

B. As a minimum all equipment specified in each Section of Division 16 shall be submitted at one time. As an example all lighting fixtures shall be submitted together, all motor control centers shall be submitted together, etc. Submittals that do not comply will be returned disapproved.

C. Shop drawings shall be submitted for the following equipment:

1. Raceways, Boxes, Fittings and Hangers.

2. MCC Buckets.

3. Wires and Cables.

4. Miscellaneous Equipment (as specified in Section 16191).

D. The manufacturer's name and product designation or catalog numbers shall be submitted for the following material:

1. Raceways, Boxes, Fittings and Hangers.

2. Wire and Cable.

E. Mark submittals to clearly identify proposed equipment including accessories, options, and features and to exclude parts not applicable to the project.

F. Check shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform this Section and the Drawings. This statement shall also list all exceptions to this Section and the Drawings. Shop drawings not so checked and noted shall be returned.

G. The Engineer's check shall be for conformance with the design concept of the project and compliance with this Section and the Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by this Section and the Drawings.

H. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

I. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "APPROVED AS NOTED - CONFIRM," "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED."

J. Operation and Maintenance Data

1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Section 01730. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc, to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Manuals shall include the following as a minimum:

a. A comprehensive index.

b. A complete "As-Built" set of approved shop drawings.

c. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

d. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints.

c. System schematic drawings "As-Built," illustrating all components, piping and electric connections of the systems supplied under this Section.

f. Detailed service, maintenance and operation instructions for each item supplied.

g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

h. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

i. Complete parts list with stock numbers, including spare parts.

1.04 REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:

1. National Electrical Safety Code (NESC).

2. Occupational Safety and Health Administration (OSHA).

3. National Fire Protection Association (NFPA).

4. National Electrical Manufacturers Association (NEMA).

5. American National Standards Institute (ANSI).

6. Insulated Cable Engineers Association (ICEA).

7. Instrument Society of America (ISA).

8. Underwriters Laboratories (UL).

9. Factory Mutual (FM).

10. National Electrical Testing Association (NETA).

11. American Society for Testing and Materials (ASTM).

12. Institute of Electrical and Electronics Engineers (IEEE).

13. Joint Industrial Council (JIC).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 PRIORITY OF THE CONTRACT DOCUMENTS

A. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.

B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Engineer and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.

C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Engineer.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times.

1.06 ENCLOSURE TYPES

A. Unless otherwise required, electrical enclosures shall be NEMA Types as follows:

1. NEMA 12 in "DAMP" location.

2. NEMA 4X in "CORROSIVE" and "WET" locations.

3. NEMA 7 (gasketed) in hazardous classified locations. Provide enclosures labeled for such use.

1.07 HAZARDOUS AREAS

A. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.08 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.09 TESTS AND SETTINGS

A. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements.

B. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

C. In addition to the specific testing requirements listed in the individual Sections, the following minimum tests and settings shall be performed:

1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, motor starters, overload relays, control circuits and equipment for proper operation.

2. Check the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the Engineer of the same, including MCC cubicle location and driven load designation, motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace them with the correct size overload.

3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.

4. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.

5. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.

6. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation is incorrect for the driven equipment correct motor connections at the motor terminal box.

7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.

8. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed.

9. Verify all circuit breaker ratings and settings are as required by the Contract Documents or as amended during shop drawing review. Advise the Engineer of discrepancies and make changes as directed by the Engineer.

10. Verify proper operation of devices and motor interlocks.

11. Verify grounding of instrumentation equipment and line surge protection equipment.

D. Testing shall be scheduled and coordinated with the Owner at least 2 weeks in advance. Provide qualified test personnel, instruments and test equipment.

1.10 INTERPRETATION OF DRAWINGS

A. Unless specifically stated to the contrary, the Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation. Where home-runs indicate conduit is to be installed concealed or exposed the entire branch circuit shall be installed in the same manner. Unless otherwise indicated install branch circuit conduits exposed in process/industrial type spaces and concealed in finished spaces.

E. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

F. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.

H. Redesign of electrical or mechanical work, which is required due to the Contractor's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

I. It is the intent of these Specifications that the Electrical Systems shall be suitable in every way for the service required. All materials and all work that may be implied as being incidental to the work of this Section shall be furnished at no additional cost to the Owner.

J. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete and operating system. Homeruns, as shown on the Drawings, are to assist the Contractor in identifying raceways to be run exposed and raceways to be run concealed. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in all process spaces. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

1.11 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.12 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings."

B. Record Drawings shall accurately show the installed condition of the following items:

1. One-line Diagram(s).

2. Raceways and pullboxes.

3. Conductor sizes and conduit fills.

4. Panel Schedule(s).

5. Control Wiring Diagram(s).

C. Submit a schedule of control wiring raceways and wire numbers, including the following information:

1. Circuit origin, destination and wire numbers.

2. Field wiring terminal strip names and numbers.

D. As an alternate, point-to-point connection diagrams showing the same information may be submitted in place of the schedule of control wiring raceways and wire numbers.

E. Submit the record drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the Owner.

1.13 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under other related Divisions and prepare coordinated wiring interconnection diagrams. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.14 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

C. Warrant all equipment furnished under Division 16 in accordance with Section 01740. Refer to individual equipment sections for additional warranty items.

1.15 EQUIPMENT IDENTIFICATION

A. Identify equipment (disconnect switches, separately mounted motor starters, control stations, etc.) furnished under Division 16 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high white letters on a black background.

C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

1.16 DEMOLITION

A. Survey the existing electrical systems and equipment identified for removal with representatives from the other trades prior to performing any demolition work. Identify all conduit and equipment to be removed with tags or paint.

B. Where a piece of equipment is to be removed all associated ancillary components (e.g., solenoid valves, pressure switches, etc.) and associated wiring and conduit shall also be removed.

C. Equipment scheduled to be turned over to the Owner shall be carefully disconnected, removed and delivered to the Owner at a location within ten miles of the existing site. Provide labor, hoisting and transportation of the equipment. All other miscellaneous electrical materials, devices, etc, associated with the equipment being turned over shall be demolished and removed from the site.

D. Remove electrical work associated with equipment scheduled for demolition except those portions indicated to remain or be reused.

E. Remove unused exposed conduit and wiring back to point of concealment including abandoned conduit above accessible ceiling finishes. Remove unused wiring in concealed conduits back to source (or nearest point of usage).

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank covers for abandoned outlets that are not removed.

G. Disconnect and remove abandoned disconnect switches, control stations, distribution equipment, etc.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Where electrical systems pass through the demolition areas to serve other portions of the premises, they shall remain or be suitably relocated and the system restored to normal operation.

J. Coordinate outages in systems with the Owner. Where duration of proposed outage cannot be allowed by the Owner, provide temporary connections as required to maintain service.

K. Removal and relocation of existing conduit, wire and equipment have not been detailed on the Drawings. Survey the affected areas before submitting bid proposal.

L. Trace out existing wiring that is to be relocated, or removed and perform the relocation or removal work as required for a complete operating and safe system.

M. Continuous service is required on all circuits and outlets affected by these changes, except where the Owner will permit an outage for a specific time. Obtain Owner's consent before removing any circuit from continuous service.

N. Remove exposed conduits, wireways, outlet boxes, pull boxes and hangers made obsolete by the alterations, unless specifically designated to remain. Patch surfaces and provide blank covers for abandoned outlets which are removed.

O. All equipment, materials, controls, motor starters, branch and feeder breakers, panelboards, transformers, wiring, raceways, etc, furnished and installed to temporarily

keep circuits energized shall be removed when the permanent installation is fully operational.

1.17 DISPOSITION OF REMOVED MATERIALS AND EQUIPMENT

A. In general, it is intended that material and equipment indicated to be removed and disposed of by the Contractor shall, upon removal, become the Contractor's property and shall be disposed of off the site by the Contractor, unless otherwise directed by the Owner. A receipt showing acceptable disposal of any legally regulated materials or equipment shall be given to the Owner.

B. PCBs and PCB contaminated equipment shall be removed, packaged, shipped and disposed of in accordance with all State and Federal regulations. Obtain the services of a firm licensed and regularly engaged in the removal of PCBs and PCB contaminated equipment. The firm shall be licensed in the State or States in which the contaminated material is handled, shipped and disposed. Pay all fees associated with the removal of the contaminated material and equipment and provide documentation showing acceptable disposal.

C. Should the Contractor discover PCB contaminated equipment that was not identified, they shall cease work on or about the equipment and notify the Engineer immediately. The Contractor shall then proceed with the work as directed by the Engineer.

1.18 ELECTRICAL ENCLOSURES IN NON-AIR CONDITIONED ENVIRONMENT

A. All enclosures containing electronic devices and/or electrical equipment shall have air conditioners that shall maintain the internal temperature at or below the equipment temperature rating without violating the NEMA rating of the enclosure under full load conditions. The panel builder shall provide calculations demonstrating the panel internal temperatures will be maintained below the equipment temperature rating when the panel is mounted in direct sunlight with the air temperature ambient is 50 degree C and a humidity of 100% non-condensing. All outside enclosures shall be provided with sunshields and the face of the panel orientated to the north. Sunshields shall extend from the top and sides of the enclosure to ensure all devices and displays remain in shadow.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. Seal all openings, sleeves, penetration and slots as specified in Section 16110.

3.02 CUTTING AND PATCHING

A. Cutting and patching shall be done in a thoroughly workmanlike manner and be in compliance with modifications and repair to concrete as specified in Section 01045. Sawcut concrete and masonry prior to breaking out sections.

B. Core drill holes in concrete floors and walls as required.

C. Install work at such time as to require the minimum amount of cutting and patching.

D. Do not cut joists, beams, girders, columns or any other structural members.

E. Cut opening only large enough to allow easy installation of the conduit.

F. Patching to be of the same kind and quality of material as was removed.

G. The completed patching work shall restore the surface to its original appearance or better.

H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

I. Remove rubble and excess patching materials from the premises.

J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.03 INSTALLATION

A. Work not installed according to the Drawings and Specification shall be subject to change as directed by the Engineer at Contractor's expense.

B. Electrical equipment shall be protected against mechanical and water damage. Store electrical equipment in dry permanent shelters. Do not install electrical equipment in place until structures are weather-tight.

C. Damaged equipment shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion and at the Contractor's expense.

D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted in accordance with the field painting requirements specified in Section 09902 at the Contractor's expense.

END OF SECTION

SECTION 16110

RACEWAYS, BOXES, FITTINGS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. Raceways and conductors are not shown completely on the Drawings, including but not limited to raceways and conductors: between lighting, switches, receptacles, other miscellaneous low voltage and signal systems, except where they are required to pass through a restricted or designated spaces. Conduit and wiring descriptions are indicated on the interconnection diagrams for the Instrumentation Systems. Home runs indicated, are to assist the Contractor in identifying raceways to be installed concealed or exposed. Raceways and conductors shall be provided for complete and operating systems. Raceways indicated to be run exposed on the Drawings shall be run near the ceilings or along the walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches, etc.

1.02 SUBMITTALS

A. Submit, in accordance with Section 01300, the manufacturers' names and product designation or catalog numbers with marked cut sheets of all materials specified.

PART 2 PRODUCTS

2.01 RACEWAYS AND FITTINGS

A. Aluminum Conduit and Fittings

1. Rigid Aluminum conduit, couplings, factory elbows and fittings shall be 6063 alloy and shall comply with ANSI C80.5.

2. Acceptable manufacturers:

a. New Jersey Aluminum Corp.

b. AFC Co.

c. VAW of America, Inc.

d. Or Equal.

B. Non Metallic Conduit and Fittings

1. PVC conduit shall be rigid polyvinyl chloride schedule 40. Rigid PVC conduit shall comply with NEMA TC-2 and UL/651 and shall be sunlight resistant, rated for use with 90 degree C conductors in exposed, direct burial or concrete encased applications.

2. Connectors, couplings, fittings and ancillary materials shall be supplied by the conduit manufacturer.

3. Acceptable manufacturers:

   a. Carlon Corp.

   b. Certained Corp.

   c. Conux Pipe Systems, Inc.

   d. Or equal.

C. Liquid-tight Flexible Metal Conduit, Couplings and Fittings

1. Liquid-tight flexible metal conduit shall be square locked, galvanized steel flexible conduit with a moisture proof, flame resistant, polyvinyl chloride jacket, for use with rigid metal conduit systems. Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.

2. Liquid-tight conduit fittings shall be hot-dipped mechanically galvanized, positive grounding, screw in type. Provide external bonding lugs on sizes 1-1/4-in and larger. Box connectors shall have insulated throats as manufactured by the Thomas & Betts Co.; Crouse-Hinds Co. or equal.

3. Acceptable Manufacturers:

   a. American Flexible Conduit Co.

   b. Anaconda Metal Hose/ANAMET Inc.

   c. Thomas & Betts.

   d. Or equal.

D. Nonmetallic Flexible Conduit and Fittings

1. Non-metallic flexible conduit shall be seamless, liquid-tight UL 1660 listed, Type B conduit with rigid non-metallic reinforcing embedded in integral flexible PVC lining and jacket wall and shall be oil, acid, ozone and alkaline resistant, rated 105 degree C, 60 degree C wet, 70 degree C oil resistant.

2. Non metallic conduit fittings shall be dustight, liquid-tight, chemical resistant thermoplastic/nylon construction with tapered thread hub and neoprene O-ring gasket.

3. Acceptable manufacturers:

   a. Thomas and Betts "XTRACFLEX LTC".

   b. CARLON "CARFLEX".

   c. Hubel/Kellems "PolyTuff I".

   d. Or equal.

2.02 BOXES AND FITTINGS

A. Dry and Damp Location Boxes and Fittings

1. Outlet boxes shall be zinc-galvanized, extra depth, pressed steel with knockouts, and of size and type suitable for the intended application.

2. Boxes that are less than 100 cubic inches in size used for junction or pull boxes shall be zinc galvanized pressed steel not less than 14 USS gauge with appropriate blank covers, minimum size 4-11/16-in square by 2-1/8-in deep.

3. Boxes that are 100 cubic inches and larger shall be constructed of hop dip galvanized sheet steel without knockouts. Covers shall be secured with round head brass machine screws. All joints shall be welded and ground smooth.

4. Terminal boxes shall be NEMA 12 sheet aluminum unless otherwise shown on the Drawings. Boxes shall be painted and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Terminal boxes shall be furnished with latching hinged doors, terminal mounting straps and brackets. Terminal blocks shall be rated not less than 20A, 600V.

5. Acceptable Manufacturers:

   a. Appleton.

   b. Raco.

   c. Steel City.

   d. Hoffman.

e. Electromate Division of Robroy Ind.

f. Or equal.

B. Wet / Corrosive Location Boxes and Fittings

1. NEMA 4X terminal boxes, junction boxes, pull boxes, etc, shall be sheet 316 stainless steel unless otherwise shown on the Drawings. Boxes shall have continuously welded seams and mounting feet. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps., 600 Volt.

2. Cast aluminum device boxes shall be Type FD. Boxes and fittings shall be copper free aluminum with cast aluminum covers and stainless steel screws.

3. Acceptable Manufacturers:

a. Appleton.

b. Crouse-Hinds.

c. Steel City.

d. Hoffman.

e. Electromate - Division of Robroy Ind.

f. Or equal.

C. Miscellaneous Fittings

1. Flexible couplings shall be type ECGJH as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Killark Electric Manufacturing Co. or equal.

2. Conduit hubs shall be as manufactured by Myers Electric Products, Inc. or equal.

3. Conduit wall seals for new concrete walls below grade shall be O.Z./Gedney Co., Type WSK; Linkseal; Spring City Electrical Manufacturing Co., Type WDP or equal.

