Johns Creek Environmental Campus

Design/Build Request for Proposals

FULTON COUNTY

DEPARTMENT OF PUBLIC WORKS

Proposals Due:

PARSONS PM TEAM

Program/Construction Management

Parsons • PMCM International • USInfrastructure

JORDAN JONES & GOULDING

VOLUME 3A

Appendices 1-15

JOHNS CREEK ENVIRONMENTAL CAMPUS
DESIGN/BUILD REQUEST FOR PROPOSALS
TABLE OF CONTENTS

Section/Page

VOLUME 3

APPENDICES 1- 19

APPENDIX 1 – FACILITIES DESCRIPTION

APPENDIX 2 – PERFORMANCE CRITERIA

Section/Page

Section/Page

Section/Page

Section/Page

Section/Page

Section/Page

Section/Page

APPENDIX 11 – CONSTRUCTION CONTROLS AND FACLITIES

Section/Page

Section/Page

APPENDIX 13 – PROJECT PLANS & MANUALS—OTHER PROJECT DELIVERABLES

APPENDIX 14 – EQUIPMENT AND START-UP TESTING

Section/Page

Section/Page

Section/Page

APPENDIX 16 – MEMBRANE WARRANTY

APPENDIX 17 MEMBRANE HANDLING AND STORAGE REQUIRMENT

APPENDIX 18 – GUARANTEES/WARRANTIES AND ASSOCIATED RISK

* **APPENDIX 19 – PUBLIC EDUCATION AND COMMUNITY OUTREACH PLAN**

Appendix 20 14 Hour Rule

App 21 Schedule

App 22 Minimum Financial Criteria

App 23 Emergency Power

APPENDIX 1
EXISTING FACILITIES DESCRIPTION

1.1 Existing Facilities and Plant Envelopes

The existing Johns Creek WPCP is located at 8100 Riverbirch Drive, Roswell, Georgia. The Existing Facilities include the Johns Creek WPCP Influent Pump Station and the Johns Creek Diversion Pump Station, both located at the east side of the existing plant site.

The Johns Creek Environmental Campus (JCEC) will be located at 883 and 884 Holcomb Bridge Road, Roswell, Georgia. The New Plant site envelope is shown in Figure A2-1(Appendix 2). The site envelope delineates the land on which the D/B Company may construct the Plant. The D/B Company may build the plant using any fraction of the land designated as the Plant site envelope, but cannot use any land beyond the envelope boundaries, for construction of permanent JCEC facilities.

The D/B Company will be responsible for all land within, below, and above the Plant site envelope during the Design/Build Project, up to and including the property lines shown in Figure A2-1.

1.2 Existing Facilities Description

General descriptions and a list of the major processes and equipment in use at the Existing Facilities are presented below and in the Data CD-ROM. The list and descriptions are provided for general information purposes only and are not intended to be complete listings of all existing equipment. The D/B Company is responsible for not hindering the operation of the Existing Facilities during the Design/Build Project. The County and its contract operator are currently responsible for operating, managing, and maintaining the Existing Facilities.

1.2.1 Johns Creek WPCP Process Description

The Johns Creek WPCP treats the wastewater with preliminary treatment, activated sludge secondary treatment, filtration, chlorination, and dechlorination. The solids are aerobically digested and dewatered prior to disposal. The following is a brief description of the liquid unit processes.

1.2.1.1 Influent Wastewater

The Johns Creek WPCP provides wastewater treatment service to the Johns Creek Drainage Basin, one of the three drainage basins in north Fulton County: Johns Creek, Big Creek, and Little River. The influent from the collection system enters the site via two 48-inch gravity sewer lines that converge in a manhole outside the influent pump station.

1.2.1.2 Screening, Influent Pumps, and Grit Removal

The influent flow passes through two mechanical bar screens before entering the influent pump station wet well. The pump station includes four dry-pit centrifugal pumps, with variable speed controls, that discharge the screened wastewater to a Parshall flume followed by two aerated grit channels. The effluent from the grit chambers flows over adjustable divider weirs to split the flow between the main plant and the two package plants.

1.2.1.3 Alkalinity

A 50-ton lime silo is located at the grit structure to supply alkalinity for the downstream biological process. The lime is combined with water to create a 30-45 % lime solution. Two parallel mixer, vibrator, and storage box trains are used to prepare the lime solution which is then pumped to the wastewater stream using chemical feed pumps.

1.2.1.4 Activated Sludge Secondary Treatment

The flow to the main plant travels through a 20-inch pipe from the grit structure to the aeration tank pre-mix chamber. The three aeration tanks can be operated as single-pass parallel flow or series plug flow. Centrifugal blowers supply air to the process through medium-bubble membrane diffusers. The mixed liquor exits the aeration basins through a common channel and is split between two clarifiers. Return activated sludge (RAS) and waste activated sludge (WAS) are pumped by submersible centrifugal pumps to the head of the aeration basins and the aerobic digesters, respectively.

1.2.1.5 Filtration, Chlorination, and Dechlorination

Two automatic backwash traveling bridge-type sand filters filter the clarified effluent. The filtered effluent is then disinfected with sodium hypochlorite in a dual plug-flow serpentine chlorine contact chamber. Dechlorination of the effluent is accomplished by addition of sodium bisulfate at the end of the chlorine contact chamber.

1.2.1.6 Package Plants

The two package plants provide the activated sludge, clarification, filtration, and chlorination processes in circular tanks. The specific details of the systems are outlined on the Data CD-ROM. The chlorinated effluent from the package plants is introduced to the post-aeration tank section of the main plant, where it is dechlorinated and aerated along with the main plant effluent prior to discharge.

1.2.1.7 Sludge Treatment and Disposal

Waste Activated Sludge (WAS) from the main plant and the package plants are pumped to the two aerobic digesters. Sludge from the aerobic digesters is chemically conditioned and then dewatered with a 2-meter belt filter press prior to landfill disposal.

1.2.1.8 Post-Aeration and Effluent Outfall

Chlorinated effluent from the main plant and the package plants combine at the post-aeration basins, where the flow is aerated to ensure the minimum dissolved oxygen concentration of 5.0 mg/L is attained. The effluent is discharged through a 55-foot long 24-inch diameter diffuser pipe into the Chattahoochee River with 2-inch diffusers (12 inches on center). Usually the wastewater flows to the river by gravity; during high-river flow stage, the treated effluent is pumped to a head box, increasing the static head above the diffuser pipe.

1.2.1.9 Odor Control Facilities

Design/Build services for the addition of interim odor control improvements at the Johns Creek WPCP have been completed. The work included relocation of an existing carbon scrubbing system from the grit chambers to the aerobic digesters, covering of the aerobic digesters, and provision of a new wet-packed scrubber tower for the grit chambers.

1.2.1.10 Power System

The Georgia Power Company provides electrical service to the Johns Creek WPCP with a primary 25kV underground feeder and two transformers. One 750 KVA transformer is located at the influent pump station. The underground loop feeder originates at the Holcomb Bridge Substation. The Holcomb Bridge Substation has two high voltage feeders. One feeder provides the principal service and other provides auxiliary service. This loop feeder also serves the Horseshoe Bend community.

The plant also has three standby diesel engine generators for emergency power: one is located at the Blower Building and the other two are located at the influent pump station. One serves the package plants as well as the diversion pump station.

1.2.1.11 In-Service Facilities

On the site of the Johns Creek WPCP, there are three additional in-service facilities: an administration building, a trailer, and a storage room. The administration building is a single story concrete block building that used for office and laboratory purposes. There is a small trailer for the use of Fulton County personnel near the influent pump station building. The storage room is located between the dewatering building and an abandoned building and is where the old influent pumps are stored.

1.2.1.12 Out-of-Service Facilities

There are three structures on the existing site that are not in use. They include a circular gravity thickener, a sludge thickening building with two dissolved air flotation thickeners, and an abandoned building. The circular gravity thickener is approximately 30-feet in diameter, approximately 10 – 12 feet deep. The sludge thickening building is a 1-story concrete block building with a basement; its contents are listed in the accompanying Data CD-ROM. The abandoned building is a 2-story concrete block building; its contents are also detailed in the accompanying Data CD-ROM.

1.3 Laboratory and Analytical Services

The laboratory located in the Administration Building is equipped to perform analyses for process control samples. The conventional tests include parameters such as pH, TSS, BOD, COD, oil and grease, and settleable solids.

1.4 Johns Creek WPCP Diversion Pump Station

The Diversion Pump Station, located adjacent to the Influent Pump Station, contains two 5.0 MGD submersible pumping units with variable frequency drives. This pump station conveys excess flows from the Johns Creek Service Area through two parallel 20-inch force mains that discharge to a gravity sewer terminating at the Ball Mill Screw Lift Pump Station to the Big Creek Service Area. The Ball Mill Creek Pump Station discharges to a gravity sewer that flows to the Riverside Road Pump Station. The flows are pumped from the Riverside Road Pump Station directly to the Big Creek WRF.

APPENDIX 2
PROCESS DESIGN AND PERFORMANCE CRITERIA

2.1 General

The D/B Company shall design and construct, for the County's acceptance, the JCEC that meets any and all Local, State, and Federal permit requirements, regulatory requirements, and applicable law relating to effluent quality, noise, and odor. RFP requirements may be more stringent than Local, State, and Federal requirements.

Process Design and Performance Criteria have been developed to reflect the County's desired performance of the JCEC. The County requires guarantees for performance in the areas of effluent quality, odor control, noise control and operational cost. See Appendix 18 for more detail. This Appendix presents the Influent Design Basis as well as requirements for redundancy, reliability, emergency power, effluent quality, process design, odor, and noise.

This Appendix also presents process design requirements. It is not the desire of the County to limit innovation by the D/B Company with regard to the process requirements presented in Appendix 2 or for the specific equipment requirements as presented in appendix 5A and 5B. The County will evaluated each design based upon the criterion in the D/B RFP, table 5-1 which includes but is not limited to quality of equipment, reliability and redundancy, constructability, ease of operations, cost of operation and the capital cost .

2.2 Process Design and Performance Guarantee

2.2.1 Influent Design Basis

The D/B Company shall design the Plant using the flows and pollutant loads shown in Tables A2-1 and A2-2. Design influent flow rates and loads for the new Plant were obtained using projected flow rates and peaking factors for the Johns Creek service area ("North Fulton County Wastewater Management Conceptual Plan Final Report," 2002), design flow rates associated with the Cauley Creek Water Reclamation Facility ("Operation and Maintenance Manual, Cauley Creek Water Reclamation Facility"), and historical influent flow data for the existing Plant.

Parameters used in Table A2-2 and elsewhere in this Appendix are as defined in Standard Methods for the Examination of Water and Wastewater, latest edition.

Table A2-1
Design Influent Flow Rates

Parameter	Flow Rate (MGD[1])
Annual Average Flow Rate (QAVG[2])	6.0
Maximum 30-Day Average Flow Rate (QMAX30[3])	15.0
Maximum 7-Day Average Flow Rate (QMAX7[4])	18.3
Peak Day Average Flow Rate (QPKDY[5])	24.7
Peak Hour Average Flow Rate (QPKHR[6])	30.2

Table A2-2
Design Influent Pollutant Concentrations

Parameter	Annual Average[7] mg/l	Maximum 30-Day Average[8] mg/l	Peak Day Average[9] mg/l
$cBOD_5$	183	260	336
TSS	185	281	372
TKN	40	50	60
COD	420	571	735
Alkalinity	140	160	
Ammonia (as N)	21	24.6	
TP (as P)	5.6	6.8	8.2
Minimum Design Temp			13°C

1 Million gallons per day
2 The average flow rate during the design year.
3 The maximum average flow rate over any 30-day period during the design year.
4 The maximum average flow rate over any 7-day period during the design year.
5 The maximum average flow rate over any 24-hour period during the design year.
6 The maximum average flow rate over any 1-hour period during the design year.
7 The average influent load during the design year.
8 The maximum average load over any 30-day period during the design year.
9 The maximum average load rate over any 24-hour period during the design year.

The values in table A2-2 are based on data from 2000-2004 with outlying values removed. All values were rounded up with no additional factor applied. The raw data for this table can be found on the data disk.

2.2.2 Reliability and Standby Power Requirements

As a minimum, the Plant shall be designed for EPA Class I Reliability, as defined in Design Criteria for Mechanical, Electrical, and Fluid System and Component Reliability, USEPA Technical Bulletin, EPA-430-99-74-001. In some cases, the requirements of this Appendix exceed these requirements.

Fulton County requires the JCEC be provided with dual power supplies; one from the local power company and the second from an emergency power system.

The emergency power generation system is required that will provide standby power generation for all plant loads. The emergency power generation system should have sufficient redundancy to allow the required amount of power generation with one generator out-of-service. The emergency power generation system should include all control systems, fuel systems and automatic start and power switching system.

Treatment processes shall be designed to be operational at the 100-year flood elevation

Fulton County requires that the D/B Company provide coordination between the local power source and the emergency power system. That the D/B Company will provide the design, construction and start-up of the emergency power generation system at the Johns Creek Environmental Campus and also for the Riverside Drive Pump Station.

2.2.3 Effluent Quality Performance Guarantee

Expected Plant effluent limits are specified in Draft National Pollutant Discharge Elimination System (NPDES) Permit No. GA0030686, issued by Georgia Environmental Protection Division (EPD) and shown in Table A2-3. Both the draft and current NPDES permits are provided on the Data CD-ROM.

The County has submitted a Wasteload Allocation (WLA) letter to EPD. As of the writing of this RFP a response has not been received. A copy of the WLA letter is

provided on the Data CD-ROM. If a response is received during the proposal preparation period it will be distributed as an addendum.

EPD has proposed effluent limits to be applied, as a minimum, to all expansions of Chattahoochee tributary NPDES facilities in Metro Atlanta (Table A2-4). EPD indicated that denitrification will be required, but it has not indicated a specific nitrate-nitrogen (NO_3-N) or total nitrogen (TN) limit. Applicable EPD guidance documents are provided on the Data CD-ROM.

Table A2-3 Proposed Effluent Limits for Metro Atlanta Expansions

Parameter	Monthly Average Except as Noted
Turbidity	Less than or equal to 3 NTU[10]
TSS	Less than or equal to 5 mg/L
Fecal Coliform	Less than or equal to 23 per 100 milliliters geometric mean
pH	6 – 9 standard units
$CBOD_5$	Less than or equal to 2.9 mg/L
NH_3-N	Less than or equal to 0.5 mg/L
ON[11]	Less than or equal to 1.5 mg/L
TP	Less than or equal to 0.13 mg/L

Effluent Quality Performance Guarantee is based on the information above and is shown in Table A2-5. These criteria have been selected to ensure that the JCEC is able:

1. To meet anticipated permit requirements,

2. To meet regulatory requirements such as those outlined in EPD's guidance documents,

3. To meet the County's resolution to implement a beneficial urban water reuse program, which is provided in the Data CD-ROM, and

4. To preclude later modifications to the Plant due to Changes in Law by meeting the strictest of proposed limits.

Table A2-4 Draft NPDES Permit Limits

Parameter	Monthly Average	Weekly Average
$cBOD_5$	2.9 mg/L[1]	4.4 mg/L
TSS	5.0 mg/L	7.5 mg/L
NH_3-N	0.5 mg/L	0.75 mg/L
TP	0.3 mg/L	Not Applicable
Total Residual Chlorine	0.5 mg/L	0.5 mg/L

A wasteload allocation letter has been submitted to EPD for a draft permit. Fulton County has not received a response at the time of issue of this RFP. The Draft NPDES Permit Limits in table A2-3 are anticipated permit limits based upon recent NPDES permits issued and prior correspondence with EPD.

Table A2-5 is the Effluent Quality Performance Guarantees for the Johns Creek Environmental Campus. The conditions of this Effluent Quality Performance Guarantee are contained in Appendix 18 and the D/B Contract. Additionally, E.coli could become criteria for Effluent Quality in the near future in Georgia. The D/B Company should insure that the plant will meet any anticipated criterion.

In the event that a parameter specifically required by this specification (Table A2-5 or else where) is not achievable with the technology or equipment specified by this RFP the D/B Company shall assist the County and EPD in determining the achievable specification. This requirement does not relieve the D/B Company of the requirement to meet the Performance Guarantee as defined in Appendix 18 and the D/B Contract.

Table A2-5 Plant Effluent Quality Performance Guarantee

Parameter	Monthly Average Except as Noted
Turbidity	Less than or equal to 3 NTU
TSS	Less than or equal to 5 mg/L
Fecal Coliform	Less than or equal to 23 per 100 mL geometric mean
pH	6 – 9 standard units
$cBOD_5$	Less than or equal to 2.9 mg/L
NH_3-N	Less than or equal to 0.5 mg/L
ON	Less than or equal to 1.5 mg/L
TP	Less than or equal to 0.13 mg/L
NO_3-N	Less than or equal to 8.0 mg/L
Total Residual Chlorine	Less than or equal to 0.5 mg/L
Receiving Water Temp Increase	Less than 2°F or 1.1°C

As defined, the Membrane System will be required to produce permeate having TSS concentration and turbidity lower than the Plant Effluent Quality Performance Criteria.

2.2.4 Operational Cost Guarantees

Fulton County desires a guarantee of operational cost. In accordance with the Appendix 15, the D/B Company to fulfill the requirements of Whole Plant Acceptance Testing will operate the JCEC for a period of 120 days. During this 120 day period the D/B Company will collect routine operating data to demonstrate that the operational cost of operating the plant in the selected areas of electrical power consumption, process chemical cost, odor control chemical cost and sludge disposal cost are met as Guaranteed Operational Cost provided on technical proposal form 10 (TPF10). See Appendix 18 and the D/B Contract for more details on the Operational Cost Guarantees and resolutions for failure of the JCEC to meet these operational guarantees.

2.2.5 Projected Monthly Average Flow

The following flow rates are projected based upon several source documents and on estimated population growth in the Johns Creek Service area. These projects of flow will be utilized for the operational life cycle cost calculations.

Table A2-6 Projected Monthly Average Flow

Year	Monthly Average Flow (MGD)	Year	Monthly Average Flow (MGD)
		2014	8.95
2004	5.65	2015	9.05
2005	6.1	2016	9.15
2006	6.55	2017	9.22
2007	7.0	2018	9.29
2008	7.45	2019	9.36
2009	7.9	2020	9.43
2010	8.35	2021	9.51
2011	8.5	2022	9.58
2012	8.65	2023	9.65
2013	8.8	2024	9.72

2.2.6 Process Design Requirements

With the exception of the membrane system, the D/B Company may provide alternate systems for the specified process and/or alternative locations for the process within the process train if supported by a full analysis of the conditions of service and the plant process requirements.

The County will evaluate all proposed processes based upon the information provided in the Proposal only for full analysis of the conditions of service and plant process requirement to ensure the functions performed as specified.

The following sub-sections present Process Design Requirements

Alternate designs may be considered, but they cannot exceed the Plant Envelope shown on Figure A2-1. The D/B Company shall provide in its proposal, a conceptual Site Plan in which the proposed plant does not exceed the Plant Envelope.

2.2.6.1 Raw Sewage Collection

The new JCEC will be constructed near an existing 48-inch gravity line that conveys raw sewage from the Johns Creek collection system to the existing Plant. As part of the Project, the D/B Company will construct a diversion structure on the existing gravity line. The diversion structure will allow raw sewage to be routed either to the existing plant or JCEC. The D/B Company shall construct a gravity line from the diversion structure to the new JCEC, delivering the wastewater to the influent pump station. This gravity line shall have a minimum capacity 110 percent of design QPKHR..

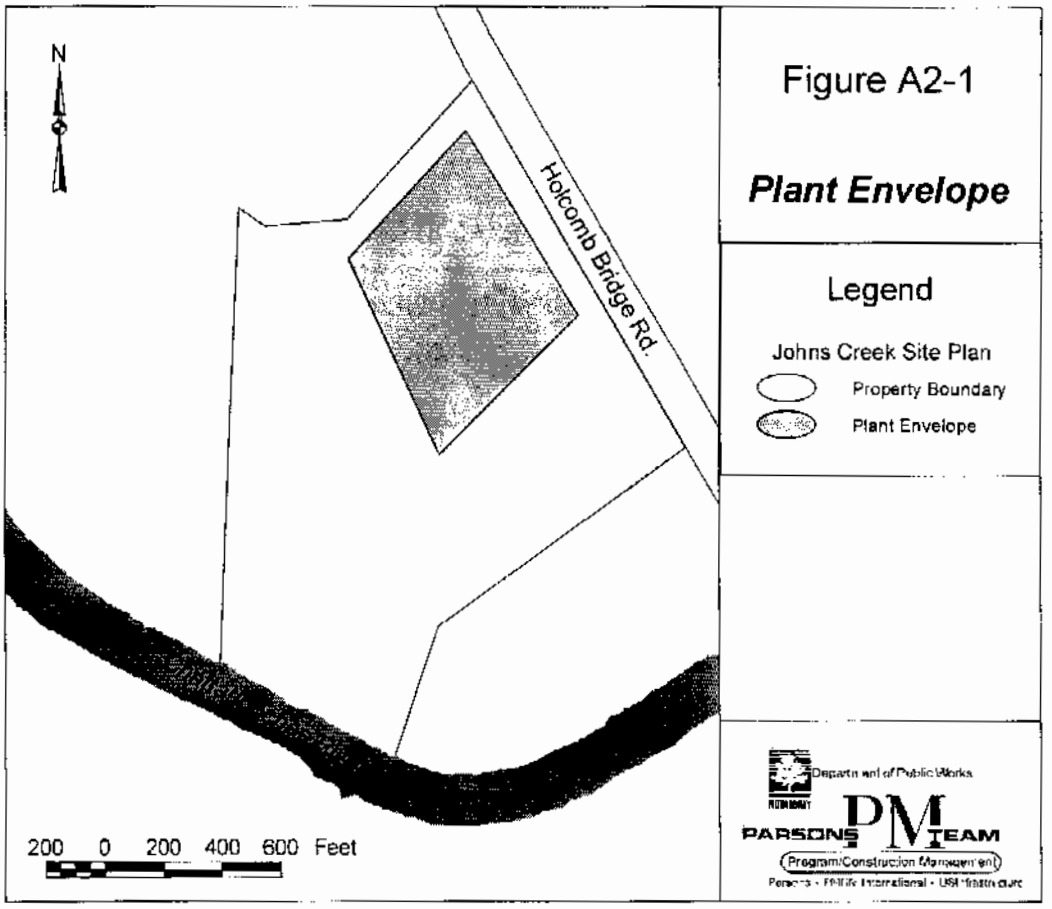
2.2.6.2 Existing Influent Pump Station (at the existing plant)

Additional raw sewage reaches the existing Plant from the Horseshoe Bend collection system. As part of the Project, the D/B Company shall modify or replace the existing influent pump station and will construct a force main from the existing to the new Plant. In the proposal the D/B Company shall provide justification for the proposed design capacity of the existing influent pump station and force main.

Based upon the proposed cost of converting the existing influent pump station and construction of the force main, Fulton County will evaluate whether it is more economical and desirable to use the existing Johns Creek Diversion Pump Station and convey this sewage to the Big Creek WRF. This decision will be at the sole discretion of the County

Odor control in accordance with the requirements of the RFP shall be provided for this pump stations and the existing diversion pump station. Restoration of the area around this pump station due to construction is required. Minor landscaping to screen the pump station from sight is required.

Note that the JCEC will *not* receive trucked-in septage.



2.2.6.3 JCEC Influent Pump Station

The pump station is required to be low-profile, near or below grade and appropriately landscaped and odor free. A minimum of four equal-sized variable-speed pumps shall be provided. The minimum firm capacity of the pump station shall be 110 percent of design QPKHR. The pump station shall include space for additional pumps, which would double the firm capacity of the pump station.

The pump station shall be designed with sufficient turndown to handle minimum influent flow rates at startup, not specifically defined.

In order to protect the influent pumps a minimum of two equal-sized, channel grinders, or other form of comminuters shall be provided, with a minimum total capacity design of QPKHR. An additional equal-sized by-pass channel shall be provided.

Chopper pumps will be considered as an option to channel grinders, conventional pumps.

2.2.6.4 Coarse Screening

A minimum of two equal-sized coarse band screens shall be provided. Flow shall split evenly to online screens. The minimum firm capacity of the screening process shall be design QPKHR. The screens shall remove all particles larger than 6 mm.

A screening handling system shall be provided which includes both a washing and compaction component to minimize the organic content of the screenings. The compactor trough shall have openings equal to or less than the opening size of the screen. The screenings handling system shall provide for a minimum 50 percent solids content. Compacted screenings shall be stored in a segregated, odor-controlled room.

2.2.6.5 Pretreatment Options

Primary clarification for a plant of this size is seen by the County as having some advantages and disadvantages. The membrane scope of supply as presented in Appendix 16 was proposed assuming primary clarification. The D/B Company shall consider all the factors of primary clarification in their design to include, footprint, aeration basin size, protection of the membranes (see additional requirements from

MSS if primary clarifiers are not use), the potential of biological phosphorus removal and solids handling.

Accordingly, the County is allowing for alternative designs following the coarse screening step. One alternative would provide vortex grit removal, equalization, primary clarification, and 2-mm screening. A second alternative allows for the elimination of primary clarification, but requires the inclusion of a grit and grease removal system, equalization, and a 1-mm drum screening facility. The following sections further describe the constraints associated with these two options. These two examples of alternatives are suggested as plausible alternatives which satisfy the County requirements. Proposers can consider other alternatives that meet the County's requirements.

Note that the County is not predisposed to the inclusion or exclusion of the primary clarifiers but leaves this to the Proposer who will provide the analysis and justification of their proposed design in their Technical Proposal.

2.2.6.6 Equalization

All processes upstream of the membrane system are specified for a flow rate of peak hour (QPKHR). The membrane system and the proposed hydraulic design for the membrane bioreactor are designed for a flow rate of peak day (QPKDY). The D/B Company shall consider the hydraulic design of the individual process, the biological design of the membrane system and the bioreactor tank with consideration for the cost of equalization and propose the their design. If the proposed design effects the Scope of Supply of the MSS this would be an alternative proposal and be documented on PPF3, the appropriate technical proposal forms and in the detailed technical approach.

The County is open to considering alternative designs to accommodate peak hour hydraulic requirements. Regardless of the Pretreatment Option chosen if a separate equalization tank is included in the design, equalization must be located between grit removal and the fine screening process.

Equalization shall provide for a peak flow rate leaving the equalization process that is no greater than design QPKDY. Equalization may be either on-line or off-line. A specific number of equalization tanks is not stipulated.

Design QPKDY and QPKHR represent average pre-equalization flow rates that, during the design year would be observed over a 24-hour or 1-hour interval, respectively. For sizing the equalization process, average flow rates that could be

observed over intervals between 1 and 24 hours shall be calculated using the following equation:

$$\text{flow rate (in MGD)} = -1.73 * \ln(X) + \text{QPKHR}$$

where "ln" is the natural logarithm function and "X" is the length of the interval (in hours).

The equalization process shall be configured such that the tank(s) can be bypassed for cleaning or maintenance. However, when the tank(s) are bypassed, any influent flow exceeding design QPKDY shall be automatically diverted to the equalization tank(s).

Equalization tank(s) shall be mixed and covered to prevent the release of odorous gases. Mixing pumps with inline grinders or chopper pumps should be used for mixing. Pumps should be able to be serviced without confined space entry. Air from the tank(s) shall be withdrawn to an odor control system. Tank(s) shall be cleaned using water cannons, without it being necessary for personnel to access the tank floor.

2.2.6.7 Influent Flow Measurement and Control

The flow rate leaving or bypassing the equalization process shall be measured using a Parshall flume and automatically controlled using a valve or gate. The flume and control device shall be configured such that either may be bypassed. At design QPKDY, the flume shall not be submerged (i.e. the downstream water surface shall be lower than the flume throat).

2.2.6.8 Pretreatment Option A - Primary Clarification

Option A consists of vortex grit removal, equalization, primary clarification and 2-mm screening processes. These processes are further described in the following sections.

2.2.6.8.1 Vortex Grit Removal

A minimum of two equal-sized grit units shall be provided. Flow shall split evenly to online units.

The design grit load shall be 10 cubic feet per million gallons at design QPKDY. The grit removal process shall be configured to allow complete or partial bypass of design QPKHR.

At flow rates up to and including design QPKHR, with all grit units online, and wastewater temperature between 13 and 27 degrees C, grit having specific gravity of 2.65 or more shall have minimum removal efficiencies as follows:

- Grit larger than 65 mesh 95 percent
- Grit larger than 100 but smaller than 65 mesh 75 percent

Hydraulically, the capacity of the grit removal process shall be QPKHR with any single grit unit offline.

Grit shall be removed from the grit units using recessed impeller centrifugal pumps with air sparge to reduce plugging. Each grit unit shall have two pumps, each capable of handling the design grit load. As an alternative, a top mounted grit pump may be provided. If the top mounted pump alternative is chosen, a shelf spare grit pump per grit unit shall be provided.

Grit shall be pumped from the grit units to cyclones/classifiers, which shall remove putricible solids and thicken grit to minimum 75 percent solids. There shall be one cyclone and one classifier per grit unit. Thickened grit shall be stored in covered containers or in open containers in a segregated, odor-controlled room. Thickened grit shall be disposed of off-site at a landfill.

2.2.6.8.2 Primary Clarifiers

A minimum of two primary clarifiers with minimum 12-foot side water depth shall be provided. Flow shall split evenly to online clarifiers. The clarifiers shall be covered, and the covers shall be designed to prevent the release of odorous gases. Clarifier sizes shall be such that the following design criteria for overflow rate (primary effluent flow rate divided by clarifier surface area) are met:

- QMAX30 One unit out of service Less than or equal to 1,000 gpd/sqft[12]
- QPKDY All units in service Less than or equal to 2,500 gpd/sqft

The goal associated with these criteria is that at QMAX30 flow rate, TSS removal will be greater than 50 percent and $cBOD_5$ removal will be greater than 25 percent.

12 Gallons per day per square foot

Overall design of the primary treatment process should be consistent with these goals.

If preceding equalization, the hydraulic capacity of the primary clarifiers shall be QPKHR with any single unit out service. If following equalization, the hydraulic capacity of the primary clarifiers shall be QPKDY with any single unit out service

Provisions shall be made to feed the same metal salt used for secondary treatment upstream of the primary clarifiers using separate pump(s). The metal salt shall be added as far upstream of the clarifiers as practical to maximize mixing.

Primary clarifier underflow shall be pumped to the solids handling process. Each clarifier shall be equipped with two progressive cavity sludge withdrawal pumps.

2.2.6.8.3 Fine Screening

A minimum of two equal-sized fine screens shall be provided. Flow shall split evenly to online screens. The minimum firm capacity of the screening process shall be design QPKDY. The screens shall remove all particles larger than 2 millimeters.

Processes and piping shall be configured such that a portion of activated sludge mixed liquor recycle (MLR) can be routed upstream of the fine screens. The flow rate of this portion shall be such that one biological process volume can be screened in 6 hours. The MLR flow rate to be screened may be manually or automatically adjustable, but flow must be started and stopped automatically by the control system (to allow mixed liquor screening based on time of day or influent flow rate).

A screening handling system shall be provided which includes both a washing and compaction component to minimize the organic content of the screenings. The screenings handling system shall provide for a minimum 50 percent solids content. Compacted screenings shall be stored in covered containers in a segregated, odor-controlled room.

2.2.6.9 Pretreatment Option B- 1-mm Fine Drum Screens

Option B consists of grit and grease removal, equalization, and 1-mm drum screening processes. These processes are further described in the following sections.

2.2.6.9.1 Grit and Grease Removal

To allow for grease and scum removal without primary clarification, a grit and grease removal system will be required under Option 2. A minimum of two equal-sized grit and grease units shall be provided. Flow shall split evenly to online units.

The design grit load shall be 10 cubic feet per million gallons at design QPKDY. The grit removal process shall be configured to allow complete or partial bypass of design QPKHR.

At flow rates up to and including design QPKHR, with all grit units online, and wastewater temperature between 13 and 27 degrees C, grit having specific gravity of 2.65 or more shall have minimum removal efficiencies as follows:

- Grit larger than 65 mesh 95 percent
- Grit larger than 100 but smaller than 65 mesh 75 percent

Hydraulically, the capacity of the grit and grease removal process shall be QPKHR with any single unit offline.

Grit shall be removed from the grit units using submersible centrifugal pumps. Each unit shall be provided with a single grit pump, each capable of handling the design grit load. One shelf spare grit pump will be provided per unit.

Grit shall be pumped from the grit units to classifiers, which shall remove putricible solids and thicken grit to minimum 75 percent solids. There shall be one one classifier per grit unit. Thickened grit shall be stored in containers in a segregated, odor-controlled room.

2.2.6.9.2 Fine (1-mm) Drum Screens

A minimum of two equal-sized internally-fed, in-channel rotary drum screens shall be provided. Flow shall split evenly to online screens. The minimum firm capacity of the screening process shall be design QPKDY. The screens shall remove all particles larger than 1-millimeter.

The long-term performance and reliability of the Membrane System is directly related to the performance and reliability of the 1-mm drum screens. The design of the 1-mm drum screen will require the approval of the Membrane System Supplier so as to ensure that the membrane life and membrane warranty are not effected.

Processes and piping shall be configured such that a portion of activated sludge mixed liquor recycle (MLR) can be routed upstream of the 1-mm drum screens. The flow rate of this portion shall be such that one biological process volume can be screened in 6 hours. The MLR flow rate to be screened may be manually or automatically adjustable, but flow must be started and stopped automatically by the control system (to allow mixed liquor screening based on time of day or influent flow rate).

A screening handling system shall be provided which includes both a washing and compaction component to minimize the organic content of the screenings. The screenings handling system shall provide for a minimum 50 percent solids content. Compacted screenings shall be stored in covered containers in a segregated, odor-controlled room.

2.2.6.10 Activated Sludge Process

The County desires to obtain a facility which achieves an equitable balance between initial capital costs and operational costs over the life-cycle of the project. To determine the relative efficiency of the proposed designs and allow for evaluation of this issue, a present worth analysis of the operational costs will be conducted by the County during the Technical Evaluation. Project life cycle costs will be considered during the price proposal evaluation. Therefore, when developing it's approach to the activated sludge process design for the JCEC, the D/B Proposers should consider, among other issues, the following: the two possible pretreatment options, chemical phosphorus removal vs. biological phosphorus removal, and the sludge handling system. The intent of the County is that the process be designed to remove nitrogen biologically and that the removal of phosphorus should not sacrifice the biological nitrogen removal. To this end the Proposer should consider biological or chemical removal of phosphorus.

An activated sludge process with membrane solids separation shall be used to achieve the effluent requirements for $cBOD_5$, NH_3-N, ON, NO_3-N, and TP. Regardless of the proposed approach to phosphorus removal, the design shall provide for multiple point addition of alum or metal salt at the JCEC. Chemical feed locations shall include the following: at the entrance to the activated sludge process, at the entrance to the membrane tanks (or in the upstream aeration tank), and within the sludge holding tank. The design shall also provide for the addition of caustic for Ph adjustment in both the liquid train and the sludge holding tank.

The activated sludge process shall be designed for a 30-day average process temperature between 13 and 27 degrees Celsius (°C) and daily average process temperature between 10 and 30 °C.

The activated sludge process shall be designed such that under design influent load conditions, the mixed liquor suspended solids (MLSS) concentration in activated sludge tankage shall never exceed the maximum value indicated by the Membrane System Supplier. The process shall be designed such that, on a 30-day average basis, the solids retention time (SRT) is not less than the minimum value indicated by the Membrane System Supplier. Subject to these constraints, selection of design MLSS concentration and SRT are the responsibility of the D/B Company.

The activated sludge process shall be divided into a minimum of four equal-sized trains, such that all performance requirements can be met with one train offline. Trains shall be configured such that one or more may be taken offline for maintenance. Flow shall split evenly to online trains. Activated sludge tankage shall be designed for minimum 18-foot water depth and minimum 3-feet of freeboard. The design of the activated sludge process must prevent the accumulation of foam and scum in all unaerated zones and minimize the level of foam on the surface of the all aerated zones, including the membrane zone. An active foam management system is required.

Hydraulically, the capacity of the activated sludge process shall be QPKDY with any single train out service.

All activated sludge tankage shall be mixed uniformly using diffused air or mixers. Process aeration (i.e., aeration to satisfy biochemical oxygen requirements) shall be provided using centrifugal blowers or positive displacement blowers and fine-bubble diffused air. If positive displacement blowers are proposed, sufficient noise abatement shall be provided to ensure the noise requirements of the RFP are achieved. The process aeration system shall be designed such that the following performance criteria are met.

Condition 1:

- Oxygen uptake rate (OUR) corresponding to influent loads less than or equal to design maximum 30-day average with one or both primary clarifier offline
- One blower offline
- Minimum 2.0-mg/L DO concentration throughout aerobic zones

Condition 2:

- OUR corresponding to influent loads less than or equal to design peak day with all primary clarifiers online
- All blowers online
- Minimum 0.5-mg/L DO concentration throughout aerobic zones

2.2.6.11 Membrane System

As stated through-out this RFP the County will not consider an alternative treatment process that does not use the Scope of Supply of the selected Membrane System Supplier. However, it is not the County's intent to restrict innovative ideas that may affect the Scope of Supply of Zenon. Questions concerning innovative ideas that affect the Scope of Supply may be submitted to the County and Zenon for resolution in accordance with the procedure in Section 3.12 or the RFP. Any change in the Scope of Supply of the MSS must be clearly documented on PPF 1 and 3.

Permeate is produced by vacuum-driven filtration through ultrafiltration hollow fiber membranes, leaving the separated solids to be returned to the activated sludge tankage. The mixed liquor will flow by gravity to the Membrane System from the activated sludge tankage. At its option, the D/B Company may modify this requirement.

The Membrane System is divided into eight equal-sized trains. The trains are configured such that one or more may be taken out of service for maintenance or membrane cleaning. Flow shall split evenly to the online trains. The Membrane System is designed for a hydraulic capacity of QPKDY, with any one membrane train out of service or any one pump from each pumping system (mixed liquor transfer and permeate) out of service during maintenance or membrane cleaning.

Permeate will be processed by a downstream ultraviolet light (UV) disinfection process. It has been assumed that membrane permeate will leave the membrane building with a minimum residual pressure of 5 pounds per square inch (relative to the water surface in the membrane tankage), when the Membrane System is operating at design permeate flow rates. At its option, the D/B Company may waive this requirement.

Please refer to Appendix 16 for complete details of the Membrane System.

2.2.6.12 Ultraviolet Disinfection

The design UV dose shall be sufficient to achieve effluent Performance Requirements for fecal coliform. In no case shall the design UV dose be less than 65 mJ/cm2 at QPKDY, as determined using UV DIS V.3.1. and according to the point summation method as described in the US EPA Design manual (EPA/625/1-86-021). The design will be sized using 0.80 end of lamp life, 0.92 quartz transparency and a 0.90 safety factors with no exceptions. Other factors will not be allowed.

The UV Disinfection System shall be capable of applying the design UV dose with any single reactor out-of-service. This requirement may be met by providing a standby bank in each channel . In no case shall there be less than two reactor trains.

The UV Disinfection System shall be designed to operate in either "flow pacing" or "dose pacing" mode, as selected by an operator using the plant control system. In flow pacing mode, lamp output shall be adjusted based on the measured flow rate and UV transmittance continuously measured by a UV transmittance monitor. In dose pacing mode, lamp output shall be adjusted based on measured flow rate, and measured UV intensity. The UV system shall be designed at a UV transmittance of 70% with no exceptions.

2.2.6.13 Post-Aeration

Post-aeration tankage can be aerated using fine-bubble diffused air and centrifugal or positive displacement blowers or cascade aeration. The system should consider temperature dissipation. **The specification for temperature dissipation is that the effluent can have a 0°C temperature rise through the JCEC.**

Post-aeration equipment shall be designed such that at design QPKDY, with all post-aeration tankage in service and one blower out of service, the effluent instantaneous DO limit will be met.

2.2.6.14 Effluent Flow Measurement

The flow rate from the plant shall be measured using a Parshall flume. The flume shall be capable of measuring 10 percent more than 31.7 MGD. At design 31.7 MGD, the flume shall not be submerged.

2.2.6.15 Effluent Pumping, Transmission, and Outfall

The pump station is required to be incorporated into the JCEC facility, either within the buildings or a low/below grade profile and landscaped appropriately. A minimum of four equal-sized variable-speed pumps shall be provided. The minimum firm capacity shall be 110 percent of design 31.7 MGD. The pump station shall include space for additional pumps, which would double the firm capacity of the pump station.

While the County has not received a response to the WLA letter the proposers should assume that a new outfall will be constructed within the section of the new site that borders the Chattahoochee River. The force main shall have a capacity of 110 percent of 31.7 MGD, with a diffuser that satisfies all requirements.

As an alternative price item on PPF1 the County desires a price for construction of the required force main from the effluent pumping station to the current outfall located at the existing plant. This force main shall have the capacity of 110 percent of 31.7 MGD.

2.2.6.16 Re-Use System

As described in Section 2.3.6 of the RFP the County operates a distributive Re-use system in North Fulton. Currently re-use water for this system is supplied by the Cauley Creek WRF. It is the County's intention to extend this re-use system to the JCEC site prior to the completion of the D/B project. All designs for the re-use system and required components of the system that are the responsibility of the D/B Company shall comply with the specifications contained in the "Guidelines for Water Reclamation and Urban Water Reuse" revised Feb 20, 2002, provided by the State of Georgia EPD. A copy of this document is provided on the Data CD-ROM but it is incumbent upon each proposer to design the system to the most current regulatory requirements.

Re-use water supplied by the JCEC to the re-use system shall meet all the requirements of the "Guidelines for Water Reclamation and Urban Water Reuse" revised Feb 20, 2002.

The responsibility for the design and construction of the extensions of the re-use system and its tie-in to the JCEC is:

1. The D/B Company shall be responsible for the design and construction of the re-use system pump station, wet well and for the pump control system. This

will include the design of the remote sensing system that will provide input to the pump control system.

2. The re-use force main construction contractor will be responsible for the extension of the force main, tying into the Re-use pump station wet well and the installation of and signal transmission to the pump control system of the remote sensing system.

The JCEC will supply water to the re-use system as necessary to maintain system pressure and flow. When the system demand is less than Cauley Creek ability to supply re-use water , the JCEC re-use pump station will be capable of receiving the excess from Cauley Creek WRF and diverting it to the JCEC outfall.

2.2.6.16.1 Reuse Storage and Pumping

The pump station is required to incorporated into the JCEC facility (either within the buildings) or low profile or below grade and landscaped appropriately. A minimum of three equal-sized variable-speed pumps shall be provided. The minimum firm capacity of the pump station shall be 5.5 MGD. The pump station shall include space for additional pumps, which would increase the firm capacity of the pump station to 10.9 MGD.

The pump station shall be designed with sufficient turndown to handle minimum influent flow rates at startup, not specifically defined. Pumps shall be vertical turbine or split-case horizontal. Minimum pump efficiency shall not be less than 80 percent at the duty point. Pumps shall be selected based on efficiency throughout the entire flow range. The discharge pressure at the pump station shall be 150 psi. Surge analysis shall be conducted and appropriate surge suppression shall be provided for the system.

2.2.6.16.2 Instrumentation and Control Systems

Flow and pressure of pumped reuse water shall be measured at the reuse pump station. The reuse pump station shall be designed to receive inputs from multiple locations throughout the reuse transmission system. Inputs will include system pressures, flows, storage tank and storage pond volumes, booster station operational data, and operational data from the CCWRF Reuse Pump Station.

2.2.6.16.3 Reuse Pump Station Wet Well

The reuse pump station wet well shall be designed in accordance with Hydraulic Institute standards. The wet well may be designed in line or as a side-stream to the plant effluent flow. In either case, the reuse pump station shall be designed

such that the Peak Hourly flow rates from both JCEC and CCWRF, 40.2 MGD, can bypass the wet well by gravity to the effluent pump station.

2.2.6.16.4 Reject Water Storage

Proposers should consider the requirements of the "Guidelines for Water Reclamation and Urban Water Reuse" revised Feb 20, 2002, provided by the State of Georgia EPD or later revision in determining the requirement for a reject water storage at the JCEC. If required, the design of this storage shall meet the requirements of the referenced document and shall be incorporated into the site layout and landscaped to the standards of the D/B RFP.

2.2.6.16.5 On-site Storage

There shall be no on-site storage of re-use water other than the re-use pump station wet well.

2.2.6.17 Digestion and Solids Handling

With respect to the overall solids handling processes, the County sees advantages and disadvantages associated with all of the potential processes involved. The DB Proposer, in presenting their design, will consider the operational cost benefits associated with the proposed solids handling process train. Specifically, the DB Proposer shall consider sludge quantities, solids reduction, thickening, odor potential, footprint impacts, and disposal costs. If the processes described in this section are utilized, the process will be provided in accordance with these minimum requirements.