4. Conduit wall seals for cored holes shall be Type CSMC as manufactured by the O.Z./Gedney Co. or equal.

5. Conduit wall and floor seals for sleeved openings shall be Type CSMI as manufactured by the O.Z./Gedney Co. or equal.

6. Combination expansion-deflection fittings embedded in concrete shall be Type XD as manufactured by the Crouse-Hinds Co.; Type AXDX as manufactured by O.Z./Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.

7. Combination expansion-deflection fittings installed exposed shall be Type XD as manufactured by Crouse-Hinds Co.; Type AXDX as manufactured by O.Z. Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.

8. Grounding bushings shall be malleable iron with integral insulated throat rated for 150 degrees C, with solderless lugs as manufactured by Crouse Hinds/Cooper, Series HGLL; Appleton, Series GIB; O.Z./Gedney, Type HBLG or equal.

9. Sealing fittings shall be EYS or ESUF Type manufactured by Appleton or equal. Fittings shall be rated for the classified area in which it is installed.

2.03 HARDWARE

A. Conduit Mounting Equipment

1. In dry indoor areas, hangers, rods, backplates, beam clamps, channel, etc., shall be aluminum.

2. PVC coated steel channel with stainless steel hardware shall be used in areas designated "WET" or "CORROSIVE" on the Drawings and in outdoor locations.

3. Furnish any and all necessary supports, brackets, conduit sleeves, racks and bracing as required. All boxes and hardware shall be galvanized zinc plated steel except that stainless steel shall be used in areas designated as "WET" or "CORROSIVE" on the Drawings.

B. Conduit Identification Plates

1. Conduit identification plates shall be embossed stainless steel with stainless steel band, permanently secured to the conduit without screws.

2. Identification plates shall be as manufactured by the Panduit Corp. or equal.

C. Wall and Floor Slab Opening Seals

1. Wall and floor slab openings shall be sealed with a UL approved expending material which equals or exceeds the fire rating of the wall or floor construction as manufactured by the Thomas & Betts Corp.; Pro Set Systems; Neer Mfg. Co.; Specified Technologies, Inc. or equal.

D. Conduit Supports

1. Flush Mounted Supports

a. In dry indoor areas, channels, struts, accessories and components shall be aluminum.

b. PVC coated steel channels, struts with stainless, accessories and components shall be used in areas designated "WET" and "CORROSIVE" where indicated and in outdoor locations.

2. Conduit Racks

a. In dry indoor areas, conduit racks, accessories and components shall be aluminum.

b. PVC coated steel conduit racks with stainless, accessories and components shall be used in areas designated "WET" and "CORROSIVE" where indicated and in outdoor locations.

3. Conduit Hangers

a. In dry indoor areas, conduit clamps, rods, beam clamps, bracing, accessories and components shall be aluminum.

b. Stainless steel conduit clamps, rods, beam clamps, bracing, accessories and components shall be shall be used in areas designated "WET" and "CORROSIVE" where indicated and in outdoor locations.

4. Adjustable steel and plastic band hangers, adjustable band hangers, adjustable swivel ring hangers and J-hangers shall not be allowed.

5. All hangers, bracing, rods, beam clamps, accessories and components shall be as manufactured by the Carpenter & Paterson Inc.; Grinnell Corporation; B-Line Systems Inc. or equal.

6. Design of supplemental structural steel required for attachment to the building structural support system shall be the full responsibility of the Support Engineer.

PART 3 EXECUTION

3.01 RACEWAY APPLICATIONS

A. Refer to Table 16110-1 for specific raceway application requirements.

B. All conduit of a given type shall be the product of one manufacturer.

C. Refer to Section 16600 for underground applications.

TABLE 16110-1 *Raceway Application Guidelines*	
Location/Circuit Type	*Raceway Type*
All areas -	• Exposed conduit for power wiring, lighting, switch, and receptacle circuits rigid aluminum. • Concealed conduit for power wiring, lighting, switch, and receptacle circuits – Schedule 40 PVC conduit when embedded within concrete floor slabs or structures.

3.02 BOX APPLICATIONS

A. Unless otherwise specified herein or shown on the Drawings, all boxes shall be metal.

B. Exposed switch, receptacle and lighting outlet boxes and condulet fittings shall be cast or malleable iron, except that non-metallic PVC shall be used with PVC.

C. Concealed switch, receptacle and lighting outlet boxes shall be pressed steel.

D. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

E. Boxes flush in block, brick or tile walls shall be located at a course line and provided with square tile covers. Flush boxes shall not project beyond the finished surfaces nor shall surfaces project more than 1/8-in beyond the box enclosure. Wiring devices located in close proximity to each other shall be installed in one solid gang box with single cover.

F. All conduit bodies and pulling outlets shall comply with NEC wire bending space requirements. Mogul type fittings shall be used for sizes 2-1/2-in and larger.

3.03 FITTINGS APPLICATIONS

A. Combination expansion-deflection fittings shall be used where rigid metal conduits stub's up out of an underground ductbank system above ground.

B. All underground conduit penetrations at walls or other structures shall be sealed watertight. Conduit wall seals and sleeves shall be used in accordance with the manufacturer's installation instructions and the details shown on the Drawings.

C. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather and at other locations shown on the Drawings.

D. Insulated throat grounding bushings shall be used where specified herein, in Section 16660 and where conduits stub up into electrical equipment such as switchboards, panelboards, etc.

3.04 INSTALLATION

A. Conduit installations shall be done in a manner to prevent conflicts with equipment and structural conditions. Exposed conduits shall be installed parallel or perpendicular to beams and walls.

B. No conduit smaller than 3/4-in electrical trade size shall be used, nor shall any have more than the equivalent of three 90 degree bends in any one run. Pull boxes shall be provided as required by the NEC after every 270 degrees of bends and for straight run not to exceed 200 feet or as directed.

C. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

D. All conduit which may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits. The ends of all conduits shall be temporarily plugged to exclude dust, moisture and debris from entering during construction.

E. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

F. Conduits noted as spare shall be capped or plugged at both ends with easily removable fittings.

G. Conduit terminating in NEMA 4, 4X and 12 enclosures shall be terminated with Myers type conduit hubs.

H. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

I. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.

J. Conduits shall be installed using threaded fittings except for PVC.

K. The use of running threads is prohibited. Where such threads are necessary, a 3-piece union shall be used.

L. All conduit entering or leaving a switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer's designated area, directly below the vertical section in which the conductors are to be terminated. The 3-in extension of conduit above the floor slab or concrete equipment pad may be reduced to a dimension that suits the equipment manufacturer's installation requirements if the 3-in stub-up interferes with the equipment being provided.

M. Liquid-tight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present or may require removal. Non-metallic flexible conduit can be used with rigid PVC conduit systems.

N. PVC coated steel conduit shall be used as a transition section where concrete embedded conduit stubs out of floor slabs or through below grade walls or where conduit installed under building slabs on grade stub out of floors. The PVC coated steel conduit shall extend a minimum of 3-in into and out of the floor slab, concrete pad, or wall to allow for proper threading of the conduit.

O. PVC conduit to non-metallic box connections shall be made with PVC socket to male thread terminal adapters with neoprene O-ring and PVC round edge bushings.

P. PVC conduit shall be supported with non-metallic clamps, PVC coated steel racks and stainless steel hardware.

Q. Expansion fittings shall be used on exposed runs of PVC conduit where required for thermal expansion. Installation and number of fittings shall be as recommended by manufacturer.

R. PVC boxes, conduit fittings, etc, with integral hubs shall be solvent welded directly to the PVC conduit system.

S. Non-metallic boxes with field drilled or punched holes shall be connected to the PVC conduit system with threaded and gasketed PVC Terminal Adapters.

T. Conduit supports, other than for underground raceways, shall be spaced at intervals not exceeding the distance required by the NEC to obtain rigid construction.

U. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on fabricated channel trapeze type racks with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-in diameter. Surface mounted panel boxes, junction boxes, conduit, etc, shall be supported by spacers to provide a minimum of 1/2-in clearance between wall and equipment.

V. Conduit Supports (Other than Underground Raceways)

1. Flush Mounted Supports

   a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.

   b. Attachment to concrete shall be with cast-in-place inserts, cast-in place welded plates with welded studs or stainless adhesive anchors.

2. Conduit Racks

   a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.

b. Attachment to concrete shall be with cast-in-place inserts, cast-in place welded plate with welded studs or stainless adhesive anchors.

3. Conduit Hangers

a. Conduit hangers shall be vertical supported 10-ft or less, as required to obtain rigid conduit construction.

b. Attachment to structural steel shall be by beam clamps or welded beam attachment. C-clamps will not be allowed for vertical hangers.

c. Attachment to concrete shall be cast-in-place inserts, cast-in place welded plates with welded studs or stainless steel adhesive anchors.

4. All reinforcing bars shall be located by the Electrical Subcontractor with the use of a rebar locator prior to installing adhesive capsule type anchors. Mark the location of all reinforcing bars in an area bounded by a line drawn at least 18-in from the edge of the support bearing/weld plates on all four sides of the bearing/weld plates prior to fabricating and installing bearing/weld plates.

5. Where interference occurs, adjust anchor locations to clear reinforcing bars and alter support configuration at no additional cost to the Authority.

W. Miscellaneous metal for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit shall be furnished and installed. Channel supports shall be ground smooth and fitted with plastic end caps.

X. Aluminum channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc, for a rigid installation. Channel supports shall be ground smooth and fitted with plastic end caps.

Y. All conduits on exposed work and within partitions shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

Z. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke in accordance with UL requirements and the details shown on the Drawings. The sealing method shall have a UL fire rating, which equals or exceeds the fire rating of the wall or floor construction.

AA. Conduits shall not cross pipe shafts, access hatches or vent duct openings. They shall be routed to avoid such present or future openings in floor or ceiling construction.

AB. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc, shall be sealed with "Duxseal" as manufactured by Manville or seal fitting to prevent the accumulation of condensation.

AC. Mandrels shall be pulled through all existing conduits which will be reused and through all new conduits 2-in in diameter and larger prior to installing conductors.

AD. 3/16-in polypropylene pull lines shall be installed in all new conduits noted as spares or designated for future equipment. Conduit noted as spare shall be capped or plugged at both ends with easily removable fittings.

AE. Junction boxes, pull boxes and terminal cabinets, shall be sized in accordance with the requirements of NEC Article 314. Enclosure type and material shall be as specified herein.

AF. Pull or junction boxes shall be furnished and installed where shown on the Drawings, in every 200 feet of straight conduit runs or in runs where more than the equivalent of four 90 degree bends occur or at any point necessary for wire pulling.

AG. A conduit identification plate shall be installed on all power, instrumentation, alarm and control conduits at each end of the run and at intermediate junction boxes, manholes, etc. Conduit plates shall be installed before conductors are pulled into the conduits. Exact identification plate location shall be coordinated with the Engineer at the time of installation to provide uniformity of placement and ease of reading. Conduit numbers shall be exactly as shown on the Drawings.

END OF SECTION

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SECTION 16120

WIRES AND CABLES (600 VOLT MAXIMUM)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as specified herein.

B. On all new instrumentation wiring that is installed, there shall be one extra (spare) wire circuit installed for future use.

1.02 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, samples of proposed wire. Each sample shall have the size, type of insulation and voltage stenciled on the jacket.

B. Approved samples will be sent to the project location for comparison by the Resident Engineer with the wire actually installed.

C. Installed unapproved wire shall be removed and replaced at no additional cost to the Owner.

D. Submit only one manufacturer for each wire or cable type.

1.03 DELIVERY, STORAGE AND HANDLING

A. Carefully handle all conductors to avoid kinks and damage to insulation.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors shall be stranded.

C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

2.02 BUILDING WIRE

A. Wire for lighting, receptacles and other circuits not exceeding 150 Volts to ground shall be NEC type THHN/THWN as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp. or equal.

B. Wire for circuits over 150 Volts to ground shall be NEC type THHN for sizes #6 AWG and smaller and shall be NEC type XHHW for sizes #4 AWG and larger as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp. or equal.

C. Multi-conductor control and power cables shall have stranded conductors with type THHN/ THWN insulated, nylon conductor covering, and an overall PVC jacket covering over the individual wires. Cable shall be TC rated meeting UL 1277 and IEEE 383 Standards. Cable shall be flame resistant, nonpropagating and suitable for installation in a Class I, Division II hazardous location and for direct burial in earth. Power and control cables shall be furnished with a green ground conductor. Power cables shall be furnished with a white neutral conductor where required to serve phase to neutral loads. Cable shall be as manufactured by the Okonite Co.; Okoseal – N type TC cable or equal.

2.03 CONTROL, STATUS AND ALARM WIRE

A. Wire shall be No. 14 AWG NEC type THHN/THWN, stranded tinned copper as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp. or equal.

B. Multi-conductor control cable, where shown on the Drawings, shall be stranded tinned copper, No. 14 AWG, 600 Volt, polyvinyl chloride insulated, nylon jacket over insulation, polyvinyl chloride jacket overall, Type TC as manufactured by the Okonite Co.; Pirelli Cable Corp. or equal.

2.04 INSTRUMENTATION WIRE

A. Wire for process instrumentation signals (i.e., 1-5 VDC, 4-20 mADC), R.T.D., potentiometer and similar signals shall be:

1. Single pair cable:

a. Conductors: 2 No. 16 stranded tinned copper and twisted on 2-in lay.

b. Insulation: PVC with 300 Volt, 105 degree C rating.

c. Shield: 100 percent mylar tape with drain wire.

d. Jacket: PVC with UL Subject 13, UL 1581 and manufacturers identification.

e. Max overall diameter: 0.262-in.

f. Misc: UL Subject 13, Type PLTC.

g. Manufacturers: Belden No. 1030A; Manhattan No. M39119.

2. Multiple pair cables (where shown on the Drawings):

a. Conductor: Multiple 2 No. 22 stranded tinned copper and twisted on a 2-in lay.

b. Insulation: PVC with 300 Volt, 105 degree C rating.

c. Shield: Individual pairs shielded with 100 percent mylar tape and drain wire.

d. Jacket: PVC with UL Subject 13, UL 1581 manufacturer's identification.

e. Misc: UL Subject 13, Type PLTC.

f. Manufacturers: Okonite: Okobon type SP – OS.

3. Three conductor (triad) cable:

a. Conductors: 3 No. 16 stranded tinned copper and twisted on 2-in lay.

b. Insulation: PVC with a nylon overcoat with 600 Volt, 95 degree C rating.

c. Shield: 100 percent mylar tape with drain wire.

d. Jacket: PVC with UL Subject 13, UL 1581 and manufacturers identification.

e. Max overall diameter: 0.276-in.

f. Misc: UL Subject 1277, Type TC.

g. Manufacturers: Okonite: Okobon type SP – OS.

2.05 MOTOR CONNECTIONS

A. Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and springwasher. Connections shall be insulated with a Raychem Type RVC, roll-on stub insulator or equal.

2.06 TERMINATIONS (CONTROL, STATUS AND ALARM CONDUCTORS)

A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

2.07 WIRE AND CABLE MARKERS

A. Wire and cable markers shall be "Omni-Grip" as manufactured by the W.H. Brady Co.; Thomas & Betts Co.; 3M Co. or equal.

B. Wire and cables with diameters exceeding the capacity of the "Omni-Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp. or equal.

C. Cable markers shall be machine printed and solvent resistant.

2.08 GROUNDING CONDUCTORS

A. Ground wire shall be #4/0AWG tinned copper wire.

PART 3 EXECUTION

3.01 INSTALLATION

A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end with wire and cable markers.

B. Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

3.02 WIRE COLOR CODE

A. All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, manholes and other accessible intermediate locations as well as at each termination.

B. The following coding shall be used:

System	Wire	Color
240/120 Volts	Neutral	White
Single-Phase, 3 Wire	Line 1	Black
	Line 2	Red
	Ground	Green
208Y/120 Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Black
	Phase B	Red
	Phase C	Blue
	Ground	Green
	Insulated Ground	Green with Yellow Tracer
240/120 Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Black
delta, center tap	Phase B (High)	Orange
ground on phase	Phase C	Blue
coil A-C	Ground	Green
480Y/277 Volts	Neutral	Gray
3 Phase, 4 Wire	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow
	Ground	Green

3.03 TERMINATIONS

A. Power conductors: Terminations shall be die type or set screw type pressure connectors as specified.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors.

D. Except where permitted by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.

3.05 INSTRUMENTATION CABLES

A. Instrumentation cables shall be installed in rigid aluminum raceways as specified. All circuits shall be installed as twisted pairs. In no case shall a circuit be made up using conductors from different pairs.

B. Terminal blocks shall be provided at all instrument cable junction and all circuits shall be identified at such junctions.

C. Shielded instrumentation wire, coaxial, data highway, I/O and fiberoptic cables shall be run without splices between instruments, terminal boxes, or panels.

D. Shields shall be grounded as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

E. Seal openings in slabs and walls through which wires and cables pass.

3.06 FIELD TESTING

A. Test all 600 Volt wire insulation with a megohm meter after installation. Make tests at not less than 500 Volt. Submit a written test report of the results to the Engineer.

END OF SECTION

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SECTION 16140

LIGHT SWITCHES AND RECEPTACLES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete lighting system including panelboards, transformers, lighting fixtures, receptacles, switches, contactors, clocks and all necessary accessories and appurtenances required as specified herein and shown on the Drawings.

1.02 STANDARDS

A. Lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." Lighting fixtures shall be Underwriters Laboratories labeled.

PART 2: PRODUCTS

2.01 MATERIALS

A. Panelboards shall be as specified under Section 16470.

B. Transformers shall be as specified under Section 16191.

C. Conduit shall be as specified under Section 16110.

D. Wire shall be as specified under Section 16120.

E. Switches

1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type, rated for 20 A. 120/277 volts. Switches shall conform to Federal Specification WS8966-E.

2. Wall switches shall be of the following types and manufacturer or equal.

   a. Single pole - Arrow-Hart, Catalog No. 1991, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

   b. Double pole - Arrow-Hart, Catalog No. 1992, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

   c. Three way - Arrow-Hart, Catalog No. 1993, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

d. Four way - Arrow-Hart, Catalog No. 1994, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

e. Single pole, key operated - Arrow-Hart, Catalog No. 1991-L, or equal.

f. Single pole, pilot indicating - Bryant Catalog No. 4901-PLR120, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

g. Momentary contact, 2 circuit, center off - Arrow-Hart Catalog, No. 1895, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

h. Fluorescent dimmer switch for 120 volt control of 2 to 12 F40 lamps. Prescolite Control Catalog No. D56F or equal as manufactured by Lutron Electronics, Valmont/Hunt Electronics or equal.

i. Weatherproof cover for standard toggle switches - Crouse-Hinds Catalog No. DS181, or equal by Appleton Electric Co., L.E. Mason Co., or equal.

j. Explosion-proof single pole switches shall be for 20 amperes, 120/277 volts, mounted in cast boxes and be similar and equal to Crouse-Hinds EDS Series, or equal by Appleton Electric Co., L.E. Mason Co., or equal.

F. Receptacles: Receptacles shall be of the following types and manufacturer or equal. Receptacles shall conform to Federal Specification WC596-F.

1. Duplex, 20A, 125V, 2P, 3W; Arrow-Hart, Catalog No. 5362, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

2. Weatherproof or corrosion resistant single, 20A, 125V, 2P, 3W; with cover Crouse-Hinds Co., Catalog No. WLRS-5-20, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

3. Weatherproof or corrosion resistant duplex, 20A, 125V, 2P, 3W; with cover Crouse-Hinds Co. Catalog No. WLRD-5-20, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

4. Ground fault interrupter, duplex, 20A, 125V, 2P, 3W; Arrow-Hart Catalog No. GF 5342, or equal by Harvey Hubbel, Inc., Pass & Seymour, Inc. or equal.

5. Duplex 20A, 125V, 2P, 3W with transient voltage surge suppressor and indicator light; Pass & Seymour Catalog 6362-GRY-5P, equal by Harvey Hubbell Inc., Bryant Electric Co., or equal.

6. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart Catalog No. 97061, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

7. Weatherproof cover for G.F.I. receptacle in FS box; Arrow-Hart Catalog No. 4501-FS, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

8. Explosion-proof, 20A, 125V, 2P, 3W; Appleton Electric Co. Catalog No. EFS175-2023 or EFSC175-2023 or equal by Crouse-Hinds Co., Killark Electric Mfg. Co. or equal. Furnish one Appleton Electric Co. Catalog No. ECP-1523 cap or equal by Crouse-Hinds Co., Killark Electric Mfg. Co., or equal for every two receptacles (minimum of one).

9. Clock hanger, 15A, 125V, 2P, 3W; Arrow-Hart Catalog No. 452.

10. Single, 20A, 250V, 2P, 3W; Arrow-Hart Catalog No. 5861, or equal by Harvey Hubbell, Inc., Pass & Seymour, Inc. or equal.

11. Single 30A, 125V, 2P, 3W; Arrow-Hart Catalog No. 5716; cap: Arrow-Hart Catalog No. 5715.

12. Single, 30A, 250V, (3 phase) 3P, 4W; Arrow Hart Catalog No. 8430N; Cap: Arrow-Hart Catalog No. 8432AN.

G. Device Plates

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

2. Plates for surface mounted device boxes shall be of the same material as the box.

H. Lighting Contactor

1. Lighting contactors shall be of the electrically operated, mechanically held type in NEMA enclosures of the number of poles as called for on the Drawings.

2. Contactors shall be rated for 20A-600 volt A.C. contacts and be similar and equal to Automatic Switch Co. bulletin 917 RC, Square D Co., Westinghouse Electric Corp., or equal.

I. Lighting Control Time Switches

1. Time switches for the control of lighting shall have astronomic dials, reserve power and be similar and equal to the following types.

a. Where time switch is indicated to be for momentary contact operation it shall be similar and equal to Tork Time Controls Cat. No. 1847ZL (120V) and 1848ZL (208/277V), or equal by Paragon, Intermatic or equal.

b. Where time switch is indicated for SPST and DPST maintained control it shall be similar and equal to Tork Time Controls Cat. No. 7200ZL (120V), 7202ZL (207-277V), or equal by Paragon, Intermatic or equal.

2. Time switches for lighting control with ON by photocell and OFF by time switch shall be two circuit type with SPDT switch contacts, 2000 watt capacity and reserve

power motors. Tork catalog number T920L (120V) and T922L (208-277V) or equal by Paragon Electric Co., Intermatic Inc. or equal.

a. Momentary contact adapter for control of contactor with mechanically held contacts shall be SPDT, 1000 watt capacity and be Tork catalog TMC1 (120V) and TMCA (208-277V) or equal by Paragon Electric Co., Intermatic Inc. or equal.

J. Photo Electric Controls

1. Photo electric controls with time delay for outdoor lighting shall be completely self-contained and not affected by moisture, vibration or temperature changes.

2. ON/OFF adjustments are to be made by movement of a light level selector without the use of tools in a range from 2 to 50 foot candles.

3. Photo electric control device shall be SPST, and have 2000 watt tungsten capacity and be Tork Catalog No. 2101 (120V); 2104 (208-277V) or equal by Intermatic Inc., Carlon or equal.

4. Photo electric control for use in conjunction with electrically operated, mechanically held lighting contactors shall have a turn-lock photo control device. The complete assembly shall be NEMA 3 rainproof construction with a SPDT, 1000 watt capacity relay and be Tork Catalog No. 5420 with a Model TMC-1 adapter for momentary contact operation or equal by Intermatic Inc., Carlon or equal.

PART 3: EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling type involved. Flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Flexible fixture hangers shall be used for pendant mounted fixtures.

D. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

E. Switch and receptacle outlets shall be installed flush with the finished floor or wall when raceways are shown as "concealed" on the Drawings.

3.02 CLEANING UP

A. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after construction activity that may cause dust formation on reflector surfaces has been completed.

B. Fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

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SECTION 16150

MOTORS 200 HORSEPOWER AND BELOW

PART 1: GENERAL

1.01 DESCRIPTION

A. Related Work Specified Elsewhere

1. General Provisions: Section 16000.

2. Motor Control Centers: Section 16480 and appropriate Drawings.

3. Appropriate Mechanical Sections.

4. Variable Frequency Drives: Section 16482 and appropriate Drawings.

B. Scope. Single or three phase motors included in this section shall comply with NEMA Standard Publication MG-1 (Latest Revision and Supplements) unless otherwise indicated. Suppliers should note: These are not Standard "Off the Shelf" motors.

C. Special Definition. The word "Drive" is to be construed to mean the driven equipment i.e. pump, hoist, fan, compressor, or variable frequency drive connected with motor.

D. Exclusion. Any self contained portable appliance, which includes the motor with or without control that is specifically referred to, by catalog number on the Drawings or in other sections of the Specifications (more specifically fan coil unit motors, exhaust fan motors, unit heater motors, and blower ventilation motors) are not covered by this Section of the Specifications.

E. Horsepower Designations. If there is inconsistency of size on different Drawing sheets or between Drawings and other sections of Specifications, then the larger size shall be required. If a larger size results in a larger wire, circuit breaker or starter, then these larger control devices shall be included at no additional cost to the Owner.

F. Suppliers of fractional horsepower motors below frame 143T will not be required to submit operational characteristics.

G. The motor manufacturer shall coordinate the variable frequency drive compatibility with the motor being furnished. The motor manufacturer shall provide a certified letter stating that the motor being supplied is suitable for operation with the proposed VFD motor controller.

1.02 QUALITY ASSURANCE

A. Motor Compatibility. The Contractor shall satisfy himself that the motor included with the drive is compatible with driven equipment and complies with these Specifications. In the event the motors described in these Specifications can not be provided, then the Contractor shall take exception outlining the deviations with his bid.

B. Acceptable Manufacturers. The motors shall be as manufactured by:

a. Reliance

b. General Electric

c. Siemens

d. Baldor

1.03 SUBMITTALS

A. The following information shall be submitted with the motor drawings for review.

1. Name of Drive

2. Horsepower of Motor

3. Phase

4. Efficiency at 1/2, 3/4, Full Load

5. Voltage

6. Power Factor at 1/2, 3/4, Full Load

7. Speed

8. NEMA Design Starting Torque

9. NEMA Frame and Dimensions

10. Full Load Current

11. Locked Rotor Current

12. Enclosure

13. Statement of Bearing Life

14. Special features (i.e., space heaters, RTDs, oversize conduit box and corrosion resistant features). Include certificate that motor is rated for Inverter duty (for motors used with variable frequency drives).

B. Submittal shall be in accordance with Section 01300.

1.04 SYSTEM DESCRIPTION

A. Motors specified herein are three phase, squirrel cage induction type for ½ HP and above; single phase for less than ½ HP or DC motors.

PART 2: PRODUCTS

2.01 OPERATING CHARACTERISTICS

A. The motor shall have adequate torque to operate the driven equipment over the entire range required of the drive without the brake horsepower exceeding the nameplate horsepower even momentarily. Starting torque shall be NEMA design B unless the application indicates otherwise. Minimum acceleration torque shall be 100 percent of full load torque.

B. All motors shall be continuous time rated suitable for operation in a 40 degrees C ambient unless noted otherwise.

C. Specific motor data such as HP, rpm, enclosure type, etc. is specified under the detailed specification for the equipment with which the motor is supplied.

2.02 ENCLOSURE DETAILS

A. Unless otherwise indicated the motor shall be totally enclosed for outdoor applications. Motor enclosures shall be cast iron construction. See mechanical specifications for pumps and other equipment that require additional enclosure requirements.

B. Service factor shall be 1.15 for totally enclosed.

C. The bearing shall have a AFBMA noted minimum life of B10 Class M5 200,000 hours of operation in a 60 degrees C Ambient.

D. Provide oversize conduit box, ground lug on motors. Provide drain plug on motors.

E. Motors shall have corrosion resistant enclosures, epoxy paint, corrosion proof fittings and stainless steel nameplates similar to Reliance Mill and Chemical motors, U.S. Motors Coroduty or equal.

F. Motors for use with variable frequency drives shall be rated for Inverter duty. The insulating system shall be designed to withstand the high voltage impulse wave form imposed on the motor insulation by the VFD in accordance with NEMA MG1.

G. The motor manufacturer's nameplates shall be engraved or embossed on stainless steel and fastened to the motor frame with stainless steel screws or drive pins. Nameplates shall indicate clearly all of the items of information enumerated in NEMA Standard MGI-10.38 or MGI-20.60, as applicable.

H. Condensation heaters shall be supplied with all motors and shall conform to the following:

1. Heaters shall be of the cartridge or flexible wrap around type installed within the motor enclosure adjacent to core iron. Heaters shall be rated for 120 V, single phase with wattage as required. The heater wattage and voltage shall be embossed on the motor nameplate. Power leads for heaters shall be brought out at the motor lead junction box.

I. Winding temperature detectors shall be provided for all motors above 75 hp when controlled by variable frequency drives. Provide factory installed, embedded, bi-metallic switch type with leads terminating in the main conduit box. Device shall protect the motor against damage from overheating caused by single phasing, overload, high ambient temperature, abnormal voltage, locked rotor, frequent starts or ventilation failure. The switch shall have normally closed contacts. Not less than three detectors shall be furnished with each motor.

2.03 INSULATION

A. The insulation shall be Class F, operated at Class B temperature rise and shall be manufacturer's premium grade, resistant to attack by moisture, acids, alkalies and mechanical or thermal shock for 480 Volt motors. The motor insulation system for motors controlled with the VFD shall have full capability to handle the common mode voltage conditions imposed by the VFD, 1600 volt insulation shall be provided.

B. Motors for outdoor service shall have vacuum/pressure impregnated epoxy insulation for moisture resistance.

2.04 TEMPERATURE RISE

A. The maximum temperature rise above 40 C ambient at a service factor of 1.00 shall be 85 degrees C for Class "F" insulation system provided (i.e. this is meant to limit Class "F" systems to a Class "B" maximum temperature rise.

2.05 RESONANT FREQUENCY

A. The critical speed of the shaft and rotor assembly shall exceed the operating speed by a minimum of 10 percent.

2.06 SINGLE PHASE MOTORS

A. Unless otherwise specified, motors smaller than ½ HP shall be single phase, capacitor start. Small fan motors may be split-phase or shaded pole type if such are standard for the equipment. Wound rotor or commutator type single-phase motors are not acceptable unless their specific characteristics are necessary for the application.

B. Motors shall be rated for operation at 115 Volts, single phase, 60 Hz.

C. Locked rotor current shall not be greater than specified in NEMA Standard MG1-12.32, Design "N".

D. Motors shall be totally-enclosed in conformance with NEMA Standard MG1-10.35. Small fan motors may be open type if suitably protected from moisture, dripping water and lint accumulation.