2.2.6.17.1 Thickening

Thickening, while not viewed as a critical process element, are viewed as potentially having advantages to the County. Accordingly, any designs proposed for thickening which has downstream process sizing impacts, should be designed consistent with the reliability and redundancy criteria stated throughout this RFP. Within this context, drum, belt and gravity thickeners are specifically not allowed.

2.2.6.17.2 Anaerobic Digestion and Solids Holding

A minimum of two mesophilic (35 °C), high-rate anaerobic digesters shall receive primary clarifier underflow. The process and piping shall be configured

such that Waste Activated Sludge (WAS) can be routed either to the digesters or directly to the sludge holding tank, described below.

The anaerobic digestion process shall be designed for a primary sludge production rate corresponding to maximum 30-day average influent loads. Under these conditions, the County believes that attaining a Class B sludge is economically feasible. While a Class B sludge is a desired result of the anaerobic digestion process, it will not be a condition for Acceptance.

The digesters shall be mixed for complete turnover in no less than 20 minutes. External heat exchangers shall be designed to limit digester temperature fluctuation to no more than 1 Celsius degree per day. Boilers shall be designed to use either digester gas and an external supply of natural gas.

The digesters shall be covered, and the covers shall be designed to prevent the release of odorous gases. Odor scrubber for digesters shall be, at a minimum a two stage scrubber capable of handling 50 ppm hydrogen sulfides.

Further, a sludge holding tank shall be provided. The tank shall be sized a minimum of five days storage of digested primary sludge and waste activated sludge at solids production rates corresponding to maximum 30-day average influent loads.

The sludge holding tank shall be mixed and covered to prevent the release of odorous gases. Air from the tank shall be withdrawn to an odor control system. The tank shall be cleaned using water cannons, without it being necessary for personnel to access the tank floor.

2.2.6.17.3 Aerobic Digestion

A minimum of two aerobic digesters shall be provided. The aerobic digestion process shall be designed for a waste activated sludge production rate corresponding to maximum 30-day average influent loads. Under these conditions, the County believes that attaining a Class B sludge, based on the standard oxygen uptake rate (SOUR), is economically feasible. While a Class B sludge is a desired result of the aerobic digestion process, it will not be a condition for Acceptance.

The digesters shall be covered, and the covers shall be designed to prevent the release of odorous gases.

2.2.6.17.4 Centrifuge Dewatering

Sludge shall be dewatered using centrifuges. A minimum of three equal-sized units shall be provided. Centrifuges shall be sized for solids production rates corresponding to maximum 30-day average influent loads. At these rates, the centrifuges shall be capable of dewatering the sludge while operating 4 days per week, 12 hours per day with one centrifuge out of service.

Centrifuges shall produce cake with minimum 20 percent solids and minimum 95 percent solids capture. Dewatered sludge shall meet, at a minimum, 40 CRF Part 503, Subparts C and D, Method 9095 Paint Filter Liquid Test as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA Publication No. SW-846), as well as any Local or State regulations applicable to landfill disposal of sludge.

The dewatering building shall be configured such that the trailers used to haul dewatered sludge to the landfill will never be outside, empty or full.

2.2.6.18 Chemical Storage and Metering

Sufficient chemical storage shall be provided for the maximum 21-day usage, during the design year, of each chemical used for treatment processes at the Plant. Chemical metering capacity shall be sufficient to meet requirements during this 21-day period with one of each type of chemical feed unit offline.

2.2.7 Odor Control Systems

Proposers shall provide information in the technical portion of their proposal that indicates the plan to provide effective odor control for the JCEC. The number, location and size of the odor control systems shall be determined by the D/B Company. The County will consider wet, dry and/or biological scrubbers. Some of the factors that will be used to evaluate the scrubbers proposed are footprint, initial cost, life cycle cost and architectural external image.

The entire plant is enclosed and to ensure adequate odor control system performance, all tanks, channels, screens, and conveyors that have the potential to release detectable odors off-site shall be enclosed and directly exhausted to an odor control system, regardless of location. Specifically, all screenings, grit, sludge, and water surfaces upstream of the activated sludge process shall be covered or enclosed and directly exhausted to an odor control system.

An experienced odor control specialist shall evaluate all other major plant processes for their potential to release detectable odor. Where such potential is present, point source control of odor as indicated above shall be required.

2.2.7.1 Odor Control Performance Guarantee

Odor control systems shall treat odorous air in order to meet the following performance criteria under the design conditions described below:

- Goal - Prevent odor complaints from the public by reducing concentrations of hydrogen sulfide, amines, ammonia, mercaptans, and other sulfur-containing compounds such that they are undetectable at the property line.

- Requirement - A maximum odor concentration standard of 5 dilution-to-threshold (D/T) shall be applied at any point 25 feet from any building of the JCEC with all doors closed. D/T is as defined in ASTM E-679: *Standard of Practice for Determination of Odor and Taste Thresholds by a Forced-Choice Ascending Concentration Series Method of Limits*.

Proposers should review Appendix 18 for details on the Odor Control Performance Guarantee.

2.2.7.2 Odor Control Design Conditions

Odor control systems shall be designed for the following design conditions:

- The Plant will be operated, maintained, and managed by the best standard of care available under Good Industry Practice.

- Plant operation during periods when odor control equipment may be functioning at less-than-optimum performance.

- Worst-case meteorological events: calm conditions, Class F atmospheric stability, wind speed of approximately 1 meter per second.

2.2.8 Noise Guarantee

The D/B Company shall take action to minimize the noise created during construction of the Design/Build Work and the noise from operation of the

permanent equipment installed at the Plant. Proposers shall review Appendix 18 for more detail on the Noise Guarantee.

Background noise levels were measured at two points beyond the Plant envelope, where the public has access and where people are living or engaging in recreational activities. The data, collected over three 24-hour periods, were measured with a noise dosimeter set with A weighting, slow response, and a 5-dB exchange rate. Table A2-7 summarizes the collected data. The average value for each monitoring point listed in the table below will be used as the benchmark for the required performance criteria regarding noise.

Table A2-7 Current Background Noise Levels

Point	TWA[13] (dB[14])			
	Day 1	Day 2	Day 3	Average
Data Point A	56.9	58.3	56.6	57.3
Data Point B	54.1	53.6	59	55.6

Construction activities must be conducted and Plant equipment must be selected and installed to meet the following performance criteria for noise.

During construction, the noise levels on a TWA basis being measured at the two monitoring points described above shall not exceed the average background level between the hours of 7 p.m. and 7 a.m. These are the hours when residents are most sensitive to noise. The community would be negatively impacted by an increase in noise during these hours. With the exception of any emergency operations, all construction activity contributing to noise above the benchmark background level must be conducted between the hours of 7 a.m. and 7 p.m. local time.

Once construction has ceased, the permanent equipment associated with the plant is placed into operation and accepted by the County, noise levels measured at the two monitoring points shall not exceed benchmark background noise levels by more than 3 dB on a TWA basis. The human ear can detect a perceptible change in noise at this

13 Time Weighted Average – The sound pressure level that is accumulated for any time period but with its average level computed over an 8-hour time period

14 decibels – a logarithmic unit, which expresses the ratio of the sound pressure level being measured to a standard reference level

point. An increase in noise by 5 dB is a readily perceptible change, impacting residents in the community.

2.2.9 System Controls and SCADA System

The D/B Company shall provide real time monitoring of all areas of the process for the JCEC consisting of remote terminal unit (RTU) programmable controllers This supervisory control and data acquisition (SCADA) system shall be capable of:

- Centralized monitoring of and equipment, level and intrusion alarms.
- Providing rapid and informed response to alarm conditions.
- Each RTU modem will be equipped with loss of transmission alarm for indication at the control center.

The telemetry and a SCADA system for the JCEC shall include a plant-wide present generation, open-architecture distributed process control system utilizing programmable logic controllers (PLC) each with redundant processors, WonderWare SCADA software and Windows based computer systems. The D/B Company shall provide new redundant network servers; two networked PC workstations with 20" monitors for plant process monitoring and total control functionality; separate alarm and event/report printers, pump station telemetry system for real time collection system monitoring.

County Office Computer Workstation

Additionally, the D/B Company shall provide a computer workstation located in the County's Representative office capable of interfacing and fully accessing the entire CMMS. The County's computer workstation shall include all associated hardware and software required to interface with the SCADD and CMMS over the installed network

Throughout the JCEC, the Company shall provide a series of PLC equipment with an installed fiber optic data highway. All necessary PLC programs with analog and digital input/output capacity shall be installed to automate process control for operational efficiency and reliability. PLC logic programs shall follow proven control strategies. Manual operational capability shall also be available in the event of a failure of the redundant processors in each PLC control unit.

The SCADA system shall be networked to allow off-site access via portable computer to all process data and alarms so that supervisors or technical support specialists can do "telephone- troubleshooting" without having to be at the facility.

Access to all data shall be password protected, involving three layers of security and time and location identified access.

A full array of process-sensing and analytical instrumentation shall be installed, calibrated, and integrated into the facility control system. These devices shall enable the real time awareness of all process values such as level, flow, pressure and analytical values including dissolved oxygen and suspended solids.

Automated comparison of actual values to programmed set-point values shall enable automatic system responses to deliver permit compliant treatment activities and maximize chemical, energy and labor efficiencies.

More information on the System Control and intrusion detection system can be found in Appendix 4.

APPENDIX 3
LANDSCAPE AND ARCHITECTURAL SPECIFICATION

3.1 Landscape Specifications

The specifications for the treatment of the site are provided in this section. It is not the desire of the County that the design/build firm reproduce this landscape plan in exact detail. These specifications should be seen as a general level of quality and treatment for the landscaping of the site following the design and construction of the project. A plant and landscaping specification is provided in this Appendix

3.2 Site Condition

Also provide is a drawing of the site grading and landscaping plan for construction of a fence and landscaping of the area on the extreme western boundary of the site that is adjacent to the Ellard Community and for the general grading of the site. This procurement document is provided on the Data CD/ROM. This work is being performed under a separate contract with Fulton County and should be complete prior to the notice to proceed on the Design/Build project. A earthwork specification is provided in this Appendix

3.3 Architectural Specification

The general specifications for the architectural treatment of the buildings are provided in this section. It is not the desire of the County that the design/build firm reproduce these exact buildings, rather the style of the architecture, the general decentralized, campus arrangement and the relative size of the buildings should be noted.

The County went through a process with a design focus group to develop the guidelines presented in this section. The focus group consisted of community members, Roswell governmental representatives and Roswell Design Review Board (DRB) and Historical Society representatives. The guidelines were developed after several meetings with this groups.

3.4 Architectural Process

The architectural design of the buildings will be evaluated in the technical portion of the relative evaluation process. The significant County desires are as follows:

- The design should be consistent with the guidelines provided in this section.
- The design should consider the view from all aspects of the site.

- The design should be consistent with the history of the Town of Roswell. The final architectural design for the project submitted by the successful Design/Build Company will be reviewed by the Roswell DRB.
- A decentralized building arrangement should be used.
- All wastewater treatment processes and all mechanical equipment should be within a building or covered space.
- Lighting of the site should be low intensity and directional to keep as much light within the boundaries of the site.
- Design and landscaping that provides both visual and noise barriers to surrounding properties should be utilized.
- The Proposers shall utilize the specifications referenced and contained in, Appendices 4, 5A and 5B, and Volume 4 for the design and construction of the JCEC buildings and structures.

3.5 Storm Water

The Johns Creek Environmental Campus has a subordinate goal of providing Environmental Awareness and Education to the citizens of Fulton County and Georgia. The area of Storm Water is at the forefront of Water Environmental issues. Fulton County wants the D/B Company to be cognizant of these issues and provide progressive and innovative ideas for the management of storm water on the JCEC site. This requirement is not intended to relieve the D/B Company of any and all requirements under the NPDES permit or other regulatory requirement for storm water.

SURFACE WATER MANAGEMENT PROCUREMENT LANGUAGE FOR COUNTY PROJECTS

"*All County projects involving land disturbance activities that require a Land Disturbance Permit (LDP) issued by Fulton County shall include provisions to mitigate site post-development surface water runoff quality and quantity. The goal of these provisions is for post-development runoff to mimic the natural runoff conditions upstream and downstream of the project before development at the site. The project design shall incorporate facilities to achieve the above stated goal* **(while the City of Roswell will issue the LDP for this project, the provisions of this section 3.5 apply to the JCEC in addition to any requirements of the City of Roswell for issuing the LDP).**

Development of a stormwater runoff management system shall be accomplished in three (3) phases, as described below:

1. ***PLANNING** - Prior to initiating design documents, the designer shall prepare a narrative planning report with sketch type figures, as required, to address conditions on-site, upstream and downstream to include the following:*

    a. *A USGS quad sheet indicating the project site and all planned surface water runoff analysis points.*

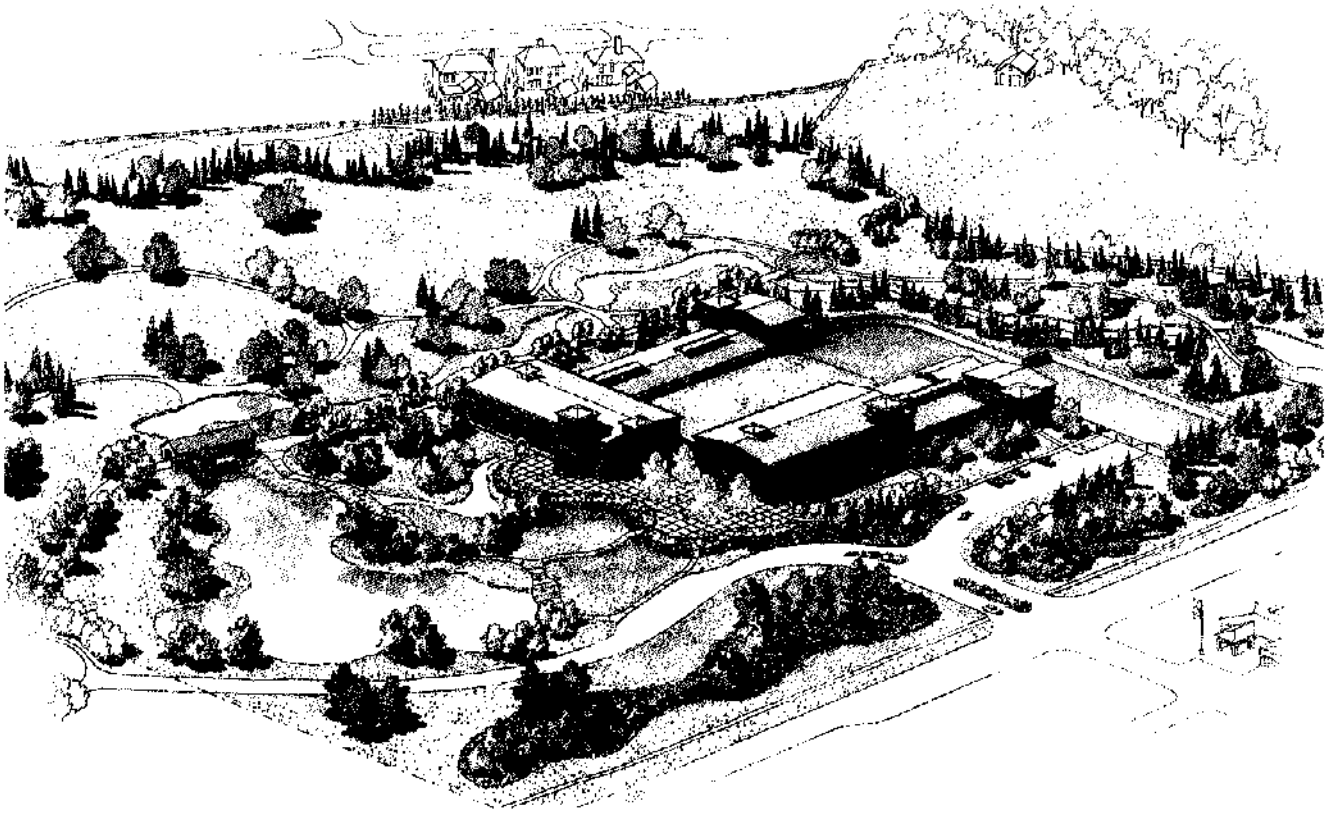
b. *A Fulton County GIS Map indicating the project site and all existing infrastructure that may be impacted by the proposed project.*
c. *A discussion of the existing surface water management system that will be impacted by the proposed project.*
d. *A discussion of how the post-development surface water runoff will be managed with respect to water quality and quantity. Include discussions of the management measures planned to address the specific issues of streambank erosion, flood control and habitat impacts.*
e. *A general description of planned* ***Best Management Practices (BMP's)****, and the basis for their selection, including intended specific water quality benefits. Include discussions of the pollutant removal potential for the following constituents; suspended solids, phosphorus, oils and grease, fecal coliform and metals.*
f. *A summary description of the stormwater analysis methods to be utilized, to determine the effectiveness and size of all proposed stormwater management system components and/or facility.*

The narrative planning report with attachment(s) shall be submitted to the Construction Manager, 20 days prior to submission to City of Roswell of the application for Land Disturbance Permit. All comments shall be incorporated into the concept plan submittal without further review, unless the designer determines that additional communication is required for clarification. The Construction Manager will provide any comments within two(2) weeks of receipt of the narrative planning report.

2. ***CONCEPT PLAN REVIEW*** *- The designer shall prepare a concept plan that addresses stormwater management issues of the proposed project and shall submit it to the Construction Manager for review. The concept plan shall include the Minimum Submittal Requirements For Concept Plan Review, as required by the Fulton County Department of Public Works, described in the Description of Submittal Document Requirements (latest revision available from the Plan Review Division). Documentation shall be provided with the concept plan submittal to demonstrate that the plans address the planning phase comments.*

3. ***FINAL DESIGN AND CONSTRUCTION DOCUMENTS*** *- The designer shall contact the Construction Manager to establish permitting requirements necessary for the issuance of a* ***Land Disturbance Permit (LDP)****, prior to finalizing the project's construction documents. The final design and construction documents shall, as a minimum, include the following:*

a. *Detail engineering analysis and design specifications for each proposed* ***BMP*** *and/or surface water management control measure.*
b. *Detail engineering analysis and/or modeling, that establishes the existing on-site100 year floodplain limit (i.e. elevation and horizontal location). Provide, if necessary, all supporting documentation to satisfy the County's floodplain management program, and requirements of the* ***Federal Emergency Management Agency (FEMA)****."*



Design Guidelines

Johns Creek Environmental Campus

Fulton Country Department of Public Works ***February 2004***

Architectural Guidelines

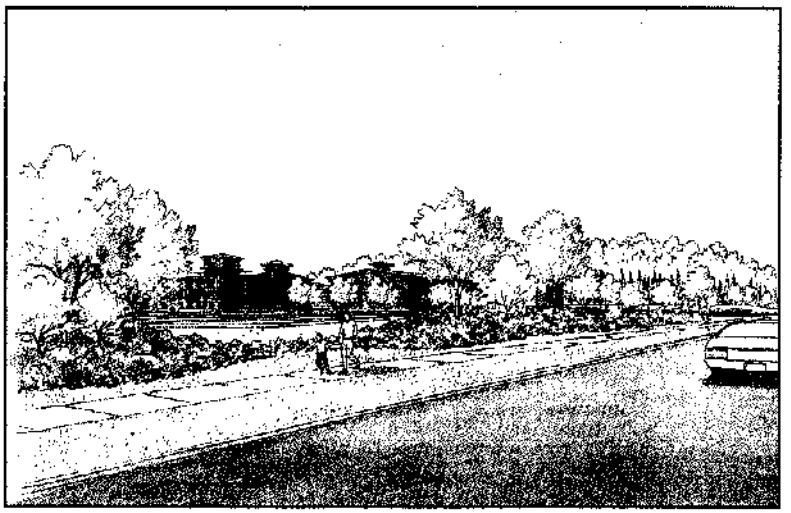
The following architectural guidelines were established to provide design guidance for the construction of the Johns Creek Environmental Campus structures at 883-884 Holcomb Bridge Road, Roswell, GA.

The Environmental Campus design is the result of several public meetings with Roswell residents and county and city government representatives. It is therefore important that the construction of the facility follow the agreed upon decisions and produce the anticipated esthetic outcome.

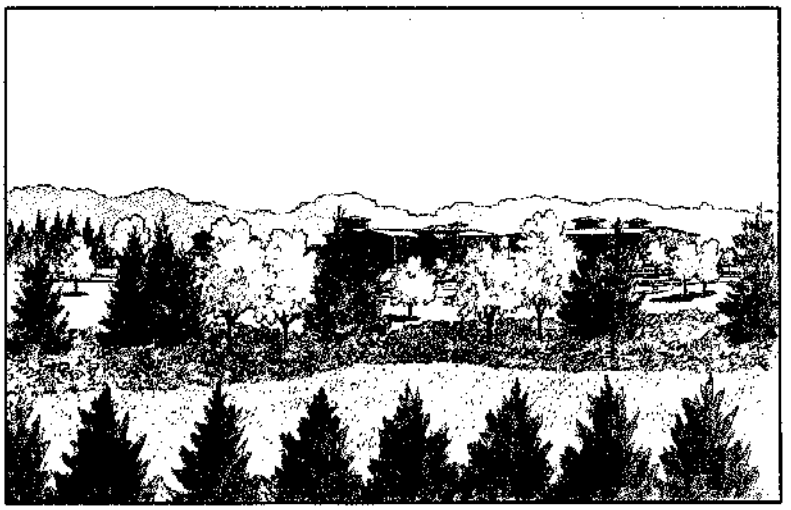
These guidelines are set forth to create the image of a historic mill complex with buildings varying in size, shape and use. The complex will not be a replica of a historic mill but the principles of the design are derived from local historic mills. The presence of water on the site is reminiscent of the era when mills used water as a source of power.

The guidelines will regulate the materials of the buildings as well as the roof pitch, massing and materials for exterior spaces. For guidance with building placement within the project area refer to the Site Development section. The architectural guidelines are to be used in conjunction with the site guidelines for the overall landscape concept.

The guidelines include in text and drawings the important concepts of the design process. This document is an important component of the design build for achieving the architectural features and the overall vision of the campus.



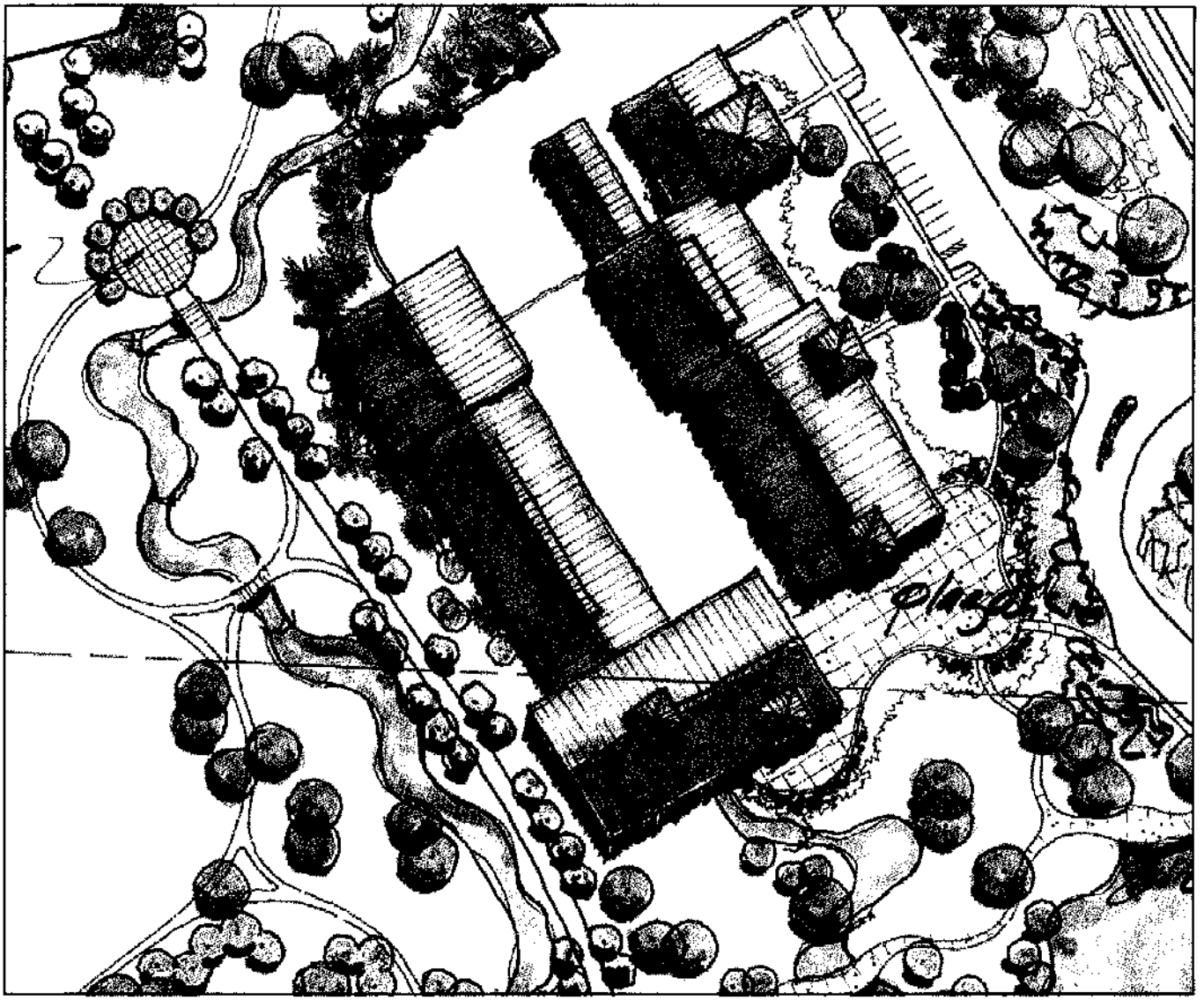
View of the Johns Creek Environmental Campus traveling northwest on Holcomb Bridge Road into the City of Roswell, Georgia.



View of Johns Creek Environmental Campus from the Ellard Community residences located west of the Johns Creek Environment Campus site.

Architectural Guidelines

THE JOHNS CREEK ENVIRONMENTAL COMPLEX was perceived as a loose grouping of buildings creating a campus atmosphere.



THE JOHNS CREEK ENVIRONMENTAL CAMPUS will be integrated visually into the park through landscaping. The history of the site is to be documented with markers along a pedestrian pathway. The importance of water will be expressed by the presence of the lake and the stream. A goal of the project is to make a facility that is aesthetically pleasing and one that is comfortable at the edge of a residential area and a public park.

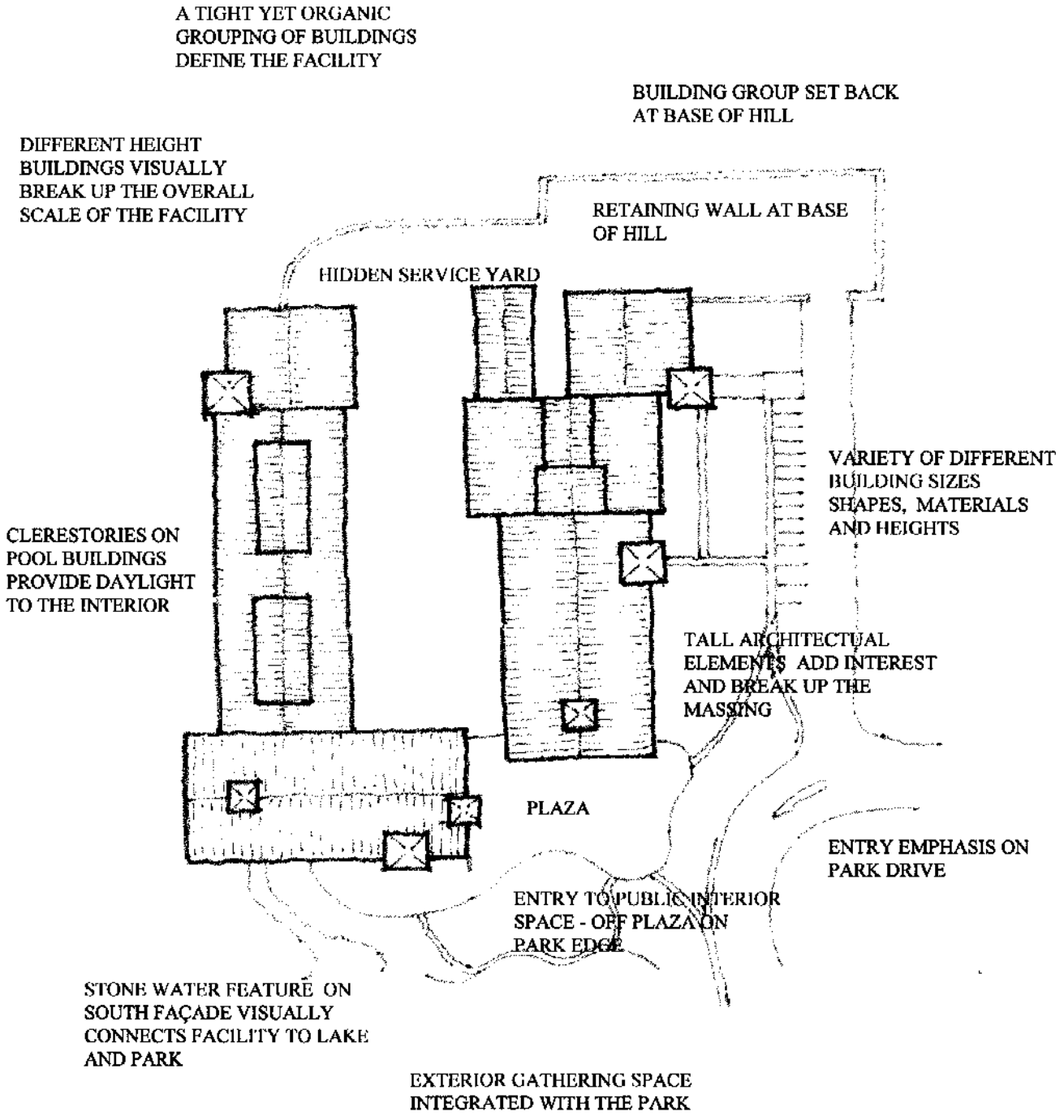
BUILDING PROGRAM

Note: Program does not include working square footage for the following processes: filtration, clarification, head-works, or basins. The square feet required for these processes will be determined through the design build process.

Square feet shown is minimum required.

Building entry	Public Area	15' x 20'	holds small tour group (standing) to be located in lg. tower in front building facing park
	Visitors Window	8' x 8'	w/reception desk
	Visitor Restroom	8' x 8'	unisex
Administration Office		16' X 20'	3 – cubicles
	Plant Mgr. Office	12' x 12'	private
	County Rep. Office	12' x 12'	private
	File Storage Room	15' x 15'	near admin. office
	Conference Room	15' x 24'	4 x 10 table – 12 people
	Library	10' x 10'	adjacent or added to Conf. Rm.
Educational			
	Classroom/training	100' x 100'	90 students w/aquarium and storage closet
Facility Support			
	Process Lab	15' x 12'	multiple stations
	Lab Office	8' x 8'	single person lab office
	Control Room	12' x 12'	2 people –
	2-Control Rm. Offices	2@ 7' x 7'	private
	Break rm.	12' x 14'	vending, sink, frig, microwave table & chairs
	(2) Women's restroom	10' x 10'	one in educational area one in work area
	Women's locker & shower	15' x 20'	locate w/restroom
	(2) Men's restroom	10' x 10'	one in educational area one in work area
	Men's locker & shower	15' x 20'	locate w/restroom
	Mechanical rooms	---------	To Be Determined
	Storage rm.	12' x 12'	closed room storage
	Maintenance	50' x 50'	tool storage/spare parts
	2- Maint. offices	2@ 8' x 8'	
	Janitor's closet (4)	4@ 7' x 7'	sink and storage
	Electric closet	5' x 5'	
	Telephone/Communications closet	5' x 7'	

Architectural Guidelines



Architectural Guidelines

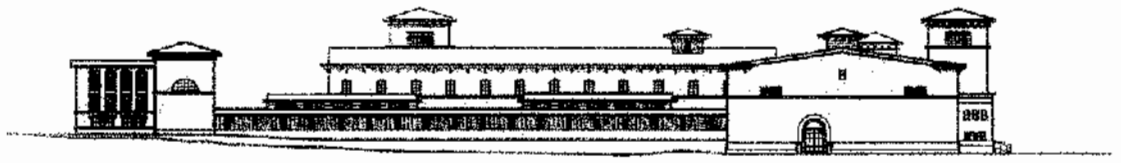
The Johns Creek Environmental Campus system is a combination of:

Head-works processing
Clarifying
Aeration and process basins
Filtration
Ultra-violet exposure,

to be designed to provide the appearance of individual buildings grouped together.

A sensitively designed public works building that will be non-industrial in appearance.

Use of different window patterns will give the facility the appearance of being built over time.

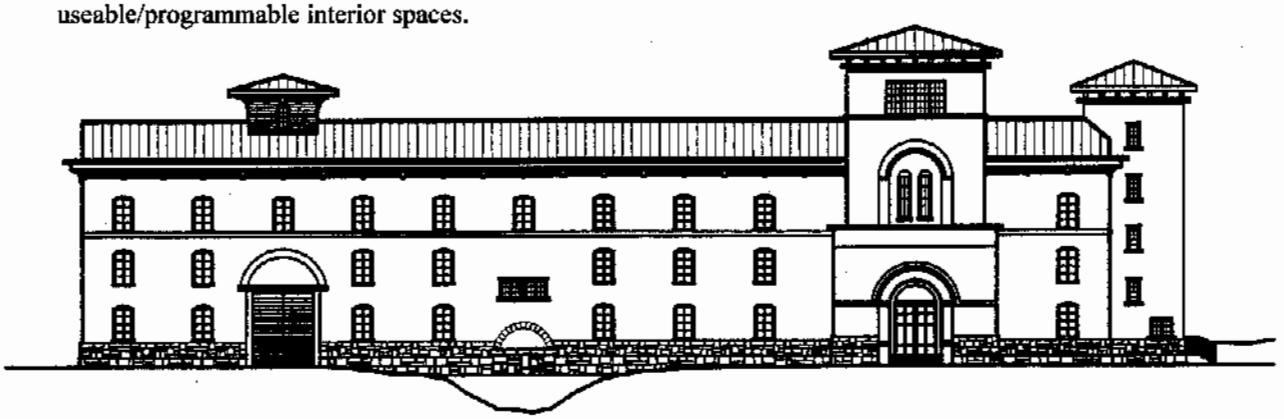


All individual treatment processes must be covered on the site.

The campus may actually be two or more buildings as determined necessary through the Design-Build Process.

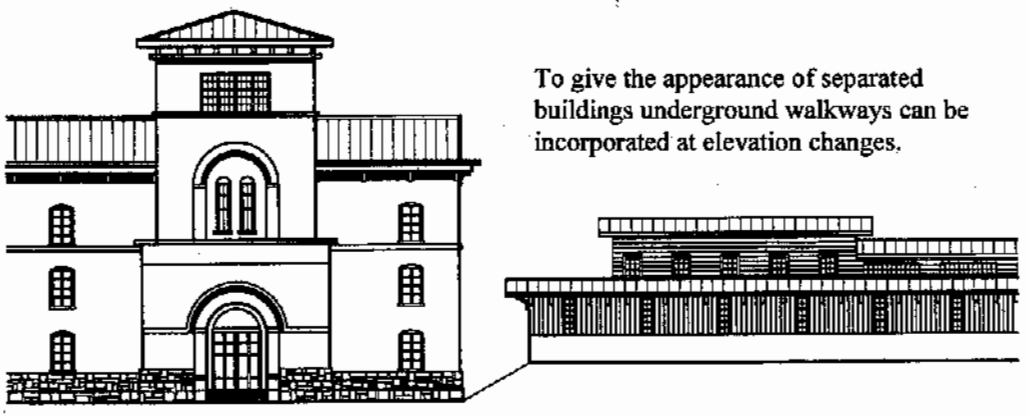
VISUAL INTEREST

Exterior architectural elements that provide necessary visual interest to a building can be creatively designed as day-lighting elements or useable/programmable interior spaces.



Large wood brackets with brick dentil work and corbeling under the overhang of the roof will add detail and the play of light and shadow will enhance the visual effect of the building.

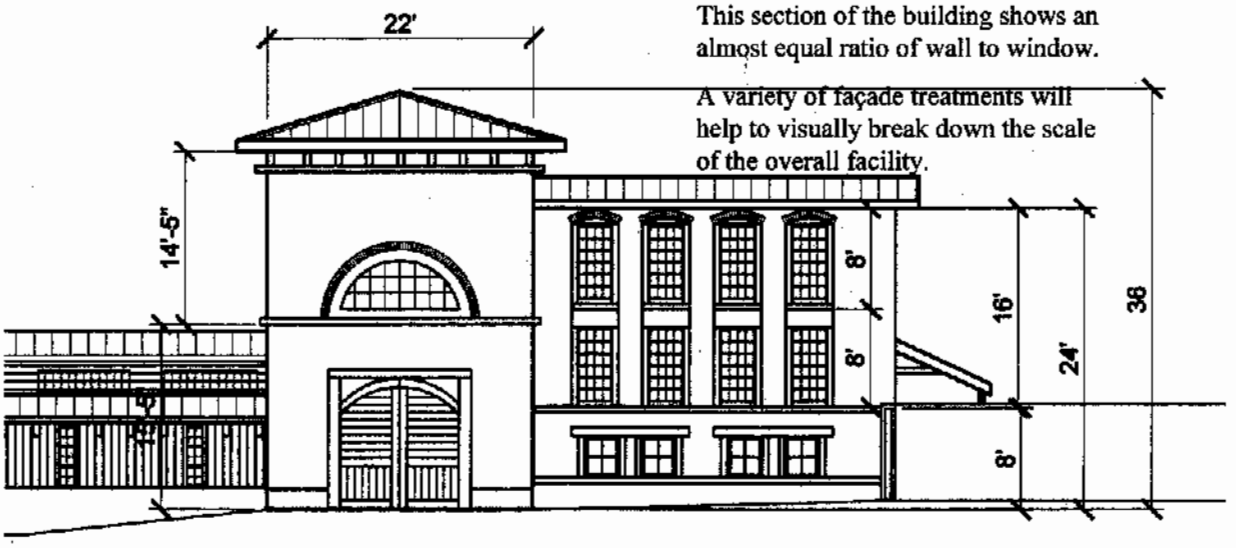
Water feature and field stone on front façade is reminiscent of local area mill buildings of the past.



To give the appearance of separated buildings underground walkways can be incorporated at elevation changes.

The complex is to be designed to include various elevation changes from higher at the base of the hill to lower at the lake.

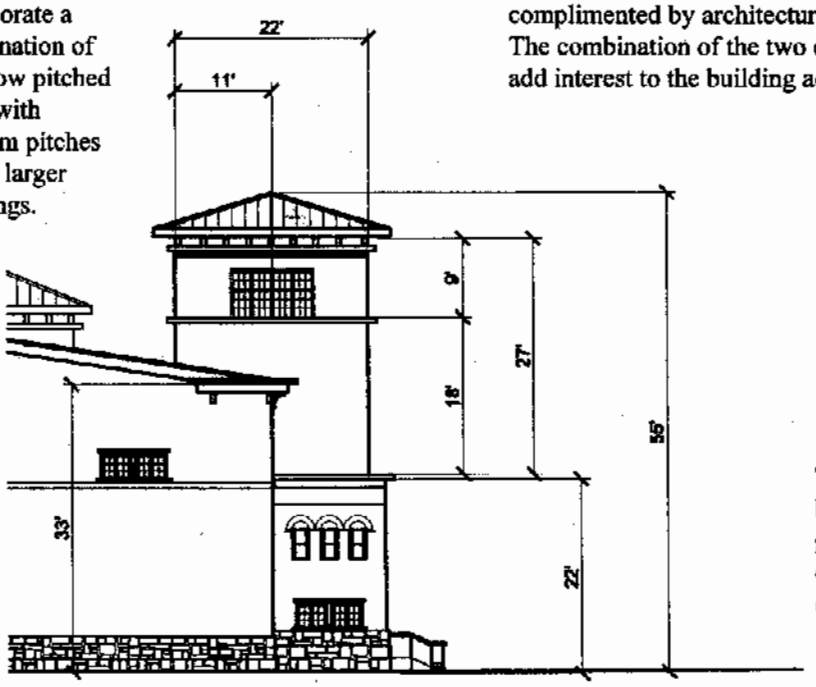
BUILDING PROPORTIONS



This section of the building shows an almost equal ratio of wall to window.

A variety of façade treatments will help to visually break down the scale of the overall facility.

Design should incorporate a combination of very low pitched roofs with medium pitches on the larger buildings.

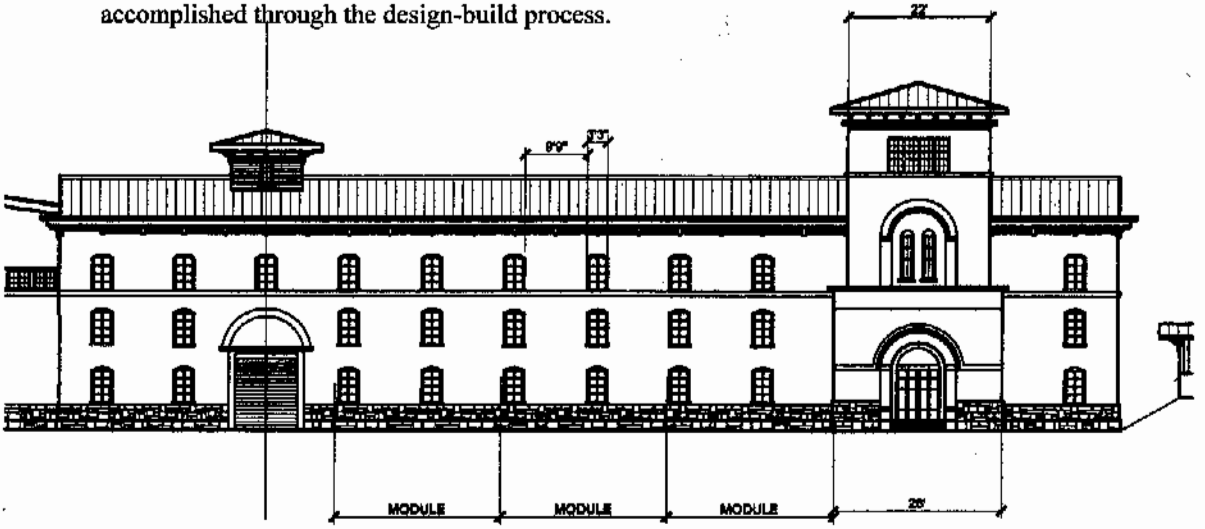


Shown here are buildings designed with 1/3 proportioning complimented by architectural features using equal division. The combination of the two complimentary proportions will add interest to the building aesthetic.

The final proportions of the buildings are important to give the complex visual order and to produce the desired campus effect.

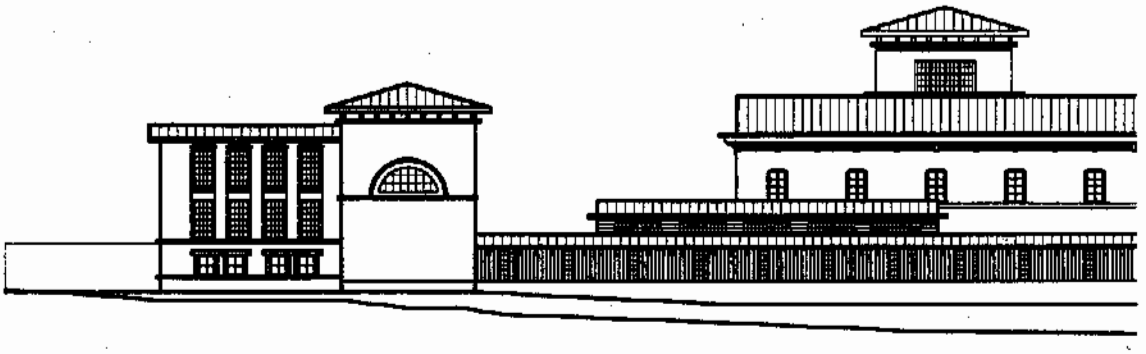
BUILDING COMPOSITION

Larger buildings should be designed with repetitive modules making the increase or decrease in square footage easily accomplished through the design-build process.



Building elements such as doors should be placed with meaning to function as well as the overall façade design.

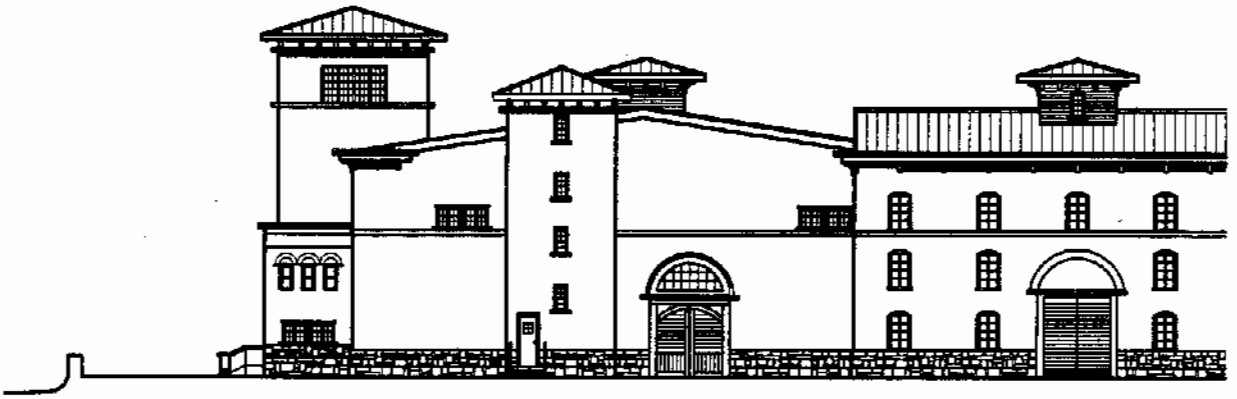
A horizontal line at the visual level of a third floor is necessary to add interest and provide a more human scale to the building.



Horizontal layering of the low buildings with the lines of the taller buildings will produce an intriguing aesthetic and eliminate mundane panoramas of the complex from offsite locations.

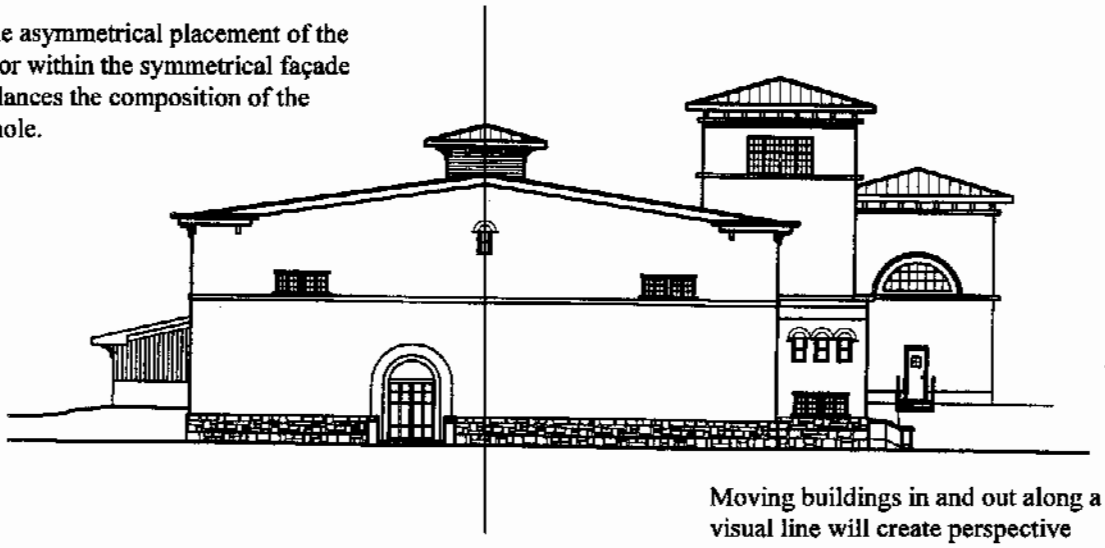
ASYMMETRY
vs.
SYMMETRY

The combination of building elements shows a symmetrical façade treatment interspersed with asymmetrical components of design.



The grand tower at the front portrays by size and location the importance of the front entry; expressing the architectural symbolism.

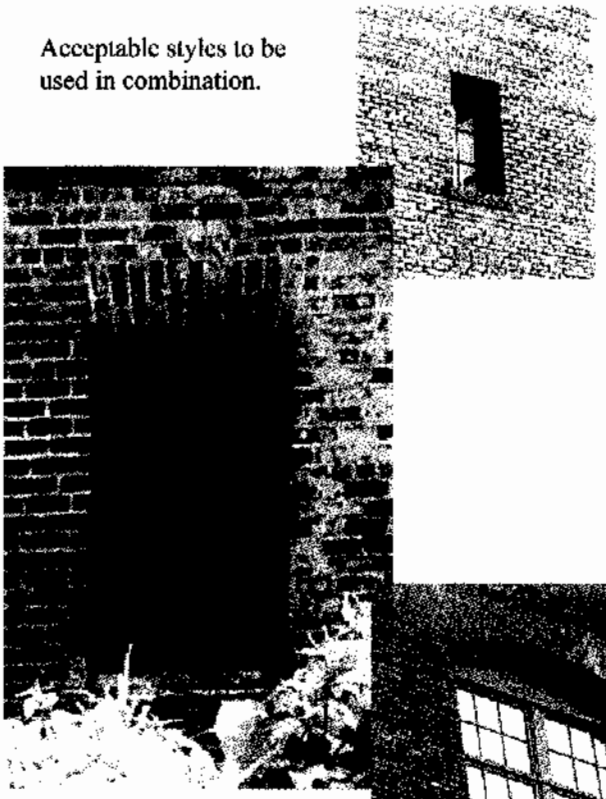
The asymmetrical placement of the door within the symmetrical façade balances the composition of the whole.



Moving buildings in and out along a visual line will create perspective locations on site that will express the elevation changes of the buildings.

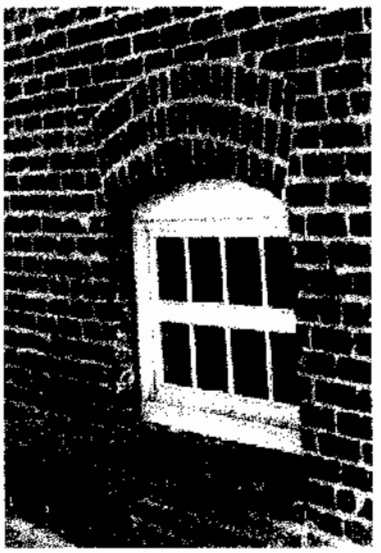
WINDOW DESIGN & PLACEMENT

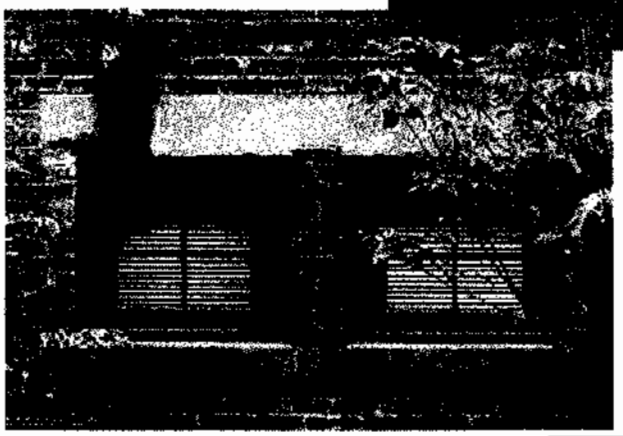
Acceptable styles to be used in combination.



Sills can be rowlock brick, stone, cast stone or metal.

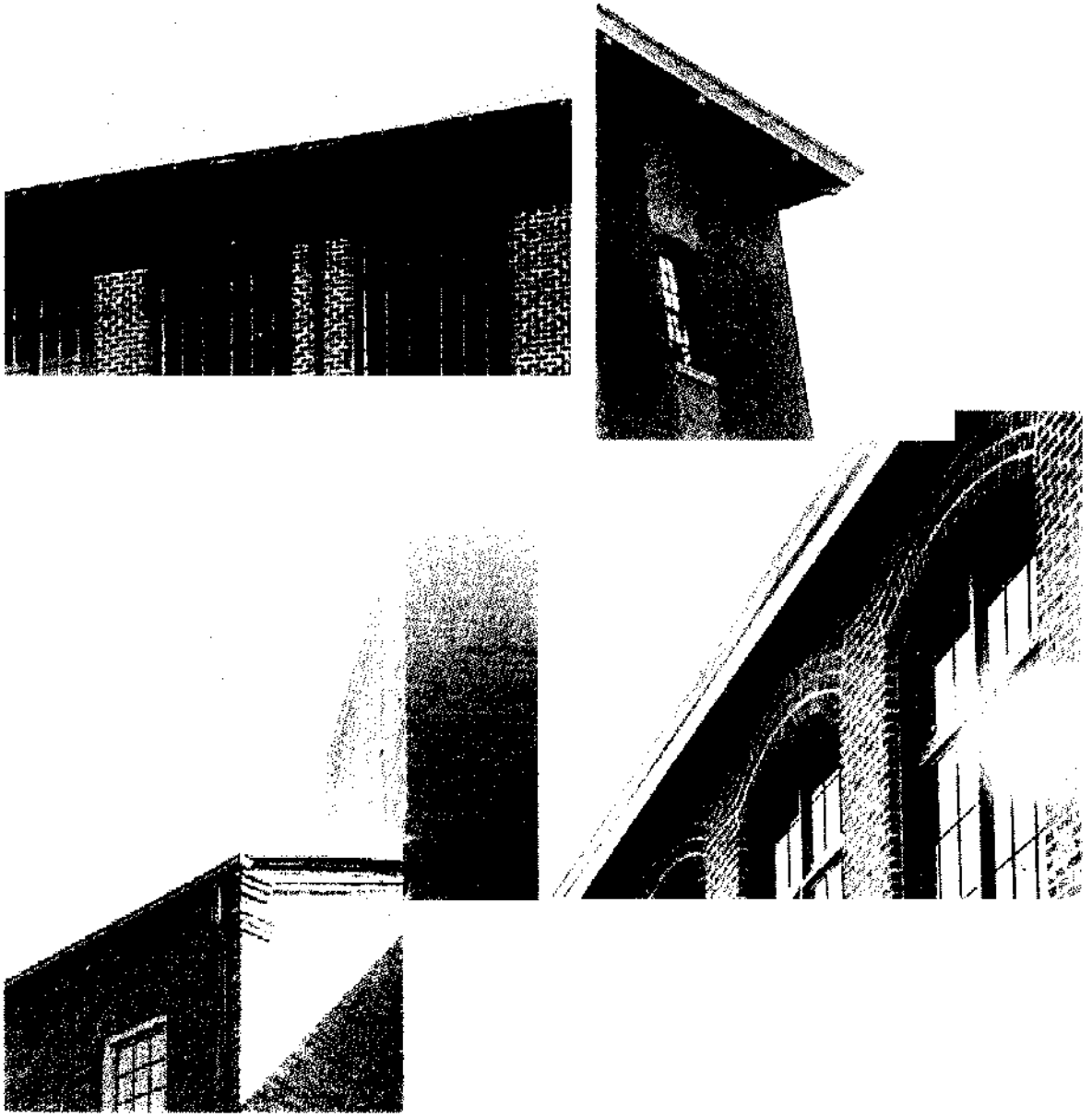
Do not use a pre-cast stone sill with rebar.





ROOF AND CORNICE DESIGN

Acceptable styles to be used in combination.



DIVISION 1 – GENERAL REQUIREMNETS

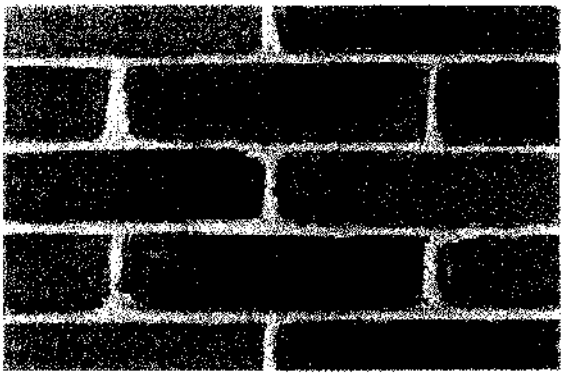
17th Century

Browsing 17th Century in All Locations
Color: Reds

L 200-232

Walls – Preferred Selection

Boral Brick 17th Cent



Building Snapshots | Showrooms Near You

This product is part of our Stocking Shapes Program and our Standard Shapes Program

This product is available in the following sizes: Modular, Queen

Walls – Alternates

General Shale – Old North Church
30-08-296

Or -Cherry Hill Tudor
14-11-743

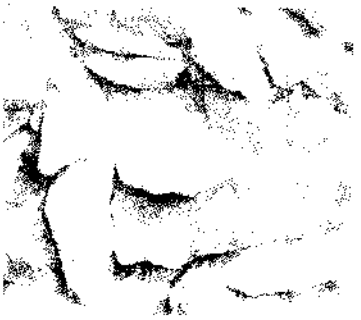
Galvin Historical Brick- Southern Mill
Handmades

Buff colored mortar or mortar to match brick color to be used with chosen brick for exterior walls.

STONE AT BASE OF BUILDINGS

Circa 1835 – MacAfee Bridge support still exists at the Chattahoochee river near site.

Preferred -
Eldorado Stone –
Stone Veneer



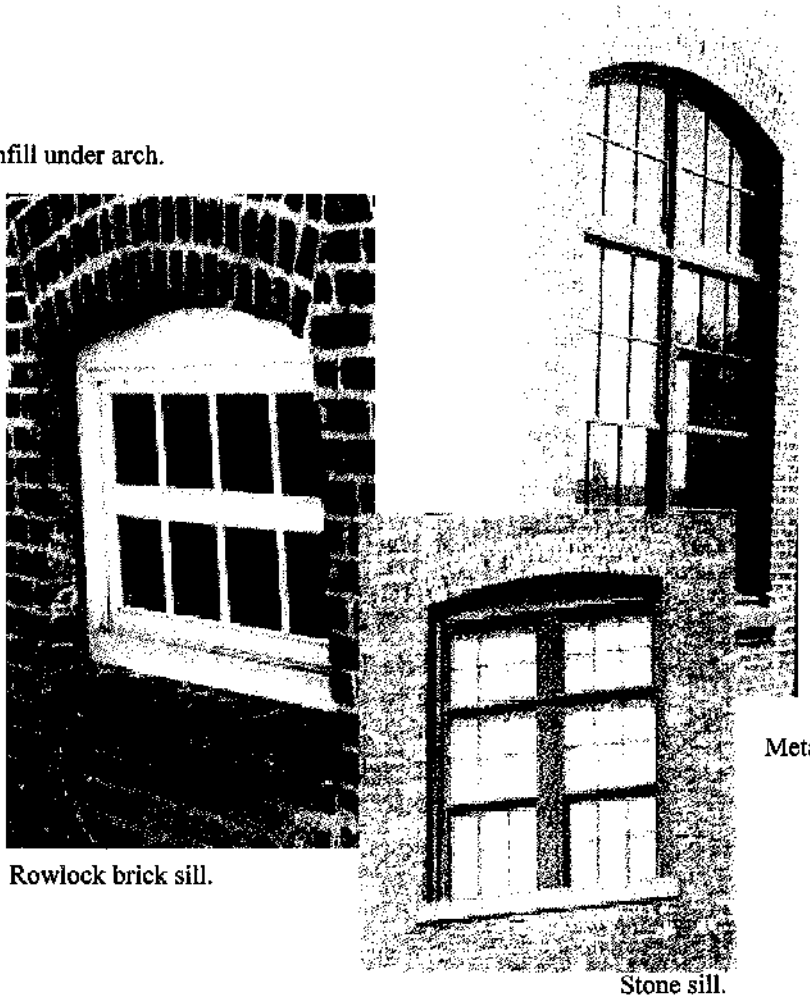
First alternate-
Georgia Marble Co.
White Georgia

Second alternate-
Centurion Stone-
New England Splitface

Mortar for rock base on buildings should match the material used. Lt. gray marble would use light gray mortar.

Architectural Guidelines

Roofing –	Metal standing seam roofing
	Centria – 12 inches between seams
	Steel - Painted gray (light or dark) but not silver in color
	In areas allowed by Code as alternate use historical roofing – Cedar Shingle
Windows –	True divided lite windows
	or
	Simulated wooden mullions
Gutters -	Aluminum half-round gutters – dark bronze in color



Gutters - Aluminum half-round gutters – dark bronze in color

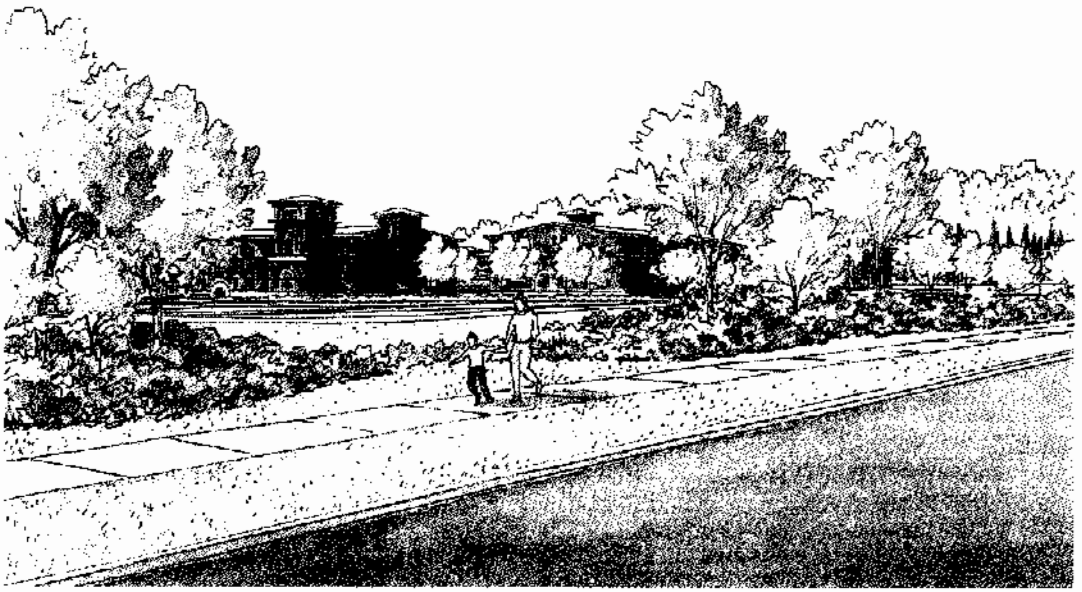
Sidewalks/Plazas-Exposed aggregate concrete with sealer (4" thick over 4" compacted base course – civil engineer to verify). Integral-colored concrete with sealer in feature plaza. Colored concrete plaza to have design with two colors and two finishes (sandblasted and broom-finish).

Exterior Stairs – Concrete with sealer.

Streets/Parking Areas -2" compacted asphaltic concrete wearing surface over 2" compacted asphaltic concrete base over 9" compacted aggregate subbase (civil engineer to verify 0.) 6" x 18" concrete curbs.

Dumpster/Compactor Pads – 8" thick reinforced concrete over 4" compacted base course with sealer (civil engineer to verify).

Interior Reception Area – Floor should be ceramic tile - 16' or 18" squares in an earthtone color – alternate flooring would be a brick floor in a color to compliment but not match the exterior brick.



View of the Johns Creek Environmental Campus traveling northwest on Holcomb Bridge Road into the City of Roswell, Georgia.

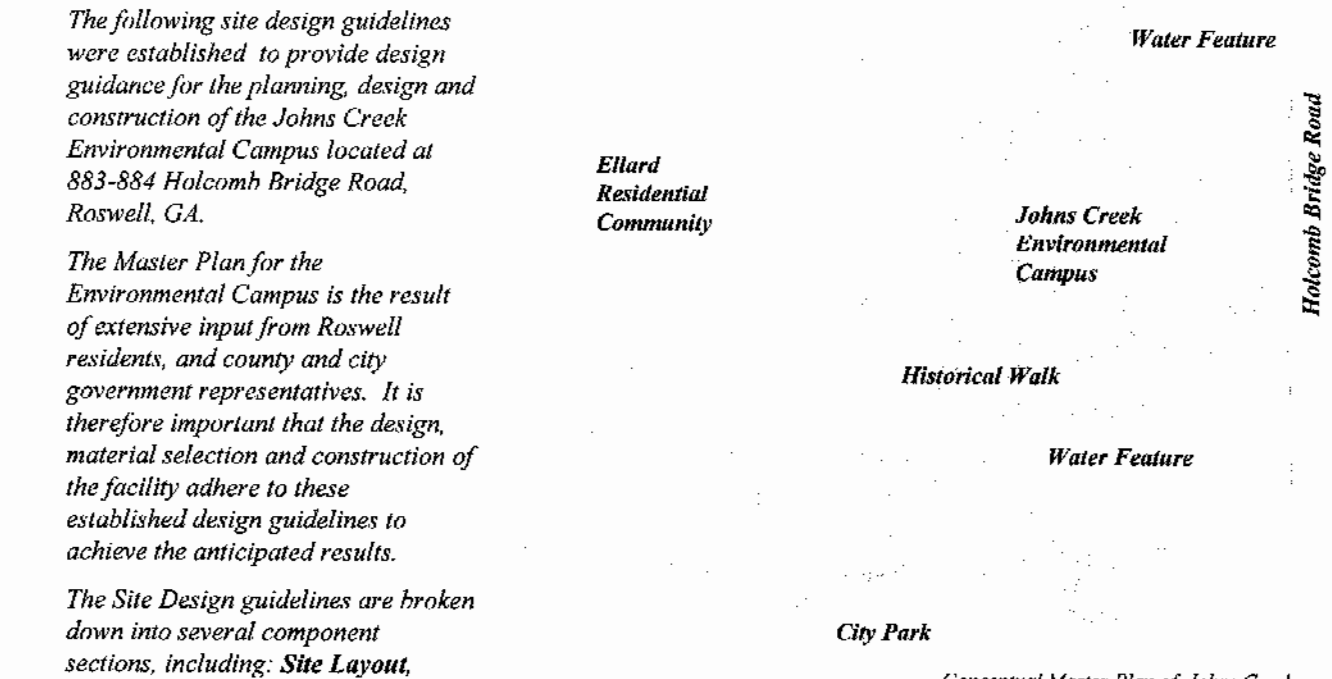
View of Johns Creek Environmental Campus from the Ellard Community residences located west of the Johns Creek Environment Campus site.

Site Design Guidelines

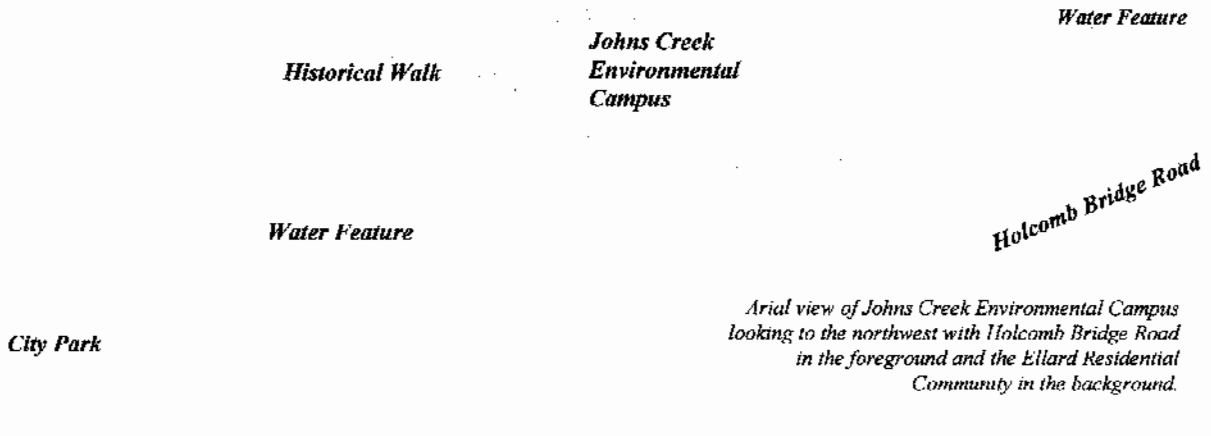
The following site design guidelines were established to provide design guidance for the planning, design and construction of the Johns Creek Environmental Campus located at 883-884 Holcomb Bridge Road, Roswell, GA.

The Master Plan for the Environmental Campus is the result of extensive input from Roswell residents, and county and city government representatives. It is therefore important that the design, material selection and construction of the facility adhere to these established design guidelines to achieve the anticipated results.

The Site Design guidelines are broken down into several component sections, including: ***Site Layout, Water Feature, Historical Walk*** *and* ***Landscape Development****. Each will be described in further detail in the following sections.*



Conceptual Master Plan of Johns Creek Environmental Campus. The campus is located at the southern edge of the City of Roswell, Georgia.



Arial view of Johns Creek Environmental Campus looking to the northwest with Holcomb Bridge Road in the foreground and the Ellard Residential Community in the background.

Site Design Guidelines

SITE LAYOUT

The Johns Creek Environmental Campus is located on a 48 acre tract of land in the southern tip of Fulton County and is a major gateway into the City of Roswell Georgia. The site is bound by the Chattahoochee River and a city park on the south and southwest sides, residential development to the west and northwest and Holcomb Bridge Road to the east. The site is readily visible to motorists traveling Holcomb Bridge Road, as well as the adjacent residential community. The site's prominence and visibility as well as the adjacent land uses helped define and direct site's layout and design.

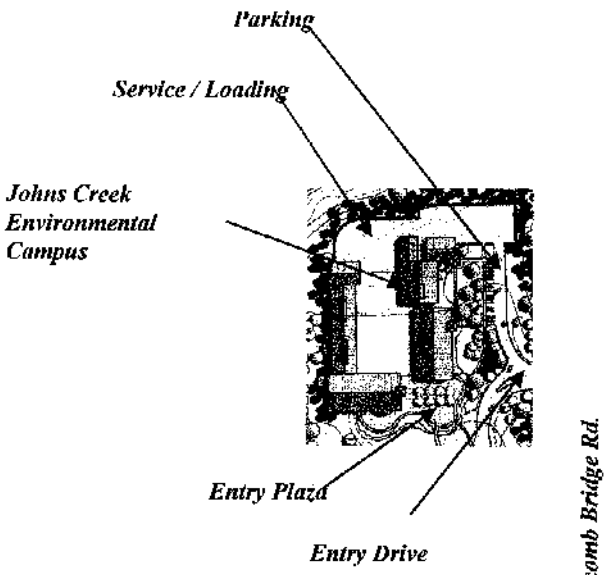
Environmental Campus:

The complex of buildings which make up Johns Creek Environmental Campus is located on approximately 8.5 acres of the 48 acre site.

To facilitate roadway access, the complex is located directly adjacent to Holcomb Bridge Road.

The campus is tucked into the hillside to the north to help screen the campus from the residential community and to help reduce the scale of the structures. In addition, the site configuration optimizes the function of the treatment facility as the site gently slopes from north (Head-works) to south (Filtration) providing a gravity flow process.

Due to the scale of the structures, it was determined that the majority of the building complex will be visually screened from Holcomb Bridge Road. This will be accomplished through the use of earth berms and landscape development. The Entry Plaza on the south side of the complex will remain visible to travelers heading north on Holcomb Bridge Road.



Site Design Guidelines

SITE LAYOUT cont.

Entry Drive, Roadway and Parking:

The entry drive configuration in conjunction with berming and landscape development focuses attention and directs vehicular circulation beyond the Environmental Campus to the City Park located to the south.

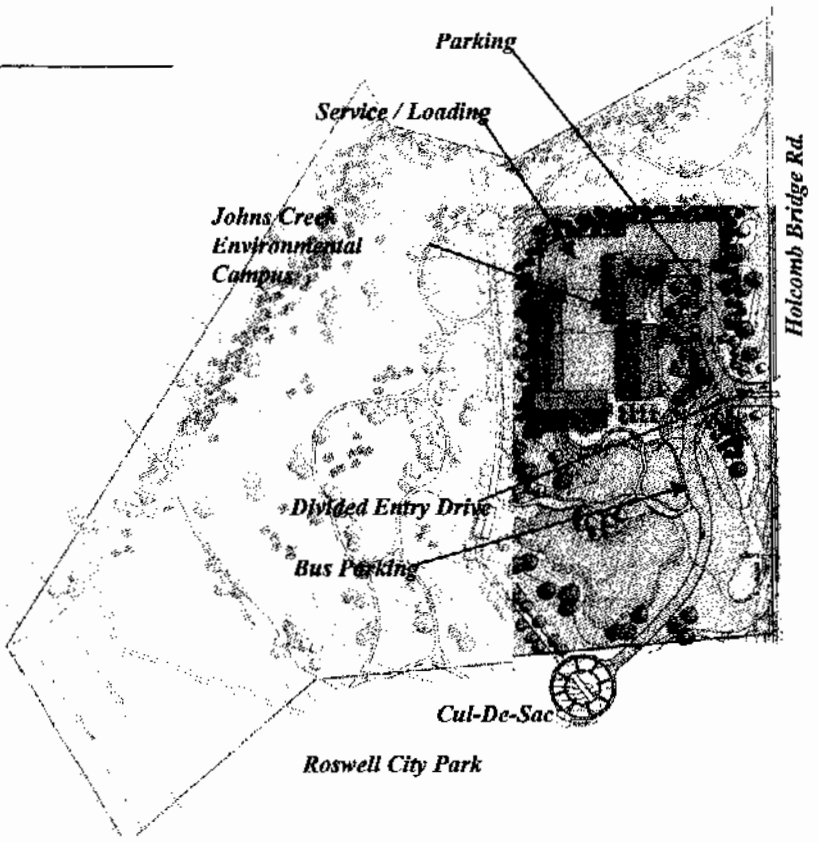
The entry drive consists of two 24' lanes separated by a 10' wide planted median. Immediately after the entrance drive branches off to the Environmental Campus, the divided roadway begins to merge, providing a single 24' wide two lane road.

Approximately 300' from the entrance and just beyond the merging traffic lanes is a 12' wide bus pull-off parking lane which extends a minimum of 120' southward, providing sufficient parking space for three school busses.

The 24' wide two lane roadway extends south beyond the Fulton County property line to a 120' cul-de-sac. The cul-de-sac will function as a traffic calming as well as providing turn around capabilities for bus traffic. The cul-de-sac requires a curb cut for future roadway expansion into the City Park to the south.

Environmental Campus parking lot shall be sized as required to accommodate all staff and visitors. Verify quantity requirements with review agencies.

Service/Loading yard shall be sized as required to accommodate loading requirements, truck turning radius and storage requirements.



Materials & Dimensions

Sidewalks - Poured-in-place concrete with epoxy joint sealer (4" thick over 4" compacted base course – civil engineer to verify).

Road & Parking Lot Pavement -2" compacted asphaltic concrete wearing surface over 2" compacted asphaltic concrete base over 9" compacted aggregate subbase (civil engineer to verify) 24" integral concrete curb and gutter.

Parking Lot Dimensions – standard parking stall-9'x20'; accessible parking stall-9'x20'; accessible aisle 5'x20'; 24' traffic aisle.

Service/Loading and Dumpster/Compactor Pads – 8" thick reinforced concrete over 4" compacted base course with sealer (civil engineer to verify).

Roadway Dimensions – 24' face of curb to face of curb.

Cul-De-Sac – 120' diameter from face of curb to face of curb. 8" thick reinforced integral-colored concrete over 4" compacted base with sealer. Colored concrete to have design with banding, two colors and two finishes (sandblasted and broom-finish).

Site Design Guidelines

WATER FEATURE

The site will have extensive naturalized water features including two lakes and one stream channel. The water feature originates at the upper lake, located north of the Environmental Campus. The water will cascade downward over naturalized falls, eventually making its way to the lower lake, approximately 50 feet lower in elevation.

Lakes:

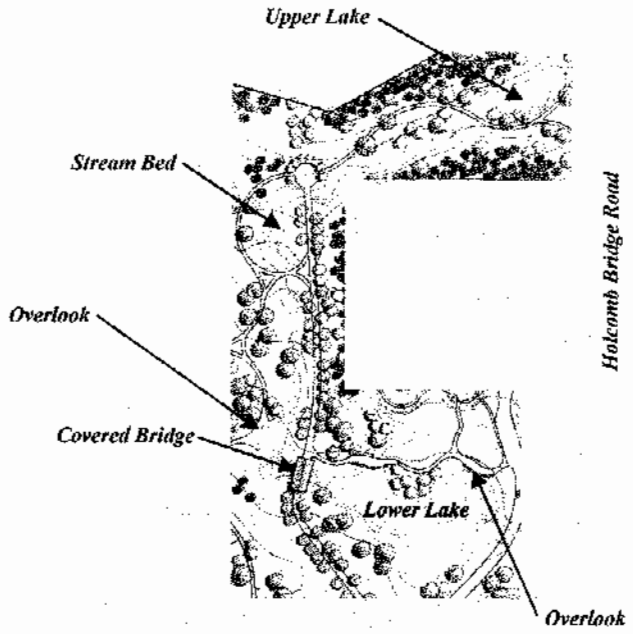
The lakes will vary in size, the upper lake will be approximately ¼ acre and the lower lake will be approximately 1½ acre in size.

Lake edge treatment will he approximately 10 percent naturalized weathered native stone and 90 percent vegetated.

The lake bottom will be a mix of native soil in the deeper low flow areas and native river gravel and boulders along the edges and in the areas of greater erosion potential near the falls and where the lake is constricted.

Stream Channel:

The stream channel will require erosion control stabilization measures as necessary accommodate the design water flow velocity. Natural stained Shot Crete, grouted boulders & river gravel will be required at the locations of the water falls in sufficient quantity and thickness to prevent displacement and undermining of the native stones. Stream edge will be approximately 60 percent naturalized weathered boulders and 20 percent river gravel and 20 percent vegetation.



Examples of naturalized vegetation and weathered native boulder lake and stream edge treatment.

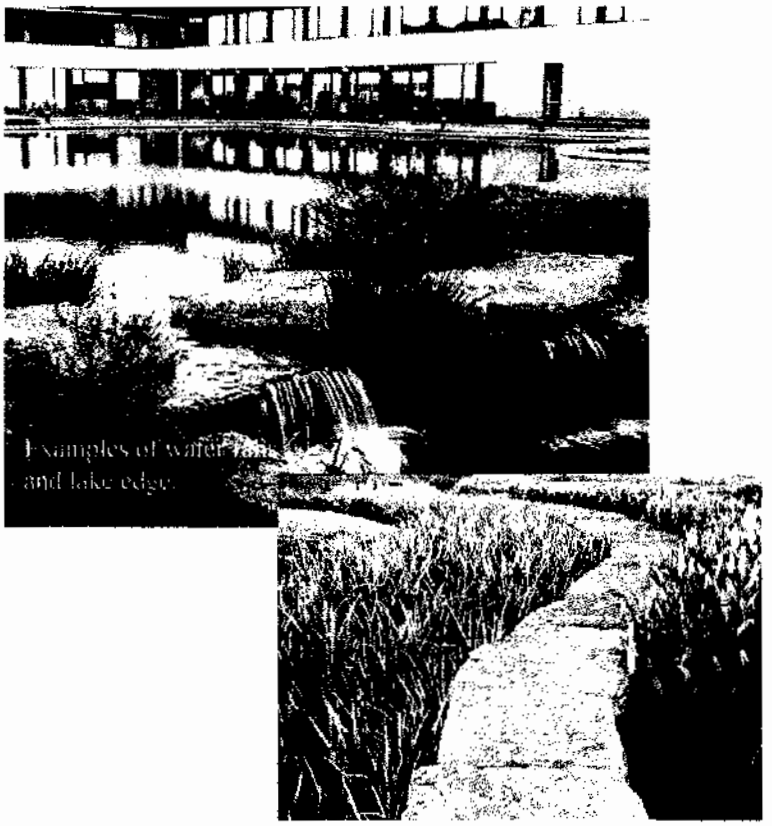
WATER FEATURE cont.

Recirculation Pump:

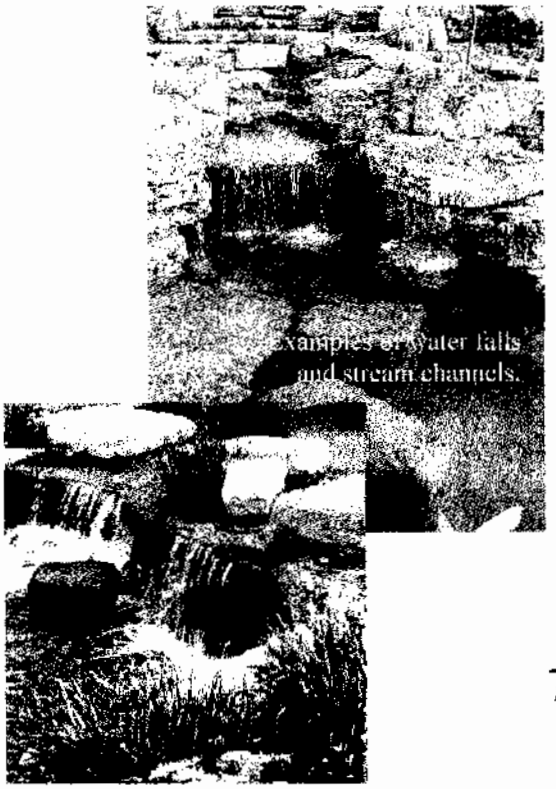
A recirculation pump, vault, controls and piping will be provided to supply a sufficient volume of water to the upper lake in order to achieve a minimum of 1 inch of water over a 15 foot wide weir. The same pump will need to generate sufficient volume of water to provide a minimum of 1 inch of water over a 7 foot wide weir located at the southern filtration building near the entry plaza.

Overlook:

Provide a minimum of two overlook viewing areas at key visual locations, one at the lower lake and one along the stream channel. Each overlook shall be a minimum of 50 feet long and shall include native stone embankment, naturalized vegetation, architecturally compatible guard railing and benches.



Examples of water falls and lake edge.



Examples of water falls and stream channels.

Materials & Quantities

Weathered Boulders - 1200 tons of naturally weathered native stone. Larger sizes range from 4' deep x 6' wide x 2' tall to smaller sizes of 2' deep x 3' wide x 8" tall. Weathered stone shall be placed in a naturalized setting with constant horizontal lines and form. Boulders shall be grouted in place as required at locations where wash-out and erosion potential occurs.

River Gravel – 750 tons of native river gravel shall be provided and placed along stream channels and at lake edges. The gravel shall range in size from between 2" and 6". Gravel shall be grouted in place as required to eliminate erosion potential and washout resulting from high velocity water volumes.

Recirculation Pump – Provide and install a three phase 240 volt recirculation pump including all controls, piping, vault and required accessories to provide sufficient water volumes to achieve the specified design requirements.

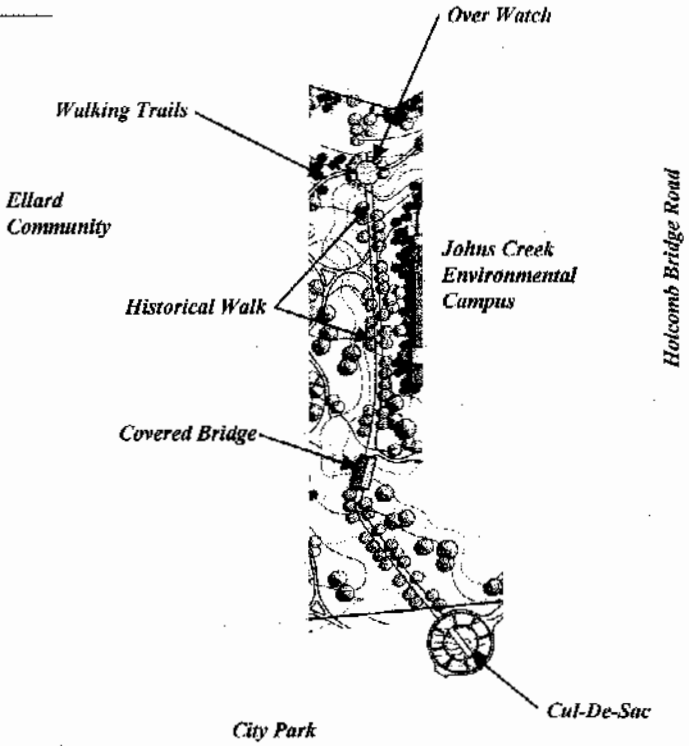
HISTORICAL WALK

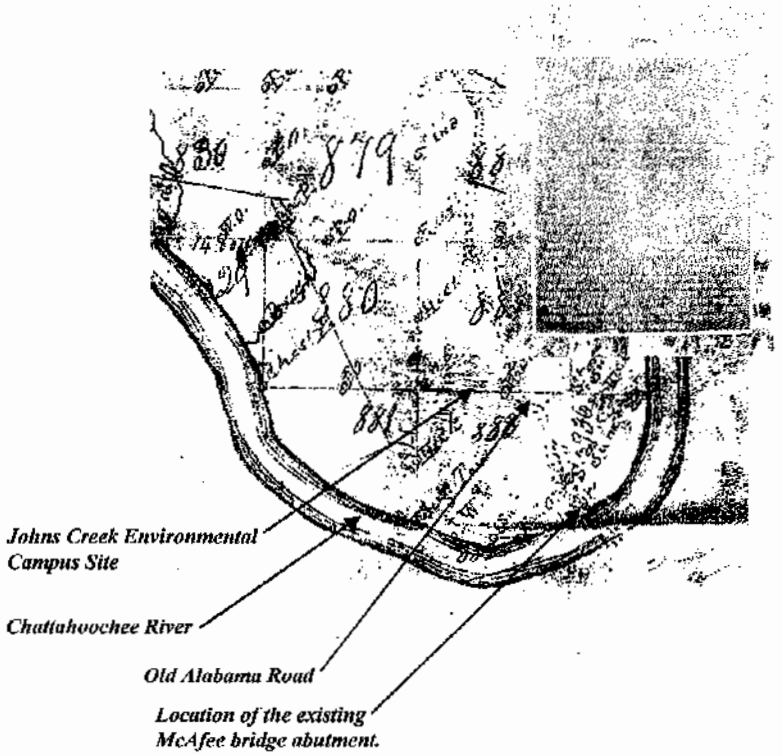
The site of the Johns Creek Environmental Campus is rich in history, Roswell King crossed the Chattahoochee River at the Gates Ferry and later founded the City of Roswell. Old Alabama Road (the road to the Alabama territories) extended northward from Gates Ferry through the Johns Creek site. In 1834 Robert McAfee replaced the ferry with a covered toll bridge over the Chattahoochee River, the hand placed stone abutment still exists today. During the Civil War the bridge was considered key to both the North and South as it was the only crossing of the Chattahoochee River in the area.

The rich history of the Johns Creek Environmental Campus shall be preserved and documented. The approximate location of Old Alabama Road shall be developed as a historical walk, and shall include historical markers, educational placards and a replica of the original McAfee covered bridge at the crossing of the stream feature.

Historical Walk:

The historical Walk shall begin at the cul-de-sac where the entrance road terminates. The walk shall extend northward at the approximate location of the original Alabama Road, crossing the stream bed at two locations and terminating at the over watch located to the northwest of the facility.