E. Motors shall be provided with sealed ball bearings lubricated for 10 years normal use.

2.07 THREE PHASE MOTORS-FRAMES 143T THROUGH 449T

A. General

1. Unless otherwise specified, motors ½ HP and larger shall be 3 Phase, squirrel cage induction type.

2. All motors ¾ HP and larger shall be a NEMA frame 143T or larger. ½ HP motors and ¾ HP motors rated 1800 and 3600 rpm, shall be a 56 frame. Motors shall be designed and connected for operation on a 480-Volt, 3 phrase, 60 Hz alternating current system. Dual voltage (230/460) rated motors are acceptable.

3. Unless otherwise required by the load, all motors shall be NEMA Design B, normal starting torque. Locked rotor kVA/HP shall not exceed Code Letter G as described in NEMA Standard MG1-10.37 for motors 20 HP and larger.

4. Motors connected to variable frequency drives shall be inverter duty rated, and insulated for 1600 volts.

B. Design Criteria

1. Type: Vertical squirrel cage induction motor and horizontal squirrel cage induction motor.

2. Operating voltage: 480 Volts, 3 Phase, 60 Hz.

3. Insulation rating: 600 Volts per NEMA MG-1 Standard for power sources and increased (1600 volt) for non-sinusoidal waveform power sources as specified.

4. Environment: Wastewater Treatment Plant, dirty environment with the continuous presence of low concentrations of hydrogen sulfide gas.

5. Maximum ambient temperature: 40 degrees C.

6. Operational humidity: Up to 100 percent non-condensing.

7. Minimum efficiencies: 95.0 percent at full load, calculated pr IEEE 112, Method B.

8. Temperature Rise: 80 degree C (NEMA Class B). Insulating material shall be NEMA Class F minimum. Temperature rise shall not be exceeded over entire operating speed range.

9. Noise Level: Limited to 85 dBA at no load measured at 3 feet from the motor.

10. Vibration limits: Not to exceed 0.2-in/sec at any frequency.

2.08 GUARANTEED MOTOR EFFICIENCY

A. Motors shall meet or exceed the following minimum guaranteed efficiencies at the following approximate nameplate current values at 460 volts.

HP	RPM	FLA	EFF	HP	RPM	FLA	EFF
1	3600	1.5	80.0	25	3600	28.4	91.0
	1800	1.4	84.0		1800	30.5	92.4
	1200	2.1	78.5		1200	29.5	91.0
	900	2.2	75.5		900	32.3	89.5
					900		
1.5	3600	2.0	81.0				
	1800	2.3	84.0	30	3600	34.3	91.0
	1200	2.6	84.0		1800	36.1	93.0
	900	3.0	78.5		1200	32.9	92.4
					900	38.6	90.2
2	3600	2.5	82.5				
	1800	3.1	84.0	40	3600	45.3	93.1
	1200	3.4	85.5		1800	47.5	93.0
	900	4.1	84.0		1200	45.9	92.4
					900	50.2	90.2
3	3600	3.8	86.5				
	1800	3.7	87.0	50	3600	55.8	91.7
	1200	4.2	87.5		1800	57.0	93.0
	900	5.6	84.0		1200	57.4	91.7
					900	63.7	92.1
5	3600	6.0	87.6				
	1800	6.1	88.0	60	3600	65.4	92.4
	1200	6.8	87.5		1800	67.2	93.6
	900	8.4	86.5		1200	74.1	92.8
					900	73.8	91.8
7.5	3600	8.9	89.7				
	1800	9.3	90.2	75	3600	80.7	93.0
	1200	9.9	90.3		1800	83.5	94.1
	900	12.3	89.8		1200	85.1	93.8
					900	101.9	91.5
10	3600	11.8	88.5	100	3600	117.2	93.5
	1800	12.1	90.2		1800	120.3	94.1
	1200	13.6	90.2		1200	120.5	94.2
	900	16.2	86.5		900	137.6	92.1
15	3600	17.1	91.0	125	3600	133	93.6
	1800	18.5	91.5		1800	135	94.5
	1200	19.3	89.5		1200	143	93.0
	900	21.0	89.8		900	146	93.8
20	3600	23.0	90.8	150	3600	157	93.6
	1800	23.4	91.9		1800	164	94.1
	1200	26.8	91.4		1200	180	94.5
	900	27.5	89.0				

HP	RPM	FLA	EFF	HP	RPM	FLA	EFF
200	3600	212	94.5	250	3600	269	94.5
	1800	216	95.0		1800	280	94.9
	1200	227	94.1		1200	305	95.1

Note: This Section does not apply to 2-speed, 2-winding and slower speed motors.

C. Power Factor Correction Capacitors

1. All single speed motors over 5 horsepower (except motors powered from variable frequency drives) shall be provided with a heavy duty industrial type power factor correction capacitor selected, recommended and furnished by the motor manufacturer to raise the motor power factor to approximately 95 percent. For non-explosion-proof motors, the capacitor shall be mounted on the equipment base plate adjacent to the motor and shall be connected to the motor junction box with liquid tight flexible conduit. For explosion-proof motors, the capacitors shall be wall mounted in a non-hazardous area.

2. Capacitors shall be dry film or liquid insulated and shall be hermetically sealed in steel enclosures.

3. Each capacitor unit shall be furnished with three high interrupting capacity current limiting fuses. Fuses shall be equipped with "blown-fuse" indicators.

4. Capacitor enclosures shall be suitable for conduit connection. Covers shall be gasketed, bolt-on type.

5. Capacitors shall be UL listed.

6. Capacitors shall be by General Electric Co.; Square D Co.; or equal.

2.10 DIRECTION

A. In general, the motors are to be bi-directional. If the fan must be uni-directional, it will be the motor manufacturer's responsibility to obtain the direction required from the drive manufacturer.

2.11 NOISE LEVEL

A. The motor shall comply in sound level to the Walsh-Healy Public Contracts Act minimum listing for continuous operation.

2.12 VFD DRIVEN MOTORS

A. Motors for the Influent and Effluent pumps shall be capable of operating at 110% speed (66 Hz) continuously.

2.14 GUARDS

A. Exposed moving parts shall be provided with guards in accordance with the requirements of OSHA. Guards shall be fabricated of flattened expanded metal screen, 3/4-inch No. 10, to provide visual inspection of moving parts without removal of the guard.

B. Guards shall be galvanized after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts. Windows shall be provided in the guard for access to the lubricating fittings.

2.15 NAMEPLATES

A. Equipment nameplates shall be engraved or stamped on stainless steel and fastened to the equipment (except pipework) in an accessible location with oval head stainless steel screws or drive pins.

B. Nameplates shall as a minimum contain manufacturer's name and address; year of manufacture; serial number; speed (if applicable) and other applicable information as acceptable to the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

A. The Contractor shall receive, mount and wire each motor, and check rotation and provide connections necessary to provide a working electrical drive system. The drive shall be properly protected during construction.

END OF SECTION

SECTION 16170

METAL FRAMING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish and install metal framing, including channels, fittings, clamps, hardware, electrical accessories and brackets.

1.02 QUALITY ASSURANCE

A. NEMA ML 1 - Metal Framing.

PART 2: PRODUCTS

2.01 CHANNELS, FITTINGS, CLAMPS, ELECTRICAL ACCESSORIES AND BRACKETS

A. Stainless steel.

B. Fabricate threaded fasteners of 316 stainless steel.

2.02 SIZES

A. Provide channels fabricated from not less than 12-gauge sheet stainless steel, 1-5/8 inches wide and not less than 1-5/8 inches deep.

2.03 ACCEPTABLE MANUFACTURERS

A. B-LINE Systems, Inc.; Unistrut or approved equal.

PART 3: EXECUTION

3.01 APPLICATION

A. Use stainless steel hardware components for all applications.

B. Use stainless steel channels with all conduits.

3.02 SUPPORTS

A. Provide metal framing to support large or heavy wall-mounted equipment, wall-mounted raceways and ceiling-hung raceways.

3.03 ANCHOR BOLTS

A. Use 1/2-inch diameter by 3 inches long stainless steel expansion bolts to attach framing to

concrete.

B. Space bolts a maximum of 24 inches on center, with not less than two bolts per piece of framing.

END OF SECTION

SECTION 16191

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as shown on the Drawings and as specified herein.

1.02 EQUIPMENT LIST

A. This Section provides the requirements for miscellaneous equipment typically employed in a facility; however, not all components specified in this Section are necessarily utilized on this project.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified.

1.04 REFERENCE STANDARDS

A. Equipment enclosures shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. NEMA 12 enclosure shall be gasketed painted steel.

2. NEMA 4 enclosures shall be 316 stainless steel.

3. NEMA 4X enclosures shall be 316 stainless steel.

4. NEMA 7 enclosures shall be cast aluminum.

B. Disconnect Switches

1. Disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle.

2. Switches shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

C. Fused Disconnect Switches

1. Fused disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle.

2. Fuses shall be rejection type, 600 Volts, 200,000 A.I.C., dual element, time delay, Bussman Fusetron, Class RK-5 or equal.

3. Switches shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

D. Magnetic Motor Starters

1. Motor starters shall be 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Minimum size shall be NEMA size 1.

2. Two speed starters shall be for single or two winding motors as shown on the Drawings.

3. Each motor starter shall have a 120 Volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.

4. Overload relays shall be adjustable, ambient compensated and manually reset.

5. Control power transformers shall be sized for additional load where required. Transformer primaries and secondaries shall be equipped with time-delay fuses.

6. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.

7. Magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer or equal.

8. Provide Custom Wiring Diagrams.

9. IEC rated contactors shall not be used.

E. Combination Magnetic Motor Starters

1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Minimum size shall be NEMA size 1. Motor circuit protectors shall be molded case with

adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. Combination motor starters shall be fully rated for 22,000 Amps RMS symmetrical.

2. Two speed starters shall be for single or two winding motors as shown on the Drawings.

3. Each motor starter shall have a 120 Volt operating coil and control power transformer. Transformer primaries and secondaries shall be equipped with time-delay fuses. Three phase starters shall have three overload relays. One normally open and one normally closed auxiliary contact shall be provided as spares in addition to contacts shown on the Drawings.

4. Overload relays shall be adjustable, ambient compensated and manually reset.

5. Furnish built-in control stations and indicating lights where shown on the Drawings.

6. Combination magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

7. Provide Custom Wiring Diagrams.

8. IEC rated contactors shall not be used.

F. Control Stations

1. Control stations shall be heavy-duty type, with full size NEMA rated operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.

2. Control stations shall be Square D Class 9001, similar by Cutler-Hammer; General Electric Co., or equal.

3. Provide Custom Wiring Diagrams.

G. Lightning Arrester and Surge Capacitor

1. Lightning arrester shall be 650 Volt, 3 Phase, "Tranquell" type; General Electric Co., Catalog No. 9L15ECC001; Square D Co., No. J9200; Cutler-Hammer, Type MW, or equal.

2. Surge Capacitor shall be 650 Volt, 3 Phase, non-toxic liquid insulated, General Electric Co., Catalog No. 9L18BAB301; Square D Co.; Cutler-Hammer, or equal.

H. Wireway

1. NEMA 4X wireway shall be 316 stainless steel with gasketed screw covers and stainless steel screws.

I. Control Relays

1. Control relays shall be heavy duty machine tool type, with 10 Amp, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. General use relays shall be General Electric Co., Catalog No. CR120B; similar by Square D Co.; Allen-Bradley Co., or equal. Latching relays shall be General Electric Co., Catalog No. CR120BL; similar by Square D Co.; Allen-Bradley Co., or equal.

2. Time delay relays shall be pneumatic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as shown on the Drawings. Relays shall be Agastat Model 7012 or 7022; similar by Square D Co.; Cutler-Hammer, or equal.

J. Terminal Blocks

1. Terminal blocks shall be NEMA type rated at 20 amperes minimum, 600 Volt, channel mounted, with tubular screw and pressure plate.

2. Terminal blocks shall be Bulletin 1492 as manufactured by the Allen-Bradley Co.; ABB; Kukla, or equal.

K. Corrosion Inhibitors

1. All equipment enclosures, terminal boxes, etc, located in a corrosive or wet rated area (where shown on the Drawings) that contains electrical or electronic equipment or terminal strips shall be furnished with an internally mounted, chemically treated corrosion inhibitor pad.

2. The corrosion inhibitor pads shall be as manufactured by Hoffman Engineering Co.; 3M or equal.

L. Equipment Identification Nameplates

1. All field mounted electrical equipment such as disconnects, push button stations, etc., shall be provided with a weather resistant engraved laminoid equipment identification nameplate screwed or bolted adjacent to the device. Nameplate shall identify the mechanical equipment controlled exactly as shown on the electrical singleline drawings (i.e., P-95 Cooling Water Pump No. 1).

M. Equipment Mounting Stands

1. Equipment mounting stands shall be custom fabricated from 1/4-in aluminum plate and 3-1/4" x 1-5/8" Aluminum Double Strut mounting channel, Unistrut P-1001-EA or equal, or as shown on the Drawings.

N. Emergency Alarm Horn, Bell and Light

1. Emergency alarm horn shall be vibrating type for 120 Volts, 60 Hz and shall be Federal Signal Corp., Catalog No. 350+WB for surface mounting or equal.

2. Emergency alarm bell shall be vibrating type for 120 Volts, 60 Hz and shall be Federal Signal Corp., Catalog No. 506WB for surface mounting or equal.

3. Emergency alarm light shall be a double strobe unit suitable for hazardous locations, housed in a NEMA 4X enclosure, with red polycarbonate globe, for use on a 120 Volts, 60 Hz power supply, and shall be Federal Signal, Catalog No. 371 DST or equal.

O. Arc Flash Protection Warning Signs

1. Provide field-affixed arc flash warning labels on all switchboards, panelboards, industrial control panels, and motor control centers in accordance with National Electrical Code Article 110.16.

2. As a minimum, warning signs shall state "WARNING: Arc Flash and Shock Hazard, Appropriate PPE required", and shall be designed in accordance with ANSI Z535.4-1998. Where available from the equipment manufacturer, additional information including Flash Hazard boundary, incident energy, voltage shock hazard, PPE required, etc. shall be provided.

P. Intrinsically Safe Relays

1. Intrinsically safe relay shall be suitable for Class 1, Division 1/Division 2 applications rated for 120VAC. Intrinsically safe relays shall be Square D Co. catalog no. NY2 A21 or equal.

Q. Control Power Transformer

1. Transformer shall be class 9070, type T, manufactured by Square D Co. or equal.

2. Transformers shall be a minimum 100VA and if necessary, be increased to provide sufficient Volt-Ampere capacity for operating all electrical devices associated with the control of the motor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mounting Stands

1. Field mounted disconnects, pushbutton control stations, etc, shall be mounted on metal stands as shown on the Drawings. Where clearance requirements for stands may not be maintained, the Engineer may direct equipment to be wall-mounted adjacent to the drive, but in no case shall the distance from the drive motor to the control station exceed 3-ft.

2. All outdoor control panels shall be mounted north facing with sunshield projecting out from the top and sides to ensure that no equipment will be in direct sunlight.

3. LED, LCD and all other displays shall be provided with screening for ease of viewing.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all panelboards as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Refer to Section 16000 for submittals

1.03 REFERENCE STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 MANUFACTURERS

A. 120/208V, 3 phase, 4 wire panelboards shall be Type Pow-R-Line C as manufactured by Westinghouse Electric Co., Sentron as manufactured by Siemens; Type NQOD as manufactured by Square D Co., or equal.

B. 277/480V, 3 phase, 4 wire panelboards shall be Sentron as manufactured by Type Pow-R-Line C as manufactured by Westinghouse Co., Siemens; Type NEHB as manufactured by Square D Co., or equal.

C. 120/240V, single phase, 3 wire panelboards.

D. NEMA 3, 4 and 12 panelboards shall be type DVP or DHP as required by voltage application; manufactured by the Crouse-Hinds Company, or equal.