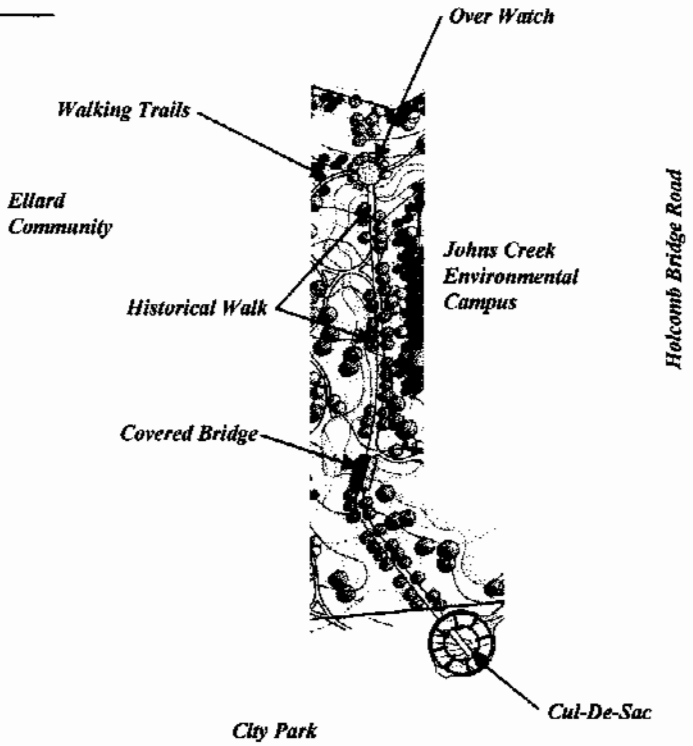
HISTORICAL WALK

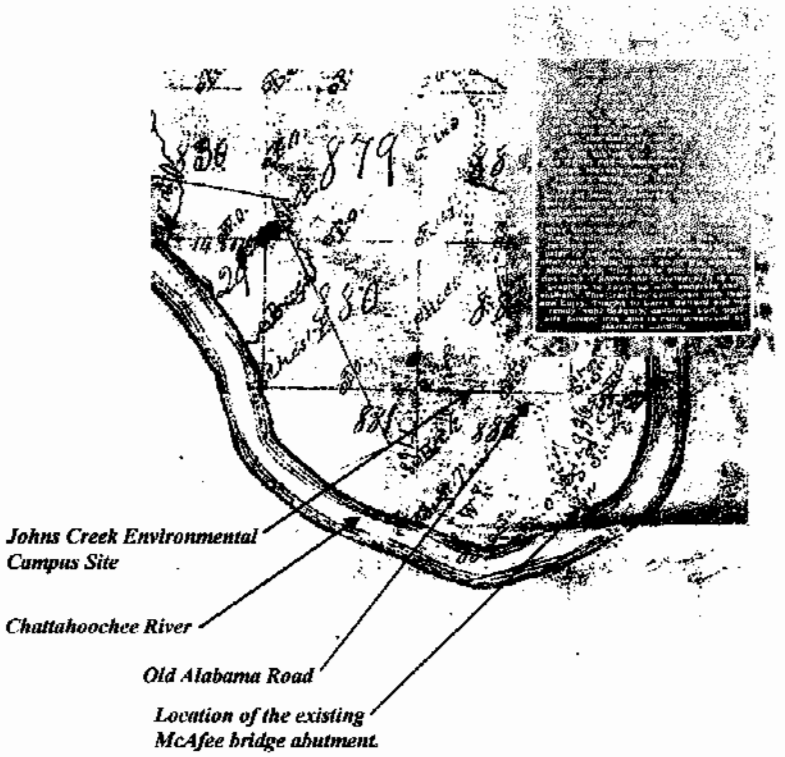
The site of the Johns Creek Environmental Campus is rich in history, Roswell King crossed the Chattahoochee River at the Gates Ferry and later founded the City of Roswell. Old Alabama Road (the road to the Alabama territories) extended northward from Gates Ferry through the Johns Creek site. In 1834 Robert McAfee replaced the ferry with a covered toll bridge over the Chattahoochee River, the hand placed stone abutment still exists today. During the Civil War the bridge was considered key to both the North and South as it was the only crossing of the Chattahoochee River in the area.

The rich history of the Johns Creek Environmental Campus shall be preserved and documented. The approximate location of Old Alabama Road shall be developed as a historical walk, and shall include historical markers, educational placards and a replica of the original McAfee covered bridge at the crossing of the stream feature.

Historical Walk:

The historical Walk shall begin at the cul-de-sac where the entrance road terminates. The walk shall extend northward at the approximate location of the original Alabama Road, crossing the stream bed at two locations and terminating at the over watch located to the northwest of the facility.





HISTORICAL WALK cont.

Historical & Educational Placards:

The contractor shall research the history of the site and document the history in graphic and written form. A minimum of 4 historical markers shall be located along the historic walk.

In addition the contractor shall provide one written and graphic educational placard which describes the treatment process that is occurring within the facility. The placard shall be located along the historical walk.

Covered Bridge:

The contractor shall research the McAfee covered bridge and construct a historically correct replica at the location where the historical walk crosses the stream. The bridge shall be constructed using historically correct materials and construction techniques that would have been found on the original McAfee covered bridge.

Examples of historical signage and informational placards.

Example of a historical covered bridge.

Existing McAfee Bridge support, constructed in 1834, located south of the site near the Chattahoochee River.

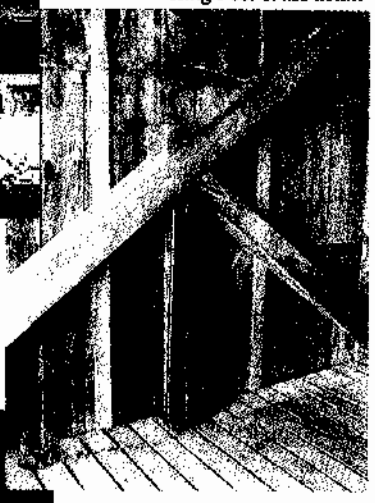
HISTORICAL WALK cont.

Over Watch:

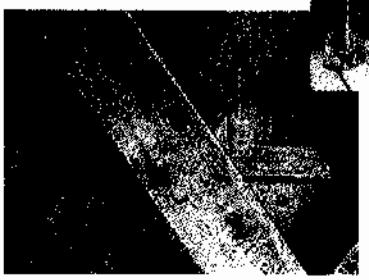
The over watch shall be located at the northern end of the historic walk and shall consist of stone bench walls, architecturally appropriate benches, site furnishings and special paving. The bridged stream crossing shall consist of a stone veneered arched concrete drainage structure with natural stone head walls guard rails. The stone shall match or closely resemble the stone used for the water feature.

Pier detail

King Post Truss detail



Examples of materials and construction techniques of historic covered bridges.



Bracing detail

Graphic illustration of the historic walk adjacent to the water feature.

Illustration of the historic walk, note the special paving and edge treatment..

HISTORICAL WALK cont.

Materials & Quantities

Historic Walk – The historic walk shall be a minimum of 12 foot wide. The paving material shall be decomposed granite, a minimum of 6" deep placed above a compacted 4" aggregate base course. A layer of filter fabric shall be placed between the base course and the decomposed granite. The edge restraints shall be 6" wide variable lengths granite banding. The granite banding shall be installed at the same grade as the decomposed granite pavement and the adjacent materials. The historic walk shall follow the general path as the Old Alabama Road corridor. Minor adjustments may be required to accommodate the adjacent facilities.

Walking Trails – Walking trails shall be a minimum of 8' wide constructed of 3" thick asphaltic concrete pavement placed over a compacted 4" aggregate base course. Walking trails shall be installed generally as layed out as indicated on the development diagram.

Historical & Educational Placards – The contractor shall provide a minimum of 5 custom crafted signs or plackards to communicate the desired educational or historical messages. The graphics shall be embedded in fiberglass to protect the images from vandalism or weathering. The exact design, size and structural materials shall be determined during the design and agency review process.

Covered Bridge – The contractor shall research the original McAfee covered bridge or other historical covered bridges in the area to determine the design, materials and construction techniques of the time. Contact historians or local historical societies to aide in the research efforts. The contractor shall then construct an historical accurate replica covered bridge at the location where the historical walk passes over the stream bed. The contractor shall utilize all historically appropriate construction methods, details and materials.

Over Watch –

Bench Walls: the bench walls shall be constructed of reinforced concrete with a natural stone veneer. The stone shall be an architectural match the stone used at the water feature. Provide a minimum of 100' of bench wall at 18" above grade

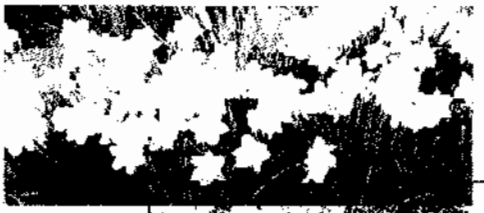
Paving Material: Provide 4" thick reinforced integral-colored concrete over 4" compacted base with sealer. Colored concrete to have design with banding, two colors and two finishes (sandblasted and broom-finish).

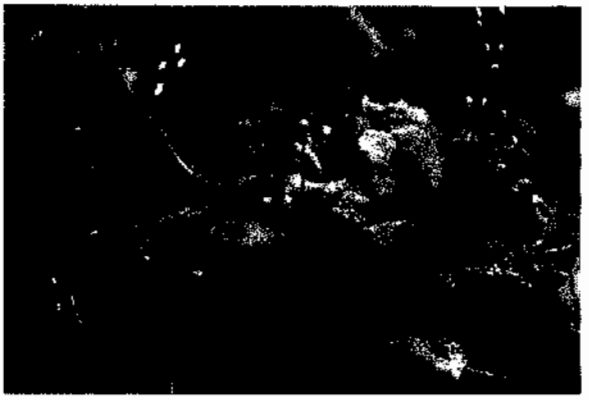
Bridged Stream Crossing: The bridged stream crossing shall consist of a stone veneered arched concrete drainage structure with natural stone head walls guard rails. The stone shall match or closely resemble the stone used for the water feature.

Site Design Guidelines

LANDSCAPE DEVELOPMENT

Landscape development for the Johns Creek site includes a variety of shade, ornamental & evergreen trees as well as groundcover & shrub beds. Evergreen trees are used to provide visual screening and year round color. Shade and ornamental trees are used to provide shade, visual interest and spatial definition. Shrub and groundcover beds are used to provide year round and seasonal color and are concentrated at the campus facilities and at the buffer between the site and the neighboring Ellard residential community. All areas disturbed by construction operations will be seeded or sod with Turf Type Tall Fescue. For discussion purposes the landscape development is broken into several zones including: the environmental campus, the Holcomb Bridge Road buffer, the park, the historic walk / water features, the northern residential buffer and the western residential buffer.





Site Design Guidelines

LANDSCAPE DEVELOPMENT
cont.

Environmental Campus:

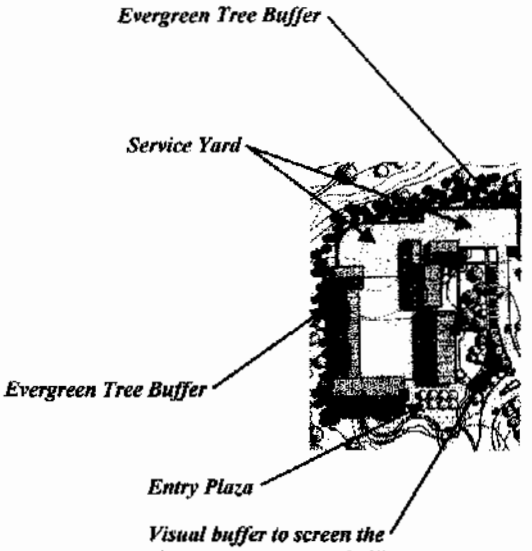
The complex of buildings which make up Johns Creek Environmental Campus is located on approximately 8.5 acres of the 48 acre site. A dense visual screen / buffer will be provided around the complex of buildings that make up the facility. The heaviest screening will be located on the north, east and west sides to buffer the facility from Holcomb Bridge Road, the surrounding park land and the residential communities.

The plan provides a mass planting of trees, shrubs and groundcover to be located adjacent to the entrance drive, partially obstructing the view of the treatment facility, thereby directing the circulation towards the City Park to the south.

The entry plaza shall remain visible to motorists traveling north on Holcomb Bridge Road. The plaza shall include an architectural arrangement of trees which will respond to the plaza and adjacent building design.

Building foundation plants shall consist of naturalized groupings of a variety of shrub types and sizes including: flowering, evergreen and deciduous. Plant arrangement shall respond to the building architecture.

The service yard shall be heavily screened on the north and west to visually buffer views from the adjacent residential neighborhoods. The plantings shall be naturalized, NO strait line linear arrangement will be accepted.



Grouping of ornamental trees at the entry plaza.

Examples of flowering perennial groundcover and ornamental trees used as foundation plantings.

Examples of evergreen shrub massing used as foundation plantings.

Site Design Guidelines

LANDSCAPE DEVELOPMENT cont.

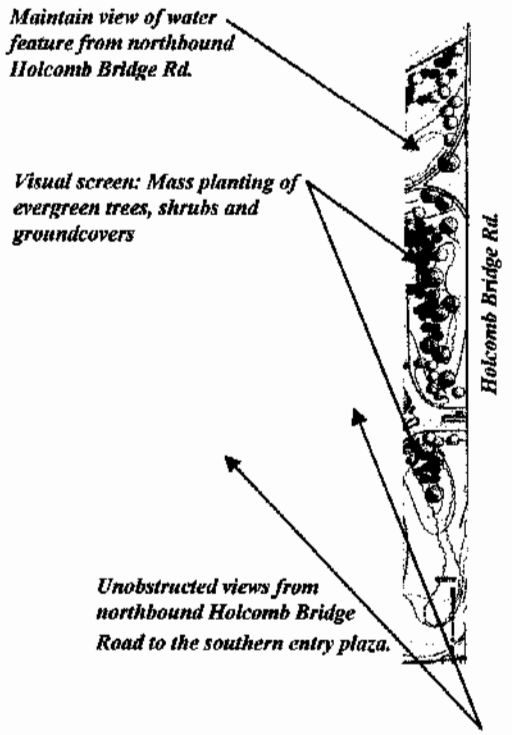
Holcomb Bridge Road:

The Johns Creek Environmental Campus is a major visual element to motorists traveling along Holcomb Bridge Road. The intent of the landscape and land form treatment along the road is to effectively screen the majority of the campus facilities from view of the motorists traveling along Holcomb Bridge Road. Berms and mass plantings of evergreens trees, evergreen and deciduous shrubs and groundcover will be used for visual screening and buffering of the treatment facility.

Low berms, shrubs and groundcover will be located at the southeast corner of the site, adjacent to Holcomb Bridge Road, in order to provide an unobstructed view of the southern entry plaza for northbound motorists.

The 10' wide median at the entrance drive shall be planted with low growing evergreen shrubs or groundcovers with end treatment of annual beds. The facility / park identification sign may be located in the median as well.

The water feature located north of the facility shall remain visible from northbound motorists. Provide small groupings of flowering ornamental and shade trees to provide visual interest without providing a visual barrier.



Evergreen shrub, Inkberry (Ilex glabra)

Example of flowering perennial groundcover.

Mass planting of Evergreen trees, Leyland Cypress (Cupressocyparis leylandii)

Site Design Guidelines

LANDSCAPE DEVELOPMENT cont.

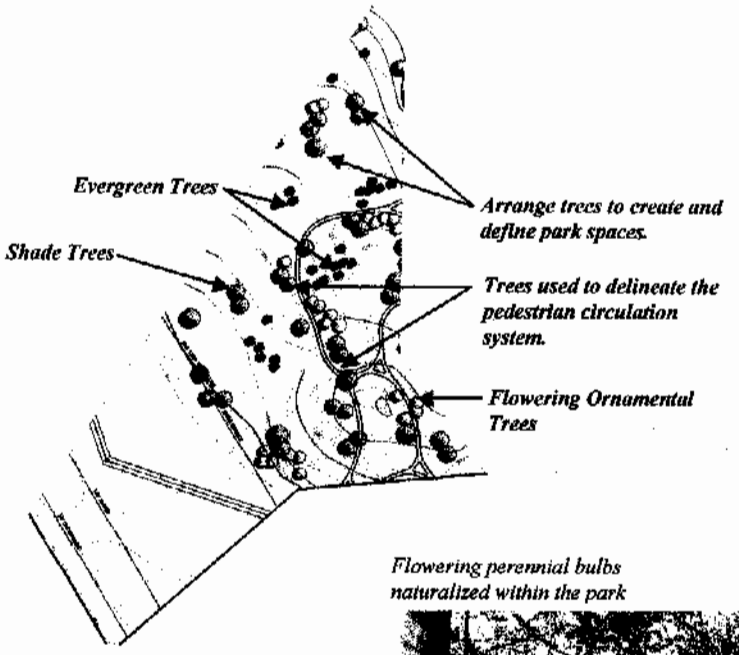
Park:

The environmental campus accounts for less than 25% of the total site. The remainder of the site is is used for visual buffering of adjacent non-compatible land uses and for water feature and park development.

The park will be passive in nature and will consist of a variety of evergreen, shade and ornamental flowering trees. Tree selection shall be based on several criteria including historical context, habit requirements and visual character.

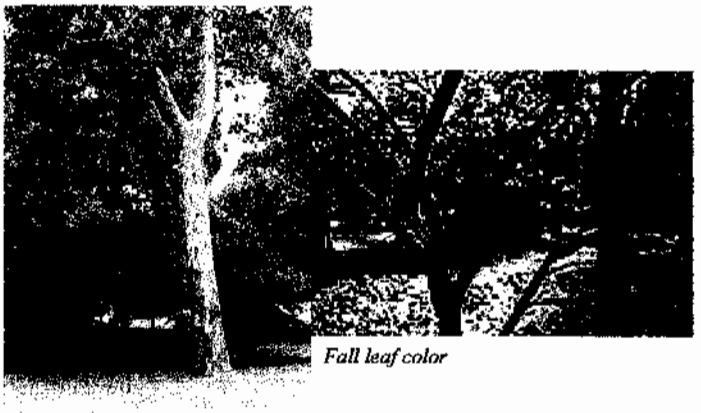
The naturalized tree massing shall be arranged in order to provide spatial definition within the park. The trees shall also be used to define the pedestrian circulation along the walking path.

Cluster evergreen trees to provide masses of year round color and visual interest. Consider flower, and leaf color as well as texture when grouping and placing trees.



Flowering perennial bulbs naturalized within the park

Fall leaf color



Fall leaf color

Sycamore (Platanus occidentalis)

Spring flowers Serviceberry (Amelanchier arborea)

Site Design Guidelines

LANDSCAPE DEVELOPMENT cont.

Historic Walk / Water Features:

The Historic Walk and Water Features are a prominent elements within the total Johns Creek Environmental Campus development.

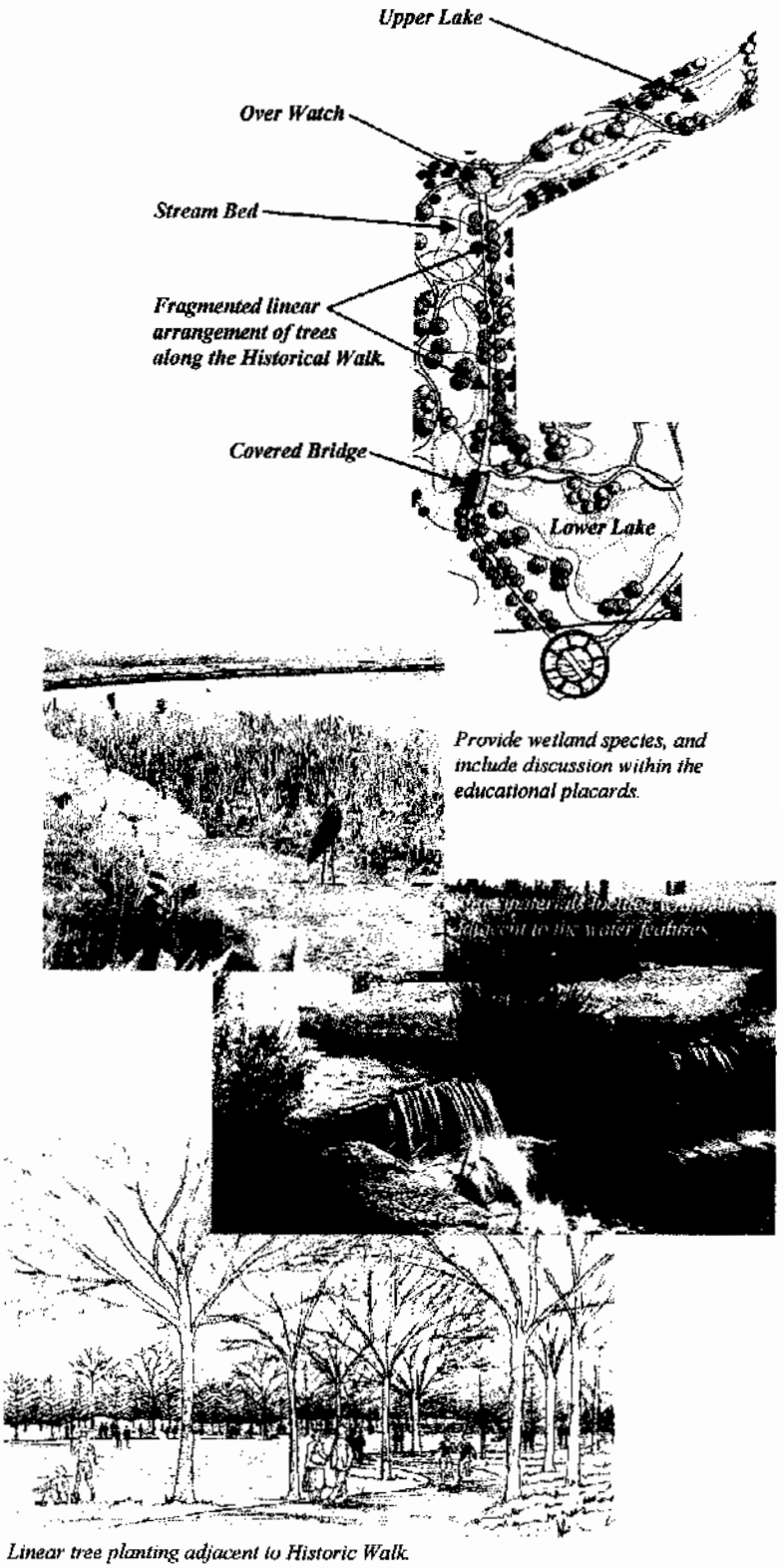
Special attention needs to be placed on the landscape development of these features. Not only are these features visually significant to the total development, they illustrate and define historical attributes of the region as well as provide educational awareness of the facility.

Historical Walk:

In order to accentuate the linear nature and importance of the historic walk, it shall be lined with a single species of specimen trees. The trees shall be selected based on its special features such as form, flowers potential or fall color. The linear arrangement of the trees shall be fragmented or broken up into random quantities, ranging from one to five trees per group to allow for removal or death without negatively affecting the overall design. The over watch shall be formally planted as well, to include trees, evergreen shrubs and / or groundcover.

Water Features:

The planting around and within the water features shall provide a natural setting complete native or naturalized riparian and wetland species. The planting shall combine trees, shrubs, groundcover and other plant materials into a homogenous landscape development which will provide educational opportunities as well as visual enrichment.

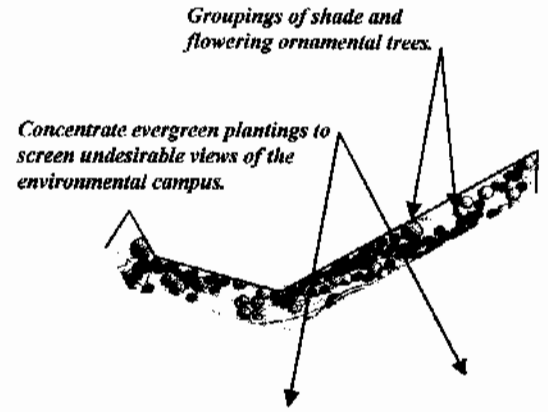


Linear tree planting adjacent to Historic Walk.

LANDSCAPE DEVELOPMENT cont.

Northern Residential Buffer:

The northern buffer is intended to provide a dense evergreen natural vegetative visual buffer between the facility and the residence to the north. The buffer consists primarily of a dense planting of large masses of evergreen trees with smaller groupings of shade and flowering ornamental trees mixed in to add variety. The large mass plantings shall be strategically placed to provide the optimum visual screening of the most undesirable views of the treatment facility. The mass plantings shall blend with the natural contours of the landscape and appear natural in form, NO strait line linear plantings will be accepted.



Mass planting of Evergreen trees, Leyland Cypress (Cupressocyparis leylandii)

Fall color, Sugar Maple (Acer Saccharum)

Spring blooms of the Pink Flowering Dogwood (Cornus florida)

Site Design Guidelines

LANDSCAPE DEVELOPMENT cont.

Western Residential Buffer:

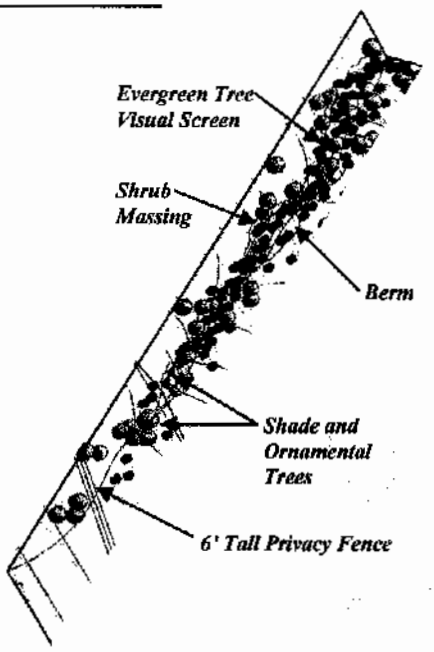
The western buffer will be constructed under a separate contract.

The western buffer consists of naturalized earth berming, a 6' wooden privacy fence and landscape development. The intent is to provide a dense visual buffer between the neighboring Ellard residential community located immediately west of the Johns Creek Environmental Campus.

The landscape development consists of a variety of naturalized plant materials including shade trees, ornamental flowering trees, evergreen trees, and large masses of shrub beds. Evergreen tree masses are strategically placed to optimize the visual screen between the neighboring homes and the treatment facility. Shrub masses which include a variety of species are placed to soften and visually screen the privacy fence from the park users and the neighboring residential community. A blend of several varieties of shade and flowering ornamental trees are utilized to enhance the visual appearance of the site.

Five to eight foot freeform earth berms are used in conjunction with other landscape elements to visually screen the facility from the Ellard Community.

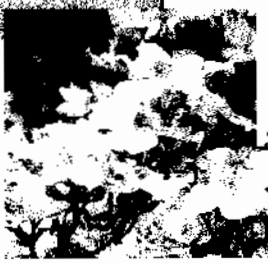
A six foot tall wooden privacy fence will be located on top of the berms to optimize the visual screening. The fence follows a curvilinear path keeping with the natural character of the site development.



Holcomb Bridge Road

Naturalized mass planting of trees, shrubs and groundcover.

Mass planting of Leyland Cypress (Cupressocyparis leylandii), used to screen a wooden privacy fence.



Flowering Dogwood (Cornus florida)

Illustration of the planting schemeat the privacy fence.

LANDSCAPE DEVELOPMENT
cont.

Materials & Quantities

Specimen Shade Trees – Specimen shade trees shall be utilized in the entry plaza and adjacent to / lining the historic walk. Specimen shade trees shall be balled and burlapped and be a minimum of 3-1/2 inch caliper and shall have a single leader with a full crown. The tree shall have a clear trunk up to 8 foot minimum height.

Shade Trees – Shade trees shall be balled and burlapped and have a minimum caliper of 2 inches with a full crown.

Flowering Ornamental Trees – Flowering ornamental trees shall be balled and burlapped and be a minimum or 1 –1/2 inch caliper. If multi-stemmed varieties are used, provide plants typical of the species form with a minimum of 3 well balanced main stems.

Evergreen Trees – Evergreen trees shall be typical of their species with a single full well shaped crown and shall range in size from between 8' to 12'.

Shrubs – Shrub massings and foundation plantings. Provide a plant material of sufficient size in order to achieve a quality landscape appearance by the end of the second growing season. Provide container grown shrubs not less than 3 gallon size and balled and burlapped plant materials no less than 24 inches in size.

Groundcover & Other Plant Materials – Provide groundcover, perennials, bulbs and wetland species of sufficient size and spacing in order to achieve a quality landscape appearance i.e. plant size and density by the end of the second growing season.

Berms - Provide berming along Holcomb Bridge Road and the western residential buffer. The berms shall be sized sufficiently to help screen the objectionable views of the facility yet not so large that the berms exceed the scale of the space. The berms at the western residential buffer shall be provided under a separate contract.

Turf – All areas disturbed by construction operations shall be sceded or sod with Turf Type Tall Fescue. Plant per standard horticulture practices in order to provide a full thick stand of grass. Provide a minimum of 1500 square yards of sod. Sod to be used at key visual locations adjacent to the treatment facility, the historic walk or the water features.

NOTES:

1. All plant material shall be provided and installed per the requirements outlined in the "American Standards for Nursery Stock" ANSI Z60.1 current edition.

2. All design and plant material selection shall be subject to review by Fulton County and the City of Roswell Georgia.

APPENDIX 4
INTERIOR BUILDING PROGRAM & EDUCATIONAL FACILITY SPECIFICATIONS

4.1 Interior Building Program

Provided in this section are general guidelines for the interior building program. The D/B Company shall use the Building Codes as the reference in section 4.1.1. Appendices 3 and 4, contain more general building specification while Appendices 5A and 5B are process and process structure specifications. Where there are discrepancies between any set of specifications in the D/B RFP, the proposers should use the most stringent specification or ask for clarification.

The building shall be arranged to optimize operational efficiency. Rooms/spaces shall be located to allow the occupants easy access to required equipment and data with a minimum of through traffic. The concept of common administrative areas shall be utilized as much as possible. While each field supervisor will have a lockable file drawer on wheels, there will be no permanently assigned work areas/desks. The building layout shall utilize a common area concept and offices should not be separated merely on the basis of "cost centers" or funding sources.

BUILDING PROGRAM

Building entry	15' x 20'	holds small tour group standing at lg. tower in front facing bldg.
Visitors window	8' x 8'	w/reception desk
Visitor restroom	8' x 8'	unisex
Administration Office	16' X 20'	3 – cubicals
Plant Mgr. Office	12' x 12'	private
County Rep. Office	12' x 12'	private
File storage rm.	15' x 15'	near admin. office
Classroom/training	100' x 100'	90 students w/aquarium and storage closet
Process Lab	15' x 12'	
	8' x 8'	single person lab office
Control rm.	12' x 12'	2 people –
2-control rm. offices	2@ 7' x 7'	private
Conference rm.	15' x 24'	4 x 10 table - 12 people
Library	10' x 10'	adjacent or added to Conf. rm.
Break rm.	12' x 14'	vending, sink, frig, microwave table & chairs
(2) Women's restroom	10' x 10'	one in educational area one in work area

Women's locker & shower	15' x 20'	locate w/restroom
(2) Men's restroom	10' x 10'	one in educational area one in work area
Men's locker & shower	15' x 20'	locate w/restroom
Mechanical rooms	as required	
Storage rm.	12' x 12'	closed rm. storage
Maintenance	50' x 50'	tool storage/spare parts
2- Maint. offices	2@ 8' x 8'	
Janitor's closet (4)	4@ 7' x 7'	sink and storage
Electric closet	5' x 5'	
Telephone closet	5' x 5'	

General Description of spaces:

- **Private Offices**: The number of private offices shall be minimized. Each section shall have a private office for the section chief, including a private area in each section for discussion of confidential matters and for performance counseling.
- **Open Office Space**: The majority of office personnel shall occupy cubicles, which will be arranged to facilitate coordination within functional areas. Such space shall accommodate 5 staff.
- **Library**: Reference material and systems shall be centrally located for common use. Permanently assigned database specialists shall assist supervisors, engineers, and engineering techs in data retrieval.
- **Training/Conference**: A combination purpose room shall be provided for training and conferences. This room shall have 15 person capacity.
- **Break Room**: A break room shall be provided which shall serve as the crew assembly area. It should be large enough to accommodate a reasonable percentage of the total field force.
- **Locker Room/Showers**: Locker rooms and showers capable of accommodating 30% of the field force shall be provided.
- **Educational Facility** - see section 4.2 of this appendix
- **Maintenance Space**—This space should be outfitted with equipment. An allowance is provided for equipment.
- **Process Laboratory:** The Lab space shall be designed to allow for the comfortable working of approximately 3 knee workstations. It shall have the capability of performing 20 separate tests each day. The lab shall have sufficient storage for glassware and chemicals and shall have chemical resistance work and storage surfaces. Its location shall be contained within the main building, and there shall be sufficient office and desk space within the lab area to allow for writing of reports and administrative work. There shall be one (1) hooded work stations. An allowance is provided for this equipment

4.1.1 Codes and Standards

The D/B Company shall utilize the following applicable codes. The following websites shall be check for applicable additions and changes to this list and for information on Fulton County permit applications as applicable: http://www.dca.state.ga.us/ and http://www.Fultonecd.org.

- SBCCI Standard Building Code (International Building Code), 2000 Edition, with Georgia Amendments
- SBCCI Standard Gas Code (International Fuel Gas Code), 2000 Edition, with Georgia Amendments
- SBCCI Standard Mechanical Code (International Mechanical Code), 2000 Edition, with Georgia Amendments
- SBCCI Standard Plumbing Code (International Plumbing Code), 2000 Edition, with Georgia Amendments
- National Electrical Code, 2002 Edition, with Georgia Amendments
- SBCCI Standard Fire Prevention Code (International Fire Code), 2000 Edition, with Georgia Amendments
- International Energy Conservation Code, 2000 Edition, with Georgia Amendments
- Occupational Safety And Health Act Regulations- OSHA, Latest Edition;
- Americans with Disabilities Act- ADA; and
- Applicable governmental entity for Land Disturbance Permit (LDP) Requirements.

Where conflicts exist between different reference codes, the more stringent, or specific shall apply.

4.1.2 Code Data

The D/B Company shall conduct a code review for this project and the code data shall be provided on the construction drawings. The data shall be located on the drawing with the first floor plan of each facility. The code data shall be as follows:

- Occupancy Group Classification(list by area if appropriate);
- Type of Construction;
- Building Height;
- Height Limitation;
- Total Floor Area(list floor area for each identified occupancy);
- Largest Floor Area;
- Area Limitation;
- Occupancy Load(list total calculated and actual); and
- Numbers of Means of Egress.

4.1.3 Design Standards

4.1.3.1 Visual Guidelines

Appendix 3 contains guidelines for scale, color, texture,color, material and detail

4.1.3.2 Interior Finishes

The following is a guide to the selection of interior finishes. Specific finishes are listed in Table A4-1.

- Interior finishes shall be selected based on the environment of the specific room-corrosive, wet, etc.
- All interior surfaces shall be finished.
- Finishes shall be light in color to enhance natural lighting.
- Provide acoustical treatment in high-noise areas.
- Submit finishes for all facilities to Fulton County for approval.

Table A4-1: Interior Finishes for Specific Areas

Room Name	Floor	Base	Walls	Ceiling
Toilet	Ceramic tile	Ceramic tile	Tile or paint	SAT
Stairs-wet areas	Concrete hardener*		Paint	Paint
Stairs-dry areas	Concrete hardener		Paint	Paint
Corridors-wet areas	Concrete hardener*		Paint	Paint
Corridors-corrosive areas	Epoxy seamless flooring		Paint	Paint
Corridors-dry areas	Concrete hardener		Paint	SAT or Paint
Corridors-office	Vinyl	Vinyl	Paint	SAT
Office	Vinyl	Vinyl	Paint	SAT
Control Room	Vinyl	Vinyl	Paint	SAT
Equipment Room	Concrete hardener		Paint	Paint
Storage-office	Vinyl	Vinyl	Paint	SAT
Storage-wet areas	Concrete hardener*		Paint	Paint
Storage-chemical areas	Concrete hardener		Paint	Paint
Janitors Closet	Concrete hardener		Paint	Paint
Electrical	Concrete hardener		Paint	Paint
Mechanical	Concrete hardener		Paint	Paint
Gallery	Concrete hardener		Paint	Paint
Wet Process	Concrete hardener*		Paint	Paint
Dry Process	Concrete hardener		Paint	Paint
High Noise			Acoustical treatment	Paint

Room Name	Floor	Base	Walls	Ceiling
High Humidity	Special Coatings	Special Coatings	Special Coatings	Paint
Highly Corrosive	Special Coatings	Special Coatings	Special Coatings	Paint

SAT= Suspended Acoustical Tiles

* Floors in wet areas shall be slip-resistant

4.1.3.3 Barrier-Free Design

The D/B Company shall design all facilities to comply with accessibility codes and laws. At a minimum, all office, control room, maintenance shops, toilets, and other areas accessible to the public for tours shall be accessible.

4.1.3.4 Noise Control

The D/B Company shall determine the levels and sources of noise emanating from facilities and limit, by appropriate means, the decibel levels, inside and outside the facilities, to comply with applicable laws and regulations. Various means can be used to absorb and limit sound transmission materials, placement of openings, wall construction.

4.1.3.5 Health and Safety

The D/B Company shall design all facilities to meet all applicable codes and laws concerning safety. It is the intent of the County to provide a safe working environment for the staff.

4.1.3.6 Sustainable Design and Construction

The D/B Company shall design and build the facilities using sustainable design principles including: energy efficient equipment and systems, low-embodied energy materials, renewable energy sources, recycled content materials and resources, enhanced indoor environmental quality, water conservation and life cycle cost analysis.

4.1.4 Building Systems

4.1.4.1 HVAC System

The JCEC HVAC systems and components shall meet local, state and federal codes. Additionally, the design shall meet American Society of Heating, Refrigerating and Air conditioning Engineers, Inc. (ASHRAE) and the National Fire Protection Association (NFPA). The outdoor design temperature shall be as listed in ASHRAE's Fundamental Handbook for 99.6 percent winter heating and 1.0 percent summer cooling conditions.

The D/B Work process areas shall be ventilated in accordance with NFPA's Standard 820, Fire Protection in Wastewater Treatment and Collection Facilities. The intended ventilation rates shall be coordinated with National Electric Code (NEC)

requirements and electrical equipment construction. Adequacy of these ventilation rates shall be verified against motor and electrical equipment heat gain calculations to ensure acceptable indoor summer temperatures, maximum of 102° F, the highest ventilation rate shall be used for design. Areas requiring routine maintenance shall be heated to 55° F in the winter time. Heating and ventilating systems shall filter the outside air before it is introduced to the D/B Work. Areas falling outside of NFPA recommendations shall be ventilated at a minimum 3 AC/Hr.

The personnel facilities, including administration, locker, toilet, meeting and laboratory rooms and areas shall be mechanically air-conditioned to maintain 72° F in the summer and heated to maintain 72° F in the winter, or as required by state and federal code. Control rooms and electrical rooms shall be evaluated for mechanical air conditioning based on the control equipment and staffing requirements.

Emergency generator rooms shall be ventilated to limit summer indoor temperature to 104° F during generator operation. The ventilation system shall be designed to minimize offsite noise impacts. Acoustical louvers and acoustical wall construction shall be considered for the Generator Room.

The HVAC equipment construction shall be coordinated with its intended use. All non-odor control HVAC equipment shall be constructed or coated to protect against low levels of H2S corrosion. Process ventilation supply air systems shall be constructed of either Type 316 stainless steel or aluminum depending on the anticipated H2S concentrations. Ventilation systems where concentrations greater than 1 ppm H2S shall require the use of Type 316 stainless steel materials. Process exhaust ventilation system ductwork, registers, fans and dampers shall be fabricated of premium grade vinyl-ester resin FRP. Chemical storage and handling area ventilation systems shall be constructed of FRP. The remaining personnel areas, electric room, control room and generator spaces HVAC equipment shall be constructed of standard HVAC construction materials in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards.

The HVAC equipment shall be controlled by local automatic temperature control (ATC) panels. The ATC panels shall be interconnected with the odor control, fire alarm and building security systems. The HVAC systems components shall be designed for their intended environment. At a minimum, all HVAC control devices and enclosures located in process areas shall be NEMA 4X rated and NEMA 7 rated in NEC Class 1, Division 1 and 2 hazardous areas. The systems control panel shall be located outside of the process areas whenever possible.

4.1.4.2 Fire Protection

The D/B Work shall include smoke and heat detectors, pull stations and audible/visible communicators meeting the requirements of local Fire Department. Fire protection during construction and operation of the D/B Work is the responsibility of the D/B Company. Fire protection (hydrants, fire jockey pump, wet

pipe sprinkler, preaction, foam AFFF, etc) shall be provided for areas including the site and all building as required by state and local code and NFPA.

4.1.4.3 Plumbing

The plumbing systems shall be designed in accordance with the local, state and federal codes.

4.1.4.4 Water Systems

The D/B Work's water service shall be connected to the local water authority's water supply. A water meter, isolation valve and reduced pressure zone backflow preventor (RPZ-BFP) and pressure reducing valve shall be installed as the water service enters the facilities. Water lines shall be routed to fire protection, toilet and locker facilities and process applications as required. Two freeze proof wall hydrants shall be provided at each facility to permit exterior wash down or watering of planting or grounds.

Hot water shall be provided for toilet and locker facilities, and tepid water for the emergency eyewash and showers. The energy source for the domestic hot water shall be coordinated with the energy being utilized for the standby generator and the hot water boiler.

Emergency eyewash and showers shall be provided at all chemical facilities in accordance with ANSI Z 358.1.

4.1.4.5 Sanitary, Process and Roof Drainage Systems

The sanitary and process drainage lines shall connect all associated toilet and locker facilities, floor drains, process drains, etc. into a local authority's sewer or routed to the D/B Work's headworks.

4.2.4.6 Material of Construction

Copper shall be used for water supply for line sizes 3 inches and smaller, cement-lined ductile iron for larger sizes. No-hub cast-iron soil pipe shall be used for all sanitary and vent lines. Sanitary waste lines containing any chemicals shall be high silicon cast iron type rated for intended duty.

If natural gas piping is used, the system shall be installed in accordance with NFPA 54, National Gas Code.

4.1.5 Electrical

4.1.5.1 Codes & Standards

Electrical designs and installation shall comply with the following codes and standards:

NEC National Electrical Code;
NESC National Electrical Safety Code;
IEEE Institute of Electrical and Electronic Engineers;

ANSI American National Standards Institute;
ICEA Insulated Cable Engineers Association;
IES Illuminating Engineers Society;
NFPA National Fire Protection Association;
UL Underwriters Laboratories;
JIC Joint Industrial Council;
ISA Instrument Society of America; and
OSHA Occupational Safety and Health Administration.

4.2.5.2 Utility Service

The D/B Company shall be responsible for making all arrangements with Georgia Power D/B Company for electrical services at the facilities.

4.1.5.3 Standby Generation

Appendix 2 contains specifications for Standby Generation system.

4.1.5.4 UPS Power

Uninterruptable power systems shall be provided for all equipment that is sensitive to power supply interruptions and disturbances.

4.1.5.5 Power Distribution

The D/B Company shall provide a reliable power distribution system with double-ended substations, dual feeders, tie breakers and other redundant features such that no single component failure or power interruption will prevent the operation of critical loads. The distribution system shall be designed to limit the steady state voltage drop to 3 percent and the motor starting voltage drop to 10 percent and to provide a minimum of 20 percent spare capacity in transformers and the busses of switchboards, motor control centers and panelboards.

4.1.5.6 Area Classifications

The facilities shall comply with NFPA 820 Standard for Fire Protection in Wastewater Treatment Collection Facilities.

4.1.5.7 Grounding

Grounding shall be provided in accordance with the National Electrical Code. Ground grids shall be provided for all new structures. Existing grounds shall be tied into the new grids. All raceways that contain power conductors at any voltage shall include a ground wire.

4.1.5.8 Surge Protection

Transient voltage surge protection shall be provided at low voltage switchgear, switchboards, motor control centers and panelboards and on the telephone service lines entering the facilities. Lightning arrestors and surge capacitors shall be provided at medium voltage motors and lightning arrestors shall be provided at substation transformers.

4.1.5.9 Lightning Protection

All structures shall be provided with lightning protection conforming to NFPA 780 Standard for the Installation of Lightning Protection Systems. A UL Master Label shall be provided certifying compliance with UL standards.

4.1.5.10 Power Monitoring System

Microprocessor metering units shall be provided at each feeder and motor starter at the medium voltage level, at motor control centers and other significant load centers. The monitoring system shall include a computer driven software package to monitor and trend loads.

4.1.5.11 Power Factor

Capacitors shall be applied to correct power factor to 95 percent for motors rated 30 HP and larger. Capacitors shall be connected so that they are switched with the motor starter. Capacitors shall not be connected to a bus that also supplies adjustable frequency drives.

4.1.5.12 Motors

Continuous duty rated motors shall be energy efficient types conforming to NEMA MG-1. Motors driven by variable frequency drives shall be inverter duty types.

4.1.5.13 Variable Frequency Drives (VFDs)

VFDs shall be 12 pulse or greater PWM types.

4.1.5.14 Lighting

Indoor lighting fixtures shall be industrial, vapor-tight fluorescent type in low ceiling applications and high pressure sodium type, with quartz restrike lamps, in high ceiling applications. Exterior lighting shall be high pressure sodium. Special attention shall be paid to minimizing sky glow and light trespass on adjoining properties. Lighting levels shall be as recommended by Illuminating Engineering Society. Battery-backed emergency lighting units and illuminated LED exit signs shall be provided where required.

4.1.5.15 Fire Protection

The facilities shall include smoke and heat detectors, pull stations and audible/visible communicators meeting the requirements of local Fire Department.

4.1.5.16 Basic Materials

Raceways

Interior conduits shall be rigid steel except in chemical areas where Schedule 80 PVC shall be used. Conduits exposed to exterior elements and individual buried conduits shall be PVC coated rigid steel. Underground ductbanks shall be constructed with Schedule 40 PVC, concrete encased. Minimum conduit size shall be 3/4-inch except that buried conduits shall be minimum 1-inch.

Wire and Cable
All conductors shall be copper. Medium voltage cable insulation shall be EPR, 133% insulation level and conductors shall be sized for full load current and a short circuit withstand for 0.5 seconds or the maximum trip time of the protective device, whichever is greater. Low voltage (600 volt) cable insulation shall be type XHHW or THWN/THHN. All conductors shall be run in conduit.

Enclosures
Equipment enclosures and boxes shall meet NEMA 4X requirements in wet, damp and corrosive locations and NEMA 7 in hazardous locations.

4.1.6 Process Instrumentation and Controls/SCADA System

4.1.6.1 Introduction
The D/B Company shall provide, install, program and make fully operational a complete process instrumentation and control/ SCADA system, including all hardware and software, to interface with the D/B Work equipment. The D/B Company shall provide a SCADA system that includes the ability to operate and monitor the D/B Work equipment and processes from a Central Control Station (CCS) or from the designated local control panels. Appendix 2 contains more information on the Process Instrumentation and controls/SCADA system

4.1.6.2 Standards
The D/B Company shall provide a process instrumentation and control/SCADA system which complies with the following standards and practices:

- National Electrical Code (NEC) - NFPA 70
- Instrument Society of America (ISA) - ISA Standards
- National Electrical Manufacturer's Association (NEMA) - NEMA Standards
- Occupational Safety and Health Administration (OSHA) - OSHA Standards
- Underwriters' Laboratories, Inc. (UL)
- American National Standards Institute (ANSI)
- Scientific Apparatus Manufacturers Association (SAMA)
- Institute of Electrical and Electronic Engineers (IEEE)
- Factory Mutual (FM)

4.1.7 Computerized Maintenance Management System (CMMS), and Communication Systems
The D/B Company shall provide, install, and fully implement a comprehensive computer network, CMMS, and communication systems for the D/B Work. The computer network shall connect all D/B Work related buildings being. The network architecture shall be suitable to support all business software and the CMMS. The CMMS shall provide a comprehensive maintenance and inventory management tool for the system. The communication systems shall be adequate for internal and external voice and data needs of to support their operations.

4.1.7.1 CMMS

The D/B Company shall install and implement a comprehensive computer-based maintenance management system that develops readily available historical data, including an inventory of spare parts, and provisions for enforcing existing equipment warranties and guarantees. The D/B Company shall provide the County five licensed, concurrent seats for the CMMS Software The D/B Company shall implement and turn-over to the County such a maintenance management program to include multiple types of maintenance activities for all components of the JCEC, including but not limited to:

- Buildings, grounds, and structures;
- Electrical systems and instrumentation;
- Mechanical equipment;
- Odor control systems;
- Laboratory, monitoring and sampling equipment;
- Heating, ventilation, and air conditioning;
- Communication equipment (i.e., telephones, facsimiles, etc);
- Computer equipment (software and hardware);
- Chemical feed systems;
- Pumping systems;
- Auxiliary power facilities (as applicable);
- SCADA facilities;
- Other facilities, equipment, and systems contained within the D/B Work; and
- Other specialized tools and equipment.

The CMMS version shall be a full-featured networked based CMMS that uses a graphical user interface, producing a viewing screen similar to those of Windows-type programs. The CMMS software shall be organized around several modules, which include, work orders and maintenance tasks; schedule, work order analysis, reporting; equipment; inventory; employees and requisition. The CMMS will have the capability, at a minimum, of:

- Maintaining repair records for each piece of equipment within the D/B Work;
- Scheduling and monitoring preventive maintenance activities;
- Issuing work orders and purchase orders;
- Maintaining spare parts inventories;
- Tracking repair warrantees;
- Automatically issuing exception reports, equipment status reports, and an equipment repair priority report;
- Tracking process variables such as temperature, vibration, and amperage to identify statistical trends that predict equipment failure;
- Alerting maintenance personnel to investigate and make any necessary adjustments or repairs before equipment failure occurs;

- Prioritizing maintenance tasks based on critical equipment designation; and
- Control backlog of maintenance activities so that maintenance staffing efficiently matches workload, and all maintenance tasks are completed.

As part of this implementation, the D/B Company shall verify the existing equipment information data for accuracy and completeness, and gather any additional information that will be necessary in order to achieve maximum system benefit, after completing an initial equipment inventory. The D/B Company shall import available existing data from the current system to the new CMMS to ensure valuable historical maintenance information is available for review and use.

4.1.7. 2 Initial Inventory/Asset Management Data

The D/B Company shall perform an equipment inventory, which includes the following activities:

- Record nameplate data and other pertinent information such as bearing sizes, total dynamic head (TDH), and flow available for each piece of equipment.
- Develop an equipment identification system that reasonably incorporates the type, number, location and existing identification number of the equipment.
- Record plant inventory of spare parts and input to the CMMS.

4.1.8 Communication Systems

Voice communications systems shall include internal and external telephone systems, paging systems and external WEB access to the PC network.

- Telephone: the internal/external telephone system shall be a PABX system or a leased system from a telephone provider. Acceptable system providers include Lucent and Nortel.
- Paging: An internal communication system shall allow communication with individuals around the plant and the broadcast of emergency information. The D/B Company can decide the nature of the paging system proposed.
- Remote Data Access: The remote data access shall be accomplished through the use of a dedicated Internet server. The server shall be configured with a suitable firewall and network security devices to protect the PC network from unauthorized entry.

4.1.9 CCTV

The D/B Company shall install in accordance with specifications in this Appendix a CCTV system with cameras at 10 access and monitoring points on the site and dedicated monitors located in the control room, the County Representatives office, and at one other location to be provided during the design phase.

4.1.10 Network Hardware and Software

The D/B Company shall provide, install, and fully implement a comprehensive computer network. The Company shall provide Ethernet cables for all LAN segments, and components (computers and ancillaries) with the latest proven technology and that are the manufacturer's latest featured products. Network computers shall be per the current Fulton Standards for Computers. In the rapidly changing and progressive technology of computers, workstations and networking, the D/B Company shall furnish the County computers, workstations and network components that are current and compatible with the County Standards.

The Operational controls system, the SCADA system, the CMMS system and the security system shall all be accessible from the network.

4.2 Educational Facility

Provided in this section are the general guidelines for the inclusion of a classroom and laboratory within the overall facility. The general theme of Environmental Education is a goal of Fulton County for the Johns Creek Environmental Campus. The classroom and laboratory will be used mostly by local high schools and middle schools for Environmental Education with specific emphasis on the conditions in the Chattahoochee River, water conservation, water re-use, and wastewater treatment. To this end the Design/Build Company should propose facilities that meet the general guidelines provided in this section. Also innovative ideas for other facilities that could further this goal of Environmental Education are encouraged.

4.3 Security System

Provide a fully functional security system for the process and non-process spaces. The system shall be capable of monitoring alarm points for intruder or fire alarms while operating keypads, magnetic door switches and other inputs and outputs. Interaction with other systems is required for, but not limited to, the CCTV system and the SCADA system. The system shall be connected to and compatible with the Fulton County 911 system.

INTRUSION DETECTION SYSTEM

Provide an integrated system for intrusion detection and access control applications. The system shall interface with the CCTV system in Section 4.1.9. The system shall be capable of monitoring alarm points for intruder alarms while operating key switches, magnetic, cyber lock door switches and other inputs and outputs. Acceptable manufacturers are Motorola or approved equal.

FUNCTIONAL PERFORMANCE:

A. Monitored Doors and Hatches:

Swinging doors, hatches and roll-up doors shall be equipped with a triple biased magnetic door position switch. A closed door shall indicate a secure condition. An open door shall indicate an alarm condition. The intrusion detection system shall allow an authorized system user to establish time of day or day of week when door position switch is active or inactive. If a door position switch is disturbed (attempt made to defeat) while active it shall indicate an alarm condition.

B. Volumetric Motion Detector:

This device shall detect motion within a defined volume. It shall be a dual technology sensor combining STEREO DOPPLER MICROWAVE Technology with a dual element Passive Infrared sensor. The independent sensor modules shall be "And Gated" and must activate simultaneously to create an overall sensor alarm. Detection of motion shall result in an alarm condition. Attempts to defeat or tamper with the detector shall indicate an alarm condition.

C. Key Switch:

This device shall be used for shunting of sensors on site. It shall consist of a momentary contact switch in a weatherproof single gang box. They cylinder shall be a CyberLock ® key cylinder.

D. Smart Key System:

This system shall consist of a programming unit, cylinder, lock programming unit, Intelligent key, and software.

E. RTU (NIC):

The alarm panel shall provide alarm outputs to the CCTV system (future) and to the SCADA system as indicated on the drawings.

F. Surge Suppressor

At every RTU, both Power and signal shall require surge suppression.

SYSTEM FEATURES

Provide a system with the following minimum features:

- Main Controller
- NEMA 4 rated enclosure
- Power supply
- Self diagnostic
- 19" rack mountable
- CPU Module
- Lightning and EMI protection

Communications

- Peer to peer from RTU to central and RTU to RTU.
- .Store & forward messages RTU to RTU
- Repeated messaging capability

Programmable Inputs/Outputs

- Digital and Analog
- High speed counter capability
- Momentary and latching operation

Software

- OSI Based MDLC communication protocol for all data signaling.
- Modbus, DNP 3.0, PLC-5, X.25 are all supported.
- Ladder logic application language.

User Interface

- PC with graphical user interface and RS232 printer capability

Specific Equipment Specifications are later in this appendix.

Activities in this area: The purpose of the educational facility is to provide students with an area consisting of a lector hall environment along with five lab work stations segregated from the main sector area. The Hall will accommodate fifty students and each lab area will accommodate ten students working as two groups of five.

I. Main Room

General Description: The area will need a minimum of 800 sq/ft of floor space with a raised lectern on one end. A storage area for stacked chairs and materials should be located in the rear. Five Lab areas will lead off the main room with view windows of at least 48 in/sq allowing a free view of the areas within.

The room will include marker board/bulletin board that will be mounted so as to not be obstructed by the lectern. There will be a motorized screen that is switch operated and ceiling mounted. The room will have vinyl tile on the floor with vinyl base. The ceiling will be drop in ceiling tile with electrical lights and ventilation mounted in the ceiling. Lighting needs to be placed for optimum coverage and switched to allow for use of the motorized screen without extinguishing all the lights. The space should allow for seating to be placed to accommodate at least fifty persons and allow entry into the adjacent lab areas. There will be a flush floor mounted box in proximity to the Motorized screen with 110/v power.

Furniture and Equipment: The following furniture and equipment will be required in the main lector area: one Podium (movable), seventy stackable chairs, a 48x36x72 inch lockable storage cabinet, one demonstration tank, pedestal mounted on the lectern, (specifications located in section III), one television mounted below the ceiling and viewable from the main floor tied into the computer system from the labs or a master station on the lectern, a computer and screen tied into the lab system and on a computer station on the lectern, and a VCR/DVD player connected to the TV in a lockable cabinet on the lectern.

II. Lab Areas

General Description: The lab areas will be five separate rooms sized each to accommodate two groups of five students. There will be two separate lab stations with storage cabinets mounted above and below each. Water and power will be required for each station and one computer station complete with printer for every two lab stations.

The rooms will be provided with two mounted black Chemproof counter tops with integral sinks. These should be cabinet mounted with storage both above and below and include three (3) outlets at each station. The floors will be tiled, not carpeted because of water and chemical spills. Each room will be vented from the ceiling to the outside. Proper lighting should be provided for the room and the work stations. The rooms will have separate power provided for each computer station with all cabling. Each area is to be provided a window, minimum of 48 in/sq, that allows full view from the adjacent lecture area.

Furniture and Equipment: The areas will be provided with one computer station desk and computer (monitor, CPU, key board, mouse, printer, and proper cabling). There will be in each room a UV goggle cabinet with twelve pairs of goggles. All mounted cabinets will be lockable and mounted to ensure accessibility to the students. Each work station will be provided with a microscope. The room will be provided with two cabinet mounted black Chemproof counter tops with integral sinks and storage both above and below.

III. Custom Equipment

Allowances:

1. An allowance will be provided for general lab equipment ie; test tubes, beakers, microscope slides, etc., the list of exact equipment to be provided by Science Advisors to the Project.
2. An allowance will be provided for the custom tank and pumps to demonstrate the flow in the river. The contractor shall provide a custom tank 120"x48"x36" with nozzles, pumps, outlets, piping, and valves to operate and maintain the aforementioned. Specific design approval of this element will be required.
3. The allowance for this and other educational equipment and furnishing is provided on PPF1.

PRODUCT SPECIFICATIONS

1.0 GENERAL

The remote terminal unit (RTU) shall be an intelligent, modular unit capable of both data acquisition and local data processing. It shall monitor and control local equipment in a stand alone mode as well as being an intelligent node in a distributed processing system. It shall be microprocessor based and allow reconfiguration and optimization to occur via software only. To facilitate installation, maintenance and future expansion, all Input/Output (I/O) modules shall connect to the basic processor module via a passive motherboard on the RTU rack. A PC-compatible computer running a single, comprehensive standard application development and diagnostic software package shall be used for program developement and downloading (directly to the RTU or through thesystems communication channels).

Each RTU must be supplied with the number and type of I/O points as indicatedelsewhere in the plans and specifications. Future expansion shall be possible by simply plugging in additional I/O modules to the I/O bus. Each RTU shall be supplied with the following minimum configuration:

a. Mother Board
b. Power Supply
c. I/O Bus
d. Battery
e. Enclosure
f. I/O Modules as required
g. CPU Processor Module
h. Communications Interface

1.1 MOTION DETECTION UNITS

1.1.1 OUTDOOR VOLUMETRIC MOTION DETECTION UNIT - Provide Pyramid XL2 Series Outdoor Sensor as Manufactured by Protech Technologies Inc., or approved equal.

Features

a. Stereo Doppler microwave detector
b. Five setting adjustable sensitivity adjustment
c. Dual element infrared detector
d. Balanced temperature compensation
e. Component failure supervision
f. Alarm status indicating LED (face of unit)
g. Environmental supervision LED (face of unit)
h. Swivel mounting - 180° horizontal adjustment, 90° vertical adjustment.
i. Tamper proof enclosure with tamper switch
j. Solid-state form C Relay
k. Metal weather proof housing - RFI and EMI shielded

l. Integral sun and rain shield

m. Changeable Lens Module

Specifications

a.	Input voltage:	8.5 to 20 VDC
b.	Current Consumption:	130 ma @ 12 VDC
c.	RF Power Density:	120 uw/cm2 max at the face of unit
d.	Operating Temperature:	-30° F to 130° F
e.	Relay Contact Rating:	0.05A @ 130 VDC
f.	Stereo Doppler Range:	Stereo Doppler portion adjustable from 10% to full range.
g.	Sensor Range:	50 foot by 50 foot

1.1.2 INDOOR MOTION DETECTION UNIT- Provide GE (Sentrol) Mirror Optic High Security PIR or equivalent.

Features

a. High security PIR with anti masking feature

b. 9 curtains at 50' each

Specifications

a.	Input voltage	8.2-15VDC
b.	Peak to peak ripple	2V max @12VDC
c.	Current consumption	17mA max
d.	Mounting height	7-10 feet
e.	Relay contacts	50mA max @ 28V
f.	Relay type	closed loop (Form A)
g.	Alarm time	2.9-3.5 sec
h.	Operating temperature	0 – 122 degrees F
i.	Humidity	93%
j.	Weight	.26 lbs
k.	View angle	89 degrees
l.	Detection range	50'

1.2 Door position switch:

MAGNETIC DOOR SWITCH: Provide a SPDT surface mounted triple biased, balanced magnetic door position switch in coordination with exit devices for request to exit and door position control and monitor. Magnetic tamper feature with a supervised loop must be provided. The housing shall be brushed anodized aluminum. Provide GE (Sentrol) model 2700 series or approved equal.

MAGNETIC OVERHEAD DOOR SWITCH: Provide a SPDT surface mounted triple biased, balanced magnetic door position switch. Magnetic tamper feature with a

supervised loop must be provided. The housing shall be brushed anodized aluminum. Provide armored flex cable for use at overhead door. Provide GE (Sentrol) model 2700 series or approved equal.

1.3 KEYSWITCH

Provide a complete unit that includes a weather resistant surface mount electrical box, brushed aluminum faceplate, rubber gasket, SPST N/O switch, cylinder lock ring, 4 socket/slotted screws, and 2 tamperproof screws. Provide CAMDEN CM1000 series or approved equal.

1.4 SMART KEY SYSTEM:

Provide a direct replacement for mechanical lock cylinders. No wiring or power is required to power the cylinder. They key shall contain a 3 volt lithium battery. They key must be programmable with the following specifications: 1250 maximum locks that they key can open, storage capacity is 1150 events per key, access is programmable based upon time and day, and also by a beginning date and expiration date. Software must provide programming and audit trail functions. Provide a base station and a remote authorizer. Provide a 9 pin serial port cable. Provide Cyberlock or approved equal.

1.5 SURGE SUPPRESSOR

1.5.1 Provide Low Voltage Line Protection for all 12VDC or 24 VDC devices connected to the RTU. It must be for outdoor use, out of direct weather. Provide Ditek model DTK-4LVLP-CR or approved equal.

1.5.2 Provide AC Hard Wired Transient Voltage Surge Suppressor for 110/125VAC power circuit at each RTU. It must be for outdoor use, out of direct weather. Provide Ditek model DTK-120HW

1.6 POLES

As indicated on the drawings, provide a 16' tapered, direct burial, breakaway style pole. It must have a UV- and weather-resistant pigmented polyurethane coating. It must have Aluminum or hot dipped galvanized steel tenons - post-top fixtures. Handhole covers are coated to match the pole color; 2-1/2" x 5" oval handholes are standard. Provide Shakespeare BO20OOS5-SC or approved equal.

1.7 MOSCAD GENERAL SPECIFICATIONS

The RTU shall consist of a unique fiberglass reinforced Lexan enclosure which shall be NEMA-4 compliant. The enclosure shall contains all RTU system components such as the module rack, power transformer, and communications device. The RTU shall be integrated into a single entity; the module rack shall contain the power supply/charger module, the CPU module, and up to three input/output modules.

1.7.1 The RTU shall be a microprocesser based, user programmable, PLC which shall serve as an interface to accumulate, process, transmit and receive discrete and analog status and control messages between FEPs and RTU sites.

1.7.2 Each RTU shall be PLC based, with sufficient backed RAM, memory to provide all discrete and analog status, monitoring and control functions and shall be designed to operate in an outdoor industrial environment.

1.7.3 The RTU shall be designed to operate in an industrial environment. The RTU shall be capable of operating in an ambient temperature range of -30 degrees to +60 degrees Celsius, and a relative humidity of 5-90 percent, non-condensing at 50 degrees Celsius.

1.7.4 All components of the RTU (including radio) shall be of the same manufacture who is regularly engaged in the manufacture of PLC and radio equipment. The manufacture shall have fully tested units similar to that being furnished in an industrial environment with associated electrical noise.

1.7.5 The telemetry system shall be provided with bi-directional RF communications between the master location and all remote sites RTUs.

1.7.6 The remote telemetry units shall be mass-produced (minimum 2000 CPUs per year), factory manufactured units of a design that has be in field use for a minimum of 5 years.

1.7.7 The RTU hardware, including radio and power supply shall be provided in a weatherproof, lockable, and vandal resistant NEMA 4 enclosure.

1.7.8 The RTU shall be capable of recording and storing data and performing internal calculations. All data shall be locally stored at the RTU site. The RTU shall have built in equipment and self diagnostics capabilities, and shall report failures, or record them locally for later troubleshooting.

1.7.9 All RTUs shall be of first class workmanship and shall be entirely designed and suitable for the intended services. All materials used in fabricating the equipment shall be new and undamaged.

1.7.10 The Front End Processor unit shall be capable of supporting Modbus, MDLC, TCP/IP and Allen-Bradley Data Highway to enable redundant interfacing with the existing control system. The FEP shall be capable of interfacing directly to the existing Allen-Bradley PLC 5/40e and directly to the existing interface personal computer.

1.7.11 The RTUs shall be capable of utilizing a store and forward communication when unable to directly communicate with the Front End Processor or repeater. The store and forward feature shall be programmable via a programming toolbox.

1.7.12 Central Computer: Graphic Master Central (GMC)
The Graphic Master Central (GMC) shall be a Microsoft Windows NT or XP based PC with a Graphical User Interface (GUI) software package to allow viewing and controlling of the entire system.

1.7.13 The computer hardware used for the central GMC computer shall be the equivalent or better to the following:

Hewlett-Packard Server TC2120, Tower
Intel® Pentium® 4 2.4 GHz processor with 533MHz front-side bus,
256KB on-chip L2 cache, 80GB 7200 rpm (IDE model) hard drive
512 MB (ECC) SDRAM

USR 5610B v.90 56K internal PCI modem
HP 48X Combo DVD/CDRW Carbon Kit (MFG PART CD197A)
AVS200W Speakers w/Mute 2.5 Watt/Channel (or equivalent)
Embedded 10/100TX LAN adapter
Integrated 1024×768, 256-color, non-interlaced 16 MB SDRAM video memory
3.5-inch, 1.44MB flexible disk drive
PCI3 - RocketPort PCI/Octa/DB25
Keyboard, Mouse, two 9-pin RS-232 serial ports, one 25-pin parallel port, two keyboard and mouse ports, one SVGA video port, two USB ports
Windows 2000 Server - Service Pack 2, Symantec PC Anywhere v10.5, XP Office Professional (SR1)
Monitor 18" Flat Panel with resolution of 1280 x 1024
UPS
Workstation/Desk
3 year next day onsite warranty
Or equivalent at time of purchase

The graphic display and database software package shall be a commercial off-the-shelf software package such as InTouch™ from Wonderware or equivalent. This software package resides on the GMC. The custom graphic screens depict current system status where the user can easily navigate from a macroscopic system view down to the individual site details. All system alarms, Change of States (COS), and controls are time stamped, stored in the alarm history file, and printed for hard copy record keeping. History files allow for retrieval of important information at all times.

1.8 POWER SUPPLY SPECIFICATIONS

The power supply shall be of sufficient capacity to provide all required DC power to all RTU equipment, discrete and analog input/output circuitry under full a load, communications interface equipment, radio, and other equipment as required. Batteries and a built-in charging circuit (within P.S.) shall be included to provide a minimum of thirty minutes of full load backup in the event of AC power loss.

1.8.1. The Primary power source shall be a power supply that connects directly to the AC power mains through a power transformer. The power supply shall be capable of providing 5 Vdc,14 Vdc and 24 Vdc to other modules and communication devices, and to other elements within the RTU.

1.8.2. The Secondary power source shall be a rechargeable 1.2 A-h battery that can provide power to other modules, communication devices and other active elements upon loss of AC main power.

1.8.3. The power supply shall be capable of supporting three unique capabilities of input power source ranges; they are 120 Vac 60 hz input option, 19-28 Vac/21-50 Vdc option, and an external 12 Vdc option.

COMMUNICATIONS

2.1 GENERAL

The RTU shall support the establishment of a sophisticated data communication network for SCADA applications utilizing a variety of radio or line communication links. Radio links shall include conventional (VHF and UHF), direct FM radio, trunked radio and microwave (analog and digital). Line links shall include private or leased lines, Public Service Telephone Network (PSTN) via dial-up modems and fiber optics. The RTU must be a true multi-port device and be able to communicate simultaneously with hierarchies above it (multiple central stations), with hierarchies parallel to it (RTU to RTU) and hierarchies below it (master/slave RTUs).

2.2 DATA PROTOCOL

Data communications shall utilize a secure, smart protocol designed in accordance with the Open System Interconnection (OSI) model as defined by the International Organization for Standardization (ISO). The protocol must include all seven layers of the OSI model and facilitate communications between all stations in the system and support:

- Multi level access control to insure high levels of data privacy
- Multiple logical sessions to allow simultaneous application execution
- Packet oriented with high efficiency variable length messages
- Ability to transfer complete programs and historical data from RTU to centrals or between RTUs
- Support high data security techniques, frame synchronization, dynamically assigned CRC codes
  (32 bit) and other sophisticated recovery and erorr detection procedures

The protocol should allow flexible, efficient communications for transmission of data, complete programs, databases or other parameters. Complete configuration and diagnostic programs shall be transferable from/to the Central site or from RTU to RTU (full data upload/download capability). Complete RTU/system debugging shall be allowed without visiting each remote site. The protocol shall support a complex hierarchical system structures of multiple host computers and sub-master stations. Its detail structure, however shall be transparent to the system user and allow him to concentrate upon the application.

2.3 COMMUNICATION METHODS

In addition to the simplistic master/slave polling configuration, the RTU shall operate in a number of more efficient contention formats required by point to multipoint networks. The RTU must support quiescent operation and initiate data transmissions under the following conditions:

A. Report by Exception - Automatically transmit upon defined exception condition(s); analog, digital or any combination

B. Timed Transmission - Automatically transmit data on programmed time interval

2.4 SPECIAL COMMUNICATION REQUIREMENTS

In addition to the communication methods above, the RTU must also support the following special modes:

Shared Transceiver Mode: each RTU shall be able to share its communications transceiver (radio, wireline, etc) with other RTUs.

Store & Forward Repeater: each RTU shall be able to receive information from other sites, store it in memory and then transmit (relay) the data to another site

Network Interface Node: each RTU shall be able to function as an interconnection point between different communication systems; e.g., radio to line, between different radio frequencies, etc.

Trunked Radio Interface: each RTU shall be able to use a trunked radio communication system.

Broadcast (Set Call): any change in RTU or system data e.g. time synchronization, control mode switching, setpoint change, or wide area command may be automatically transmitted to a dynamically defined set of locations.

2.5 RADIO COMMUNICATION CHANNELS

The RTU shall be able to operate on a Motorola Private DataTac system. Each RTU shall monitor the communication channel(s) to prevent transmission during a busy period. Channel priority assignments shall be available (both network and individually) to handle avalanche conditions. The RTUs are fixed equipment that transmits digital information over the 800MHz radio frequency using 4-level FSK (Frequency Shift Keying). This area of radio operation is strictly governed by the FCC (Federal Communications Commission) and all units must meet the appropriate sections of: Subpart J: 90.235 (secondary fixed tone signaling) and 90.238 communication systems and/or communication networks using FSK. The RTU need support the following minimum characteristics:

- Operating Mode: Asynchronous
- Transmission Mode: Half duplex
- DataTAC Radio: 2400 bps (FSK)

2.6 WIRELINE COMMUNICATION CHANNELS

The RTU shall support a number of communication options over traditional two or four-wire voice grade phone lines. The RTU shall have optionally available different internal modems to support point to point, party line ,as well as auto-answer/dial-up operation. General line characteristics required:

- Operating Mode: Synchronous/Asynchronous
- Transmission Mode: Half or full duplex
- Baud rate: 1200/2400 dependent upon line
- Output impedance: 600 ohm or high impedance, balanced
- Input signal level: 0 Dbm to -30 Dbm

2.7 SERIAL DATA CHANNELS

The RTU shall also be able to communicate via a number of different serial interfaces. Communication to an external DTE/DCE device shall be supported for RS-232 and RS-485.

2.8 EXTERNAL COMMUNICATION DEVICES

The RTU shall be able to operate with a number of external communication devices.

3.8.1 The RTU shall be interfaced to a fiberoptic (FO) link via a FO RS-232 modem. These devices, e.g. Fibronics FM630 allows transmission up to 6 km at data rates up to 19.2 kbps.

3.8.2 The RTU shall be able to interface to a Motorola VRM 660 compatible with Fulton County's existing 19.2 kbps DataTac Network.

2.9 MOSCAD-L COMMUNICATION SPECIFICATIONS

The RTU shall have plug-in communication interface boards for MDLC to an internal radio, for an Intrac radio, for RS-232 to an external modem, and for the 1200 bps or 2400 bps internal modems. The communication interface boards shall plug into a single socket on the RTU CPU module via a RJ-45 connector.

2.9.1. The RTU shall consist of a maximum 3 amp out power supply. The 3 amp power supply output shall restrict the radio selection to one of the following Motorola Radios; HT-1000, MTS 2000, VRM 660 and Spread Spectrum Radio.

2.9.1.1. The RTU shall be capable of supporting Motorola's Private DataTac system. The RTU shall be able to operate on the 800MHz radio frequency:. Each RTU shall monitor the communication channel(s) to prevent transmission during a busy period.

2.9.1.2. The RTU shall be capable of operation over Motorola DataTac mobile data infrastructures. A RTU model with vehicular radio modem (VRM) built-in shall be available for operation over the DataTac network. Other DataTac network devices such as gateways or message switches and associated software necessary to support RTU communications over the network must also be supplied by the vendor.

2.9.2. The RTU shall be capable of being ordered with no internal radio. The RTU shall be capable of supporting an external radio.

2.9.3. The RTU shall be capable of supporting the MDLC protocol that is common to the MOSCAD RTU family.

3.9.4. The RTU shall support F2 emission, so this emission type must be shown on the FCC (or other) license and included in the design of any intended external radio.

3.9.5. The RTU shall be capable of operating on a VHF splinter channel with an external radio that is type accepted for splinter channel operation.

3.9.6. The RTU shall be capable of operating in a trunked radio infrasture. The RTU shall be capable of properly handling Notch-filters, and PL/DPL filters.

2.9.7. The RF modulation signaling shall be capable of using FSK @ 1200 bps, DPSK @ 2400 pbs, or DFM @ 4800 bps.

2.9.8. The Remote sites shall be monitored from the master site through report-by-exception, programmable polling, and transmission upon change of state. Transmission upon change of state shall be defined as an RTU transmitting an event without provacation by the Master Unit (FEP).

2.9.9. The Master Site (FEP) and each RTU in the system shall continuously monitor communications and shall report failure to communicate as communications failures.

2.9.10 Over the Air programming downloads to the RTUs, RTU diagnostics, site status monitoring, frame/packet recording, and process error logging shall be provided FROM the Master Site Location or any other remote RTU via the RF. Provide antenna, cable, mounting hardware, surge protection, pole (if required) and necessary engineering services and field labor to establish stable communication to the Fulton County 911 Call Center.

HARDWARE MODULES

3.0 RTU HARDWARE MODULES

3.1 BASIC PROCESSOR MODULE

The basic processor module (CPU) of the RTU shall be a real time process controller and support:

A. Bus communication with I/O modules
B. System memory allocation
C. System parameter/logic programming
D. Communication port control

3.1.1 The Central Processing Unit (CPU) shall be a high speed (16MHz clock rate), 32 bit CMOS microprocessor, Motorola 68302 or equivalent. This VLSI design must incorporate a separate co-processor (embedded RISC chip) to handle all external communication tasks so as to not affect base CPU performance.

3.1.2 The CPU shall be equipped with a minimum of 704 kbyte on-board memory of different types.

EPROM	for system programs
RAM	for data and parameters
FLASH(EEPROM)	for application programs

Total RTU memory must be expandable to a minimum of 1.5 Mbyte. Provision must be available to add a numerical co-processor (Motorola 68882 or equivalent) with true double precision floating point capabilities along with additional memory and support for trigonometric and transcendental functions.

3.1.3 The CPU module must incorporate a real-time clock (RTC) with lithium battery backup for both RTC and module RAM. Large scale CMOS gate array technology must be used for minimum component count and maximum performance and reliability. CPU features include:

A. Watch-dog timer (WDT)
B. Symbolic debugging support
C. Diagnostic LED indication
D. Power monitor for clean program start/stop

3.1.4 The CPU module must include at least the three built-in communication ports as listed below:

Port 1: RS-232 or RS-485, software controlled, full DCE/DTE operation to 9600 bps
Port 2: RS-232, full DCE/DTE, 9600bps, transient protected

Port 3:Configurable (Plug-In) communication module for radio, wireline, trunked radio, and dial-up wire line, 600-9600 bps, dependent upon media.

Support shall be available for additional serial channels, second radio, wireline or other external communications.

3.2 INPUT/OUTPUT MODULES

3.2.1 The RTU shall address variable I/O requirements by the addition of appropriate expansion modules. Each module shall communicate with the CPU module via a high speed (> 1 Mbps) data bus. Up to 44 modules shall be supported by a single CPU module; dual CPU configurations shall optionally be available. Each expansion module may be plugged into an empty slot on the I/O bus.

All modules, regardless of type (unless specifically noted), must share the following features:

3.2.1.1 Input Protection: dc/dc converter with 2.5kv optical isolation per IEEE SWC 472/587. Output Protection: 1 kv between contacts, 1.5kv between contact and coil per IEEE SWC 472, CMOS Gate Array: all logic, bus and LED interface contained in one gate array on each module to minimize components and increase reliability.

3.2.1.2 Diagnostics: Loopback test, system clock, WDT, 20 diagnostic LED indicators of status and module failure modes.

3.2.1.3 Terminal Boards: Removable, Phoenix type up to 14 AWG (2.5 sq. mm) or DIN connector.

3.2.2 Digital Input Module - Type 1
Capacity: 16 dry contacts, all isolated inputs; 2 high speed counters (up to 10 Khz)
Counters: All base inputs may be defined as low speed counters, 50-500Hz
Interrupt-Handling: Change of State (COS) reporting to 1 ms in interrupt mode
Input filtering: 1-32 ms, software controlled

3.2.3 Digital Input Module - Type 2
Capacity: 16 wet contacts, 10-28 or 20-56 volts AC and/or DC isolated inputs
Interrupt-Handling: Change of State (COS) reporting to 1 ms in interrupt mode
Input filtering: 1-32 ms, software controlled
Option: Higher voltage capability by adding external resistance

3.2.4 Digital Input Module - Type 3
Capacity: 32 contacts, DC Voltage inputs, separate termination board required
Input filtering: 1-32 ms, software controlled
Interrupt-Handling: Change of State (COS) reporting to 1 ms in interrupt mode
Option: 10-28, 20-56 and 35-80 Vdc versions available

3.2.5 Digital Input Module - Type 4
Capacity: 60 contacts, separate termination board required
Input filtering: 1-32 ms, software controlled
Interrupt-Handling: Change of State (COS) reporting to 1 ms in interrupt mode

3.2.6 Digital Output Modules
Type 1: 16 magnetically-energized relay contacts (12 Form A, 4 Form C)
Type 2: 16 electrically-energized relay contacts (12 Form A, 4 Form C)
Type 3: 8 electricall-energized relay contacts (Form C)

Type 4: 32 Open collector (FET) outputs each with separate common

All shall have local, internal read back of an auxiliary relay contact (Type 4 has read back of Open Collector device) for positive indication of output command execution.

Type 1 and Type 2 relay contact load 60W dc (resistive loads only) or 125VA ac; Type 3 relay contact load 10 A @ 277 Vac or 30 Vdc. Type 4 is rated 0.5A @ 32 Vdc maximum.

3.2.7 Analog Input Module
Capacity: 8 floating, isolated inputs
Type: 4-20mA, (optionally ±1mA, ±2mA, ±1V, ±2.5V, ±5V) all inputs same type
Resolution: 13 bits including sign
Accuracy/Linearity: ± 0.05 % full scale/ ± 1 LSB
Calibration: Automatic, software controlled (no potentiometer)

3.2.8 Analog Output Module
Capacity: 4 optically isolated outputs
Type: 0-5 V or 4-20ma, performance dependent upon power supply
Resolution: 12 bits including sign
Accuracy: ± 0.1% full scale

3.2.9 Mixed I/O Module

This module shall combine DI, DO and AI capability into a single unit.

Capacity: 8 isolated dry contact digital inputs,
4 electrically-energized relay contacts, 3 Form A, 1 Form C or
3 magnetically latched, 1 form A, 2 form C and 1 form A electrically energized
2 analog inputs (12 bits including sign)

3.3 MOSCAD-L HARDWARE SPECIFICATIONS

THE RTU SHALL SUPPORT A VARIETY OF INTERCHANGABLE I/O MODULES THAT ARE AVAILABLE TO COLLECT DATA FROM AND SEND COMMANDS TO OTHER PHYSICAL DEVICES LOCATED AT A REMOTE SITE.

3.3.1 CPU MODULE

The CPU module shall be programmed by ladder-logic, using a Programming ToolBox to provide it with the capabilities expected of a PLC. The RTU shall be capable of downloading compiled functions written in C into the CPU module.

3.3.1.1. The RTU CPU Module Processor shall utilize a Microprocessor equal to a Motorola 68LC302 (16/32 bit) CMOS; and shall operate at a clock speed of 16.6 MHz.

3.3.1.2. The RTU shall provide the following on board Memory: 1024 kB Flash for operating system and 256 kB RAM for Application Size.

3.3.1.3 The RTU shall support an on board Software clock that supports year, month, date, day, hour, minute, and second.

3.3.1.4 The RTU shall support programmable Serial Data Ports: Port 1: RS-485 2-wire multidrop or RS-232 (no handshake); up to 57.6 kbps. Port 2 shall be capable of supporting RS-232 with full DTE/DCE support up to 57.6 kbps. The Communication Port (port 3) shall be capable of supporting 1200 bps DPSK to an internal/external radio, or 2400 bps FSK to an internal/external radio, or 4800 bps DFM to an external radio, or 9600 bps Synchronous to MDS 9710 radio, or 600 bps Intrac to internal/external radio, or 1200/2400 bps wireline modem, or RS-232 Sync/Async up to 57.6 kbps.

3.3.2 110 VOLT DIGITAL INPUT MODULE

The RTU shall be capable of supporting up to 16 wet closures, from switches or relays in other on-site equipment to be connected to the RTU.
Examples include site or equipment door switches, centrifugal switches on motors, equipment malfunction switches, and tank float switches.

The high-voltage module shall accept nominal 110 Vac inputs. Each of the inputs shall be opto-isolated from the remaining circuitry on the module to provide the highest possible input surge immunity.

3.3.2.1 Data Input
Under the control of the defined Application Program, the RTU shall allow the CPU module to read the current instantaneous status of one or more of the 16 inputs. It shall then be capable of moving that data from the 16DI module into the CPU module via the motherboard.

3.3.2.2. Low-Speed Counter Inputs
The RTU shall allow each of the 16 digital inputs to be used as low-speed counter inputs if desired. The totalizing will be done within the CPU module under Application control at the Remote location.

3.3.2.3. Wet Inputs
The RTU shall allow each of its digital inputs to accept input currents from external sensors that provide a switched 110 Vac output.

3.3.2.4. Time-Tagging
The RTU shall allow any of the 16 digital inputs to be defined to tag the time of the input event with one millisecond accuracy.

3.3.2.5. Optical Isolation
All Digital Inputs on the RTU must be protected by optical isolators that are built on the module.

3.3.2.6. The RTU shall support 150 Vac maximum input voltage on all Sixteen (16) inputs of the Digital Input Module.

3.3.2.7. The Digital Input Module shall support an Input Signal of: Vin > 60 V or Iin > 1.0 ma Off: Vin < 30 V or Iin < 0.3 ma.

3.3.2.8. The Digital input shall support Filtering Software that allows control of hardware filtering from 2-38 Msec. Longer filtering shall be capable within the application programmer.

3.3.2.9. The Digital Input module must support an Interrupt upon COS Event time-tag resolution equal to or better than 5 msec.

3.3.2.10. The Digital input module shall support Diagnostics LEDs on the front panel that indicate the status of the 16 digital inputs.

3.3.3 STANDARD 16 DIGITAL INPUT MODULE

The 16 Digital Input (DI) modules shall provide 16 wet digital inputs that may also be used as low-speed counters under application control. The low-voltage module shall accept voltage inputs in the 10-56 Vac/dc range and provides an isolated 24 Vdc wetting voltage so the open/closed state of dry-contact sensors may be determined.

3.3.3.1. Wet or Dry Inputs
The Digital Input module shall be capable of allowing each digital input to accept input currents from external 12 or 24 Vac/dc sensors. The Digital Input module shall be capable of providing a floating 24 Vdc output to wet the contacts on dry-contact sensors.

3.3.3.2. All sixteen (16) inputs on the Digital Input module shall support a maximum of 56 Vdc input voltage.

3.4.4 ANALOG OUTPUT MODULE

The RTU shall allow up to 12 other on-site pieces of Analog equipment to be connected to and controlled by the RTU via an Analog Output signal. Examples include variable speed motors, proportional gate valves, chart recorders, and more.

3.3.4.1. Data Output
The RTU shall allow the defined Application Program to move the current data value of one or more logic variables from the CPU module into the 4AO module via the motherboard. The 4AO module will pass that data through on-module digital-to-analog converters (DAC). There shall be one converter for each output event, to the controlled device.

3.3.4.2. Dual Outputs per Channel
Each Analog Output module shall provide 4 independent output channels that provide both 4-20 ma and 5 Vdc outputs. All outputs shall be protected against surges and other disturbances.

3.3.4.3. The Analog Output modules shall be capable of supporting 4 channels each may be calibrated for either 4-20 ma current output or 0-5 Vdc voltage output.

3.3.4.4. The Analog Output module must support a Resolution equal to 12 bits (including sign bit).

3.3.4.5 The Analog Output module shall maintain Overall Accuracy of ±0.1% of full scale @ +25°Celsius.

3.3.4.6 The Analog Output module shall maintain a stability of less than 50 ppm.

3.3.4.7 The Analog Output module shall have an Output Load for the 4-20 ma less than 250 ohms when a loop Power Supply is equal 12 Vdc; and less than 750 ohm when a loop Power Supply is equal to 24 Vdc.

3.3.4.8 The analog Output module shall support an output Isolation of 2.5 kV optical isolation between outputs.

3.3.4.9 The Analog Output module shall have an update time of 30 Msec per channel when only 1 channel is used and 120 msec with 4 channels used.

3.3.4.10 The Analog Output module shall have Diagnostics LEDs that indicates output active, 1 update and 1 uncalibrated per channel.

3.3.5. SIX (6) ANALOG INPUT MODULE

The 6 Analog Input (AI) module shall provide six 4-20 mA analog inputs. Each of the inputs, plus ground, shall be opto-switched into a precision A-to-D converter. Ground is measured so short-term drift may be canceled.

3.3.5.1. The analog currents applied to the module are multiplexed to an on-module analog-to-digital converter (ADC), all inputs shall be under the control of the RTU's CPU module. As controlled by the defined application program, the 6AI module will read the instantaneous value of one or more of the inputs and move that data from the 6AI module into the CPU module via the motherboard.

3.3.5.2. The 6AI module shall utilize the process of multiplexing two additional on-module inputs to the ADC, namely logic ground and a calibration voltage. These digitized signals are used to eliminate any ADC offset (drift), thereby stabilizing the ADC output.

3.3.5.3. The Analog Input Module shall protect all inputs by optical isolators that also function as the multiplex switches. An on-module power supply further isolates the field-side circuits from the RTU. Surge Withstand Capability (SWC) conformance is assured for the safety of the equipment and technicians.

3.3.5.4. The Analog Input Module(s) shall be plug-in modules and lock into the module rack. Wire connections (up to 14 ga. wire) shall be to removable connectors on the front of the module. No jumpers, calibration pots, etc. shall be located on the module any calibration is done electronically with software.

3.3.6 EIGHT (8) DIGITAL OUTPUT MODULE

The RTU shall provide an Eight (8) Digital Output (DO) module that provides eight relay outputs. The Digital Output module shall be capable of supporting either eight magnetically-latched relays or eight electrically-energized relays.
Four relays shall provide Form A (normally open) contacts and four relays shall provide Form C (transfer) contacts. All relays shall be rated for 60 watt (dc) or 125 VA, not to exceed either 2 amps or 30 Vdc/250 Vac. There shall be an internal feedback from each relay available so the application may determine the state of the relays. Both the magnetically-latched relay module and the electrically-energized relay module utilize plug-in screw terminals for connection of the associated wires.

4.3.6.1. The RTU shall be capable of supporting up to 24 digital outputs.

4.3.6.2. Under the control of the defined application program, the CPU module will move the current status of the data variables in the CPU module that are associated with the relays to the 8DO module via the motherboard. The 8DO module then opens or closes relays according to the status of the data.
4.3.6.3. The electrically-energized relay module shall have 8 conventional relays. These relays shall have a single coil each. The relays shall remain closed for as long as their coils are energized.

3.3.6.4. The magnetic-latched relay module shall have 8 latch-type relays. These relays shall have two coils each plus a small internal magnet. The relay shall be closed by briefly energizing the Set coil the magnet then keeps the relay closed.

3.3.6.5. Both types of 8DO modules shall have secondary contacts on the relays that provide positive feedback that the relay has closed.

3.3.6.6. The RTU shall allow an operator to remotely (over the air) check the status of the relays via a software programming toolbox.

3.3.7 MIXED INPUT/OUTPUT MODULE

The RTU shall have one plug-in module that permits up to eight dry contact closures, up to two 4-20 ma analog inputs, and provide two relay outputs that are either electrically energized or magnetically latched.