PART 2: PRODUCTS

2.01 GENERAL

A. Rating

1. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

2. Circuit breaker panelboards shall be fully rated for the specified circuit breaker fault current interrupting capacity. Series connected short circuit ratings will not be acceptable.

3. Panelboards shall be UL listed.

2.02 MATERIALS (NEMA 1)

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A nameplate shall be provided listing manufacturer's name, panel type and rating.

B. Buses

1. Bus bars for the mains shall be of tin plated copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be tin plated copper.

2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

4. Equipment ground bars shall be furnished.

C. Boxes

1. Recessed or flush mounted boxes shall be made from galvanized code gauge steel having multiple knockouts, unless otherwise noted. Boxes shall be of sufficient size to provide a minimum gutter space of 4-in on all sides.

2. Surface mounted boxes and trims shall have an internal and external finish as hereinafter specified in Paragraph 2.02 D.4 below. Surface mounted boxes shall be field punched for conduit entrances.

3. At least 4 studs for mounting the panelboard interior shall be furnished.

D. Trim

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48-in in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Furnish two keys for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

3. The trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4-in all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

2.03 MATERIALS (NEMA 3, 4 and 12)

A. Interiors and Buses

1. Interiors and buses shall be as hereinbefore specified for NEMA 1 construction.

B. Boxes and Covers

1. Boxes and covers shall be made from stainless steel with natural finish.

2. Boxes and covers shall be bolted together and gasketed.

3. Conduit openings shall be tapped.

C. For panelboards mounted outdoors or in corrosive areas as indicated on the drawings, the enclosure shall be NEMA 4X 316 stainless steel.

2.04 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-in type.

C. Each circuit breaker used in 120/208 V panelboards shall have an interrupting capacity of not less than 22,000 amperes, RMS symmetrical.

D. Each circuit breaker used in 277/480 V and 480 V panelboards shall have an interrupting capacity of not less than 25,000 amperes RMS symmetrical.

E. Each circuit breaker used in 120/240V panelboards shall have interrupting capacity indicated on drawings.

F. GFCI (ground fault circuit interrupter) shall be provided for circuits where shown on the Drawings. GFCI units shall be 1 pole, 120 volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be UL listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time) and an interrupting capacity of 10,000 amperes RMS.

G. Circuit breakers shall be as manufactured by the panelboard manufacturer.

H. Circuit breakers shall be able to be locked in the OFF position.

PART 3: EXECUTION

3.01 INSTALLATION

A. Mount boxes for surface mounted panelboards so there is at least 1/2-in air space between the box and the wall.

B. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

C. Type circuit directories giving location and nature of load served. Install circuit directories in each panelboard.

D. Install markers on the front cover of all panelboards which identify the voltage rating. Markers shall be made of self sticking B-500 vinyl cloth printed with black characters on an Alert Orange background, 2-1/4-in high by 9-in wide, Style A as manufactured by W.H. Brady Co. or equal.

E. Install a 1-in by 3-in laminated plastic nameplate with 1/4-in white letters on a black background on each panelboard. Nameplate lettering shall be as shown on the Drawings. Nameplates shall be stainless steel screw mounted.

END OF SECTION

SECTION 16471

PANELBOARD MODIFICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish labor, materials, equipment and incidentals required to remove and install new circuit breakers in existing panelboards as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data as follows:

1. Product data sheets and catalog numbers for overcurrent protective devices. List all options, trip adjustments, and accessories furnished specifically for this project.

1.03 REFERENCE STANDARDS

A. Circuit breakers shall be designed, built, and tested in accordance with the Underwriter Laboratories, Inc. UL489 and shall be so labeled. Installation shall comply with NEMA Standard for Panelboards and the National Electrical Code.

1.04 QUALITY ASSURANCE

A. Where possible, circuit breakers shall be the product of the manufacturer of the original panelboard in which they are installed.

PART 2 PRODUCTS

2.01 GENERAL

A. Rating

1. Circuit breaker short circuit ratings shall be not be less than minimum rated device in the panel. The overall short circuit rating of the existing panel shall be maintained. Circuit breakers shall be rated for the required utilization voltage.

2. The integrity of series rated panels shall be maintained. Series combinations shall be UL listed.

2.02 CIRCUIT BREAKERS

A. Circuit breakers shall be a product of the manufacturer of the original circuit breakers in the panelboard, or shall be a UL listed replacement product.

B. Circuit breakers shall be molded case, bolt-in or plug-on type as required. Contractor shall verify the proper type.

C. Each circuit breaker used in 120/240 Volt and 120/208 Volt panelboards shall have an interrupting capacity of not less than 10,000 amperes, RMS symmetrical. Contractor shall verify the required short circuit interrupting rating and supply the correct breaker for the application.

D. Each circuit breaker used in 277/480 Volt and 480 Volt panelboards shall have an interrupting capacity of not less than 22,000 amperes RMS symmetrical. Contractor shall verify the required short circuit interrupting rating and supply the correct breaker for the application.

E. GFCI (ground fault circuit interrupter) shall be provided for circuits where shown on the Drawings. GFCI units shall be 1 pole, 120 volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be UL listed, Class A, Group I device (5 milliamp sensitivity, 25 millisecond trip time) and a minimum interrupting capacity of 10,000 amperes RMS. Contractor shall verify the required short circuit interrupting rating and supply the correct breaker for the application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install circuit breakers in accordance with manufacturer's instructions.

B. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

C. Install new circuit directory cards in each panelboard. New directories shall be heavy card stock with machine printed text. Verify all existing circuits and update circuit directories giving location and description of every load served by the panel.

END OF SECTION

SECTION 16480

480 VOLT MOTOR CONTROL CENTERS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to provide, and make ready for operation, Motor Control Centers (MCCs) as specified herein.

B. Variable frequency drives shall be factory installed by the motor control center manufacturer as shown on the Drawings.

C. Motor control centers shall be sized to include all equipment, spares and spaces shown on the Drawings.

1.02 RELATED WORK

A. Concrete for equipment pad is included in Division 3.

B. Motor Starters are specified in Section 16191.

C. Variable Frequency Drive Controllers are specified in Section 16482.

1.03 SUBMITTALS

A. Submit shop drawings and product data, in accordance with Section 01300, as follows:

1. Equipment outline drawings showing elevation and plan views, dimensions, weight, shipping splits and metering layouts. Indicate all options, special features, ratings and deviations from the Specifications.

2. Conduit entrance drawings.

3. Unit summary tables showing detailed equipment description and nameplate data for each compartment.

4. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. List all options, trip adjustments and accessories furnished specifically for this Project. Submit information on VFD's supplied with motor control centers in accordance with Section 16482.

5. Provide wiring diagrams including all interwiring and interlocking between units and to remotely mounted devices. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Contract Drawings. Copies of the Engineer's schematic drawings will not be acceptable. Provide all drawings from the original MCC manufacturer's engineering department. Drawings from an

independent panel shop doing part of the work is not acceptable.

6. Instruction and renewal parts books.

7. Itemized list of spare parts furnished specifically for this Project, including quantities, description and part numbers.

1.04 REFERENCE STANDARDS

A. The manufacturer of the MCC shall also manufacture all major components and subsystems contained therein (e.g., circuit breakers, etc.)

B. The motor control center shall be designed, constructed, and tested in accordance with the latest applicable requirements of NEMA, ANSI, UL, and NEC standards including, but not limited to:

ANSI 68.1	NEMA AB-1
NFPA70	UL 508
ANSI 255.1	NEMA ICS-1
UL98	UL 845
NEMA ICS-2	UL 489

C. All starters and contactors shall be rated and designated in accordance with NEMA standards. Starters and contactors rated in amperes without manufacturers published data indicating the corresponding NEMA sizes will not be acceptable. Cross reference data shall include details of the manufacturers compliance with NEMA standards, test methods, and results of those test for all non-NEMA contactors and starters. International (IEC) starters will not be acceptable.

D. For specific requirements on the motor control center, refer to the one line diagrams and motor control center data sheets.

1.05 QUALITY ASSURANCE

A. The following minimum tests and checks shall be made before energizing the MCC's. These tests shall be performed by a Factory Trained Field Technician specializing in power distribution equipment installation and repair.

1. Thoroughly inspect motor control center for items such as loose connections and presence of foreign material, and remedy prior to energizing.

2. Check all mechanical interlocks for proper operation.

3. Calibrate protective relays according to settings provided by MCC supplier and verify proper operation.

4. Megger terminals and buses for grounds after disconnecting devices sensitive to megger voltage.

5. Verify continuity of ground bus throughout motor control center.

6. Verify heater circuits are operational.

7. Verify ratios of all CTs, and proper operation of all metering.

8. Submit documentation of all tests outlined above to City personnel for review and acceptance. Additionally, include all data in operation and maintenance manuals.

B. Manufacturer shall determine protective device settings coordinated to the up stream breaker.

1.06 OPERATION AND MAINTENANCE MANUALS

A. Furnish six copies of manuals including the following information on each component used after installation is complete:

1. Installation and operation manual.

2. Renewal parts bulletin.

3. Component description, rating, catalog number, etc.

4. Vendor drawings.

5. As built drawings with terminal number, etc.

6. Test data.

7. Protective relay settings coordinated to upstream feeder device (furnished by Motor Control Center Supplier).

1.07 MANUFACTURERS

A. MCC's shall be as manufactured by Cutler Hammer WH, Siemens Model 95, Square D, GE or equal.

B. The MCC shall be completed in the original equipment manufacturer' s factory. Shipping an incomplete MCC to an independent panel shop for the addition of any component or wiring prior to shipping to the job site is prohibited. MCCs manufactured in such a manner will not be accepted.

1.08 WARRANTY

A. Manufacturer shall provide a one year warranty from the time manufacturer's start-up services are completed or 18 months from date of shipment whichever is later. Warranty shall include all parts and labor to troubleshoot and replace failed devices.

1.09 TOOLS AND SPARE PARTS

A. Furnish the following spare parts with the equipment for each motor control center in conformance with the specifications:

1. One set (minimum 3) of fuses for each type and size used.

2. One set of starter contacts for every three starters used (minimum of 1 for each size used). If contacts are not replaceable a spare starter for each size used shall be supplied.

3. Two contactor coils for every three starters of each NEMA size installed (minimum of one coil per size).

4. 10% spare control relays for each type used (minimum of two).

5. 10% spare pushbuttons, selector switches, indication light assemblies for each type used (minimum of two).

6. 25% pilot lights for each type used (minimum of 12).

7. 25% spare lenses for each type and color used (minimum of 6).

8. One set of overload heaters for each size and type used.

9. Spare parts for VFD' s as specified in Section 16482.

PART 2: PRODUCTS

2.01 GENERAL

A. For additional construction notes and special requirements, refer to the MCC drawings.

2.02 CONSTRUCTION

A. Structure

1. Each MCC shall consist of the specified number of vertical sections bolted together to form a rigid, self supporting freestanding assembly. All MCCs shall be manufactured with NEMA 12 rated enclosures. Vertical sections shall be mounted on steel channel sills provided by contractor. The structure shall be not more than 90 inches nominal height, and be fabricated of formed steel of not less than 14 gauge thickness. It shall be furnished with removal lifting facilities as well as base construction designed for rolling or skidding.

2. Front mounted (dead front) units, where specified, shall not require rear access and shall be suitable for back-to-back or back to wall mounting. All wiring, bus joints, and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.

3. Each vertical section shall be divided into no more than six compartments which shall contain a feeder breaker, combination motor control unit, or other control assemblies connected to a common vertical power bus.

4. Vertical sections shall contain horizontal wire ways at top and bottom of the structure. The design shall be such to permit a continuous wiring trough from end to end of the entire width of the motor control center. End vertical sections shall have cover plates, which can be easily removed to allow continuation of wire ways and horizontal bus extensions for future addition of vertical sections.

5. The vertical section shall also have a continuous vertical raceway extending the full height of the structure and shall intersect with the horizontal raceways. This wire way shall be completely barriered from the bus compartments, the controller compartment, and the adjacent vertical units, and shall have its own separate hinged door or bolted cover.

6. Holes or slots provided in wire ways or other metal members for routing of wires shall be provided with bushings or grommets to avoid damage to the wiring insulation.

7. Combination motor control units (size 5 and smaller), as well as other electrical assemblies, including feeder tap units (225 amp and smaller), shall be provided with appropriately rated stab assemblies for draw out (plug-in) type construction.

8. Plug in provisions shall include a positive guide rail system and stab shrouds to insure alignment of stabs with the vertical bus. The stab shall be designed to increase bus contact pressure during a fault. The stab design shall assure a consistent low-resistance contact with the vertical bus, even after repeated insertions and removals. The unit shall be equipped with a latching mechanism to lock the drawer in an extended or stabbed position for maintenance and testing. Each draw out compartment is to have a separate hinged door.

9. Each unit compartment shall be provided with an individual front hinged door. Motor control and feeder units shall be interlocked mechanically with a unit disconnect device to prevent unintentional opening of the door while unit is energized. Provide an interlock between the unit disconnect and the structure shall prevent the removal or reinsertion of the unit when the unit is in the "OFF" position. Means shall be provided for releasing the interlock for intentional access and/or application of power. Pad locking arrangements shall permit locking the disconnect device in the "OFF" position.

10. The MCC shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit. Minimize shipping splits if required.

11. All painted steel work shall be treated with a primer coat and a finish coat, or bonderized and finished with a coat of baked enamel at the factory, such that no field painting will be required except for "touching up" of damaged areas. Color shall be manufacturers standard.

12. Furnish documentation with the equipment as follows: Compartments containing panel boards shall have a cardholder on the inside of the door with the branch circuits clearly identified. Compartments containing motor starters shall each have an overload heater section table posted inside the door. All control compartments shall

have a pocket on the inside of the door with a copy of the appropriate schematic and wiring diagram.

13. Provide screw on type engraved laminated nameplates as follows: Main equipment nameplate shall be located at the top of the MCC near the main breaker compartment. Individual compartment nameplates screwed to their respective doors. Control device nameplates for all devices screwed on near the vicinity of each device as approved by the Engineer. A manufacturer's plaque shall be attached to the MCC giving model number, bus amps, voltage, maintenance reference documents, and other applicable information.

B. Buses

1. All vertical and horizontal power buses shall be tin plated copper. The main horizontal bus shall extend the entire length of the motor control center. The main bus bars shall be rated as shown on the drawings and/or data sheets, but shall not be less than 600 amperes.

2. Each vertical draw out section shall have a full height vertical tin plated copper bus rated as specified, but not less than 300 amperes. Each vertical bus shall be of uniform cross sectional area from top to bottom. Tapered bus shall not be acceptable. The bus support system shall be high dielectric strength, low moisture absorbing high impact material.

3. A continuous tin plated copper ground bus shall be furnished for the entire length of the MCC. Provide ground bolted connectors for 2/0 AWG wire at each end of the bus.

4. Bus bracing shall be 65,000 amperes RMS, symmetrical unless otherwise indicated on the Contract Drawings.

5. All buses, except ground buses, shall be completely concealed by steel plates or insulating material. Cutouts shall be provided in the vertical isolation barriers for stab connections to vertical bus. Unused cutouts shall be covered.

6. All bolted bus mating surfaces shall be tin plated copper.

C. Wiring

1. Unless otherwise stated in the data sheets, the motor control center shall be wired Class II, type B construction with master terminal blocks for each cubicle.