3.3.7.1. The RTU shall read the current instantaneous status of one or more of the eight status inputs or two analog inputs and move that data from the module into the CPU module via the motherboard.

3.3.7.2. Each of the eight digital inputs shall be capable of being used as a low-speed counter input. The totalizing will be done within the CPU module under application control. The application shall read the associated input(s) in a timely manner to assure not missing any input event.

3.3.7.3. Any of the eight digital inputs shall be capable of being defined to tag the time of an input event with one millisecond accuracy.

3.3.7.4. Each digital input shall accept input currents from external 12 or 24 Vac/dc sensors. The module shall provide a floating 24 Vdc output to wet the contacts on dry-contact sensors.

3.3.7.5. The RTU shall provide modules that are available with two electrically-energized (EE) relays or with two magnetically-latched (ML) relays.

3.3.7.6. The electrically-energized (EE) relays shall be used when it is mandatory that the relays open when power is lost or control otherwise disrupted.

3.3.7.7. The magnetically-latched (ML) relays version shall be used when prolonged operation from the backup battery power source is expected.

3.3.7.8. All inputs shall protected by optical isolators on the module.

RTU SOFTWARE

4.0 RTU SOFTWARE

4.1 OPERATING SYSTEM

The software shall be based upon a multi-tasking executive system optimized for real-time environments, Motorola's Object Oriented MTE or equivalent.

4.2 Application Software: The RTU shall be programmed with a high level, multiple process ladder diagram language which includes Boolean and arithmetic functions as well as specialized function blocks such as proportional, integral, derivative (PID) control and American Gas Association (AGA) flow calculations. The ladder diagrams shall be used for process definitions as well as symbolic monitoring and debugging.

The RTU application shall be defined using a stand alone programming package running on a computer with Windows-based operating system. This package shall allow the user to develop and download the site and system configuration as well as all local application programs, plus provide source level debugging. This terminal shall be connected either locally via RS-232 to the RTU or remotely from any site in the system through the designated system communication channel.

The configuration software shall be designed so that it will automatically create all software entities needed to support the different hardware modules and communication ports as configured by the system engineer. The application database definition shall support a tabular format in which the database is defined as a set of tables, where each table defines a group of devices; each row signifies a separate device and each column contains specific device data. The table entries are to be assigned user-significant names such as PUMP1. Table values are to contain easily understood data such as equipment run time or number of pump starts.

After the RTU database is complete, the communications, monitoring and control processes shall be defined. These may be simultaneous (up to 5 processes may run independently) or sequential and may contain subprocesses to be performed dynamically. These subprocesses may include auto failover to backup communication channel(s), alternative control programs, etc.

The RTU application development package shall be able to download the modified software to the RTU and allow real-time monitoring of the process. Ability to 'force, jump, or skip to' must be supported so that the user may view/ change the actual values in the target system during program execution. The software shall support time tagging of events at the RTU which will allow accurate timing of the occurrence at the central location.

4.3 DIAGNOSTICS

Error detection software, running as a background task within the RTU shall continuously check the RTU I/O modules. Several levels of specially built in test circuitry shall be provided in each module for these tests. A 20 LED matrix shall provide fault identification and system diagnostics on all modules. It shall be possible to test any RTU remotely using the RTU application developmentpackage connected to any location in the system. The error log list in the CPU shall provide a comprehensive list of errors, including as a minimum date, time, software or hardware entity name and full error description.

4.4 FOREIGN PROTOCOL SUPPORT

The RTU shall allow use of various foreign, ie non Motorola MDLC, byte oriented protocols. It shall do so by encapsulating or emulating the foreign protocol via its application programming interface language. In so doing however, the RTU will be limited to the performance of the other protocol and some features will not be available.

MECHANICAL

5.1 CONSTRUCTION

The RTU shall be totally modular in design and construction, allowing specific configuration merely by plugging in the appropriate CPU and I/O modules. All modules and their assembly shall be accomplished without screws or fasteners of any type. All connections shall utilize a snap-in action and a tool shall be supplied to aid easy connector removal. The RTU shall be available in several sizes to fit different application requirements including 3, 6, 8 and 16 module assemblies. Basic RTU models shall consist of a mounting plate and motherboard, a CPU module (occupies 1 slot) and a power supply/charger.

All elements must use CMOS components and LSI circuitry. No jumpers, DIP switches, or adjustable potentiometers shall be allowed. Extensive use of SMD (surface mount device) is required.

Front access to all controls, indicators, lithium battery and external cables shall be provided. Motherboard connection to I/O modules shall be direct; no daisy chain or multiple ribbon cable connections allowed.

All I/O modules shall be equipped with a front cover door to serve as: module latch release, wiring identification label and terminal board protection. Space shall be available to direct and route external wires from outside the RTU that are connected to the I/O modules.

5.2 ENCLOSURES

The RTU shall be available in a variety of wall mounted CRS NEMA standard housings of category 1, 3, 4, 12 and 13. Optionally a NEMA 4x housing shall be available in a baked epoxy finish, stainless steel or Fiberglass housings shall also be available. An industry standard 19 inch rack mounting assembly shall be available (required for 8 or more module units).

5.3 ENVIRONMENTAL

The RTU must operate over an ambient temperature range of -30 to +60 C with relative humidity < 95% @ 50 C. It must meet or exceed EIA standards RS-204B and RS-152B.

The RTU shall meet or exceed the SWC standards as defined in IEEE C37.90A for all inputs and outputs. In the appropriate enclosure, the RTU shall meet all qualifications for UL 611, paragraph 26.

The RTU shall operate from 115/230 VAC, ± 15%, 50/60 Hz primary power. A battery and charging circuit shall be included to provide 4 hour standby operation (for defined RTU capacity and use). Larger capacity batteries shall be available to extend operating time.

ENGINEERING SUPPORT

6.1 REMOTE ACCESS/PROGRAMMING

An auto-answer modem shall be provided to enable remote diagnostics and program debugging. A dial-up telephone line connection will be provided upon request by the customer to aid his staff in this process.

6.2 Software shall be available for an IBM compatible laptop computer to enable remote (via 1200-9600bps modem) or local diagnostics through any one of the RTUs (via one of the

RS-232 ports). This package shall also support the transfer of complete application programs either uploaded to the next hierarchy or downloaded to the RTU. Such diagnostics and program transfer shall be possible to any of the RTUs over the system radio channel and/or wireline, depending upon system configuration.

6.3 The following engineering services shall be provided by the vendor:

- RTU programming, software configuration, and optimization.
- Central computer database, screens, and application programming, configuration, and optimization.
- As-built drawings of the RTU's showing communication port assignments, site names, and other appropriate information.
- On-site trip with site walk and to capture requirements for the project. Documentation of requirements shall be provided within a detailed system implementation document as well as an Acceptance Test Plan document.
- Completion of on-site Acceptance Testing Plan before final acceptance.

EXECUTION

7.1 INSTALLATION:

The Intrusion Detection System shall be installed and wired completely as shown on the plans by a trained and manufacturer authorized systems integrator, who shall make all necessary wiring connections to external devices and equipment.

7.1.1 General: Install system according to NFPA 70, 72 applicable codes and manufacturer's printed instructions.

7.1.2 Wiring Method: Install wiring in raceways. Conceal raceways except in unfinished indoor spaces.

7.1.3 Wiring Within Enclosures: Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars and distribution spools.

7.1.4 Number of Conductors: As recommended by system manufacturer for functions indicated.

7.1.5 Taps and Termination's: Make taps and termination's on numbered terminal strips in junction, pull and outlet boxes, terminals cabinets, and equipment enclosures.

7.1.6 Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams.

7.1.7 Install power supplies and other auxiliary components for detection devices at the terminal controllers except as otherwise indicated. Do not install such items in the vicinity of the devices they serve.

7.1.8 All security systems conductors shall be separated from one-hundred-twenty (120) VAC primary power lines by no less than twelve (12) inches: security systems conductors shall not share any conduit in which primary power conductors are run.

7.1.9 Wire fill, conductors, and conduit shall be sized by the Contractor, except where indicated, in compliance with the National Electrical Code. The number of

conductors required may vary on the basis of the manufacturers of the selected equipment.

7.1.10 All conductors shall be run continuously between sensors, processors, junction boxes, terminal strips or panels, and other approved devices. Splices between such locations are not permitted. Necessary junctions shall be made using screw-type terminal blocks, or in accordance with manufacturer's requirements for connections to the equipment.

7.2 ADJUSTMENT/ALIGNMENT/SYNCHRONIZATION/CLEANING

Subsequent to installation, the Contractor shall clean each system component of dust, dirt, grease or oil incurred or accrued from other project activities, and prepare for system activation by manufacturer's recommended procedures for adjustment, alignment, or synchronization. Each component shall be prepared in accordance with the appropriate provisions of the component's installation, operations, and maintenance manuals.

7.3 DOCUMENTATION

Accurate "as built" drawings shall be furnished by the systems integrator to aid the owner in programming. These should indicate the door(s) controlled by each output, the monitoring points for the door controlled area, and any enunciator outputs or specified inputs into the system. The systems dealer shall supply operating and maintenance manuals to aid the owner in the programming of the system. A CD ROM disk with drawing files created in AutoCad R14 with complete schematic and interconnection diagrams shall be turned over the Contracting Officer's representative prior to system sign off.

7.4 SERVICE AND SUPPORT

7.4.1 STARTUP

The systems integrator shall guarantee all material and workmanship involving the system for 1 year after startup.

7.4.2 TRAINING

After system startup, the systems dealer shall instruct owners personnel in how to program the system and demonstrate a typical operating program for a single door controlled area. Provide up to 40 hours of on-site training.

7.4.3 WARRANTY SUPPORT

The Authorized Systems Dealer shall be available during the warranty to answer programming and application questions to support owners personnel during this period. The Authorized Systems Dealer shall have the training and capability to provide additional support services including:

9.4.3.1 Regular testing and inspection of all system components and to submit r reports on the results.

9.4.3.2 Emergency Service for repairs and adjustments to the system and part replacement if necessary.

7.5 SYSTEM PROGRAMMING

7.5.1. SYSTEM PROGRAMMING

The Contractor shall provide technical services and personnel to perform programming functions for the Intrusion Detection System. The system shall operate as outlined in the attached event matrix. A systems flow chart or outline matrix, describing the system functions shall be coordinated with and provided to the Owner Representative for approval prior to commencement of programming.

9.5.1.1 A minimum of 16 hours of programming time shall be provided to meet the requirements of the site security personnel.

7.6 FIELD QUALITY CONTROL, TESTS, AND INSPECTIONS

7.6.1. MANUFACTURER'S FIELD REPRESENTATIVE

Provide services of a factory-authorized field representative to supervise the field assembly and connection of components and system pre-testing, testing, adjustment, and programming. Final testing and system programming shall be under the supervision of a factory-authorized field representative that is an employee of the manufacturer.

7.6.2 CERTIFICATION

The Contractor shall certify that all requirements of this specification have been met. Verification shall be through a written statement in accordance with inspection, demonstration and tests, as described below.

7.6.4 VERIFICATION BY TEST AND DEMONSTRATION

The Contractor shall verify by formal demonstrations or tests that the requirements of this specification have been met.

7.6.5 TEST VERIFICATION REQUIREMENTS

Demonstration is verification by operation of a device or system and the comparison of the device or system performance against a qualitative standard or standards as set forth in the specific requirements of the specifications. Test is the systematic exercising of an device or system under all specified conditions with quantitative measurement of specified parameters and comparison of performance against the quantitative standards set forth in the specifications. The Owner Representative shall be afforded a fourteen (14) day advance notice of all system demonstrations.

7.6.6 PRELIMINARY TESTS

Following installation, the Contractor shall individually test each sensor, device and system component, and verify the proper functioning of each sensor, device or system component. Each sensor, device and system component shall be similarly tested until all doors, gates, sensors and intrusion detection system interfaces have been verified. Any deficiency pertaining to these requirements shall be corrected by the Contractor prior to final functional and operational tests of the system.

7.6.7 SYSTEM OPERATION TEST

Following completion of the preliminary tests and the Access Control System and component formal demonstrations, the Contractor shall conduct a formal test, to be known as the System Operation Test, in which all components and systems of the Access Control System are demonstrated to operate together as a system. This test shall be performed over a continuous seventy-two (72) hour period and shall be witnessed by the Owner Representative. A formal test plan and test procedures for each portion of the test shall be prepared by the Contractor and submitted to the Owner Representative for approval in accordance with this specification. The Contractor shall demonstrate that the Access Control System components meet specification requirements in the as-installed operating environment during the system Operation Test. While no formal environmental testing is required, the Contractor shall measure and record temperature, humidity, and other environmental parameters, and shall include this data in the test report to document the environmental parameters and the environment conditions which were encountered during the System Operation Test.

7.6.8 TESTS UPON COMPLETION OF WORK

Upon completion of the Contractor's work, the system shall be subjected to complete functional and operational tests. When all required corrections have been accomplished, the system shall be re-tested and the Owner Representative notified in writing, twenty-one days in advance of the proposed final acceptance testing and inspection date. The advance notice shall include certification that the installation is complete and operable, and has satisfactorily performed the final tests specified herein. The acceptance testing and final inspection will be accomplished in the company of the Owner Representative. Fourteen days prior to that date, the Contractor shall prepare and submit for approval of the Owner Representative, a complete and detailed final acceptance test check-off list (punch list). The list shall be a complete representation of all specified functions and conditions. At the time of final acceptance testing, all required tests shall be repeated, and all defects will be corrected, until the system is found to be acceptable to the Owner Representative. A log of all test activities and results shall be maintained by the Contractor. The Contractor shall furnish all instruments, labor, and materials required for tests, the equipment manufacturer's technical representative, and a qualified technician to perform the tests.

7.6.9 FINAL TESTS: FINAL TESTS SHALL INCLUDE THE FOLLOWING:

7.6.9.1 Test electrical supervision of all input/output sensor and data communication bus circuits;

7.6.9.2 Test of all alarm initiating devices;

7.6.9.3 Test of all circuit supervision and self-testing systems;

7.6.9.4 Test of batteries and battery chargers;

7.6.9.5 Test of door monitoring;

7.6.9.6 Complete operation tests under emergency power;

7.6.9.7 Visual inspection of all wiring;

7.6.9.8 Verification that all required submittals have been provided and have been accepted;

7.6.9.9 Demonstration of software and programming/reprogramming functions of all microprocessor systems.

7.6.9.10 Verification of systems response time.

APPENDIX 5A
MINIMUM TECHNICAL REQUIRMENTS

5.1 Design/Build Requirements

The D/B Company shall be responsible for delivery for the County's acceptance, a Plant that meets all of the requirements of the RFP as well as any and all Local, State, and Federal permit, regulatory, applicable law, and County requirements.

The Design/Build Project shall incorporate the Minimum Technical Requirements specified in Appendices 5A and 5B. Appendix 5A addresses the Minimum Technical Requirements for process mechanical, structural, building mechanical, electrical, and instrumentation and controls. Appendix 5A also presents the Membrane System Scope of Supply. Appendix 5B addresses Minimum Technical Requirements for treatment process piping and valves, including their testing. The D/B Company shall design and construct a facility, which meets the performance criteria set forth in Appendices 2 and 18.

In an overall effort to minimize the impact of the JCEC to the environment and surrounding community, the D/B Company shall also incorporate the Architectural/Landscaping Requirements and Building Program of Appendices 3 and 4 into the design. Appendices 3 and 4 and Volume 5, contain more general building specification and standards while Appendices 5A and 5B are process and process building specifications. Where there are discrepancies between any set of specifications in the D/B RFP the proposers should use the most stringent specification or ask for clarification.

5.1.1 Equipment General, Design Requirements

Provide products conforming to all specified, scheduled, or indicated performance requirements including site elevation above sea level, ambient temperature and humidity range, utility supply conditions, and service pressure-temperature ratings. Design products for continuous operation unless otherwise noted. Where any specific service condition would adversely affect product performance capabilities, request revision of performance rating or modification of product from Construction Manager to obtain specified performance.

5.1.2 "Or Approved Equal"

Through out this and other appendices the County has listed approved manufacturers. These approved manufactures provide equipment that the County generally anticipates will meet the level of quality that is desire for this project. "Or Approved Equal" is added to each list of manufactures to allow the D/B Company the flexibility to investigate and recommend equipment from other manufacturers. The County **will not**, prior to selection, approve or disapprove any manufacturer, vendor or specific

piece of equipment. It is the responsibility of the D/B Company to submit equipment manufacturers and vendors who can and will supply equipment that meets the technical specifications of the appendices. During the evaluation process all equipment submitted in the proposal will be evaluated as to its ability to meet the requirements of this D/B RFP.

5.2 Process Mechanical Requirements

5.2.1. Pumps

5.2.1.1. Reference Standards: All pump designs shall comply with the applicable standards listed below except as otherwise specified:

- Standards of the Hydraulic Institute
- American National Standards Institute
- Standards of American Water Works Association.
- American Gear Manufacturers Association.
- National Electric Code
- Standards of National Electrical Manufacturers Association
- Institute of Electrical & Electronic Engineers
- American National Standards Institute
- Anti-Friction Bearing Manufacturers' Association Standards
- Occupational Safety and Health Administration

5.2.1.2. General Requirements

Unless otherwise stated all pump types shall comply with the following general design criteria:

A. Provide seal water on all raw sewage and sludge pumps.

B. Furnish pumps with mechanical seals. Provide mechanical seal water pressure approximately 3-5 psig higher than the stuffing box pressure.

C. In abrasive services, bowl or line shaft bearings on vertical turbine pumps shall be flushed by a screened or protected clean water supply.

D. Motor shall have a 1.15 service factor, and shall comply with the latest ANSI, NEMA, and IEEE Standards as a minimum.

E. All pumps shall be non-overloading throughout the entire operating range and shall be sized so that the operating point will be in the mid-range of characteristic curves and reasonably close to maximum efficiency. In no case

will pumps be sized for the operating condition with a maximum or near maximum impeller diameter. Impellers shall be dynamically balanced.

F. All pumps of a single type shall be by a single manufacturer.

G. Provide nameplates of corrosive resistant metal and contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity, head rating and other pertinent data.

H. Spare parts for each pump shall include a complete set of seals, bearings, wearing rings, shaft sleeve, etc. and sufficient lubrication material for a complete pump rebuild of each pump.

5.2.1.3. Controls

A. Control Panels shall be NEMA 4X 316 SS control panel. All motor starters, variable speed drives, relays, timers and other control devices required for control and operation of the equipment shall be mounted in the panel.

B. All controls shall operate on 120 VAC. Provide a suitably sized control transformer with primary and secondary overcurrent protection. The panel shall have a nameplate engraved with panel name and number FCP-XXX-N.

5.2.1.4 Close Coupled/Frame Mounted End Suction Centrifugal Pumps

A. Design Requirements

1. Pumps shall be designed for continuous duty with a maximum motor speed of 1,800 rpm.

2. Frame Mounted Type Pumps shall be mounted on a common base with a flexible coupling between the motor and the pump. The pump shaft shall be designed to limit shaft deflection at the stuffing box to no more than 0.002-inch conforming to ANSI B73-1.

3. Acceptable manufacturers shall be manufactured by Aurora, Berkley, Burks, Cornell, Goulds, Flowserve, or Peerless or approved equal.

B. Materials and Construction

1. The pump casing and impeller shall be cast iron.

2. Fittings shall be stainless steel with cast iron impellers..

3. The pump shaft shall be stainless steel or carbon steel with either a stainless steel sleeve.

4. Pumps shall be furnished with mechanical seals of tungsten carbide construction. Mechanical seal parts shall be of stainless steel.

5. The pump shall have replaceable casing wear rings of stainless steel, depending on impeller material.

5.2.1.5 Vertical Turbine Pumps

A. Design Requirements

1. The pumps shall be single or multistage, designed to operate at a maximum 1800 rpm.

2. Pumps shall be manufactured by Peerless, Patterson, or Goulds, or Flowserve or approved equal.

B. Materials and Construction

1. Columns The discharge column shall be steel pipe fabricated in accordance with ASTM A 53.

2. Shaft Shafts shall be 416 stainless steel, turned, ground and polished over the entire length. Shaft sections shall be connected through screwed couplings.

3. Lineshaft Bearings
   a) Bearings shall be bronze sleeve type flanged at one end for ease of installation and to prevent rotation of the bearings.

   b) Bearings shall be water lubricated, cutless rubber type installed in bronze bearing retainers.

4. Pump Bowl and Suction Bell
   a) The pump bowl and suction bell shall be ASTM A 48, Class 30 cast iron designed for easy removal of impeller and bearings. Upper and lower connections on the bowl shall be flanged, rabbeted and machined. The suction bell shall have a flared inlet to reduce entrance losses and a sufficient number of vanes to support the lower guide bearing as well as to

support the weight of the impeller and pump shaft when dismantling the pump.

b) The bowl shall have a bronze main bearing immediately above the impeller and a bronze, grease packed lower bearing below the impeller. Multi-stage pumps shall have a bronze intermediate bearing between impellers.

c) Upper and lower connections of the bowls shall be flanged, rabbeted and machined. Each bowl shall have a bronze main bearing immediately above the impeller. The top bowl shall have a line shaft enclosing tube adaptor of SAE 40 bronze, and shall be permanently fitted with a line shaft bearing. The suction bell bearing shall be packed permanently with non-soluble grease and sealed. Bowls shall have bronze wear rings.

d) Impellers: Impellers shall be of the turbine type of cast bronze or stainless steel. Impellers shall be accurately machined to fit the contour of the bowl. The impellers shall be mounted and keyed on the shaft.

5. Drive

a) The pump shall be direct connected to a vertical, hollow shaft motor with non-reverse ratchet.

b) The weight of the rotating parts of the pump and the unbalanced hydraulic thrust of the impeller shall be carried by a thrust bearing located in the pump drive. Provision shall be made at the thrust bearing for adjusting the impeller with reference to the bowl.

c) The drive shall be coupled to the column shaft through a three-piece, flanged adjustable driver coupling.

5.2.1.3 Submersible Pumps

A. Design Requirements:

1. Pumps shall be suitable for continuous operation under submerged or partially submerged conditions, electric motor driven, non-clog, sewage pumps.

2. Pump design shall incorporate an automatic discharge connection,

allowing each unit to be removed for inspection or service by simply lifting the pump. Re-connection shall require only lowering of the pump into position.

3. Pumps shall be as manufactured by Flygt, KSB, or Cornell or approved equal.

B. Materials and Construction

1. Pump Construction

a) All major castings, including the motor housing, bearing housing, volute and impeller shall be of as a minimum ASTM A48 Class 35 cast iron.

b) All major parts, such as the stator casing, oil casing, volute, sliding bracket and discharge connection shall be of gray iron.

c) No portion of the pump unit shall bear directly on the floor of the wet well. Guide bars and all associated hardware shall be 316 stainless steel.

2. Impeller

a) The pump shall be provided with wear rings of 400 series stainless steel having a Brinell Hardness Rating of a minimum 300. The impeller shall have a Brinell Hardness Rating of 200, minimum, of non-clogging design.

b) The impeller shall be a slip fit or taper fit to the shaft and key driven. Non-corroding fasteners shall be used.

3. Shaft Seals

a) Each pump shall be provided with a mechanical, rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated, lapped seal faces.

b) A leakage sensing system shall be provided to detect the intrusion of moisture in either the seal chamber or stator housing.

4. Motor

a) The submersible motor shall be housed in a completely watertight and air filled chamber. The motor shall be suitable for use in Class I, Division I, Group C & D atmospheres as Explosion Proof.

b) Provide a common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. The shaft shall be stainless steel.

c) The shaft shall be supported above and below the rotor by anti-friction bearings designed to provide long life and minimize shaft deflection. At least one bearing shall be double row type. Bearings shall have a minimum AFBMA B10 life of 40,000 hours.

d) Thermal sensors shall be provided to monitor stator temperature. One thermal switch shall be imbedded in the end coils of each stator winding.

5. Cable

a) Cable shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors.

b) The cable entry-sealing fitting shall relieve stress on conductors and provide a watertight and submersible seal, without the use of sealing compounds and without the application of specific torques to connectors.

6. Accessories

a) Pump Hoist: A pump hoist shall be provided. The pump hoist shall be designed with a minimum safe load capacity of 2.0 times the weight of the pump and with a minimum cable length to raise and lower the pump as required for proper operation. All components shall be Type 316 stainless steel.

5.2.1.4 Progressing Cavity Pumps

A. Design Requirements

1. The pumps shall be heavy duty, positive displacement, cradle-mounted, top suction and discharge, progressing cavity type.

2. Progressive cavity pumps shall be manufactured by Moyno or Netzsch or approved equal.

B. Materials and Construction

1. The body castings of the pumps shall be thick-walled cast iron or stainless steel. The suction housing shall incorporate two rectangular inspection ports, 180 degrees apart and provide access to the universal joint(s) within the suction housing.

2. The rotor shall be a machined from steel alloy and be hardened to a Rockwell C of 57 to 60 and polished chrome-plated, single helix. It shall have a nominal chrome plate of 0.010-inch for a maximum abrasion resistance. The chrome plating shall provide a minimum Brinell Hardness of 550. Provide anti-rotational device to prevent reverse rotation of the rotor.

3. The stator shall have double helix design, and shall be chemically bonded to a steel tube. The stator shall use 720-degree clamp rings to fasten to the normal horizontal flange and suction housing, and shall have sealed ends. The clamp rings will facilitate stator removal. The stator seals shall be designed to prevent the material being pumped from contacting the stator bonding and tube.

4. The universal joints shall be of the grease lubricated, totally enclosed sealed and shielded, crowned gear type.

5. A splined connecting rod shall connect the gear joints of the eccentrically moving rotor and the drive shaft.

6. The drive shaft shall be of two-part design with the chrome-plated, hollow quill removable for repair without removing the bearings from the bearing housing or disconnecting the driver.

7. The bearings will be of the grease-lubricated ball or tapered roller type. Fittings shall be located in the bearing housing to permit

occasional re-lubrication. The B-10 life of the bearings shall exceed 50,000 hours.

8. The pump shall be equipped with the appropriate mechanical seal.

9. Motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of service, and shall have a minimum B-10 life of 30,000 hours.

5.2.1.5 Sludge Diaphragm Pumps

A. Sludge Diaphragm Pumps shall not be used without the approval of the County.

5.2.1.6 End Suction Dry Pit Centrifugal Pumps

A. Materials

1. The materials of the end suction dry pit centrifugal pumps shall comply with the following requirements:
2. Each horizontal pump and motor shall be mounted on a common steel base, which shall be fabricated of A-36 structural steel.
3. Each vertical pump shall be supported on a fabricated base of A-36 structural steel.
4. Casing shall be constructed of cast iron ASTM A-48, Class 35. Casing shall be provided with a handhole and with vent, drain and gauge connections.
5. The impeller shall be constructed of cast iron ASTM A-48, Class 30 and shall be non-clog type with minimum number of vanes designed to handle solids and stringy material and statically and dynamically balanced.
6. Motor shall be an energy efficient, totally enclosed solid shaft motor with Class F insulation, Class B temperature rise, with a maximum speed as indicated in the Design Conditions. Motor shall have a 1.15 service factor, and shall comply with the latest ANSI, NEMA, and IEEE Standards as a minimum.

5.2.1.7 Torque Flow Pumps (Grit Pumps)

A. Design Requirements

1. Pumps shall be manufactured by Wemco or Hayward-Gordon or approved equal.

B. Materials and Construction

1. Casing

   a) Casing shall be two-piece, vertically split type, with inlet designed so that impeller can be withdrawn without removing discharge casing and/or disturbing discharge piping.

   b) Casing shall be constructed of Ni-Hard conforming to ASTM A 532 Class I material with a minimum Brinell Hardness of 650, suitable for abrasive service. Casing thickness shall be not less than 3/4-inch.

2. Impeller

   a) Impeller shall be of recessed design, minimum Brinell Hardness of 650.

   b). Impeller shall be of the cup-type design such that the blades are surrounded by an integral rim which shall direct the flow to the center of the volute.

   c) Impeller shall be rabbitted to a tapered shaft and be secured to the shaft by an impeller bolt and secured against reverse rotation.

3. Pump Shaft and Shaft Sleeve shall be of ASTM A108, Grade 1141, or equal, steel accurately machined and shall be protected throughout the packing area by a removable, 11-13 percent chrome stainless steel, hardened shaft sleeve.

4. Stuffing box shall contain not less than five graphite impregnated packing rings and a bronze or Teflon lantern ring arranged for water sealing from an outside source. Packing shall be retained with a split adjustable gland. Packing gland shall be machined to the bearing housing for proper alignment and easy removal.

5. Bearing Housing:

   a) Bearing housing shall be one-piece rigid cast iron construction.
      1) Provide the frame with a cast iron bearing cap at the inboard end, and a cast iron end cover and steel-bearing cap at the outboard end.
      2) Provide both ends of the frame with lip type seals to

prevent the entrance of contaminants.

3) Radial and thrust ball bearings shall be provided which shall safely carry all radial and thrust loads. Bearing B-10 life shall be 100,000 hours, minimum.

6. Motor: Motor shall be energy efficient, totally enclosed solid shaft motor with Class F insulation, Class B temperature rise, with a maximum speed of 1200 rpm.

5.2.1.8 Chopper Pumps

A. Design Requirements

1. Pumps shall be designed for continuous duty with a maximum motor speed of 1,800 rpm.

2. Chopper pumps shall be specifically designed to pump waste solids at heavy consistencies without plugging or dewatering of the solids. Materials shall be macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging.

3. Acceptable manufacturers shall be manufactured by Vaughn or approved equal.

B. Materials and Construction

1. The pump casing shall be ASTM A536 ductile cast iron.

2. The impeller, cutter bar, upper cutter, and cutter nut shall be ASTM A148 cast alloy steel, case hardened to minimum Rockwell C hardness. If provided for the pump type, the cutter bar plate shall be constructed of ASTM A536 ductile cast iron, heat treated to minimum 50 Rockwell C Hardness. Pumps with fabricated impeller, cutter bar or casing shall not be acceptable.

3. The pump shaft shall be stainless steel with a stainless steel sleeve.

4. Pumps shall be furnished with mechanical seals constructed of silicon carbide or stainless steel with silicon carbide faces. Mechanical seal parts shall be of stainless steel.

5.2.2 Blowers

A. Reference Standards: The design of blowers shall comply with the applicable standards listed below, except as otherwise shown or specified.

- Standards of the American Society for Testing and Materials.
- National Electric Code.
- Standards of National Electrical Manufacturers Association.
- Institute of Electrical and Electronics Engineers.
- American National Standards Institute.
- ASME Power Test Code for Centrifugal Compressors and Exhausters.
- AWS D1.1, Structural Welding Code.
- AISC, Manual of Steel Construction.
- AGMA Standards.
- Joint Industrial Council.

B. General Requirements

1. Blowers shall be designed for continuous 24 hour per day, 7 day per week operation, and shall be provided and designed for the local ambient and service conditions.

2. Noise levels five feet from each blower in any direction shall not exceed 90 dbA free field noise.

3. Blowers shall be frame mounted, V-belt driven. Each blower shall function at the rated capacity throughout the specified temperature and barometric pressure ranges without exceeding the motor nameplate rating.

4. Accessories that the blowers shall be provided with, include but are not necessary limited to, are inlet filters, inlet silencers, discharge silencers, pressure gauges, suction and discharge pressure switches, temperature gauges, and expansion couplings and relief valves.

5. Filter shall be capable of 95 percent efficiency on particles with a mean diameter of 2 microns or more. Headloss through the filter/silencer shall not exceed 3-inches of water for a clean filter.

6. Each blower shall be provided with inlet and discharge silencers. Acoustical material shall be hair felt, fiberglass or stainless wool.

7. Silencers shall be capable of an average attenuation of 25-30 db, and shall have a pressure drop through each unit of not more than 8-inches of water column at blower design discharge conditions.

C. Controls

1. The D/B Company shall provide a local control panel for each blower that can start up and shut down the blower in either a manual or automatic mode. These panels shall contain safety and permissive interlocks for the operation of the blowers, including as a minimum:

   a. Lubrication oil pumps and filter.
   b. Water cooled oil cooler.
   c. Bypass valve and discharge valve.
   d. Blower motor run status.
   e. Blower discharge temperature

2. Alarms—the following conditions shall initiate an alarm this is displayed both locally and remotely.
   a. High oil temperature
   b. High inlet air temperature
   c. Impending surge condition
   d. High Bearing or winding temperature
   e. High vibration
   f. High discharge temperature
   g. High discharge pressure

3. Emergency Shutdown— provisions shall be made for emergency shutdown and alarm upon conditions included in subsection 2 above.

4. Operations--Provisions shall be made to allow for automatic and manual control of inlet guide vanes to achieve optimum blower performance and efficiency

5. Start-up—the blowers shall have a manual and automatic start feature. The manual feature shall allow for manual start of lubrication, opening of blow-off valve, closing discharge valve and other functions necessary to safely start-up blower. Automatic start-up feature shall be totally automatic with all ancillary equipment being also automatically controlled.

D. Tools and Spare Parts

1. The following spare parts shall be furnished for each blower, suitably boxed and plainly labeled:

   a. One complete set of bearings for total bearing replacement.
   b. One set, complete of all shaft seals.
   c. One set of gaskets.
   d. Two spare filter elements.
   e. One complete set of spare V-belts

5.2.2.1 Centrifugal Blowers

A. Design Requirements

1. The blowers shall be sufficiently sized to provide continuous mixing and aeration of the process stream.

2. Acceptable Manufacturers: All centrifugal blowers shall be manufactured by Hoffman, Lamson, or approved equal.

B. Materials and Construction

1. Each blower shall be of the multistage centrifugal type with outboard-mounted bearing construction, in which impellers are keyed to a shaft supported by roller-type bearings.

2. Each blower casing shall be rated per its standard published data sheets for at least a 25-psig maximum casing pressure. Inlet diffusers shall be stainless steel.

3. The complete assembly (motor, coupling and blower) shall be dynamically balanced to ensure that mechanical vibration does not exceed 1.25 mils double (total) amplitude, when measured on the bearing housings at design speed. Tip speed of the rotating assembly shall not exceed 530 feet per second, and the first critical speed shall be at least 20 percent above its operating speed.

4. Each blower shall be provided with balance piston that is integrally shaft mounted on the discharge end of the machine. All air leakage past the balance piston shall be returned to the inlet by an external return line that is provided by the manufacturer.

5. Base: Each blower and its electric drive motor or engine driver shall be mounted on a common, welded structural ASTM A 36 steel base. The base of structural members or heavy steel plate shall be fabricated and strongly reinforced to make it rigid.

6. Casing: The casing shall be of close grained gray cast iron, or modular iron.

7. Shaft: Shaft shall be of high-grade steel single forgings, finished all over and accurately ground to gage where necessary. Shaft shall be of the stiff or flexible shaft design with the first critical speed at least 20 percent removed from the operating speed. Renewable shaft sleeves shall be provided at close clearance points, and at all points subject to abrasion, erosion and corrosion.

8. Impeller: Impeller shall be cast aluminum secured to the shaft in a manner to withstand all working stresses, and in particular, stresses incident to the starting of the blower.

9. Bearings: The D/B Company shall provide each blower with oil lubricated anti-friction bearings designed for a minimum B-10 life of 100,000 hours and one dual type 100 ohm platinum resistance temperature detector (RTD) and vibration transducer in each bearing and wired to the termination terminal box.

10. Blower Driver: Motor shall be an open drip proof motor with Class F insulation, high efficiency type design, with a maximum speed of 3600 rpm. Motor shall have sufficient torque and thermal capacity to successfully start and accelerate the coupled blower from the plant power system without subjecting the motor to excessive heating. Motor shall have a 1.15 service factor.

5.2.2.2. Rotary Positive Displacement Blowers

A. Design Requirements

1. All blowers shall be rotary lobe, positive displacement type, of the two-lobe involute design, and furnished by a single manufacturer.

2. Blowers shall be manufactured by Roots (Dresser), Spencer, Sutorbilt, or Kaeser or approved equal.

B. Materials and Construction

1. The impeller casings and end plates shall be of a close-grained, high strength cast iron. The casing and end plates are to be suitably ribbed for strength and to prevent distortion under operating conditions.

2. The impellers shall be cast or ductile iron. The shaft may be integral with the impeller or made separately of steel. The shafts shall run in heavy-duty bearings having a B-10 life expectancy of at least 60,000 hours.

3. Lubrication

   a. The timing gears and gear-ending bearings shall be splash oil lubricated by oil slingers mounted on the shaft. The timing gears shall be AGMA quality 12 or better. Drive end bearings shall be oil lubricated.

   b. Piping and silencers shall be lagged and frames shall be grouted for additional vibration dampening. Lagging shall include all hot piping within reach of operator to insulate and protect operator from heat.

   c. High Discharge Temperature Switch: Each blower shall be furnished with a high-temperature cutout switch with adjustable range to open on temperature rise.

4. Motor

   a. Motors shall be designed and manufactured in accordance with the standards of NEMA and shall have the following characteristics:
      1) Design B
      2) Class F insulation
      3) Service factor: 1.0
      4) Open drip-proof
      5) Inverter duty

   b. Motors shall be connected to the blowers through a V-belt drive arrangement with provisions for convenient adjustment of belt tension. The V-belt drive shall be sized with a minimum safety factor of 1.5.

5. Variable Speed Drives

a. Blowers shall be equipped with constant torque, variable frequency AC drives.

b. Provide 120 V 10, amp dry contacts to receive signals for high discharge air temperature, low suction pressure and high discharge pressure.

c. High discharge air temperature low suction pressure or high discharge pressure shall cause blower to shut down and individual fault signals to be displayed remotely.

6. Accessories

a. The blower manufacturer shall provide the required accessories and appurtenances for the complete installation:

b. Relief Valves: Each blower shall be furnished with one relief valve for installation on the blower discharge silencer. Valves shall be sized to provide adequate protection for the blower and motor in case of operation against a closed discharge valve. Valves shall be either all bronze or cast Iron.

c. Discharge Check Valves: Each blower shall be furnished with a split disc type, wafer body check valve for mounting on the discharge of the blower. Valves shall have cast iron bodies and aluminum-bronze plates with Type 316 stainless steel pins and springs with Viton seals.

d. Thermometer: Each blower shall have a suction and discharge thermometer installed on the discharge pipe. The range shall be inlet thermometer: minus 20 to 120 degrees F., discharge thermometer: 30 to 300 degrees F. The thermometers shall have a 3-1/2-inch face and shall be equal to American or Ashcroft.

e. Pressure Gauges: Each blower shall have a vacuum gauge on inlet side and pressure gauge on discharge side before and after the silencer. Vacuum gauges shall be magnehelic type with 4-inch face, zero adjustment screw, aluminum case and diaphragm actuated equal to Dwyer Instruments, Inc., Series 2000. Pressure gauges shall be bourdon tube type, stainless steel case and tube with a 3-1/2-inch face equal to American or Ashcroft. The range shall be:

1) Vacuum gauge on inlet side: 0 to 30-inches of water
2) Pressure gauge on discharge side: 0 to 10 psig

6. Expansion Couplings

a. Each blower shall be furnished with a reinforced, flexible, single filled, arch spool type; rubber expansion joint equal to Metraflex 300HT. Couplings shall have full-faced flanges per 125 pound ANSI specifications. Steel washers shall be used at the joint where the rings are split.

b. Discharge couplings shall be suitable for pressures to 15 psig and temperatures of up to 250 degrees F. and shall be provided with retaining bolts. Inlet couplings shall be suitable for a maximum vacuum of 12-inches within center and temperatures up to 110 degrees F.

5.2.3 Vortex Grit Removal Equipment

A. General Requirements

1. The grit removal system shall be a vortex-type separation system. The equipment shall generally consist of a gear motor, gear head, drive tube, axial flow propeller, baffle, and all related appurtenances.

2. Grit removal equipment shall be Smith & Loveless, Inc., or Jones & Attwood or approved equal.

B. Materials and Construction

1. Drive

a) The propeller drive tube shall be 304 stainless steel and shall be driven by a large, totally enclosed combination spur gear and turntable bearing. Pinions and gears shall be high quality steel, machined and hardened. Propeller blades shall be 304 stainless steel and shall be tapered with rounded leading edge.

b) All bearings of the drive unit shall have a minimum B-10 bearing life of 50,000 hours, except for the turntable bearing supporting the propeller assembly, which shall have a minimum B-10 life of 20 years.

c) The bull gearbox shall have an opening for a minimum 10-3/4-inch diameter torque tube driving the propeller. The gearbox shall be sealed and the bottom opening shall have an air bell around the torque tube to prevent water from entering the gearbox.

d) Motor: Enclosure shall be explosion-proof with space heater, which activates when the motor is turned off.

2. Grit Washer and Concentrator

a) Units shall be constructed of stainless steel, carbon steel is unacceptable.

b) The classifier and concentrator shall be recommended by the grit separator manufacturer.

c) The classifier shall be constructed with a hopper equipped with parallel settling plates having a protected settling area rated for the maximum anticipated flow discharged from a single fine screen at peak flow.

d) Screw Conveyor: The conveyor shall be a helicoid screw running in a minimum 3/16-inch steel U-trough. Provide anti-friction bearings at the outlet end and a bronze bushing at the inlet end. Furnish a grease fitting for the bushing extended to the top of the hopper using stainless steel tubing. Outlet pipe shall be provided and shall positively drain back to a discharge point prior to the fine screens.

e) Concentrator: The vortex-type concentrator shall be constructed of steel with an inlet and an outlet 180-degree return bend overflow. All mounting hardware shall be stainless steel.

f) Pinch Valve and Accessories: Furnish an air operated pinch valve for the concentrator feed line. Valve shall be equal to Type A as manufactured by Red Valve Co. or Flexible Valve Corp. The valve shall also be provided with a solenoid for on-off service, isolation ball valve, air pressure regulator and air pressure gauge all mounted in a 12-gauge type 304 stainless steel enclosure. Enclosure shall be NEMA 4X. The

panel shall include a momentary contact pushbutton on face of panel to activate blow-down.

5.2.4 Grit and Grease Removal Equipment

A. General Requirements

1. If primary clarification is not provided, the grit removal system shall consist of an aerated type grit and grease removal system, complete with baffle separated grit and grease channels, traveling bridge, air diffuser assemblies, air blowers, grease collection appurtenances and discharge system, submersible grit pump, grit classifier, and all other related appurtenances.

2. The grit and grease removal equipment shall be manufactured by Schreiber Corporation, Inc. or approved equal.

B. Materials and Construction

1. Air Diffusion Equipment

a) Distribution Pipe & Air Supply Drop Legs - Provide a 304 L stainless steel air header.

b) Aeration Assemblies

1) Aeration assembly shall consist of a PVC tee connected to a drop leg and two PVC diffuser assemblies. Additionally, a drop leg with one diffuser assembly shall be located at the inlet end of the grit tank to prevent excessive accumulations of grit immediately below the inlet.

2) Diffusers shall be 1-inch diameter PVC by 30 inches in length and be provided with a minimum of 15 air discharge points, each 1/8-inch in diameter.

c) Supports

1) Attach supports to wall with Type 304 stainless steel anchor bolts.

2) Supports shall be adjustable, plus or minus 1-inch, vertically.

3) Supports shall be designed to bear the entire weight of

the drop leg and aeration assembly so that the union between the drop leg and the air supply header can be easily connected or disconnected.

d) Traveling Bridge

1) The traveling bridge shall contain and support the grit removal pump and drive mechanism. Each traveling bridge shall be fabricated of structural steel of welded construction and shall span the grit compartment with wheels running on top of the exterior wall and the longitudinal beam. The bridge shall be supported by dual axels, one with two idler wheels and the other with two drive wheels. It shall be guided by four UHMW wheels on vertical axis attached to the bridge, two running on each side of the interior beam. All drive and idler wheels shall have bonded solid urethane tires for minimum maintenance and noise and for maximum traction.

2) The bridge frame shall be of welded steel construction with maximum deflection not to exceed 1/720 of the span with a dead load plus 100-lb./ft^2 live load. Main member shall be braced to assure rigidity.

e) Bridge Drive

1) The drive gears shall be precision-cut helical gears, consist of SAE 8620 drop forgings, be provided with a AGMA Class 12 Finish and a 58-62 RC hardness.
2) The gearbox shall be cast iron, designed for maximum rigidity, absorbance of high torsional or linear stresses and noise absorption, and shall be painted on the inside with a corrosion-resistant paint.
3) The bearing life shall be 40,000 hours minimum, run in oil bath or packed with bearing grease with a minimum ABEC 1 quality.
4) Provide double lip seals on all input and output shafts. Seals shall be nitrile (Buna N) and capable of withstanding a temperature range: -40° F to 250° F.
5) The motor shall be design for continuous duty, reversible, 460 volt AC, 60 hertz, 3-phase brushless. Conform to AGMA standards with a minimum

service factor of 1.5 based on nameplate motor horsepower. Wound Class F with a B temperature rise, sealed anti-friction type ball or roller or tapered bearings with a minimum B-10 life of 40,000 hours. The gear motor shall have premium helical gearing with AGMA Class 12 finish. Provide a motor stator housing and conduit box with weep holes, positioned for drainage, based on the mounting position of the motor. Coat the motor stator bore, rotor surface, and conduit box interior with a polyurethane insulator paint.

3. Grit Removal Pump

   a) Service Conditions - Provide submersible grit removal pump with Vortex impeller for handling a grit slurry, supported from and moving with the traveling bridge. Pump shall discharge to grit trough, which feeds grit classifier. The pump shall be submersible, with the pump casing, impeller, and motor housing constructed of gray cast iron, and provided with 18/8 or 304 type stainless steel. The pump shall be equipped with pump attachment, stainless steel cable, and hand cable winch for removal.

4. Grease Collection and Removal

   a) Grease collection shall be accomplished only with the use of air. Mechanical grease removal systems are not allowed. Stainless steel support brackets with stainless steel anchorage shall be used to support adjustable air nozzles located to move the floating grease from the rear end of the tank to a collection area at the head end of the tank.

   b) Grease removal shall consist of a stainless steel shafted screw conveyor lifting the floatables from the collection area at the head end of the tank for discharge. Shafted screw conveyor consists of screw, trough, bearing, and drive assembly.

5. Baffles - Provide divider baffles between the grit and grease channels. Baffles shall be constructed of UHMW.

6. Blowers shall comply with the appropriate section of these specifications.

7. Grit Classifier

a) Grit classifier unit shall consist of an inlet/decant housing, support frames, screw conveyor, and drive assembly.

b) Inlet/decant housing shall be fabricated of stainless steel. It shall be of a triangular hopper configuration mounted on top of the screw conveyor housing inclined at 25° above horizontal. A flanged 6-inch pipe stub shall be provided on the top of the hopper or on the end for the grit slurry inlet. Another flanged stub of the same shall be provided in the end for the liquid decant overflow. The entire hopper shall be covered by stainless steel plate with bolted-on access hatch.

c) Two support frames shall be provided, fabricated of 1/4-inch stainless steel plate and structural members. Upper support frame shall be an "A" profile located beneath the inclined screw housing and near enough to the grit discharge end to ensure stability. Both lower and upper support frames shall have base plates with holes for anchoring into foundation. (Where required for elevated dumping heights, support frame extensions shall be included to raise the entire classifier assembly.)

d) The inclined screw conveyor shall be comprised of a stainless steel pipe forming a trough. The trough shall accommodate a fabricated hardened steel shaftless screw. The round trough shall be notched at the lower end for fabrication with inlet/decant housing. The upper end shall be totally enclosed with a flanged cap adjacent to the drive unit. The lower end of the trough shall be equipped with four stainless steel wear bars to prevent wear and to support the shaftless screw.

e) Adjacent to the upper end of the trough and in the bottom of the circular section there shall be a gravity grit outlet consisting of a welded pipe stub of 8-inch diameter terminating with a standard pipe flange in a horizontal orientation.

f) Each spiral screw shall consist of a hardened steel shaftless flight, extending end to end. Flight thickness shall be 1/2-inch minimum. The upper end shall be welded to a flanged pipe with a bolted-on drive shaft extension.

g) The shaft mounted drive assembly shall be mounted to a framework on the upper end of the inclined trough and keyed to the drive shaft extension. The drive assembly shall contain case-hardened gearing of AGMA Class 12 finish in a rugged, corrosion-proof cast iron housing. Double lip seals shall be provided on both input and output shafts, together with additional gasketing to assure oil leakage protection.

5.2.5 Coarse and Fine Screening Equipment

A Design Requirements

1. This specification applies to screens with 2-mm opening (fine screens) and 6-mm openings (coarse screens). The equipment shall be designed to operate with a maximum temperature of 120 degrees F. The screen shall consist of an endless band of 316L stainless steel plate with punched perforations within a vertical, self-supporting system.

2. Acceptable Manufacturers: Screening equipment shall be manufactured by Jones & Attwood, Hycor or Brackett Green. JWC (Tri-Star) is specifically not allowed.

B. Materials of Construction

1 The frame shall be constructed of 1/4 inch thick Type 316L stainless steel.

2. Each screen plate shall be connected to the adjacent plate utilizing an integral hinge and separate rod ensuring no gaps exist throughout the screening band. The rod shall be attached to a UHMW connecting link at each end of every screen plate and linked together to form two screening band guide chains.

3 Main Chains: The chain shall be water-lubricated. The main chain shall be the UHMW connecting link chain on either side of the screen band. Everything else on the screen will be 316L stainless steel.

4. Sealing Arrangement: The screening band chains slot into the frame to create a three sided positive seal to prevent solids bypassing downstream. The inside of the frame shall be fitted with glide strips to act as the guide system for the screening band to travel. The screening manufacturer shall supply 316L stainless steel shrouds in the bottom front and bottom back of each screen as an added protection. For 2 mm screens, a snap on type seal will be provided on every screening hinge connection to ensure solids will not pass between the screening plates.

5. Head Section: The head section of the frame shall incorporate a horizontal head shaft fitted with two sprockets, over which the main UHMW chains will pass. The head shaft shall be supported at each end by self-aligning split-roller bearings sealed in grease-packed, waterproof housings. The bearings shall be retained in parallel slides supported by the chain tension screws carried in the head section of the frame. The main chain sprockets shall be cast iron.

6. Jet Pipes: The perforated plate panels shall be washed as they pass the discharge point above the debris hopper by a series of wash water jets mounted on two jet pipes located inside the top of the screen head. The jets shall be attached to the jet pipes by quick release connections for ease of cleaning. The jet pipes shall be fitted with removable end caps for flushing purposes, control valve and pressure gauges. The jet pipes shall be Type 316 stainless steel. Alternatively, a deluge system may be used for screen cleaning. If the deluge is selected, the manufacturer will supply a high speed rotating brush positioned to clean on the inside of the screening band.

7. Debris Discharge: The debris and wash water shall be discharged into a hopper supported within the head section of the frame which will discharge into a launder trough feeding into the screening handling system. The discharge trough shall be Type 316 stainless steel.

8. Screen Cover: The head section of frame projecting above deck level shall be fitted with removable access panels and a splashguard incorporating inspection ports, designed to reduce aerosol from the spray jets to a minimum. The screen cover shall be Type 316 stainless steel.

9. Drive Unit: The screen shall be driven by a shaft-mounted gear unit keyed directly to the head shaft, fitted with a flange-mounted electric motor. Motors shall be fitted with an anti-condensation heater. If the

rotating brush is supplied, it shall be an integral part of the geared motor that is hollow shaft mounted to the brush drive shaft.

C. Motors

1. Motor shall be a totally enclosed fan cooled motor with Class B insulation, space heaters and a maximum speed of 1800 rpm.

2. Motor shall have a 1.15 service factor, and shall comply with the latest ANSI, NEMA, and IEEE Standards as a minimum.

5.2.6 Parshall Flumes

A. Design Requirements

1. Flumes shall be full length; single piece construction (through 60-inch size); polyester resin reinforced with not less than 30 percent fiberglass by weight. Minimum wall thickness is 3/16-inch for throat widths to 9-inches; 1/4-inch for throat widths greater than 9-inches to 36-inches; and 3/8-inch for throat width greater than 36-inches. Provide 2-inch-stiffening flanges on the top and ends of the flume. Dimensions shall conform to U.S. Department of the Interior, Bureau of Reclamation, Water Measurement Manual.

2. Acceptable Manufacturers: Flumes shall be manufactured by Plasti-Fab, or Tracom or approved equal.

5.2.7. Fine-Bubble Aeration System

A. Design Requirements

1. Diffusers shall provide fine bubbles uniformly along the entire aeration basin (aerobic zone) through a grid placed on or near the floor of the aeration basin.

2. Acceptable Manufacturers: Sanitaire, Wilfley Weber, Inc., Envirex, or Environmental Dynamics, Inc. (EDI) or approved equal.

B. Materials and Construction

1. Fabricate all parts and assemblies from sheets and plates of stainless steel.

2. Fabricate stainless steel piping and fittings in accordance with ASTM A 778-80 and A 774-80.

   a) Perform all welding in the factory using shielded arc, inert gas, MIG or TIG method.
   b) Continuously weld both sides of face rings and flanges. Field welding will not be permitted.
   c) Furnish all nuts, bolts and washers including anchor bolts in 18-8 series stainless steel.

3. Produce all PVC moldings and extrusions from PVC compound conforming to ASTM D 1784, compound cell classification 12454-B with a minimum tensile strength of 7,000 psi. Provide PVC fittings conforming to ASTM D 2241.

4. Provide distribution headers conforming to ASTM D 2241, SDR 26, with a hydrostatic design stress rating of 2,000 psi.

5. Add two parts by weight of titanium dioxide per 100 parts of resin to PVC compounds for air distribution headers, diffuser element holders and retainer rings to minimize ultraviolet degradation.

6. Flexible membrane disc diffuser shall be fabricated of synthetic rubber, a minimum of 9-inches in diameter with precision die formed slits or circular apertures. Furnish membrane diffuser mounting saddles, factory installed on the distribution piping.

7. Air Distribution Piping

   a) All drop legs shall be stainless steel. PVC manifolds shall be of the same nominal pipe size as the drop pipe. Fabricate manifolds in sections up to 20 feet in length. Join manifold sections with drilled flanges and gaskets or gasketed slip couplings. Support each manifold section with a minimum of two stainless steel supports. Maximum spacing between supports shall not exceed 8 feet. Design manifold, connections, and supports to resist thrust generated by expansion or contraction of the air distribution headers.

   b) Fabricate manifolds with fixed joint connections to each air distribution header.

   c) Furnish manifolds for long-term exposure to 120 degrees F

mean wall temperatures.

8. Diffuser Assemblies

   a) Furnish diffuser assemblies consisting of a diffuser membrane, diffuser holder, airflow control orifice, and retaining device. Diffuser membrane shall be an elastomeric material with an ultraviolet inhibitor and compounds designed for resistance to chemical attack, weathering and aging. Furnish PVC diffuser holders. Provide a mechanism to attach the diffuser to the holder. Diffusers utilizing plastic type media elements will not be acceptable.

9. Drain line, Sump and Airlift System

   a) Furnish a PVC drain line; sump and airlift purge system to drain the entire submerged aeration piping system for each aeration grid.

   b) Connect drain sump to a Schedule 80 PVC airlift eductor line extending to the drain line invert elevation. Extend airlift eductor to a point above the basin water level and terminate with a PVC ball valve located at the tank walkway.

10. Diffuser Pressure Monitoring System

   a) Furnish monitoring equipment to measure dynamic wet pressure of a typical diffuser in each aeration grid and airflow for each zone. Furnish one portable monitoring panel housed in a fiberglass NEMA 4X enclosure suitable for hand carrying and fitted with hanger device suitable for handrail placement. Provide monitoring panel with:

      1) Differential pressure gauge.
      2) PVC ball valves.
      3) Quick coupling connectors.
      4) Polypropylene fittings.
      5) Polyethylene tubing.
      6) One set calibration curves.

5.2.8. Mixing Equipment

A. Design Requirements

1. The mixer shall be complete with all anchorage, motors and controls, drives, couplings, base plates, shafting, supports, and all other accessories necessary to provide a complete installation. The mixing equipment shall also be suitable for installation and proper operation within the rapid mixing prior to the biological system and within the biological reactor. Mixing provided by anoxic tank mixers shall be sufficient to suspend the required maximum mixed liquor suspended solids concentration. Suspended solids concentrations and flow may vary. All mixer components shall be compatible with the process environment in which the equipment will operate.

2. Acceptable Manufacturers: The mixers shall be manufactured by Lightnin, Philadelphia Mixers Corporation, or Flygt or approved equal.

3. The propeller shall be dynamically balanced and shall be 316 stainless steel.

5.2.8.1 Rapid Mixers

A. Materials and Construction

1. Speed Reducers

a) Each speed reducer shall consist of a fine grain, cast iron, heavy-duty housing. The reducer shall be designed specifically for mixing service and shall be capable of 24 hour/day, uniform load, continuous operation rated for an outdoor environment. The AGMA service factor of the speed reducer shall be at least 2.0, based on full motor nameplate horsepower. The reducer shall bear an AGMA nameplate. All gearing shall be Quality 10 minimum. All drives shall be a vertical in-line single maximum efficiency coupled with the convenience of mounting, maintenance and installation. The speed reducer used shall be directly connected through a flexible coupling to the electric drive motor.

2. General maintenance, specifically including replacement of all anti-friction bearings, all oil seals, and lubricant maintenance shall not require removal of the speed reducer housing from its foundation. The speed reducer shall be provided with lifting lugs.

3. All reducer bearings shall be taper roller anti-friction type; oil lubricated and shall have a minimum L-10 bearing rating of 100,000 hours. All bearings shall be oil lubricated.

4. The thermal rating of the speed reducer shall exceed the design mechanical rating to eliminate the need for external cooling. External cooling vices are not allowed.

B. Mixer Shaft

1. The mixer shaft shall be connected to the output shaft of the speed reducer by means of a split removable coupling located above the mounting surface. The rigid coupling shall be designed to minimize run out to less than 1/4-inch per 10 feet of shaft. Installation and removal of the shaft from the speed reducer must be accomplished completely above the mounting surface of the mixer. No special tools shall be required. The shaft supporting the turbine shall be removable from the reducer without disturbing gearing and/or bearings of the speed reducer.

2. The rotating speed of the shaft and turbine assembly shall not exceed 80 percent of the first lateral critical speed when stabilizing devices are used. All rotating components above the platform level shall be supplied with guards according to OSHA standards.

3. The shaft shall be a minimum of 3-inches in diameter.

C. Impeller: The impeller shall be the axial flow type, designed for high volume pumping capacity with a minimum of turbulence. The impeller blade shall be carbon steel.

D. Motor: The motor shall be designed and manufactured in accordance with the standards of NEMA. Enclosure shall be totally enclosed fan cooled, chemical duty, explosion-proof with space heater, which activates when the motor is turned off.

5.2.8.2 Submersible Mixers

A. Design Requirements

1. Submersible mixers shall be equipped with a submersible electric motor. Each unit shall be fitted with enough lifting cable of adequate

strength to permit raising and lowering the mixer.

2. The mixers shall be able to be raised and lowered and shall be easily removed for inspection or service without the need for personnel to enter the basin. A sliding guide bracket shall be an integral part of the mixer unit. The entire weight of the mixer unit shall be guided by a single bracket which must be able to handle all thrust created by the mixer. The mixer, with its appurtenances and cable, shall be capable of continuous submergence underwater, to a minimum depth of 15 feet, without loss of watertight integrity.

3. Each mixer shall be of the closed-coupled, submersible type. All components of the mixer, including motor, shall be capable of continuous underwater operation.

4. All components of the mixer shall be capable of continuous unsubmerged operation for a minimum of two hours.

B. Materials and Construction

1. Seals

a) Each mixer shall be provided with mechanical seals, running in oil, for cooling and lubrication. The mechanical seals shall be lapped end face type and shall contain one stationary and one positively driven rotary tungsten carbide face ring.

b) The seals shall require neither maintenance nor adjustment, but shall be easy to check and replace. Shaft seals without positively driven rotating members shall not be considered.

2. Shafts and Bearings

a) The mixer shaft shall be stainless steel.

b) All bearings shall have a minimum B-10 rated life of 100,000 hours.

3. O-Rings

a) All mating surfaces, where watertight sealing is required, shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact

between machined surfaces. This will result in controlled compression of the O-rings without requiring a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

4. Cable

a) The cable entry shall be an integral part of the stator casing. The cable entry shall be comprised of two cylindrical chloroprene rubber elastomer grommets, flanked by washers and a ferrule designed with close tolerance. Epoxies, silicones, or other secondary sealing systems shall not be acceptable.

b) Cable shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable.

5. Accessories

a) Winch

1) A portable stainless steel winch assembly shall be provided. The winch shall be provided with enough stainless steel cable to retrieve the mixer from the lowest point in the basin. The winch shall be a crank operated, geared mechanism with a mechanical brake and safety, such that the mixer can be suspended at any height. The winch assembly shall be capable of being maneuvered 360 degrees in rotation when loaded. The winch assembly shall be fixed and removable to the mast.

b) Guide Holders and Support Cable

1) The guide holders shall be designed such that when installed, all free movement of raising and lowering the mixer shall occur without interference or obstruction.

2) Each mixer shall be held at proper elevation by a stainless steel support cable. The cable shall be anchored to the mast above the water level and to the mixer frame.

5.2.8.3 Jet Mixing Systems

A. Design Requirements

1. Design and furnish each system to achieve the performance requirements specified herein subject to the indicated design conditions. Adjust sizing and arrangement of mixer nozzles to achieve specified degree of agitation for each basin with net head required less than or equal to the available head indicated herein. Items designated as "Design Base" are provided for guidance only to indicate general parameters that will be evaluated to determine responsiveness of design submittals to specified requirements.

2. Basin. Design directional jet mix systems for uniform suspension of all particles with settling velocity less than or equal to 0.5 fpm throughout each basin subject to the conditions indicated in the following table:

B. Jet Mixing Manifold

1. The jet mixing manifold shall be comprised of a liquid duct with multiple jet nozzle assemblies. Fabricate the liquid duct and all in-basin jet mix system piping of corrosion resistant, structurally sound, machine filament wound fiberglass reinforced thermosetting vinyl ester resin pipe (FRP) conforming to ASTM specification D-2996 with a 100 mil corrosion barrier and rated for 100 psig operating pressure at 100°F. The liquid duct shall be a cylindrical member that shall be internally smooth and free from protrusions that might collect stringy material with jet mixing nozzle entry orifices that are horizontally and equally spaced.

2. The jet mixing nozzles shall be mounted on one side of the liquid duct and aligned on a common horizontal plane. Nozzles shall have a minimum ½-inch spherical solids handling capability, and shall be constructed of 316 stainless steel or high density erosion resistant FRP conforming to ASTM-D-2996.

3. The liquid duct shall be provided with a cleanout/flushing connection at the end opposite the motive fluid connection point, which shall terminate above the tank wall.

C. In-Tank Piping

1. Fabricate in-tank FRP liquid piping headers and manifolds with adequate length and diameter to transport the motive liquid from the basin interface to the jet manifold in each basin. Provide ANSI B16.1 flanged ends on all in-basin piping segments shipped separately for field installation. Schedule 10, type 316 stainless steel is an approved alternative material of construction for the in-tank liquid piping.

2. Provide flexible, flanged end couplings (i.e. single arch, reinforced EPDM expansion joint with flanged ends) to connect the in-basin piping to the tank mounted nozzle connections. The coupling shall serve to accommodate joint deflection and prevent any residual stresses as the result of piping support alignments.

D. Supports

1. Provide all necessary supports and hardware for installation of each jet mix system including mixing manifolds and in-tank piping in indicated tanks. All hardware supplied shall be 300 series stainless steel unless otherwise noted. Jet mix manifold supports shall be single or dual leg design with provision for field leveling adjustments with maximum spacing on ten (10) feet centers.

2. Fabricate structural shapes to support piping headers and manifolds from tank floor. Support wetted materials shall be glass fiber reinforced, thermosetting resin plastic and type 304 stainless steel.

3. Pipe supports shall include a contoured saddle welded or molded to a supporting base. The support base shall be anchored to the tank floor with epoxy set anchor bolts (½- inch minimum). A bolted clamp shall hold the piping to the saddle. Provide the saddle and clamp with Neoprene rubber pads to prevent abrasion.

4. Nuts, bolts, and washers shall be ASTM A276 18-8 Type 304 stainless steel. Other non-welded parts shall be ASTM A473 Type 304 or Type 316 stainless steel. Chemically treat or lubricate threaded assemblies prior to assembling to prevent galling.

E. Acceptable Manufacturers

1. Acceptable manufacturers include: Mixing Systems, Inc., Mass Transfer Systems, Liquid Dynamics or approved equal.

5.2.8 Chemical System

A. Design Requirements

1. Chemical systems shall be housed indoors with adequate secondary containment and ventilation.

2. Tanks shall be manufactured by Nalge Company or Poly Processing, Inc or approved equal.

3. Pipe connections shall be flanged conforming to ANSI/ASME B16.5, Class 150.

4. A minimum of four tie down lugs and lifting lugs shall be provided to facilitate handling and installation.

5. The exterior surface of each tank shall indicate the chemical service. All letters shall be 2-inches high and shall be shown in each quadrant at the top of the tank.

6. Each tank shall contain a vertical bulk storage tank level indicator of all stainless steel construction.

7. A quick release male adaptor, dust cap and ball valve for installation on the fill line.

8. The tank shall be furnished with a flanged, watertight manway, mounted on the side of the tank over the discharge pipe and a flanged and bolted manway, in the tank dome.

5.2.9 Chemical Metering Pumps

A. Design Requirements

1. Acceptable Pump Manufacturers: (progressive cavity type) Mono, Moyno or Netzsch; (diaphragm type) shall be Pulsafeeder, ProMinent, Wallace & Tiernan or Milton Roy or approved equal.

   a) Material of construction for the wetted parts shall be resistant to the chemical being pumped.

   b) The pumps shall be supplied with a variable speed DC drive

motor.

c) Pump Stands/Supports: The pump stand or shelf shall be fabricated from welded carbon steel structural components. The stand shall be sandblasted to near white, shop primed and painted with PVC coating material. The final coating shall have a minimum of 20-mil dry film thickness.

d) Pulsation Dampeners: An air or nitrogen charged type double or single diaphragm pulsation dampener shall be provided, sized by the pump supplier. Isolation diaphragms shall separate the process chemical from the air chamber.

e) Backpressure Valve: Each pump shall be furnished with a backpressure valve as recommended by the manufacturer having the size and pre-set pressure.

f) Calibration Chamber: suction piping shall have provisions provided by the Contractor for temporary or permanent installation of a removable and transferable calibration chamber.

5.2.10.1 Progressive Cavity Metering Pumps

A. Materials and Construction

1. Shaft seal shall be mechanical cartridge, water flushed.

2. The rotor to drive shaft connection shall be a double sealed crown gear type universal joint.

5.2.10.2 Diaphragm Metering Pumps:

A. The capacity adjustment from 0 to 100 percent providing positive repeatable accuracy of two percent or better over a 10:1 range shall be accomplished by changing stroke speed. The stroke speed shall be manually adjustable and shall be capable of being automatically adjustable proportional to a 4-20 mA signal. The stroke length shall also be manually adjustable. The manually adjustable stroke mechanism shall incorporate a calibrated stroke length indicator. Pumps shall be self-priming and capable of continuous operation without process fluid.

B. Solenoid driven, diaphragm type chemical metering pumps: The solenoid shall

be thermally protected to shut off the pump upon detecting excessive temperature.

5.2.11 Ultraviolet Disinfection Equipment

A. Design Requirements

1. Provide a UV disinfection system complete with UV modules and automatic cleaning system, power distribution receptacles, and support racks. The UV disinfection system supplied shall be CSA or UL approved. Low Pressure, low intensity and medium pressure systems are unacceptable.

2. The system shall be designed to allow for complete system shut down or bypass. The system shall be able to continue providing disinfection while replacing UV lamps, quartz sleeves, ballasts, and while cleaning the UV lamp sleeves.

3. Acceptable Manufacturers: The equipment shall be manufactured by WEDECO – UV Technologies, Inc. or Trojan Technologies Inc or approved equal.

B. Materials and Construction

1. All metal components in contact with effluent shall be stainless steel. All material exposed to UV light shall be Type 316 stainless steel, Type 214 quartz, or Teflon. All wiring exposed to UV light shall be Teflon coated.

2. The lamp array configuration shall be the uniform array with all lamps parallel to each other and to the flow. The single array pattern shall be continuous and symmetrical throughout the reactor. Vertical lamp and enclosed-vessel configurations are not acceptable.

3. The system shall be designed for complete immersion of the UV lamps including both electrodes and the full length of the lamp tube in the effluent. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent. Systems designed whereby the lamps are inserted through a metallic bulkhead or which otherwise prevent continuous cooling of the lamp electrodes by the effluent is not permitted.

4. Lamps shall be rated to produce zero levels of ozone. Lamp bases shall

be of a metal and ceramic construction resistant to UV and ozone. Electrical connections shall be at one end. 90 percent of UV output shall be within the wavelengths of 233.7 to 273.7 nm.

5. Lamp sleeves shall be rated for UV transmission of at least 92 percent and shall not be subject to solarization over the length of their life.

6 The rack shall be stainless steel and be suspended above the effluent allowing adjustment to the precise height of the channel and requiring no fastening of the individual UV lamp modules.

7 The UV lamp module shall be made of stainless steel and shall be designed so that no ultraviolet light radiates above the channel when the UV lamp modules are energized and fully immersed in the effluent. A modulating effluent weir gate shall be provided in the effluent channel.

8. Two face shields shall be provided which block UV light wavelengths between 200 and 400 nm.

5.2.12 Centrifuges

A. Design Requirements

1. Centrifuges shall be of the horizontal, solid bowl, counter-current, or co-current scroll type. Dynamically balance unit to minimize vibration.

2. Centrifuge system shall utilize chemical conditioning by an organic polyelectrolyte chemical that is readily available in bulk quantities. Conditioning with inorganic chemicals such as lime or ferric chloride will not be acceptable.

3. Acceptable Manufacturers: Humbolt/Bird, Sharples, and Alfa Laval or approved equal.

B. Controls

1. Control panel construction shall be NEMA 4X. Controls for remote electrically operated or motor driven equipment shall be complete including all necessary auxiliary relays so as to require only wiring and connection to the equipment control circuit. The control panel shall include all push buttons, selector switches, speed dials, lights, alarms, and other controls to operate the associated equipment in Automatic and Manual mode.

2. Provide automatic control and sequencing with a programmable controller for all required equipment operations and interlocks. The controller shall be an all solid state logic control system capable of performing the same functions as conventional relays, timers, counters and drum sequencers. The system shall consist of a programmable controller, a programmer unit, and all interconnecting cables. Controller shall be supplied as a completely programmed unit, fully operational, and with complete documentation of the final operating program.

C. Materials and Construction

1. All parts of the centrifuge contacted by process material shall be of Type 316 stainless steel except O-rings and seals. The O-rings and lip type seals shall be of Viton-A or Buna-N material and feed tube seals shall be of Teflon. Centrifuge casing shall consist of a fabricated steel integral frame and stainless steel lower casing. Solids end of the casing shall include a stainless steel replacement liner.

2. Bearings shall be designed for forced flow oil lubricated and shall have an AFBMA L-10 rating without adjustment factors of 200,000 hours at the design condition.

3. Provide a drainage system to reliably and properly convey all centrate and wash waters to the headworks of the Plant.

4. Conveyor shall be equipped with helical flights and be independently mounted concentrically within the centrifuge bowl. Conveyor bearings shall be anti-friction type and shall be grease lubricated from external fittings, easily accessible for proper maintenance.

5. Sludge feed compartment: Feed compartment shall be designed with a polyurethane liner, which shall act as an abrasion barrier for the inner hub, or be protected with a replaceable feed zone liner or extension. Feed shall be uniformly distributed through feed ports of ceramic or sintered tungsten carbide construction, which shall be field replaceable.

6. Gear box: Provide a planetary type gearbox to control the differential speed between the bowl and the conveyor. It shall be suitable for 24 hour per day continuous operation. Provide a gearbox guard.

7. Hard-surfacing system: Edge and the face of the flights on the conveyor shall be protected against abrasion, for the entire length of the conveyor.

8. The centrifuge bowl shall be equipped with an electric motor, V-belt drive and guards. A fluid coupling shall be incorporated between the drive motor and the centrifuge drive pulley to provide soft acceleration of the centrifuge bowl. The drive system shall use one motor for the bowl drive, started by an AC variable frequency drive.

9. Shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearings shall be anti-friction type, oil lubricated.

10. Motor shall be free of objectionable noise and vibration. Motor sound pressure level shall not exceed 85 dbA at 4 feet under free field, no load conditions in accordance with IEEE Standard 85. Vibration level measured on the bearing housing shall be in accordance with values shown in NEMA Standards.

11. Vibration Isolators: Centrifuge unit shall be mounted on not less than four spring type or rubber buffer isolators. Bracket and plate assembly for main drive motor shall be mounted on not less than two spring type or rubber buffer isolators.

12. Variable Differential Scroll Speed - Back drive System: Provide an Alternating Current (AC) Motor and a solid state SCR Controller. The AC Back drive System shall function to maintain the differential speed between the centrifuge bowl (Main Drive) and the conveyor (Back drive). Include provisions for local manual or automatic control, remote automatic control, clean-in-place operation, alarming and electrical interlocks for equipment protection.

13. Provide sampling taps to sample unthickened feed Sludge, centrate, and thickened Sludge from each centrifuge. Sampling taps shall be easily accessible from the centrifuge operating floor level.

14. Vibration and Motion Detectors: Provide a vibration detector system for monitoring and control. It shall consist of vibration pick-up probe(s) and a monitoring unit with adjustable set point and output circuitry.

15. Provide motion sensors and associated transducers to detect the rotation and the speed of the back drive and the speed of the main drive.

16. Provide a motor operated gate valve to direct centrate solids until machine solids content is up to the specified solids concentration.

5.3 Structural Design Criteria

A. Design all structures for a service life of 100 years. Comply with applicable codes and standards listed below except as otherwise specified.

B. Governing Codes and Standards

- International Building Code (2000)
- ASCE Standard ANSI/ASCE 7
- ACI 318/318RBuilding Code Requirements for Structural Concrete and Commentary
- ACI 350R Environmental Engineering Concrete Structures
- AISC Manual of Steel Construction, ASD
- ACI 530 Building Code Requirements for Masonry Structures
- ACI 530.1 Specification for Masonry Structures
- AWS D1.1 - American Welding Society
- ASTM – American Society for Testing of Materials
- PCI – Precast Concrete Institute

C. Design Loads

1. Live Loads

a) General personnel areas: 100 psf

b) Electrical equipment rooms: 250 psf

c) Mechanical equipment rooms: 250 psf (but not less than equipment plus 125 psf)

d) Stairs and walkways: 100 psf or 300 lbs concentrated load

e) Truckways: AASHTO HS20 wheel loads

f) Roof: 20 psf

g) Wind: 90 mph

h) Seismic: In accordance with the International Building Code

i) Pipe loads: To be determined

2. Lateral Earth Loads: In accordance with the Geotechnical Investigation Report

D. Foundations

1. Foundations shall be designed in accordance with the Geotechnical Investigation Report.

2. The bottom of foundations shall extend no less than 12 inches below finish grade.

3. Uplift

a) Groundwater elevation and/or 100-year flood elevation shall be used to determine uplift force.

b) Minimum factor of safety against uplift shall be 1.2.

c) Neglect vertical frictional shear in backfill.

E. Deflection

1. Design for the following maximum deflections (L = span):

a)	Aluminum Floor Plate	L/300 (Live Load = 100 psf)
b)	Aluminum Grating	L/300 or ¼" maximum (Live Load = 100 psf)
c)	Roofs with Ceilings	L/360
d)	Roofs without Ceilings	L/240
e)	Floors (Live Load)	L/360

f)	Beams & Lintels maximum	vertically L/600 or .3" supporting masonry

F. Vibration: Design for vibration in accordance with ACI 350R.

G. Concrete

1. Materials

a) All concrete shall a 4000-psi compressive strength at 28 days. Maximum water/cement ratio of 0.45. Non-structural concrete fill shall have a 1500-psi compressive strength at 28 days.

b) Type I cement, ASTM C150.

c) Fly ash, ASTM C618, Type F, in walls of liquid containment structures.

d) Air content, ASTM C260, 4.0 to 7.0 percent.

e) Reinforcement, ASTM A615, Grade 60.

f) Waterstops

g) 6-inch PVC, CRD-C572, at new construction joints.

h) ¼ x 1-inch hydrophilic rubber at joints between new construction and existing construction.

i) Premolded joint filler, ASTM D1752.

2. Design Considerations: Minimum reinforcement shall conform to ACI 350R construction joint spacing.

H. Precast-Prestressed Concrete

1. Materials

a) Concrete shall have a 5000-psi compressive

strength at 28 days.

b) Reinforcement, ASTM A615, Grade 60.

c) Welded Wire Fabric Reinforcement, ASTM A185.

d) Prestressing Strands, ASTM A416.

I. Metals

1. Materials

a) Structural Steel: ASTM A36

b) Structural Steel Tubing: ASTM A501

c) Stainless Steel: AISI Type 304 (sheets & plates)
AISI Type 316 (bolts & items in corrosive areas)

d) Aluminum (shapes & plates): 6061-T6

e) Steel Bolts: ASTM A325

f) Anchor Bolts: ASTM A307 or ASTM A 193,Grade B8

g) Structural Steel Welding: AWS A5.1, E-70 series

h) Aluminum Welding: AWS A5.10

i) Hot Dipped Galvanizing: ASTM A123

J. Masonry

1. Materials:

a) Hollow masonry units shall comply with "Specification for Hollow Load-Bearing Concrete Masonry Units", ASTM C 90; Grade N. Hollow masonry units shall be one of the following:

1) Medium weight, 105 to 125 pcf concrete.

Minimum net compressive strength of 1,900 psi.

2) Light weight, concrete weighing less than 105 pcf. Minimum net compressive strength of 1,900 psi.

2. Face brick units, ASTM C 216

5.4 Building Mechanical Systems

A. Reference Standards: All systems and equipment designs shall comply with the applicable standards listed below except as otherwise specified.

- 2000 International Mechanical Code
- 2000 International Plumbing Code
- 2000 International Building Code
- 2000 International Fire Prevention Code
- 2000 International Gas Code
- NFPA - National Fire Protection Association Standards
- UL – Underwriter's Laboratories, Inc.
- ASHRAE 90.1 - American Society of Heating, Refrig., and Air
- Conditioning Engineers
- CABO Model Energy Code – 1995 with 2000 Amendments
- ASME – American Society of Mechanical Engineers
- ASTM – American Society of Testing Materials
- ANSI - American National Standards Institute
- AGA – American Gas Association
- API – American Petroleum Institute
- AMCA – Air Movement and Control Association
- NACE – National Association of Corrosion Engineers
- SMACNA – Sheet Metal and Air Conditioning Contractors'
- National Association
- STI – Steel Tank Institute

B. Building Environmental Constraints

- Headworks - Corrosive atmosphere (Class 1 Division 2)
- Dewatering - Corrosive atmosphere (Unclassified)
- Aeration Tank - Corrosive atmosphere
- UV Disinfection Building - Corrosive atmosphere
- Membrane Process Building - Non-corrosive atmosphere

- Administration & Education Building - Non-corrosive atmosphere

C. Heating, Ventilation, and Air Conditioning (HVAC) Criteria

1. Minimum Construction Standards

a) As a standard, all equipment located in area classified as hazardous per NFPA 820 shall be of intrinsically safe/explosion-proof explosion-proof construction.

2. Fans

a) Corrosive atmosphere – Fiberglass Reinforced Plastic (FRP)
b) Non-corrosive atmosphere – Aluminum
c) Class 1, Group D, Division 1 and 2 areas – Explosion-proof

3. Ductwork and Accessories

a) Corrosive atmosphere – FRP
b) Non-corrosive Process Areas – Aluminum
c) Non-corrosive General Areas – Galvanized Steel

4. Unit Heaters

a) Corrosive atmosphere - stainless steel, hose down type
b) Non-corrosive atmosphere - painted steel
c) Class 1, Group D, Division 1 and 2 areas – Explosion-proof

5. Make-Up Air Units

a) Aluminized steel casing, 5,000 hr salt spray resistant coating
b) Aluminum and copper coils
c) Stainless steel FM/IRI gas burner sections and gas train or
open electric coil section

6. Fan Coil Units, Air Handling Units, and Condensing Units

a) Painted steel casing

b) Aluminum and copper coils
c) Open electric coil sections
d) Corrosion-resistant seacoast construction on condenser coils

D. General HVAC Design

1. General indoor air-conditioned space shall be maintained at 75°F/50%R.H. during cooling season and 72°F during heating season.
2. Electrical or computer rooms housing sensitive electrical equipment shall be air conditioned to maintain 78°F/50%R.H during summer and 50°F during winter.
3. General indoor, ventilation shall maintain electrical and process spaces at a maximum of 10° above ambient conditions during summer.
4. Ductwork shall be designed for a maximum pressure drop of 0.1 in. water gauge per 100 ft. of duct.
5. Control system shall be electric/electronic type.
6. Heat tracing and insulation shall provided on mechanical and process piping exposed to ambient conditions and shall be sized to maintain an internal fluid temperature of 50°F.
7. Process spaces requiring continuous ventilation in accordance with NFPA 820 shall be ventilated year round and the space temperature shall be maintained at 50°F during winter.
8. Flow sensors and alarms shall be provided per NFPA 820 in all continuous ventilation systems meant to serve for area de-classification.
9. Smoke detectors shall be provided per Mechanical codes.
10. Maximum thermal conductivity for board and blanket types of ductwork insulation shall be 0.23 BTU·in/h·ft2·°F at 75°F and 0.30 BTU·in/h·ft2·°F at 75°F, respectively.
11. Maximum thermal conductivity for piping insulation shall be 0.29 BTU·in/h·ft2·°F at 70°F for indoor applications and 0.27 BTU·in/h·ft2·°F at 75°F for indoor applications.
12. The following ductwork shall be insulated:
    a) Ductwork carrying conditioned (heated or cooled) supply air located above suspended ceilings in return air plenums.
    b) Ductwork carrying conditioned (heated or cooled) supply, return or exhaust air located in attic, concealed or other non-conditioned areas.

c) Ductwork carrying conditioned (heated or cooled) supply or return air located in mechanical rooms or other service areas.
d) Ductwork carrying outside air.
e) Ductwork carrying exhaust air above suspended ceilings in return air plenums may require insulation.
f) Ductwork carrying conditioned (heated or cooled) air located outdoors or otherwise exposed to weather shall be insulated.

13. The following piping shall be insulated. Where domestic service is called out, it is defined as piping concealed above ceilings and within walls or exposed in return air plenums and mechanical rooms:

- Domestic potable water piping.
- Domestic non-potable piping.
- Hot water piping.
- AHU condensate piping.
- Horizontal roof drain piping and roof drain bowls.
- Makeup water piping to scrubbers.
- Chemical feed piping to scrubbers.
- Recycle piping to and from scrubbers.
- Insulate all piping, valves and fittings that are heat traced in addition to those services listed above.

E. The support systems for the mechanical equipment and ductwork shall be design to meet Seismic Hazard Exposure Group 3, Performance Category C.

F. Plumbing and Fire Protection Criteria

1. Minimum Construction Standards

a) As a standard, all equipment located in an area classified as hazardous per NFPA 820 shall be of intrinsically safe/explosion-proof explosion-proof construction.

2. Water Supply System

a) Above ground piping - interior/exterior

- Corrosive atmosphere – Schedule 40 PVC
- Non-corrosive atmosphere – Copper

b) Buried piping
- Cement-lined Ductile Iron - 3" and larger
- Copper - 2" and smaller

c) Sanitary Waste & Vent, Drain System Piping

1. Exposed/Concealed
- Corrosive service or atmosphere - Schedule 40 PVC
- Non-corrosive service or atmosphere - Cast Iron Soil Pipe

d) Buried piping
- Corrosive service - Cast Iron soil pipe
- Non-corrosive service - Cast Iron soil pipe

3. Natural Gas Piping

a) Exposed/Concealed
- Schedule 40 black steel pipe

b) Buried piping
- Wrapped schedule 40 black steel pipe
- Polyethylene gas pipe

G. General Plumbing and Fire Protection Design

1. Potable water will be supplied to facility fixtures at a pressure ranging from 40 – 80 psig via pressure reducing valves. Backflow prevention devices, including reduced pressure zone backflow preventers, double check valves and vacuum breakers will be applied commensurate with hazard condition at each facility.

2. The drain, waste and vent system will be arranged such that all drainage from each facility will be conveyed by gravity to the plant's sanitary sewage collection system or directly to the plant influent stream where possible. Where gravity conveyance is not possible, sump pumps will be used.

3. Natural gas will be distributed on-site at a pressure of 50 psig. Pressure regulators shall reduce facility pressure at each building service entrance. Facility pressure will range from 13-inches water column to approximately 2 psig depending upon the pressure requirements of gas-burning equipment at or in each facility. In

addition, each piece of gas-burning equipment will be supplied with a pressure regulator for even more precise control of appliance pressure.

4. Fire protection systems for buildings shall consist of sprinkler systems designed in accordance with NFPA 13. For buildings subject to freezing temperatures that require sprinkler systems, dry pipe sprinkler systems shall be used. For heated facilities that require sprinklers, wet pipe sprinkler systems shall be used.

5. Fire service water shall be drawn from the plant's potable water distribution mains. Backflow prevention and site fire hydrants shall be provided throughout site with a maximum spacing between hydrants of 900 feet, and a maximum spacing from the nearest hydrant to the most remote exterior point of any building of 500 feet. The distances shall be measured on a roadway surface meeting fire department access requirements.

H. Odor Control Systems

1. Minimum Construction Standards

a) As a standard, all equipment located in spaces classified as hazardous per NFPA 820 shall be of intrinsically safe/explosion-proof explosion-proof construction.
b) Scrubbers and Chemical Tanks - Vinyl-ester resin saturated FRP with stainless steel fasteners.
c) Scrubber internals – FRP, PVC, or polypropylene.
d) Chemical Feed Pumps - Cast iron body peristaltic hose pumps.
e) Recycle Pumps – FRP centrifugal end-suction pumps.
f) Makeup, Chemical Feed & Recycle Piping, exposed and concealed, shall be schedule 80 PVC for corrosive and non-corrosive atmospheres.

2. General Odor Control Design

a) In general, scrubbers may be wet, dry or biological type scrubber systems shall be used to provide odor control depending on the compounds to be removed, influent concentrations of odor compounds and removal efficiencies required to meet performance requirements.

b) The odor control system shall have redundancy built into the

system to guard against potential odor events in the event of an equipment failure. Redundancy may be provided for the odor control system scrubbing using an additional spare scrubbing train in that if any sub-system of a particular train or vessel or fan fails, that vessel or entire train may be isolated out of the air stream and serviced while the remaining vessels/trains in the system continue at full scrubbing capacity. The support systems for the odor control equipment and ductwork shall be design to meet Seismic Hazard Exposure Group 3, Performance Category C.

c) All indoor process areas that are accessible by plant operations and maintenance personnel and contain covered or enclosed processes and/or equipment that are controlled for odor shall be ventilated at a minimum rate of 12 air changes per hour. All other areas shall have ventilation rates that comply with the requirements of NFPA 820 (Standard for Fire Protection in Wastewater Treatment and Collection Facilities) or meet the requirements for good engineering practice, whichever is greatest. Where it becomes necessary to control odors throughout an entire room, room exhaust rates shall be large enough to induce a containment velocity of 200 feet per minute minimum through all openings in the building envelope, regardless of prevailing wind direction or the number of man doors or bay doors that may be opened.

d) Maintenance access can be provided using an elevated, grated platform constructed completely of fiberglass. The platform can be elevated to a level facilitating access to the maintenance man ways near the top of the scrubber vessels for access to scrubbing internals, packing removal, and replacement. Elevated, secondary catwalks will be provided on top of the main platform to access the overhead ductwork and air valve actuators. Handrails can be provided for operator safety.

e) For aesthetic reasons, odor control systems must not be externally visible at the JCEC. Therefore, low-profile type packed tower chemical scrubbing systems should be used wherever feasible. Acceptable manufacturers of these systems are US Filter/RJ Environmental and Severn-Trent/EST.

5.5 Electrical

A. Codes and Standards

1. Provide the complete electrical installation in accordance with the 2002 National Electrical Code (NFPA 70). All products, where applicable, shall be labeled or listed by third party certification agencies.

2. Comply with applicable local codes and have all work inspected by appropriate authorities.

B. Electrical Power Distribution

1. The power distribution system shall be arranged to meet EPA Class I reliability requirements. There shall be two (2) services to the facility, a normal service from the utility company and a standby service from an onsite generator.

2. The plant main service switchgear shall be arranged in a double-ended (main-tie-main) configuration with each main supplied from one of the services noted above.

3. All distribution switchboards and motor control centers shall also be arranged in a double ended configuration with two (2) independent feeders (one from each side) from their associated upstream distribution equipment. The two sets of feeder conductors shall be run in separate raceways and physical separation shall be maintained to the extent practical.

4. Provide relays or interlocks as required on all double-ended equipment to avoid cross-connecting asynchronous sources.