2. Each MCC shall be completely wired at the factory or a satellite factory that is completely under the control and responsibility of the original MCC manufacturer. All drawings shall be from the MCC manufacturer. The MCC shall be shipped totally complete from the Factory. The completed MCC shall bear a UL label from the original MCC manufacturer. The Contractor is prohibited from purchasing the MCC without it being complete including all control wiring and sending it to an independent panel shop for completion.

2. All wiring shall be stranded copper not smaller than #14.

3. All control wiring to draw out units shall be run through split type terminal blocks (draw out) which can be split to allow easy unit removal. Motor "T" leads shall bolt directly to starter or overloads and shall not be split type.

4. All wiring shall be neatly bundled with ty-raps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

5. One spare normally open and one normally closed contact on all relays, selector switches, push buttons, "m" contact, alarm points, etc. shall be wired to terminal blocks.

6. Where "shipping splits" are required between the control compartments and the starter cubicles, interconnecting jumper wires shall be provided for field re-connection.

D. Identification

1. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the MCC Single Line Drawing and/or as approved by the Engineer. For devices not shown on the single line drawing such as time delay relays, the names will be as shown on the Control Schematic Drawings and/or as assigned by the Engineer.

2. All wiring shall be tagged and coded with an identification number as shown on drawings. Coding will be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS, or equal.

3. All terminal blocks shall be identified by a system approved by the Engineer.

E. Main Section

1. The MCC main sections shall include the main breaker, metering and power feeder entrance to the MCC. Provide bus extensions and compression lugs for number and size of incoming cables as shown on the Drawings.

F. Main Circuit Protective Device

1. Main circuit breakers shall be insulated case (encased), 3-pole, 600-volt, 100 percent rated, stationary type, manually operated with stored energy closing Mechanism, Cutler Hammer, Siemens Type SB, Square D, or equal. Trip devices shall be solid state with adjustable long-time pickup, delay and timing light, adjustable short-time pickup and delay, short-time i^2t switch, adjustable high range instantaneous, adjustable ground fault pickup and delay, overload, short circuit and ground fault indicator lights, ground fault delay and pickup trips for selective tripping.

2.03 COMPONENTS

A. Provide three valve type lightning arresters in each incoming line where required by drawings or data sheets.

B. On incoming line circuit breakers of 1000 amps or more, provide ground fault protection (relay) complete with CT's and local indication that a ground fault has occurred (or solid state breaker trip unit with indication). As a minimum the breaker shall have the following:

1. Independently adjustable long time pick-up and delay.

2. Independently adjustable short time pick-up and delay with i^2t in and out switch.

3. Adjustable instantaneous.

4. Independently adjustable ground fault pick-up and delay.

5. Trip mode targets for over load, short circuit and ground fault.

6. Long time pick-up light.

C. Unless otherwise noted on drawings, provide a microprocessor based solid state power metering device for each incoming line with the following minimum features:

1. Volts and amps each phase

2. Power reading in KW

3. Consumption in KWH

4. Power factor

5. Frequency

6. Vars

7. RS232 or RS485 remote communication capability.

8. Monitor shall be field configurable by jumpers, dip switches, etc.

9. Phase loss, phase unbalance, phase reversal.

10. Over voltage and under voltage.

11. Protective device is to have field adjustable trip levels and time delays for phase unbalance, over voltage and under voltage conditions. It shall be wired to trip the incoming breaker unless otherwise noted. Phase loss and phase reversal shall trip the breaker immediately. Provide spare set of auxiliary contacts for interlocking and remote alarm. Protective relays shall have a device to identify cause for trip. Device must indicate even if power is lost. Protective features may be built into power

monitor unit.

D. Furnish lugs for incoming line feeders, sizes as specified on related data sheets. Allow adequate clearance for bending and terminating of cable type specified.

E. All motor starters shall be combination units, full voltage non-reversing (FVNR), with adjustable instantaneous trip magnetic only circuit breakers, unless otherwise specified on drawings or data sheets. NEMA starter sizes and breaker trip ratings shall be as required for the horsepower indicated, but shall be in no case less than NEMA Size 1. International (IEC) starters shall not be acceptable.

F. Each motor starter shall have a 120 volt operating coil (unless otherwise noted).

G. If full voltage non-reversing (FVNR) starters are specified, NEMA Size 5 and smaller shall be draw out design with stab-on connectors engaging the vertical buses. Larger units shall be of fixed (bolt-in) design.

H. Overload relays shall be standard class 20, ambient compensated, manually reset by pushbutton located on front of the compartment door. A normally closed contact shall be directly used in the start circuit and a normally open contact shall be wire to a terminal board for overload alarm.

I. Control power transformers shall be 120 volt grounded secondary. One leg of the secondary transformer shall be solidly grounded while the other leg shall be equipped with a slow acting fuse. The transformer shall be oversized for auxiliary loads as indicated on drawings, but in no case be smaller than 100 VA. Primary side of the transformer shall be fused.

J. Provide the pilot devices as shown on the electrical drawings on the front of the MCC, for each motor starter.

K. Reduced Voltage Starters

1. Solid state type with six (6) input SCR and adjustable current limit start from 50-600% of full load current. Solid state starter shall be capable of extended starting durations of up to eight (8) minutes. Starter shall incorporate the use of MOV protection integral to the controller for transient over voltage protection.

2. Each starter shall have a circuit breaker disconnecting means, overload relay, green "off" pilot light, red "on" pilot light, start pushbutton, stop pushbutton, brake pushbutton, and a local-off-auto selector switch.

3. Soft starter shall have the following starter mode options. Starter mode shall be dip switch selectable in the field and shall not require special tools or devices.

   a. Voltage ramp: Application of voltage over an adjustable (0-60 second) ramp time.

   b. Voltage ramp with impulse: Initial application of impulse voltage to provide breakaway torque followed by voltage ramp. Impulse magnitude, impulse duration, and voltage ramp duration shall all be adjustable.

c. Limited voltage (current limit): Adjustable percent of line voltage applied for adjustable time period.

d. Emergency start: Allows motor to start with pair of input SCR' s shorted.

e. Hold ramp modes: Holds voltage magnitude when a control voltage is activated to the starter.

4. Run modes shall include full voltage operation to reduce harmonics or energy savings mode to reduce power consumption and improve power factor of lightly loaded motors.

5. Stop modes shall include cost to stop based on load and inertia and soft stop to ramp motor speed down over an adjustable ramp time.

6. Soft start unit shall be incorporated into the motor control center. Starter start, run, stop, and other operating modes shall be stored in non-volatile EEPROM

7. Starter protective features shall include line overload, load loss, overhauling load, shorted SCR, phase reversal, under/over voltage, and phase loss.

8. Provide tracking and testing of the solid state soft starter per Section 16000.

9. Solid state soft starter shall be Siemens Model 3RW2 or equal.

L. Thermal Magnetic Circuit Breakers

1. All branch feeder or main/tie circuit breakers shall be of the thermal magnetic trip type.

2. Circuit breakers shall be installed in draw out buckets, molded case, 600 volt. All circuit breakers with 225 ampere frames and larger shall have interchangeable trips units. Breakers shall have fixed thermal and adjustable magnetic trips.

3. Furnish lugs for terminating cable to starters and circuit breakers, sizes as specified on drawings and related data sheets. Allow adequate clearance for bending and terminating of cable type specified.

4. Circuit breakers shall be able to be locked in the OFF position.

M. Miscellaneous Accessories

1. Transformers and transducers.

a. Instrumentation transformers: Indoor, 600-volt, butyl rubber molded, metering class designed in accordance with ANSI and NEMA standards. Window type current transformers, with burden capacity as low as 50 VA, may be used where such capacity is sufficient. Current transformer accuracy ratings shall be at least equal to NEMA standard requirements for the particular application.

b. Instrument transducers: Inputs matched to the corresponding metering circuit, 4-20 ma DC output, 0.5 percent accuracy, as manufactured by Rochester Instrument Systems or equal.

N. Motor Protection Relay

1. Provide a Multilin 369 motor protection relay with RTD and metering options for all motors 150 HP and up.

2. The motor protection relay shall be provided for constant speed and variable speed motors.

3. Provide a mod bus plus communications port to communicate with a Modicon QuantumPLL.

4. Pilot Devices

a. Control operators: Heavy duty, full size, oiltight, with NEMA A600 contact rating. Types and quantities as shown on the Drawings, or integral with protective relay.

b. Indicator lights: Full size, oiltight, low voltage, with push-to-test feature. Colors and quantities as shown on the Drawings, or integral with protective relay.

5. Control relays and timers: Heavy duty machine tool type, with 10 ampere, 600 volt convertible contacts, General Electric Co. CR120 Series; Square D Type X or equal. Provide Spare N.O. & N.C. contacts. Provide pneumatic timing or latching attachments as required by the control schemes shown on the Drawings.

6. Control relays and timers: 300 volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 amperes resistive, 1/4 HP, at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Provide spare N.O. & N.C. contacts. Relays shall be Porter & Brumfield KRP Series or equal with neon coil indicator light. Timers shall be Agastat SCC Series or equal, with calibrated timing knob.

O. Variable frequency drives mounted in motor control centers are specified in Section 16482.

PART 3: EXECUTION

3.01 SHOP TESTING

A. The Motor Control Center shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer's routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. The operational test shall include the proper connection of supply and control voltage and, as far as practical, a mockup of simulated control signals and control devices shall be fed into the

boards to check for proper operation.

C. Factory test equipment and test methods shall conform with the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards, and shall be subject to the Engineer's approval.

3.02 STORAGE AND HANDLING

A. The Contractor, and hence the MCC supplier, shall be responsible for safety of the MCC during storage, transporting and handling.

B. At all times the MCC shall be housed inside a moisture free weatherproof housing.

C. The MCC shall have weatherproof non-porous extra heavy duty plastic covers at all times, until it is ready for test and start-up.

D. Interior and exterior of the motor control centers shall be kept clean at all times.

E. Space heaters within the MCC shall be energized during storage and installation.

3.03 FIELD INSTALLATION

A. Field installed wiring to MCC shall be neatly bundled with ty-raps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

B. All field wiring shall be tagged and coded with an identification number. Coding will be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS, or equal.

C. Field testing and training shall comply with Section 16000 and as specified in Part 1 herein.

3.04 EQUIPMENT PROTECTION AND RESTORATION

A. Clean and vacuum interior of the equipment.

B. Touch-up and restore damaged surfaces to factory finish.

C. After all connections have been made, the Contractor shall spray all terminals, terminal blocks, starters (with contacts closed) with a moisture repelling chemical such as provided by CMC or Dow Chemical Corporation or approved equal.

D. Notify the Engineer 24 hours prior to the spraying of each motor control center. If no such notification is made it will be presumed that moisture proofing has not been accomplished.

E. Remove all current transformer shunts after completing secondary circuit.

F. Install overload relay heaters based on actual motor nameplate current. Set overload relay settings at maximum values permitted by the NEC 430-32.

G. Verify proper phase rotation of all loads.

H. Set overcurrent device trip settings at the levels recommended in the coordination study performed per Section 16000. Confirm and record all device trip settings.

END OF SECTION

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SECTION 16482

VARIABLE FREQUENCY DRIVE CONTROLLERS (PWM)

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Provide labor, equipment, supervision and materials for the installation, testing and start-up of the variable frequency drives (VFD) as shown on the Drawings and as specified herein.

B. Provide a factory trained technician to start-up each VFD. The technician shall be present during the field acceptance testing. Start-up service shall include overtime charges, travel and living expenses and replacement parts.

C. Provide on-site instructions on VFD operation for the Owner's personnel as listed in Section 16000.

D. The VFD manufacturer shall verify in writing that he has coordinated the VFD with the motor being furnished, and the VFD is suitable for the system.

E. The VFD's shall be mounted in the motor control center or free standing enclosure as shown.

F. Provide clean power, 18 pulse VFD's for motors 150HP and above. See drawings and/or other specifications for VFD requirements for smaller motors.

G. The VFD manufacturer shall review each installation and shall provide inductor filters on the output, as required, to mitigate the reflected wave associated with the installation.

1.02 RELATED WORK

A. Instrumentation work is included in Division 13.

B. Motors 200 HP and below are specified in Section 16150.

C. Large Electric Motors (over 200 HP) are specified in Blue Book.

1.03 SUBMITTALS

A. Submit shop drawings and product data, in accordance with Section 01300, as follows:

1. Equipment outline drawings showing elevation, plan and interior views, front panel arrangement, dimensions, weight, shipping splits, conduit entrances and anchor bolt pattern. Indicate all options, special features, ratings and deviations from the specifications.

2. Power and control schematics including external connections. Show wire and terminal numbers and color coding.

3. Drive performance specifications. Include specifics on harmonics, the number of pulses for electrical design, efficiency, power factor, etc.

   a. Certification that system operation conforms to IEEE Standard 519-1992 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

b. Provide a harmonic analysis showing that the drives meet IEEE Standard 519-1992.

c. The point of common coupling shall be the Owner's switchboard bus as shown on the one line diagram.

d. The voltage harmonic distortion at the point of common coupling shall not exceed 5% as indicated in Table 10.2 of IEEE Std. 519-1992 for General Distribution System.

e. The current harmonic distortion at the point of common coupling shall not exceed the limits in Table 10.3 of IEEE Std. 519-1992.

f. The harmonic analysis and torsional analysis shall include all voltage and current harmonics to the 99th.

g. Compliance shall be verified with onsite field measurements of both the voltage and current harmonic distortion at the defined point of common coupling with and without the VFD's operating.

4. Instruction and replacement parts books.

5. As-built final drawings.

6. Field test and inspection report.

1.04 REFERENCE STANDARDS

A. IEEE Standard 519 (latest revision) - "Guide for Harmonic Control and Reactive Compensation of Static Power Converters."

B. National Electrical Code (NFPA 70) latest edition.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Variable frequency drives shall utilize a field proven design. The VFD manufacturer shall demonstrate at least three years of continuous field operating experience with equipment of similar size and design.

B. A factory authorized service and parts organization shall be located within 400 miles of the project location. Provide the name and address of the factory authorized service and parts organization nearest to the project location at the time of the bid.

C. Equipment shall be UL or ETL labeled.

1.06 SYSTEM DESCRIPTION

A. Refer to the driven equipment specifications for description of system operation.

B. Refer to the Instrument Loop Diagrams in Division 13 of the Specifications and the control schematic diagrams on the Electrical Drawings for control system operation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Package the equipment for maximum protection during delivery and storage.

B. Store the equipment indoors in a clean, dry, heated storage facility until ready for installation. Do not install the equipment in its final location until the facilities are permanently weather tight. Furnish, install and wire temporary electric space heaters in the equipment until the permanent heating equipment is operational. Protect the equipment at all times from exposure to moisture, chemicals, hydrogen sulfide and chlorine gas.

C. If required in the driven equipment specifications, the VFD manufacturer shall ship equipment to the driven equipment manufacturer's testing facility for use during the factory acceptance test.

1.08 PROJECT/SITE REQUIREMENTS

A. Under normal operating conditions, harmonic currents introduced into the power system supply network from the variable frequency drives shall not exceed the distortion limits for a general system as defined in IEEE Standard 519, latest edition.

B. The VFD shall not produce motor noise in excess of the manufacturers published noise standards for 60-Hz operation.

1.09 SPARE PARTS

A. Provide the following spare parts for each size drive in the quantities specified:

1. One of each type printed circuit board.

2. Two power diodes.

3. One pair power transistors.

4. 50 percent replacement fuses, all types and sizes.

B. Spare parts shall be boxed or packaged for long term storage. Identify each item with manufacturers name, description and part number on the exterior of the package.

1.10 QUALIFICATION

A. The VFD supplier shall furnish with their bid on this project a statement verifying that they will furnish a system for this project which will meet the specified requirements for harmonics and line notching.

1.11 OPERATING INSTRUCTION

A. After approval, during and after construction, operating manuals covering instruction and maintenance on each type of equipment shall be furnished in accordance with Section 16000.

B. The instructions shall be bound and shall provide at least the following as a minimum:

1. A comprehensive index.

2. A complete "as-built" set of approved shop drawings.

3. Detailed service, maintenance and operation instructions for each item supplied.

4. A table listing of the "as left" drive set up parameters and alarm and trip settings.

5. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

6. Complete parts list with stock numbers, including spare parts.

PART 2: PRODUCTS

2.01 RATING

A. Service Conditions

1. Input power: 460 VAC, plus 10 percent, minus 5 percent, 3 phase, 60 Hz.

2. Input frequency: 57 to 66 Hz.

3. Ambient temperature: 0 degrees C to 40 degrees C.

4. Elevation: Up to 3300 feet above mean sea level.
5. Relative humidity: Up to 90 percent non-condensing.

B. Minimum drive efficiency: 96 percent or better at 4/4 motor base speed and rated torque.

C. Displacement power factor: 95 percent or higher from the VFD input to the motor leads, including all of the required reactors and transformers.

D. Drive output: 100 percent rated current continuous, suitable for operation of the driven equipment over the required speed range without overloading. Drives shall be capable of a continuous overload up to 110 percent rated current for variable torque loads and 150 percent rated current for constant torque loads. Starting torque shall be matched to the load. For the plant influent and effluent pumps, the VFD shall be sized such that 100 per cent of the rated drive output equals 115 per cent of the motor's nameplate voltage at the service factor rating.

E. Voltage regulation: plus or minus 1 percent of rated value, no load to full load.

F. Output frequency drift: No more than plus or minus 0.5 percent from setpoint.

G. Drives shall withstand five cycle transient voltage dips of up to 30 percent of rated voltage without an undervoltage trip or fault shutdown, while operating a variable torque load.

2.02 CONSTRUCTION

A. General

1. Drives shall be installed as shown on the Drawings. All drives shall be the product of one manufacturer. Variable frequency drives shall be one of the following products.

a. Robicon Corporation

b. Cutler-Hammer

d. Allen Bradley

e. Square D

d. Approved equal

2. The VFDs shall utilize a digital eighteen pulse width modulated (PWM) design to convert the fixed AC input to a variable voltage, variable frequency AC output. Construction shall be modular, using plug-in type component mounting or keyed ribbon cable connections wherever possible to minimize downtime during repair.

3. The VFD operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10 percent total harmonic voltage distortion and commutation notches up to 36,500 volt microseconds, or when other VFD's are operating from the same bus. The drive shall include transient voltage suppression to allow reliable operation on a typical commercial power distribution system.

4. The VFD shall consist of a full-wave diode bridge converter to convert incoming fixed voltage/frequency to a fixed DC voltage. Provide a input line reactor or DC link choke smoothing reactor to limit fault throughput. The PWM strategy shall be of the space-vector type implemented through a microprocessor which generated a sinecoded output voltage.

5. The output shall be generated by power transistors which shall be controlled by six identical, optically isolated base driver circuits. The VFD shall have an output voltage regulator to maintain correct output Volt/Hertz despite incoming voltage variations. The VFD shall have a continuous output current rating equal to or greater than the motor full load nameplate current.

B. Features and Options

1. Each VFD shall have a molded case, circuit breaker type main power disconnect switch, with an external operating handle. The circuit breaker shall have a short circuit rating of 65,000 amperes RMS symmetrical (minimum), or larger if required as indicated on the drawings and shall be labeled in accordance with UL Standard 489.

2. Provide the following safety features:

a. Provision to padlock main disconnect handle in the OFF position.

b. Mechanical interlock to prevent opening motor control center door with disconnect in the ON position, or moving disconnect to the ON position while the unit door is open.

c. Barriers and warning signs on terminals that are energized with the power disconnect OFF.

C. Operator interface

1. Provide a door-mounted digital keypad/display, capable of controlling the drive and setting drive parameters. The digital display shall normally display:

a. Speed demand in percent

b. Output current in amperes

c. Frequency in Hertz

d. Control mode - manual or automatic

2. The digital keypad shall allow operators to enter exact numerical settings in English engineering units. A user menu shall be provided as a guide to parameter settings. Coded messages on keypad will not be acceptable. Parameters are to be factory set in EEPROM and resettable in the field. Parameters shall be password protected. The EEPROM stored variables shall be transferable to new and spare boards.

3. The keypad/display module shall be password protected to control operation of the keypad. The key shall be removable in either the "Enabled" or "Disabled" positions. The keypad module shall contain a "self-test" software program that can be activated to verify proper keypad operation. The keypad display shall contain a full alphanumeric character set.

4. The following controls and indicators shall be provided, either separately or as part of the keypad/display:

a. POWER ON, RUN AND FAULT indication.

b. FAULT RESET control.

c. MANUAL-AUTO control mode selector.

d. Manual START/STOP controls.

e. Manual speed adjust capability.

D. Auxiliary Contacts

1. Provide one set of Form C auxiliary dry contacts for remote indication of VFD running status.

2. Provide one set of Form C auxiliary dry contacts for remote indication of VFD fault.

E. Marking and Identification

1. Provide 1-in by 3-in, nominal, engraved lamicoid equipment nameplates on each VFD fastened with stainless steel screws or rivets. Nameplates shall be black with white core, 3/8-in high lettering.

2. Provide permanent warning signs as follows.

a. "Warning-Hazard of Electric Shock - Disconnect power before opening or working on this unit" on main power disconnect.

2.03 PROTECTIVE AND OPERATIONAL FEATURES

A. Make provisions for field adjustment of the following parameters through the keypad/display:

1. Current limit and boost.

2. Voltage (Volts/Hertz.)

3. Frequency (Minimum/Maximum)

4. Independently adjustable acceleration and deceleration rates.

5. Auto restart delay.

B. The VFD shall accept a remote dry contact closure to start and stop the drive(s) with the drive control system in the AUTO mode.

C. The VFD shall accept a 4-20 mA DC input signal for remote speed control. Input shall be isolated at the drive and active with the drive control system in the AUTO mode. Zero and span adjustability shall be provided.

D. Provide a 4-20 mA DC isolated output signal proportional to speed for remote speed indication.

E. Provide the following short circuit and input protective features.

1. High speed current limiting input fuses and input line reactors.

2. Solid state instantaneous overcurrent trip.

3. Undervoltage protection with automatic restart.

4. Ground fault protection.

F. Provide the following internal protective features.

1. Transient surge protection.

2. Transistor overcurrent protection.

3. Current limit.

4. DC bus fuse protection and discharge circuit.

5. DC bus overvoltage trip.

G. Provide the following output protective features.

1. Inverse time motor overload protection.

H. The VFD enclosure shall house all the control relays, etc. as shown on the Drawings.

I. The VFD shall be equipped to communicate via Modbus Plus protocol with a Modicon Quantum PLC.

2.04 DIAGNOSTIC AND FAULT CAPABILITY

A. The following conditions shall cause an orderly drive shutdown and lockout.

1. Incorrect phase sequence.

2. Blown input fuse or single phasing of supply.

3. Control power supply failure.

4. Instantaneous overcurrent.

5. Sustained overload.

6. Transistor overcurrent.

B. Provide complete built-in diagnostic and test capability to enable maintenance personnel to rapidly and accurately identify the cause of equipment failure.

2.05 SURFACE PREPARATION AND SHOP COATINGS

A. All non-current carrying metal parts of the equipment cabinet shall be cleaned of all weld spatter and other foreign material and given a heat cured, phosphatized chemical pre-treatment to inhibit rust.

B. Equipment shall be finish painted with one coat of manufacturers standard electrocoated, heat cured enamel.

C. Unpainted non-current carrying parts shall receive a protective zinc plating to prevent corrosion. Printed circuit boards shall be coated with a protective conformal epoxy. All device contacts shall be silver cadmium plated.

2.06 SHOP TESTING

A. Perform manufacturers standard production testing and inspection.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install the equipment in accordance with the manufacturer's instructions.

B. Remove temporary lifting angles, lugs and shipping braces. Touch-up damaged paint finishes.

3.02 FIELD TESTING

A. Make the following minimum test and checks before the manufacturer's representative is called in for testing and adjustment.

1. Verify that all connections are completed in accordance with shop drawings.

2. Verify supply voltage and phase sequence are correct.

3. Check mechanical interlocks for proper operation.

4. Test ground connections for continuity and resistance.

5. Check control circuit interlocking and continuity.

B. The manufacturers service technician shall perform start-up and adjustment of the drive(s).

C. In the event of an equipment fault, notify the Engineer immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the Contractor, the Engineer and the equipment manufacturers factory service technician. Repair or replace the equipment as directed by the Engineer.

D. After startup, the manufacturer/Contractor shall measure the harmonics generated at the defined point of common coupling.

E. Compliance shall be verified with onsite field measurements of both the voltage and current harmonic distortion at the defined point of common coupling with and without the VFD's operating.

F. If the harmonics are not within the limits specified, the manufacturer shall install all necessary filters required to meet these specifications, and retested to prove compliance.

3.03 ADJUSTMENT

A. Make all VFD internal adjustments and all adjustments necessary for manual and automatic operation of the entire system of driven equipment.

3.04 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

END OF SECTION

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SECTION 16484

MOTOR CONTROL CENTER MODIFICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Modify the existing motor control centers as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Motor Starters, Control Relays, Terminal Blocks, etc. are listed in Specification Section 16191.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data of the following:

1. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. List all options, trip adjustments and accessories furnished specifically for this Project.

2. Provide individual bucket elementary drawings showing internal wiring and interlocking with remotely-mounted devices. Show wire and terminal number.

1.04 REFERENCE STANDARDS

A. Motor control centers shall be modified and tested in accordance with the latest editions and revisions of NEMA Standard ICS-2 and Underwriters' Laboratories Standard No. UL-845. Equipment shall conform to ANSI C19.3 test standards and the requirements of the National Electric Code.

B. Circuit breakers shall be designed, built, and tested in accordance with the Underwriter Laboratories, Inc. UL489 and shall be so labeled. Installation shall comply with NEMA Standard for Panelboards and the National Electrical Code.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Where possible, new circuit breakers, fused switches and motor starters shall be the product of the original manufacturer of the motor control center in which they are being installed.

B. Modifications shall maintain UL listing of the equipment.

C. Modifications shall be made by a Contractor specializing in this type of work. Qualifications and experience on past similar projects shall be submitted for approval.

PART 2 PRODUCTS

2.01 GENERAL

A. New or replacement starter units shall be furnished complete with new circuit breakers, control transformers, and overload relays. No existing parts shall be re-used unless noted otherwise.

B. Rewire the control circuits to provide the control schemes shown on the Drawings.

2.02 RATING

A. Rating

1. Component short circuit ratings shall be not be less than minimum rated device in the motor control center. The overall short circuit rating of the existing motor control center shall be maintained. Components shall be rated 600 volts.

2. The integrity of series rated devices shall be maintained. Series combinations shall be UL listed.

B. Motor starter units shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.

C. New devices installed in existing motor control centers shall be designed for continuous operation at rated current in a 50 degree C ambient temperature. Follow the manufacturers recommended clearances and ventilation practices to prevent overheating and to maintain UL listing.

2.03 CONSTRUCTION

A. Enclosure

1. Provide new sheet metal cubicles and doors to match existing equipment enclosure as required. New cubicles shall be supplied by the original equipment manufacturer where possible. Where existing units are obsolete, new cubicles may be supplied by a third-party vendor.

2. Provide individual, flange formed, pan type door with concealed hinges and quarter turn latches for each device compartment as required. Doors shall be removable. Door removal shall not be required to withdraw starter units or feeder tap devices.

B. Unit Compartments

1. Provide individual compartments for each removable combination starter and feeder tap device unit. Steel barriers shall isolate the top, bottom and sides of each compartment from adjacent units and wireways. Removable units shall connect to the vertical bus in each section with tin plated, self-aligning, pressure type copper plug connectors. Size 5 and larger starter units may be wired directly to the bus. Removable units shall be aligned in the structure on guide rails or shelves and secured with a cam latch mechanism or racking screw.

2. Provide individual, isolated compartments for fixed mounted devices such as circuit breakers, cable lugs, metering, relaying and control devices. Main and bus tie circuit breakers shall be wired directly to the main horizontal bus. All bus connections shall be fully rated.

3. Provide the following features:

   a. Provision to padlock removable units in a partially withdrawn TEST position, with the bus stabs disengaged.

   b. Provision to padlock unit disconnect handles in the OFF position with up to three padlocks.

   c. Mechanical interlock with bypass to prevent opening unit door with disconnect in the ON position, or moving disconnect to the ON position while the unit door is open.

   d. Mechanical split-type terminal blocks for disconnecting external control wiring.

   e. Auxiliary contact on unit disconnect to isolate control power when fed from an external source.

   f. Disconnect operating handles and control devices mounted on the removable units.

   g. Compartments containing motor starters shall have wiring diagrams and heater tables fastened to the compartment door. Compartments containing panelboards shall have circuit directories fastened to the compartment door.

C. Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation. Line side power wiring shall be sized for the full rating or frame size of the connected device.

2. Identification: Numbered sleeve type wire markers at each termination point, color coding per NEMA Standards and the NEC. Foreign voltage control wiring shall be yellow.

D. Nameplates

1. Provide 1-in by 3-in engraved nameplates for new units of two ply laminated plastic, black face, white core, screw fastened to each door with stainless steel screws. Equipment names shall be as shown on the single line diagrams.

2.04 COMPONENTS

A. General

1. The drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the NEMA size starter, circuit breaker trip ratings, control power transformers and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with the National Electrical Code and the manufacturer's heater selection tables. All variations necessary to accommodate the motors and controls as actually furnished shall be made at no additional cost to the Owner.

B. Branch Circuit Feeder Breakers (Non-motor loads)

1. Molded case circuit breakers: Thermal-magnetic trip type, 600 volt, 2 or 3 pole as required, labeled in accordance with UL Standard 489. Circuit breakers shall be fully rated to meet the specified equipment short circuit rating. Provide independently adjustable magnetic trips on 225A frame breakers and larger.

C. Pilot Devices

1. Control operators: Heavy duty, full size, oiltight, with NEMA A600 contact rating. Types and quantities as shown on the Drawings.

2. Indicator lights: Full size, oiltight, low voltage, with push-to-test feature. Colors and quantities as shown on the Drawings.

2.05 SURFACE PREPARATION AND SHOP COATINGS

A. New metal parts of the control center assembly shall be cleaned of all weld spatter and other foreign material and given a phosphatized chemical pre-treatment and two coats of primer to inhibit rust.

B. New equipment shall be finish painted with one coat of polyurethane enamel to match existing color.

C. Unpainted non-current carrying parts shall receive a protective zinc plating to prevent corrosion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Modifications to existing motor control centers shall be made in accordance with manufacturer's instructions and recommendations. Provide all hardware necessary for installation.

B. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed.

C. Touch-up damaged paint finishes.

D. Make wiring interconnections between units.

E. Cable connections to existing bus shall be made with two hole NEMA lugs. Remove busbar sections for shop drilling and re-install. Re-torque all connections. Fabricate and install any custom bus extensions.

3.02 FIELD TESTING

A. Make the following minimum tests and checks before energizing modified equipment:

1. Megger buses, phase-to-phase and phase-to-ground after disconnecting devices sensitive to megger voltage.

2. Install overload heaters or adjust relays for actual motor nameplate currents. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.

3. Check mechanical interlocks for proper operation.

4. Test ground connections for continuity and resistance.

5. Adjust unit compartment doors.

6. Check control circuit interlocking and continuity with starters in the TEST position. Provide external source of control power for this test.

7. Adjust motor circuit protectors and voltage trip devices to their correct settings.

B. In the event of an equipment fault, notify the Owner immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the Contractor, the Engineer and the equipment manufacturer's factory service technician. Repair or replace the equipment as directed by the Engineer prior to placing the equipment back into service.

3.03 ADJUSTMENT

A. Test all operational features of the installed equipment to the satisfaction of the Owner. Submit a certified copy of the field inspection to the Engineer. No equipment shall be energized without the approval of the Engineer.

B. Make the following inspection, tests and adjustments:

1. Calibrate and test circuit breaker trip devices per the coordination study specified in Section 16000.

2. Inspect the installation for compliance with the manufacturers recommended installation practices and report all deviations to the Engineer.

3.04 CLEANING

A. Remove all rubbish and debris from inside and around the control center. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

END OF SECTION

SECTION 16500

LIGHTING SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete lighting system ready for operation as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Panelboards are included in Section 16470.

B. Transformers are included in Section 16191.

C. Conduit is included in Section 16110.

D. Wire is included in Section 16120.

E. Time switches, photo-electric controls and contactors are included in Section 16191.

F. All concrete and reinforcing steel required for exterior lighting pole bases shall be as specified under Division 3, Concrete, but the responsibility of furnishing and installing the material shall be that of Division 16.

1.03 SUBMITTALS

A. Submittals shall include those set forth in Section 16000, Paragraph 1.03 "SUBMITTALS".

1.04 REFERENCE STANDARDS

A. All lighting fixtures shall be in accordance with the National Electrical Code (NEC) and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be Underwriters Laboratories labeled.

B. All emergency lighting shall be in accordance with NFPA 101 (Life Safety Code).

PART 2: PRODUCTS

2.01 MATERIALS

A. Lighting Fixtures

1. Lighting fixture types shall be furnished as required by the "Lighting Fixture Schedule" on the Drawings. The catalog numbers are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of

other manufacturers will be acceptable upon approval by the Engineer.

B. Lamps

1. Fluorescent lamps shall be medium bi-pin, recessed, double contact, rapid start, tri-phosphor, 4100 Kelvin and compact types all as shown on the "Fixture Schedule".

2. Mercury vapor lamps shall be deluxe white of the size and type as shown on the "Lighting Fixture Schedule."

3. High pressure sodium lamps shall be clear and of the size and type as shown on the "Lighting Fixture Schedule."

4. Metal halide lamps shall be clear and of the size and type as shown on the "Lighting Fixture Schedule."

5. Incandescent lamps shall be inside frosted, extended service, 2500 hour life with medium base.

6. All lamps shall be of one manufacturer and shall be as manufactured by General Electric Co.; North American Philips Lighting Corp.; Sylvania Electric Products, Inc., or equal.

C. Ballasts

1. Magnetic fluorescent ballasts shall be energy saving, Class P, rapid start, high power factor, CBM certified by E.T.L. and listed by Underwriters Laboratories, Inc., for operation on 120 volts or as shown on the "Lighting Fixture Schedule". Ballasts shall have ballast efficiency factors (BEF) of: 1.805 for 1-F40T12 lamp and 1.060 for 2-F40T12 lamps.

   a. Ballasts for two F48 (800 MA) lamps shall be similar and equal to Advance Transformer Co., Mark III equal by MagneTek Universal Manufacturing; Holophane Lighting or equal.

2. Unless otherwise indicated in the Lighting Fixture Schedule, fluorescent ballasts shall be electronic, high-frequency, full-output rapid-start type for use on 265 mA, T8 lamps.

   a. All ballasts shall be U.L. listed, ETL certified, Class "P", high power factor (minimum 0.90).

   b. Ballasts shall have a "A" sound rating or better.

   c. All ballasts used in exterior applications shall have a minimum starting temperature of 0 degrees F unless otherwise specified.

   d. All interior ballasts shall have a minimum starting temperature of 50 degrees F.

e. Ballasts shall be series wired type and designed to operate the number and length of lamps specified.

f. The total harmonic distortion (THD) of each ballast shall be in accordance with the requirements of the utility company and in no case shall it exceed 10 percent THD.

g. Ballasts shall have a minimum ballast factor of 0.95.

h. Ballasts shall have nominal power factor 0.90 or higher.

i. Ballasts shall have a maximum lamp current crest factor of 1.7.

j. Ballast shall provide normal rated life for the lamp specified.

k. All electronic ballasts shall be warranted for parts and replacement for one full year from the date of installation.

l. Electronic ballasts shall be Advance Model Mark V or equal as manufactured by Valmont, equal by Motorola or equal.

3. Mercury vapor ballasts shall be of the constant wattage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Holophane Lighting; MagneTek Universal; Advance Transformer Company or equal.

4. High pressure sodium ballasts shall be of the constant wattage type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Advance Transformer Co.; Holophane Lighting; MagneTek Universal Manufacturing or equal.

5. Metal halide ballast shall be of the constant voltage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Holophone Lighting; MagneTek Universal Manufacturing; Advance Transformer Co. or equal.

D. Flexible Fixture Hangers

1. Flexible fixture hangers used in non-hazardous areas shall be type ARB and flexible fixture supports used in hazardous areas shall be type ECHF as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Killark Electrical Mfg. Co. or equal.

E. Lamp Changing Equipment

1. Lamp changing equipment shall be able to handle BT-37, E-18, E-23-1/2 and E-28 type H.I.D. lamps in open luminaries.

2. Equipment shall consist of three 5-ft steel poles each similar and equal to McGill Catalog No. 160-P and two lamp holders similar and equal to McGill Catalog Nos. 158C and 161C.

F. Emergency Lighting Battery Units

1. Emergency lighting units and remote lighting heads shall be as specified in the "Lighting Fixture Schedule" shown on the Drawings.

2. Battery units shall be of the self-contained, fully automatic type with sealed lead acid batteries, volt-meters and time delay relays where used in H.I.D. lighted areas. Provide brownout feature that prevents battery unit from becoming fully discharged.

3. Unit enclosures shall be compatible to their environment and units shall comply with the requirements of NFPA 70 (N.E.C.) and NFPA 101 (Life Safety Code).

4. All necessary mounting hardware shall be provided.

G. Emergency Lighting – Fluorescent Fixture Integral Battery Units

1. Fluorescent fixtures designated for emergency lighting shall have an integral battery unit that automatically supplies power when the normal building power fails. During normal operation, the fixture operates from normal power.

2. Emergency lighting fluorescent fixtures shall include a press-to-test feature that indicates that the battery is in adequate condition.

3. All necessary mounting hardware shall be provided.

PART 3: EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Fixtures noted to be installed flush in suspended ceilings shall be of mounting types suited for the type ceiling involved. It shall be the responsibility of the electrical contractor to verify the ceiling types prior to ordering fixtures.

D. Flexible fixture hangers shall be used for all pendant mounted fixtures. Fixtures two feet long and larger shall be supported with a minimum of two fixture hangers.

E. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

F. Exterior lighting poles shall be mounted plumb.

G. Fixture locations are shown on the Drawings in approximate locations; however exact

locations shall be coordinated so as to avoid conflicts with HVAC ducts, equipment and other obstacles.

3.02 REPLACEMENT

A. Lamps (except for H.I.D.) used during the building construction, prior to two weeks from completion of the work, shall be removed and replaced with new lamps.

3.03 CLEANING UP

A. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.

B. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

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SECTION 16502

LIGHTNING PROTECTION SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Provide a complete lightning protection system for the Belt Filter Press Structures (building and conveyor structures) at the Monroe Water Pollution Control Center. The system shall be UL Master Labeled and shall be designed and installed in compliance with provisions of the latest "Code for Protection Against Lightning" as adopted by the Underwriters Laboratories Inc. (UL-96A) and the National Fire Protection Association (NFPA-780).

B. The Contractor shall employ the services of a licensed lightning protection systems engineering company to design and install the lightning protection system and prepare detailed installation drawings and material specifications. These Drawings and specifications shall be submitted for review in accordance with Section 01300.

C. The lightning protection system shall be checked by a UL field inspector upon completion of the installation. The Contractor shall assume full responsibility for the correctness of the installation and shall make any and all corrections and additions deemed necessary by the UL inspector. The Contractor shall pay for all costs of the UL inspection and any subsequent re-inspections as required.

D. The lightning protection system for the facilities shall consist of a copper ground wire with air terminals which shall be grounded to the building structural steel or ground grid at regular intervals. The Contractor has the option of submitting alternate methods of lightning protection for consideration in his/her Proposal, provided they offer an equal or greater degree of protection than those specified.

E. The grounding systems for the building shall be provided under Section 16660.

PART 2: PRODUCTS

2.01 MATERIALS

A. All materials shall be new and shall comply in weight, size and composition with the requirements of the Underwriters Laboratories Inc. and NFPA.

B. Grounding materials and methods shall be equal to those specified under Section 16660.

C. The following is a brief description of the various items of material:

1. Air Terminals

Air terminals shall be 5/8-in by 18-in minimum solid copper and shall extend at least 18-in above the object to be protected. All air terminal bases shall be cast bronze with stainless steel bolt pressure cable connectors. The air terminals should be spaced so as not to exceed 20-ft apart around the outside perimeter of the roof or the ridge and not over 50 feet apart through the center of flat roof areas. The air

terminals in the center roof area shall be 5/8-in by 48-in solid copper with a proper brace. All air terminal bases for flat roof areas shall be of the adhesive type.

2. Conductors

Conductors shall be copper , consist of wire size, stranding, and weight in accordance with NFPA 780, and installed in accordance with the UL Code. Conductors on the flat roof areas may be run exposed. Ground connections shall be made to the main down conductor at a maximum of 60-ft-0-in on centers.

3. Fasteners

Conductor fasteners shall be an approved type of non-corrosive metal, have ample strength to support conductors and shall be spaced not to exceed 3-ft-0-in centers. Masonry type cable fasteners spaced every 3-ft-0-in on masonry. Adhesive type cable fasteners spaced every 3-ft-0-in on flat roofs.

4. Cable Connectors

All cable connectors shall be cast bronze with screw-pressure type stainless steel bolts and nuts.

PART 3: EXECUTION

3.01 INSTALLATION

A. All materials shall be installed by experienced workmen that specialize in this type of work. The lightning protection system shall be installed per approved shop drawings and UL and NFPA recommended practices.

B. The lightning protection system engineering company shall provide jobsite assistance and supervision of the installation as required, and shall be present during the UL inspection.

C. The structural steel columns on the outside perimeter of the building may be utilized as the main down conductor from roof to ground for the lightning protection system. No other parts of the structural steel structure will be accepted to substitute for lightning conductors. The steel columns around the outside perimeter of the building shall be grounded at every other column and in no case shall average over 60-ft apart. Where the steel columns are used, a connection to the top of each steel column shall be made through the roof and connected to the roof conductor. A thru the roof connector shall be installed where a conductor penetrates the roof, by the lightning protection contractor. The thru the roof connector will be 1/2-in stainless steel threaded rod equipped with the necessary lead or neoprene washers and stainless nuts for a watertight seal. Also, copper pitch pans shall be furnished under this Section and installed by the roofing contractor.

D. All concealed conductors shall be installed in Schedule 40 PVC conduit.

E. All metal bodies within 6-ft of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connections.

F. Install a UL Master Label sign to the exterior of the building or structure when all work and inspection has been completed.

END OF SECTION

SECTION 16660

GROUNDING SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (N.E.C.), as shown on the Drawings and as specified herein. This is to include all new buildings and structures.

B. All raceways, conduits and ducts shall contain equipment grounding conductors sized in accordance with the N.E.C. Minimum sizes shall be No. 12 AWG.

1.02 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01300, as follows:

1. Manufacturer's name and catalog data for ground rods and exothermic welding methods and materials.

PART 2: PRODUCTS

2.01 MATERIALS

A. Conduit shall be as specified under Section 16110.

B. Wire shall be as specified under Section 16120.

C. Ground rods shall be 3/4-in by 10-ft copper clad steel and constructed in accordance with UL-467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld or equal.

D. Grounding conduit hubs shall be malleable iron type similar to Thomas & Betts Co.; Cat. No. 3940 (3/4-in conduit size) by Burndy; O.Z. Gedney Co. or equal, and of the correct size for the conduit.

E. Waterpipe ground clamps shall be cast bronze saddle type, similar to Thomas & Betts Co. Cat. No. 2 (1/2-in, 3/4-in, or 1-in size) or equal by Burndy; O.Z. Gedney Co. or equal, and of the correct size for the pipe.

F. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system. Crimp connectors shall not be used underground.

PART 3: EXECUTION

3.01 INSTALLATION

A. Run grounding electrode conductors in PVC coated rigid steel conduits. Bond the protecting conduits to the grounding electrode conductors at both ends. Do not allow water pipe connections to be painted. If the connections are painted, dis-assemble them and re-make them with new fittings.

B. Install equipment grounding conductors with all feeders, control and branch circuits.

C. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus, as shown on the Drawings.

D. Ground wire connections to structural steel columns shall be made with long barrel type one-hole heavy duty copper compression lugs, bolted through 1/2-in maximum diameter holes drilled in the column web, with stainless steel hex head cap screws and nuts.

E. Metal conduits stubbed into a motor control center shall be terminated with insulated grounding bushings and connect to the motor control center ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with Table 250-95 of the National Electrical Code, except that a minimum No. 12 AWG shall be used.

F. Liquid tight flexible metal conduit in sizes 1-1/2-in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.

G. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with Article 250-94 of the N.E.C.

H. Drive grounding electrodes as shown on the Drawings.

I. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and all other equipment and materials required by the N.E.C. to be grounded, shall be grounded and bonded in accordance with the N.E.C.

J. Seal exposed connections between different metals with No-Oxide Paint Grade A or equal.

K. Lay all underground-grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

L. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

M. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THWN/ THHN green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.

3.02 INSPECTION AND TESTING

A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

B. Use Biddle Direct Reading Earth Resistance Tester or equivalent test instrument to measure resistance to ground of the system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

C. All test equipment shall be provided under this Section and approved by the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install raceways to drain away from buildings. Raceways between manholes or handholes shall drain toward the manholes or handholes. Raceway slopes shall not be less than 3-in per 100-ft.

B. Reinforce raceway banks as shown on the Drawings.

C. Lay raceway lines in trenches on mats of bank gravel not less than 6-in thick and well grade.

D. Use plastic spacers located not more than 4-ft apart to hold raceways in place. Spacers shall provide not less than 2-in clearance between raceways.

E. The minimum cover for raceway banks shall be 24-in unless otherwise permitted by the Engineer.

F. Make raceway entrances to buildings and vaults with steel conduit not less than 10-ft long. Conduits run below floor slabs in slab-on- grade construction shall be steel.

G. Where bends in raceways are required, use long radius elbows, sweeps and offsets.

H. Swab all raceways clean before installing cable.

I. Plug spare raceways and seal them watertight at all manholes, buildings and structures.

J. Seal the ends of raceways and make watertight at all manholes, buildings and structures.

K. Install pulling-in irons opposite all raceway entrances to manholes.

L. Train cables in manholes and handholes and support and restrain them on racks and hooks. Furnish inserts on all manhole and handhole walls for mounting future racks as well as racks required for present installation.

END OF SECTION

D. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

E. Testing shall be performed before energizing the distribution system.

F. A separate test shall be conducted for each building or system.

G. Notify the Engineer immediately if the resistance to ground for any building or system is greater than five ohms.

END OF SECTION

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