5. Each main breaker in double-ended equipment (and associated transformer where applicable) shall have a capacity of not less than 80 percent of the total load supplied by the equipment.

6. Critical process equipment items of the same type and serving the same function shall be divided as equally as possible between the two sides of the double-ended equipment. Non-critical equipment shall be similarly divided so as to balance the load on each side as equally as possible.

7. All panelboards supplying plant lighting and control systems shall be supplied by an automatic transfer switch with normal and standby inputs to the transfer switch supplied by different sides of the associated upstream double-ended distribution equipment. Panelboards supplying HVAC equipment may be radially fed unless operation of HVAC equipment is necessary for critical process equipment (i.e. air conditioning for critical process equipment variable speed drives). In such cases, equip panelboard with automatic transfer switch as described for lighting and control system panelboards.

C. Electrical Equipment and Installation

1. All products shall be new and of the manufacturers' current design.

2. Feeder and Branch Circuit Conductors shall be single conductor copper, PVC insulated with nylon jacket; type THWN/THHN; minimum size #12 AWG. Instrument signal cables shall be #16 AWG twisted, shielded, 600 Volt polyethylene insulation with vinyl outer jacket, aluminum polyester shield and #18 copper drain wire. Branch circuit cables for variable frequency drives (VFDs) shall be shielded type with oil and chemical resistant outer jacket, specifically designed for use with VFDs.

3. Install all feeder and branch circuit conductors in raceway. Provide raceways as follows:

   a) Underground or under slab - Schedule 40 PVC, concrete encased, 1-inch minimum.

   b) Underground beneath roadways - Schedule 40 PVC, concrete encased with steel reinforcing bars, 1-inch minimum.

   c) Exposed - Galvanized rigid steel (GRS) or IMC, 3/4-inch minimum. In corrosive areas all exposed conduit and

associated boxes and fittings shall be 40 mil minimum PVC coated GRS.

d) Concealed in walls or above ceilings - Electrical metallic tubing (EMT) - ½-inch minimum.

e) Make connections to motors, transformers, lighting fixtures and other vibrating equipment with flexible conduit. Use liquid-tight flex in all process and unfinished areas.

4. Wall switches shall be 20 amp, 120/277 volt, specification grade. Convenience receptacles shall be 15 amp, 125 volt, specification grade. As a minimum, provide convenience receptacles as follows:

a) Finished area (offices) - 4 per office.

b) Finished area (open) - 1 per 12 linear feet of wall.

c) Unfinished (process) areas - 1 per every 24 feet of wall.

d) Restrooms - 1 per restroom (GFI type).

5. Low Voltage Switchgear and Switchboards: Circuit breaker type overcurrent protective devices, 480 Volt, 3 phase, 3 wire or 277/480 Volt, 3 phase, 4 wire as required. Switchgear shall meet NEMA SG-5 and ANSI C37.20 with power circuit breakers in accordance with NEMA SG-3 and ANSI C37.13. Switchboards shall meet NEMA PB-2 with molded case circuit breakers in accordance with NEMA AB-1. Main and tiebreakers in switchboards shall be individually mounted; feeder breakers may be group (panel) mounted. Where used for service entrance equipment, switchgear and switchboards shall include UL service entrance label and ground fault protection. Provide a minimum of 20% space for future load. Switchgear and switchboards shall be manufactured by General Electric, Square D or Cutler-Hammer.

6. Motor Control Centers (MCCs): Magnetic only circuit breaker type combination starters or molded case circuit breaker feeder overcurrent protective devices, 480 Volt, 3 phase, 3 wire or 277/480 Volt, 3 phase, 4 wire as required. All controls shall operate on 120 Volts maximum; provide individual fused CPT for each combination starter. MCCs shall be manufactured by General Electric, Square D or Cutler-Hammer.

7. Provide distribution, lighting and branch circuit panelboards with quantities and locations selected to keep circuit voltage drops within acceptable limits. Panelboards shall be rated 480/277 or 208/120 volt, three phase, four wire circuit breaker type with copper bus and bolt-on circuit breakers. Provide a minimum of 20% space/spare circuit breakers for future load. Provide dry-type distribution transformers as required. Panelboards shall be manufactured by General Electric, Square D or Cutler-Hammer.

8. Provide safety switches at all mechanical and utilization equipment. Switches shall 600 volt, heavy-duty type for 460-volt loads and 125 volt; horsepower rated type for 115-volt loads. Switches shall be manufactured by General Electric, Square D or Cutler-Hammer.

9. Install a building ground grids constructed as follows:

   a) Provide a horizontal loop of #4/0 bare copper, electrically and mechanically continuous, routed approximately 3-feet inside the building or structure perimeter with cross ties spaced 50-feet apart.

   b) Bond all building columns to the ground grid.

   c) For each 100 feet of ground grid conductor, provide connection to earth by use of driven ground rods.

   d) Bond service entrance equipment to ground grid per NEC article 250.

10. Provide lighting levels in maintained foot-candles (fc) as follows:

   a) Office and laboratory areas: 70 fc; 2-foot x 4-foot, lay-in fluorescent fixtures with 3500oK T-8 lamps, electronic ballasts and clear, prismatic acrylic lens.

   b) Other finished areas: 30-40 fc; fixtures same as office.

   c) Process Areas: 30 fc; 400 watt, high or low bay high - pressure sodium fixtures, mounted in a uniform pattern.

   d) Building perimeter (general): 1 to 2 fc along perimeter; high-pressure sodium wall packs.

e) Exterior parking and process areas: 0.14 to .20 fc (1.5 lux minimum); pole mounted, high pressure sodium "shoe box" sharp cutoff type fixtures.

f) Emergency/egress lighting: Provide self contained (battery, inverter, battery charger) exit signage and egress lighting.

g) Lighting in process and finished areas will be controlled by wall switches. Exterior lighting will be controlled via photocell operated lighting contactors with H-O-A selector switch.

11. Provide a FM-approved proprietary fire alarm system in accordance with NFPA 72 for protected premises fire alarm systems.

12. Provide a lightning protection system in accordance with UL 96.

13. Provide empty raceways for County furnished telephone and communications systems.

14. Standby Generator: Outdoor type in sound attenuating enclosure, standby kW rating sufficient to operate all critical process equipment, lighting and controls. Equip with base mounted fuel tank with sufficient capacity to permit 24 hours of operation at full load. Standby generator shall be manufactured by Caterpillar, Cummins or Kohler.

15. Motors: Premium efficiency type meeting the standards of NEMA MG-1, TEFC enclosure unless otherwise indicated. VFD fed motors shall be in accordance with NEMA MG-1, Part 31, "Definite-Purpose Inverter-Fed Motors".

16. Variable Frequency Drives: Variable or constant torque as required by the driven equipment, 18-pulse or comparable design for harmonic distortion within limits per IEEE 519. Provide start-stop and speed adjustment on front of drive along with Local-Off-Remote selector(s) to permit local and remote start-stop and speed control. Also provide VFD/Bypass selector switch, Drive on/off lights, VFD Fault Light, Bypass fault light and reset push botton. Provide for remote indication of run, speed (4-20 mA) and fault conditions.

17. Provide a heat trace system, complete with all components and accessories, for the piping and equipment identified on the Drawings as requiring heat tracing. Provide the heat trace system with components suitable for indoor and outdoor use and for use in ordinary and classified areas. Provide the heat trace system suitable for use with the power source voltage as identified on the Drawings or shown in the schedules. Design the heat trace system to operate from the power available at the heat trace power junction boxes as located on the Drawings. Heat trace cables, thermostats, and accessories shall all be from the same manufacturer. Heat trace system shall of the industrial type and be Factory Mutual approved for use in ordinary and hazardous areas.

5.6 Instrumentation and Controls

A. Plant Control System Overview

1. The D/B Company shall provide the county with a PLC-based system to monitor and control all areas of the plant and all processes, process equipment, tanks, and doorways associated with the various areas of the plant.

2. The Plant Control System shall have at least one I/O cabinet with associated PLC CPU in each process area. For communication among the PLCs and communication with the County Computer Workstation, provide a redundant, fault-tolerant fiber optic ethernet ring. No two sections of the fiber optic ring shall be installed in the same duct bank. The existing Johns Creek plant and outlying processes with the influent pump station and outfall process area shall be included in the fiber optic ring.

3. Provide telemetry to communicate with the existing Big Creek WWTF telemetry system. Critical alarms, flows, and other operating parameters as required by the County shall be communicated between John's Creek and Big Creek. The telemetry system hardware shall be 100% compatible with the existing telemetry system. Provide programming for graphic screens, alarm annunciation, and historical recording in the telemetry computer at Big Creek. Configure the system with a firewall such that external signals shall not be able to cause changes to the operation of equipment, devices, or data associated with the Plant Control System.

4. For the Control Room, provide a minimum of two MMI Computers

and one Data Historian Computer. The Data Historian computer shall not be physically accessible by unauthorized plant staff. Provide one large wall-mounted display for viewing MMI screens.

B. Plant Control System Hardware and Software

1. All PLC hardware shall be by recognized major PLC manufacturers: Allen-Bradley, Modicon, General Electric. Provide each PLC cabinet with a UPS rated to provide a minimum of 15-minutes of reserve power at the full load of all components in the enclosure and powered by the enclosure. Furnish the County a minimum of one copy of each PLC programming software application used for the PLCs in the project. Programming software furnished to the County shall be licensed to the County and shall have a start date for manufacturer's upgrades starting near or on the date of Substantial completion.

2. Hardware for interfacing the Plant Control System components to the fiber optic ethernet ring shall be industrial fiber optic switches by Hirschmann or Phoenix Digital. Switches shall be suitable for both 10 MBPS and 100 MBPS, auto sensing. Provide redundant ethernet switches for interfacing the MMI computers and Historian Computer to the fiber optic ethernet ring.

3. Fiber optic cables shall be rated for the duct bank environment and shall have a minimum of 75% unused fibers for future expansion. Each fiber shall be terminated and OTDR tested. Provide patch panels and patch cables in each PLC cabinet and as required for incorporating control room fiber optic switches into the fiber optic ring.

4. HMI software and associated historical software shall be by Wonderware or Intellution and shall be the most recent stable version at the Design-Build Date.

5. MMI Computers shall utilize the latest Pentium-based microprocessor available at the Design-Build Date with a minimum processor speed of 2.5 GHz, have a minimum of 1GB of memory, 100 GB of disk space, and shall be updated as needed to be compatible with the D/B Company's computer system. Provide multiple server-class 100 MBPS ethernet cards for communication with the plant control network and with the Data Historian Computer. Operating system for the MMI computers shall be the latest version of Microsoft Windows Professional certified for use with the MMI

software and associated applications. MMI Computers shall be equipped with Tape and DVD-R/CD-R backup hardware and software. Manufacturer shall be Dell.

6. Data Historian Computer shall be a server-class machine with a minimum processor speed of 2.5 GHz. It shall be equipped with RAID hard drives having a minimum individual drive capacity of 100 GB, redundant hot-swappable power supplies, and operating system as required for the historian application associated with the MMI software. It shall be equipped with multiple server-class 100 MBPS ethernet cards. Configure the operating system such that the ethernet control network will not be accessible from the ethernet card to which the other plant computers are connected to read data from the Data Historian Computer. Data Historian Computer shall be equipped with Tape and DVD-R/CD-R backup hardware and software. Provide three-year, same day, 4-hour response, 7 days x 24 hours, on-site parts and labor warranty in the County's name from the PC manufacturer. Manufacturer shall be Dell.

7. Monitors for each MMI and Data Historian Computer shall be minimum 21-inch, 0.26-dot pitch, SVGA.

8. Provide a laptop computer loaded with the MMI software and associated programming for access, monitoring, and control as allowed by access level from any ethernet port on the Plant Control System fiber optic ethernet ring. Laptop computer shall also be loaded with licensed copies of all PLC programming software.

9. Provide a minimum of two Hewlett-Packard color inkjet printers for reports and graphics. Printers shall be suitable for printing on 11"x17" paper. Provide three boxes of 11"x17" inkjet paper and three boxes of 8-1/2"x11" inkjet paper.

10. Provide a minimum of two 9-pin dot-matrix printers for printing alarms and events. Printers shall be suitable for printing on wide-format line-feed paper. Provide three boxes of wide line feed paper.

11. Provide OPC-enabled SNMP software on each MMI Computer for plant ethernet network monitoring and extensive diagnostics.

C. MMI Computer Screens and Plant Control System Programming

1. Graphic screens shall be programmed to represent plant process

areas, process equipment, process parameters, the Plant Control System, and telemetry system.

2. Graphic screens shall each have a maximum of 40 live points, not including graphic objects used for navigation to other graphic screens, unless otherwise agreed to in writing by the County. The screens shall have graphic objects representing items including, but not limited to, the individual process equipment items, process items, tanks, and measured process parameters. Colors, objects, and line types shall be as agreed to by the County. Provide password-protected screens from which authorized personnel shall be able to change parameters including, but not limited to, set points, dosages, dead bands, time delays, etc.

3. It is expected that the MMI screens will be viewed and observed by the general public during tours that will be conducted at the facilities. The displays that are developed for the Plant Control System must be pleasing to the eye as well as functional. To this end all displays must be approved by the County prior to being installed on the system. The system integrator shall develop a scheme of display implementation that includes review with the County at the 30%, 60%, and 90% completion milestones for each display.

4. Provide programming to limit access to graphic screens and limit control based on individual access rights as determined through meetings with the County.

5. All equipment control programming shall reside in the PLCs. The MMI Computers shall write set points and basic commands to the PLCs.

6. Provide text event and alarm annunciation on the graphic screens as well as prerecorded verbal messages for annunciation of critical alarm conditions through the MMI computer speakers and plant Public Address system.

7. Where modem access to the Plant Control System or other equipment control is provided for the convenience of the system integrator or vendor, provide contacts and programming to physically disconnect the telephone line to which the modem is connected after an adjustable period of time when the access session is completed.

D. Interface with Process Equipment

1. All process equipment shall be monitored by the Plant Control System. Provide automatic or semi-automatic control of process equipment as determined during the design process. All process equipment, which is controlled and monitored by the Plant Control System, shall also be controllable manually.

2. In the case that a vendor provides PLC-based controls for equipment provided under his scope of supply, the Plant Control System shall communicate digitally with the PLC in the vendor-provided controls to read status conditions, commands, alarm conditions, process values (including but not limited to pressure, temperature, level, flow, pH, ORP) from the vendor PLC and write set points, values, and commands to the vendor PLC as appropriate for control of the equipment. To accommodate communication protocols of PLCs in vendor panels which may differ from the protocols of the PLCs provided by the system integrator providing the Plant Control System, provide communication modules, including but not limited to gateways and signal converters, and provide programming necessary to translate the communication protocol of the vendor panel to the communication protocol of the Plant Control System.

3. Monitored conditions for process equipment shall include the following for each equipment item and process, as applicable:

   a) RUN indication

   b) FAULT indication

   c) MANUAL mode indication

   d) AUTOMATIC mode indication

   e) Speed Feedback

   f) High Temperature alarms

   g) Vibration alarms

   h) Dissolved Oxygen concentration

   i) pH values

j) ORP values

k) Indications of alarm conditions which will affect operation of process equipment including, but not limited to, seal water loss, phase loss for large Hp equipment, low wet well levels, etc.

1) Monitoring and alarming levels of hazardous gasses in classified areas.
2) Monitoring chemical storage tank levels and alarming on low levels, high levels, and other levels as determined during design.

3) Monitoring and alarming on building sump High-High levels
4) Monitoring any other alarm conditions which represent operating conditions hazardous to personnel and/or compliance with regulatory requirements

4. Monitored conditions for the Plant Control System shall include, but not be limited to, the following:

a) Monitoring UPS for Loss of Line Power, Low Battery Reserve, On UPS Power.
b) PLC Failure
c) Loss of communication between fiber optic Ethernet switches.

5. Equipment Control shall include, but not be limited to, the following:

a) Flow pacing chemical feed equipment based on flows and/or process parameters including, but not limited to, dissolved Oxygen, pH, ORP, or other measured criteria as applicable.
b) Pump speed control and staging necessary to maintain set point wet well level.
c) Flow pacing samplers.
d) Automatic shutoffs and interlocks for equipment, which can cause liquid and solid overflows and spills.

6. The system integrator shall develop a scheme of monitoring and control design that includes review with the County at the completion milestones for the Plant Control System design.

E. Plant Control System and Process Instrumentation Documentation

1. Provide all information to reflect the system as-built. Include also any instruction books, operation manuals, and other information pertaining to service and maintenance. Bind record documents in 3-ring, hardback notebooks complete with tabs and index. Include name, address, and telephone number for each manufacturer's service contact. For all major components, provide a recommended spare parts list.

2. Provide loop diagrams including the following:

a) Provide a wiring diagram for each analog and discrete loop showing all terminations, terminal numbers, conductor numbers, cable numbers, the location of the DC power supply, power panel and circuit numbers for all 120 VAC power to field instruments, MCC and bucket numbers for all 480 VAC power to motor operated valves, signal polarity, the location of any dropping resistors, surge protectors, shielding, grounding, etc. Cabling between sensors/elements and associated transmitters shall be included. The loop diagrams shall meet the minimum requirements of ISA S5.4.

b). Each loop diagram shall be divided into areas for identification of device locations (e.g. panel face, back-of-panel, field, etc.). Loop diagrams shall be on 11x17-inch drawings.

3. Instrument Hardware Documentation

Documentation shall include bills of material, front views, assembly drawings, component layout drawings and schematics, nameplates, schedules, electrical schematics, electrical connection diagrams and tubing/piping connection diagrams. Electrical and piping connection diagrams shall show all terminations of equipment, complete with instrumentation, wire, equipment and cable designations. Interconnecting diagrams shall be prepared in a neat and legible manner on 11 x 17-inch or 22 x 34-inch sheets.

4. Instrument Software Documentation

Provide hard copies of drawings, programming and literature generated specifically for the project, two sets of compact discs shall be provided to the County with copies of all custom files specifically created for the project including all panel drawings, I/O drawings,

termination drawings, communication architecture drawings, data sheets, bills of material, operating procedures etc. Additional files included in this set shall be PLC programs and copies of operator interface software application program and MMI applications. Drawing format shall be the most recent version AutoCAD. Include copies of all *.shp, *.shx files and external reference files used in the AutoCAD drawings. In addition to the AutoCAD drawing files, provide *.PDF files for each drawing and graphic file. Compact discs shall have a complete listing of their contents along with the names and version numbers of the software used to generate each file. Discs shall be clearly identified by the following:

5. Narrative Description of Operation Documentation
   This shall include As-Built narrative descriptions for all loops. Narrative descriptions shall include all final submittal narrative descriptions of operation and any changes made in the field during startup.

F. Process Instrumentation

Where not specifically identified below, process instrumentation equipment shall be by nationally recognized manufacturers with manufacturers' representatives and service facilities located within a 3-hour drive of the site. Provide "smart" instrumentation equipment with non-intrusive calibration, when available from the instrumentation manufacturers. Field devices not rated NEMA 4X shall be housed in NEMA 4X enclosures made of stainless steel.

G. Magnetic Flowmeters

1. Magnetic flow meters shall be sized such that the normal operating velocity range is between 15 FPS and a minimum velocity, which is sufficient to keep solids from settling within the flow tube, but not less than 0.5 FPS. Accuracy shall be 0.5% of flow from 0.5 FPS to minimum 32 FPS.
2. Liners shall be hard rubber or PTFE for non-abrasive process fluids and ceramic or natural rubber for abrasive process fluids.
3. Electrodes shall be conical for non-abrasive process fluids and flat for abrasive process fluids.
4. Flow tubes shall be rated IP68.
5. Manufacturers shall be Krohne, ABB, or approved equal

H. Combustible Gas Sensors

1. Combustible Gas sensors shall be Infrared Absorption type. Sensors shall have heated mirror assemblies and NEMA 7 electronic enclosures.
2. Manufacturers shall be Draeger, MSA Ultima X or approve equal.

Piping Schedule

The type of piping specified shall conform with the requirements of the following Schedule, unless otherwise specified or approved.

Table A5B-1
Process Piping Schedule

System	Service	Material	Interior Lining	Test Pressure, psi
FM, SR	Influent Pumps Suction and Discharge Surge Relief	DI	EP, PE CL	150
G	Degritting Facilities	DI	GL	50
PS, CS	Primary Sludge Combined Sludge	DI	GL	50
WAS, RAS	Waste Activated Sludge Return Activated Sludge	DI	CL	50
NPW	Plant Water	C	-	150
NPW	Plant Water	DI	CL	150
UW	Utility Water	DI	CL	150
D, PD	Drain, Process Drain	C	-	50
D, PD	Drain, Process Drain	DI	CL	50
CA	Compressed Air	C	-	150
PA	Process Air BNR Aeration	SS	-	25
PA	Process Air Primary Sludge Storage Mixing	DI above ground CS (buried)	CL	25
FOR, FOS	Fuel Oil Return, Supply	CS	-	50

System	Service	Material	Interior Lining	Test Pressure, psi
SPKLR	Sprinkler System	CS	-	125
PY	Liquid Polymer System	CPVC	-	75
CLS	Chlorine Solution	CPVC	-	50
DG, NG	Digester Gas Natural Gas	CS	-	25
AL	Liquid Alum	CPVC	-	25
PER	Permanganate Solution	SS	-	25
PW	City Water, Potable Water (except Sprinkler system)	C	-	100
PW	City Water, Potable Water (after PRV)	DI	CL	150
SAM	Sample, Air Relief	C	-	50
SC	Scum	DI	EP	25
OCC	Odor Control Chemical	CPVC	-	50
L	Lime Systems	PVC	-	50
SPD	Sump Pump Discharge	DI	CL	50
SPD	Sump Pump Discharge	C	-	50
SW	Stilling Well	DI	-	10
INF	Influent	DI	EP	50
PI, PL,	Primary Influent	DI	EP	25
PSL	Primary Sludge	DI	EP	50

System	Service	Material	Interior Lining	Test Pressure, psi
O	Outfall	RCP	-	--
PL	Process Liquid	DI	CL	25

All piping materials shall be stamped, marked or identified with the following:
1. Name or trademark of the manufacturer.
2. Pipe class.
3. Size and length dimensions.
4. Date and place of manufacture.

The following abbreviations are used in the piping schedule.

Service Abbreviations

AL	Liquid Alum	PI	Primary Influent
AR	Air Relief	PL	Process Liquid
CA	Compressed Air		
CLS	Chlorine Solution	PSL	Primary Sludge
CS	Combined Sludge	PW	Potable Water
D	Drain	PY	Liquid Polymer
DG	Digester Gas	RAS	Return Activated Sludge
FM	Force Main	RW	Raw Water
FOR	Fuel Oil Return	SAM	Sample
FOS	Fuel Oil Supply	SC	Scum
G	Grit	SD	Storm Drain
INF	Influent	SPD	Sump Pump Discharge
L	Lime System	SPKLR	Sprinkler System
NG	Natural Gas	SR	Surge Relief
NPW	Non-Potable Water	SW	Spray Water
O	Outfall	SW	Stilling Well
OCC	Odor Control Chemical	TEAS	Thickened Excess Activated Sludge
PA	Process Air	UW	Utility Water
PD	Plant Drain	WAS	Waste Activated Sludge

Material Abbreviations

C	Copper	DI	Ductile Iron
CI	Cast Iron	PVC	Polyvinyl Chloride
CPVC	Chlorinated Polyvinyl Chloride	RCP	Reinforced Concrete Pipe
CS	Carbon Steel	SS	Stainless Steel

Lining/Coating Abbreviations

BC	Bituminous Coated	INS	Insulated
CL	Cement Lined	P	Painted
EP	Epoxy	PE	Polyethylene
GL	Glass Lined	PVC	Polyvinyl Chloride

DUCTILE IRON PIPE

1.01 General Design

A. Ductile iron pipe shall be utilized for all piping as indicated in Table A5B-1.

B. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. All pipes shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
14 - 18	350
20	300
24	250
30 - 42	200

C. Flanged pipe minimum wall thickness shall be equal to Special Class 53. Flanges shall be furnished by the pipe manufacturer.

D. Restrained joint pipe on supports shall have bolted joints and shall be specifically designed for clear spans of 36 feet, minimum.

E. Fittings and Accessories

1. Fittings shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 with a minimum rated working pressure of 250 psi.

3. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer.

4. Welded-on Outlets: Welded-on outlets shall be ductile iron body type and shall be faced and tapped for AWWA C110/ANSI A21.10 flange or mechanical joint connection. All welding, fabrication and outlet hole drilling shall be performed by the manufacturer. Outlets shall be free of burrs. The outlets shall be welded on minimum Class 51 ductile iron pipe greater than 12-inches and Class 52 for smaller pipe.

5. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected.

F. Joints for Ductile Iron Pipe and Fittings

1. General

a. Joints for ductile iron pipe and fittings shall be mechanical joint, flanged joint, restrained joint or push-on joint as specified herein.

b. Unless specified otherwise, all ductile iron pipe laid underground shall be joined using restrained joint or push-on type joints. Fittings shall be standard mechanical, push-on or restrained joints.

c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported or by the environment in which the pipe is installed.

d. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A. All bolts and nuts shall be suitable for the environment which pipe is being installed.

2. Mechanical Joints

   a. Joints shall conform to AWWA C111/ANSI A21.11.

   b. Bolts and nuts shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.

   c. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of plain rubber.

   d. Mechanical joint glands shall be ductile iron.

   e. Retainer glands shall be Megalug Series 1100 or approved equal.

3. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints.

4. Flanged Joints

   a. Flanged joints shall conform to AWWA C115/ANSI A21.15. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.

   b. Gaskets shall be made of 1/8-inch thick, cloth reinforced rubber. Gaskets may be ring type or full face type.

   c. Flanged ductile iron pipe shall have flanges cast solidly or threaded to the pipe barrel. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange

neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.

d. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.

e. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.

f. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.

g. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.

h. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

5. Restrained Joints

a. Restrained joints shall be ACIPCO "FLEX-RING" or "LOK-FAST" or McWane (Clow) "SUPER-LOCK" or U.S. Pipe "TR-FLEX".

b. Restraining gaskets shall be ACIPCO "Fast-Grip" or U.S. Pipe "Field-Lok Gasket".

c. Bolts and nuts shall be in accordance with the manufacturer's recommendations.

d. Gaskets shall be in accordance with the manufacturer's recommendations.

e. Joints for restrained joint pipe on supports shall be equal to American "LOK-FAST", U.S. Pipe "LOK-TYTE", or Clow "LONG SPAN".

f. No field welding of restrained joint pipe will be permitted.

G. Interior Lining: Ductile iron pipe and fittings shall be lined with polyethylene or epoxy, as specified below:

1. Linings shall cover all exposed surfaces of pipe and fittings subject to contact with sewer liquid or gas. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.

2. Lining Materials

a. Polyethylene lining material for pipe barrel shall conform to ASTM D 1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during aboveground storage. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. Lining material for exterior of spigot and interior of socket shall be equal to Roskote Mastic B-151 or Madewell 1104 Coal Tar Epoxy. Polyethylene lining system shall be ACIPCO Polybond Plus.

b. Epoxy: The lining material shall be Protecto 401 Ceramic Epoxy, a two component, modified epoxy formulated for corrosion control with the following minimum requirements:

1) A permeability rating of 0.0 perms when measured by ASTM E 96, Procedure A. Duration of test shall be six weeks.

2) A direct impact resistance of 125 inch-pounds with no cracking when measured by ASTM D 2794.

3) The ability to build at least 50 mils dry in one coat.

4) The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.

5) The material shall contain at least 20 percent by volume of ceramic quartz pigment.

6) A test and service history demonstrating the ability of the material to withstand the service expected.

7) Possess a minimum solids volume content of 88 percent, ± one percent.

8) Possess a maximum drying time to allow recoating as follows: 50 degrees F - 72 hours; 75 degrees F - 18 hours; 90 degrees F - 8 hours. If recoating cannot be accomplished within seven days, a light brush blast shall be performed to improve intercoat adhesion.

3. All surfaces to be lined with polyethylene shall be blast cleaned equal to the requirements of SSPC-SP6. All surfaces to be lined with polyurethane shall be blast cleaned equal to the requirements of SSPC-SP10. All surfaces to be lined with epoxy shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.

4. Application

   a. Lining of pipe barrel and fittings shall be 60 mils nominal thickness; minimum-lining thickness shall be 30 mils. Lining thickness for exterior of spigot and interior of socket shall be 8 to 10 mils.

   b. The lining shall be applied using a centrifugal lance applicator by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film.

5. All pipe and fitting linings shall be tested for pinholes in accordance with ASTM G 62, Method B and shall be holiday free.

6. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.

7. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.

H. Wall Sleeves and Wall Pipes

1. Where piping passes through concrete structures, furnish and install wall sleeves unless wall pipes or other provisions are specifically required. Wall sleeves shall be accurately located and securely fastened into position before concrete is poured.

2. Wall Sleeves

a. For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral, or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps, or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. Sleeves and seal shall be Link Seal.

b. For larger pipe sizes, wall sleeves shall be statically cast ductile iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be mechanical joint bell-plain end type with waterstop/thrust collar. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Sleeves shall be constructed with studs and mechanical joint [retainer] gland on the air side of the concrete structure. Where the concrete structure is exposed to dirt on one side and is wet on the other side, construct with studs and glands on the dirt side. Wall sleeves shall be equal to ACIPCO A-10771.

3. Wall Pipes

a. Wall pipes shall be either statically cast ductile iron with integral waterstop/thrust collar or centrifugally cast ductile iron with a

continuously welded waterstop/thrust collar. The welded on collar shall be attached to the pipe by the manufacturer. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished uncoated on the outside [and cement lined on the inside]. Unless specified or shown otherwise, wall pipes shall be flange end type.

b. Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facilities and delivered to the job site ready for use.

2.01 Surface Preparation and Shop Painting

A. Unless otherwise specified herein, all ductile iron pipe and fittings shall be cleaned and provided with cement and bituminous lining applied at the factory.

B. Pipe and fittings for submerged or buried service shall be factory coated outside with an asphaltic coating conforming to AWWA C151 for ductile iron pipe, AWWA C115 for flanged pipe and AWWA C110 for fittings. Pipe and fittings which shall be exposed shall be factory coated with a general purpose rust inhibitive primer compatible with the type of paint which will be field applied.

3.01 Installation

A. Proper and suitable tools and appliances for safe and convenient handling and lying of pipe and fittings shall be used. Great care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.

B. All pipe and fittings shall be carefully examined by the Contractor for defects just before lying and no pipe or fitting shall be laid if it is defective. If any defective pipe or fitting is discovered after having been laid, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at Contractor's own expense.

C. All pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.

D. Pipe laid in trenches shall be laid true to line and grade on a firm and even bearing

for its full length at depths and grades. Adequate precautions shall be taken to prevent floatation of pipelines prior to backfilling. Installation of ductile iron pipe in underground pressure piping systems shall conform to the requirements of AWWA C600.

E. All ductile iron piping laid underground shall have a minimum of 48-inches of cover.

F. All elbows, tees, brackets, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping containing unharnessed push-on or mechanical joints or expansion joints shall be restrained by thrust blocks. Thrust blocks shall consist of Class "B" concrete as specified in this section. The Contractor may use forms or earth walls to mold the thrust blocks. When earth walls are used, they shall be cut true to shape and all excess earth shall be removed. The work shall be conducted so that no loose earth will become mixed with the concrete. At the end of 24 hours, damp earth may be placed over the concrete to retain moisture.

G. All ductile iron pipes entering buildings or basins shall be adequately supported between the structure and undisturbed earth to prevent breakage resulting from settlement of backfill around the structure.

H. All ductile iron pipe installed under buildings or basins shall be encased in Class "B" concrete as specified in this section. The size of the encasement concrete shall be a minimum of 6-inches larger than the outside diameter of the pipe.

I. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed.

J. Wall pipe and wall sleeves shall be installed when the wall or slab is constructed. Blocking out or breaking of the wall for later installation will not be permitted.

K. Cutting or weakening of structural members to facilitate pipe installation will not be permitted. All piping shall be installed in place without springing or forcing.

L. Exposed ductile iron piping shall be supported at all times

M. Permissible Deflection of Joints

1. Deflection of ductile iron pipe at joints for long radius curves or for avoiding obstacles shall be permitted only upon approval of the Engineer.

2. Where deflection of joints is permitted, such deflection shall be made in accordance with and shall not exceed limits provided in Section 9b.5 and Section 9c.4 as applicable, of AWWA C600.

N. Joints of Dissimilar Metals: When a flanged joint consists of a ductile iron flange mated to a steel or alloy flange, the steel flanges shall be flat faced and furnished with full-faced gaskets, insulating bushings, and stainless steel bolts.

3.02 Cut-Ins to Existing Piping

A. In general and unless otherwise shown, cut-ins to existing ductile iron piping for installation of new mechanical joint fittings and valves shall be made using cast iron solid or cutting-in sleeves.

B. Solid or cutting-in sleeves shall have a pressure rating not less than that of the existing pipeline and cutting-in sleeves shall be furnished with a mechanical joint end on one end and a plain end on the other.

3.03 Drilling and Tapping

A. Wherever required ductile iron pipe and fittings and cast iron fittings shall be drilled and tapped to receive drainage or any other piping. All holes shall be drilled accurately at right angles to the axis of any pipe or fitting. Where plugs are drilled, holes shall be at right angles to the face of the plug.

B. Where the size of the pipe to be connected is such as to require bosses for

connection and when the pipe wall thickness is too thin to permit the effective length of pipe threads to be utilized as necessary for the size pipe being connected by threads, the Contractor shall furnish such pipe with cast-on bosses suitable for drilling, tapping, and connecting such pipe. Alternately, where shown or specified a tapped saddle clamp may be used in lieu of a cast-on boss. Saddle clamp shall be of the heavy-duty type with O-ring gasket and two heavy U-bolt clamps.

C. All tapping shall be carefully and neatly done by skilled workers with suitable tools.

D. Where connections are made between new and old piping the connections shall be made in a thorough and workmanlike manner using proper fittings and specials to suit actual conditions.

E. Cut-ins to existing and operating pipelines shall be done at times agreeable to the Owner.

F. Existing pipelines that may be cut or damaged during the performance of work under this item shall be repaired, reconnected, and returned to service in equal or better condition in which they were found and in accordance with the requirements of this Section.

G. No separate payment will be made for drilling, tapping, making connections, cut-ins, repairs to damaged existing pipelines, and reconnections in existing pipelines.

3.04 Concrete

Concrete shall have a compressive strength of not less than 2500 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

3.05 Inspection and Testing

After all piping has been placed and backfilled between the joints, each run of newly laid pipe, or any valved section thereof, shall be tested by the D/B Company in accordance AWWA C651 and the requirements of "Piping Testing and

Acceptance" in this Attachment.

3.06 Cleaning

Prior to acceptance of the work of this Section, thoroughly clean all installed materials, equipment and related areas in accordance with AWWA C 651.

REINFORCED CONCRETE PIPE

1.01 General Design

A. Pipe shall be bell and spigot reinforced concrete conforming to ASTM C 76 for Class III, IV, and V pipe.

B. In addition, the pipe and materials shall meet the following requirements:

1. Concrete shall have a minimum compressive strength of 5,000 psi for Class III and IV and 6,000 psi for Class V and special design;

2. Cement shall meet the requirements of ASTM C 150, Type II;

3. Absorption shall not exceed six percent when tested in accordance with ASTM C 497.

4. Reinforced concrete pipe shall be supplied in lengths of at least six feet.

C. Joints

1. Joints for pipe 24-inches and larger shall have steel end rings with rubber O-ring gaskets conforming to ASTM C 361.

2. Pipe less than 24-inches in diameter shall have concrete and rubber gasket type joints conforming to ASTM C 361. In addition, joints for pipe less than 24-inches in diameter shall conform to Joint Type R-4 as designated by the U.S. Department of the Interior Standard Specifications for Reinforced Concrete Pressure Pipe.

3. A rectangular groove shall be supplied in the spigot end to receive the rubber O-ring gasket, and it shall be so formed that when the joint is

complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.

4. The steel end ring, on both the spigot and the bell ends, shall be provided with a 4-inch wide skirt. The skirt shall be 14 gauge and shall be connected to the end ring by a continuous weld for the full circumference. The skirt shall be welded to the wall or joint reinforcing. The skirt shall be provided with a 1.00-inch impact collar/waterstop, 0.25-inch thick, perpendicular to the skirt and located at the center of the skirt. The impact collar/waterstop shall be continuously welded for the full circumference to the skirt. All steel surfaces not encased in concrete shall be galvanized.

5. The steel end O-ring pipe joint shall also be provided with a butyl rubber sealant. Butyl rubber sealant shall have a minimum nominal diameter of 1-inch and shall be equal to Kent Seal No. 2 or Concrete Sealants CS-202. The sealant shall be installed on the shoulder of the spigot in such a manner that the sealant will be compressed by the jointing of the bell and spigot and fill the void between the bell and spigot.

B. Fittings: Reinforced concrete pipe fittings shall meet all requirements for reinforced concrete pipe, including materials of construction, structural strength, linings, and joints.

C. Acceptance

1. Acceptance of pipe shall be on the basis of plant load-bearing tests for the load to produce 0.01-inch crack and the ultimate strength of the pipe, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in Paragraph 5.1.1 of ASTM C 76.

2. Provide results of tests on pipe, pipe materials, joint material, and made-up joints performed by an independent testing laboratory approved by the Engineer. Include materials, absorption, crushing, and hydrostatic leakage tests on pipe of each size in accordance with applicable specifications.

3. Each length of pipe shall be stamped by a regular employee of the approved testing laboratory.

4. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Do not accept or use pipe with repaired or patched gasket grooves or shoulders. Any pipe repaired or patched is subject to rejection if such repairs or patches, in the opinion of the County, are not sound and properly finished.

5. No pipe shall be shipped before it has been cured for a minimum of 14 days.

D. Detection Tape: Provide detection tape over all RCP sewers.

STEEL, STAINLESS STEEL, AND COPPER

1.01 General

A. Piping and appurtenances specified in this Section shall pertain only to seal water, instrument air systems, and process piping.

B. Steel, stainless steel pipe, copper tubing, stainless steel tubing, and appurtenances covered under this Section shall include all pipe and accessories inside and under buildings or structures outside.

C. This Section includes piping and fittings in utility vaults and manholes.

2.01 Pipe and Fittings

A. Steel Pipe (Less than 6-Inches) (CS)

1. Steel pipe in sizes 2-1/2-inches and smaller shall be seamless carbon steel pipe conforming to the requirements of ASTM A 120. Steel pipe in sizes 3 to 6-inches shall be seamless carbon steel pipe conforming to the requirements of ASTM A 53, Grade B.

2. Unless otherwise specified or shown, steel pipe 6-inches and smaller shall be Schedule 80 with welded joints.

3. Threaded fittings 2-1/2-inches and smaller shall be 150 pound malleable iron conforming to ASTM A 197 and ANSI B16.3. Unions shall be 300 pound malleable iron conforming to ASTM A 197 and ANSI B16.3 with bronze seats.

4. Welded fittings shall be of the butt-welded type of wrought carbon steel conforming to ASTM A 234, Grade WPB and ANSI B16.9. Reducing branch connections shall be made using threadolets or weldolets.

5. Flanged Joints

   a. Flanges, where required for connection to valves, shall be forged steel conforming to ASTM A 181, Class 60, and ANSI B16.5, Class 150.

   b. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Nuts shall be hexagonal. Bolts and nuts shall be zinc plated, cold pressed, steel machine bolts, conforming to ASTM A 307, Grade B. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1. Zinc plating shall conform to ASTM B 633, Type II.

   c. Gaskets shall be cloth reinforced rubber, neoprene, Buna N, 1/16-inch thick, conforming to ANSI/ASME B16.5 and shall be suitable for the service it is installed. Gaskets for air piping operating at temperatures between 120 and 300 degrees F shall be viton. Gaskets for piping with operating temperatures between 300 and 600 degrees F shall be soft corrugated metal or expanded PTFE.

   d. Bolts for submerged service shall be heavy hex stainless steel conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex stainless steel conforming to ASTM A 194, Grade 8.

6. Unless noted otherwise, steel pipe and fittings 6-inches and smaller in size shall be hot dip galvanized in accordance with the requirements of ASTM A 153.

B. Large Diameter Steel Pipe (CS)

1. Pipe shall be furnished in accordance with ANSI/AWWA C200 Section 2.1, manufactured to meet the requirements of ASTM A 139 or ASTM A 53, or may be fabricated to meet the requirements of ANSI/AWWA Standard C200 Section 3.1 through Section 3.6 of steel sheet conforming to ASTM A.

2. Fittings shall be fabricated in accordance with ANSI/AWWA C200, Section 4 from pipe conforming to the above standards. Fittings fabricated from previously hydrostatically tested straight pipe shall require testing of only those welded seams that were not previously hydrostatically tested in the straight pipe. This testing shall be dye penetrant meeting the requirements of ASTM E 165 or magnetic particle, meeting the requirements of ASTM E 709 or ultrasonic where pipe is ultrasonically inspected. Fittings shall conform to the dimensions of ANSI/AWWA C208. All tees, laterals and outlets shall be reinforced in accordance with AWWA M11.

3. All welding procedures used to fabricate pipe shall be qualified under the provision of ANSI/AWS B2.1 or ASME Sec. IX. Welding procedures shall be required for, but not limited to, longitudinal and girth or special welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

4. Design

a. Pipe size shall be the nominal inside diameter of the pipe.

b. Pipe shall be designed by the pipe manufacturer for internal pressure, localized stresses at supports, installation loads and external loads, both singularly and in combination.

c. Pressure pipe shall be designed for an internal pressure equal to the sum of working pressure plus surge pressure. No variation in the design internal pressure shall be allowed for varying pipe elevation.

d. All pipe shall be designed for external loads equal to the sum of the

dead load plus live load. The minimum dead load shall be that created by a depth of cover of eight feet, or the depth of cover based on difference in elevation of near edge of pavement and top of pipe, whichever is greatest. The minimum live load shall be equal to AASHTO HS-20 loading including an appropriate impact factor. The external loading shall be based on saturated clay soil type with a soil density of 120 pounds per cubic foot. The pipe shall be designed with a maximum modulus of soil reaction, E', of 1000 psi (2-10 feet of cover), E' of 1,200 psi (10-15 feet of cover), E' of 1300 psi (15-20 feet of cover) and a deflection lag factor (DL) of 1.5.

e. The allowable design stress shall be 50 percent of the yield strength of the material at the working pressure and 75 percent on the yield strength at working pressure plus surge pressure, whichever is less.

f. The maximum allowable pipe deflection shall be three percent.

g. Minimum wall thickness shall be 0.13 inches (Pipes 8 inches and smaller), 0.18 inches (Pipes 12 inches through 10 inches), 0.25 inches (Pipes 22 inches through 12 inches), 0.5 inches (Pipes 24 inches through 42 inches). All lines sizes above 42 inches shall have 0.75 inch wall thickness. Steel pipe shall not exceed 72 inches.

h. All pipe installed on pipe saddles shall be designed for beam strength and for localized stresses at the support for the above stated internal and external loads.

i. Design calculations for pipe design and fittings reinforcement shall be in accordance with AWWA M11 and ANSI/AWWA C200. Design calculations shall be stamped by a professional engineer registered in the State of Georgia.

4. Joints

a. Bell and spigot lap-welded slip joints shall be used for 36-inch diameter and larger pipe. Joints for pipe 36-inches and larger shall be welded on both inside and outside of pipe. All field welding shall conform to the requirements of AWWA C206. The standard bell shall provide for a 2-1/2-inch deep bell providing a minimum 1-1/2-inch lap and shall have a 1/4-inch tapped hole for field testing.

The tapped hole shall be shipped with a plug.

b. Flanges

1) For all exposed pipe provide flanged joints. Flanges shall be in accordance with ANSI/AWWA C207, Class D for pressures to 175 psi on 4 through 12-inch diameter pipe flanges and 150 psi on diameters over 12-inches. Flanges shall be ANSI/AWWA C207, Class E for pressures over 150 to 275 psi when mating steel to steel. Shop lining and coating shall be continuous to end of the pipe or back of the flange. Flange faces shall be shop coated with a soluble rust preventative compound.

2) Gaskets shall be made of 1/8-inch thick, Neoprene or Buna-N and shall be suitable for the service it is intended. Gaskets shall be full face type

c. Bolts and Nuts

1) All bolts and nuts shall be made in the U.S.A. Bolts and nuts shall be threaded in accordance with ANSI/ASME B1.1, Coarse Thread Series, Class 2A external and Class 2B internal fit.

2) Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.

3) Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

4) Unless otherwise shown or specified, steel pipe and fittings 6-inches and smaller in size shall be hot dip galvanized in accordance with the requirements of ASTM A 153. Exposed steel piping shall be field primed and painted in accordance with these Specifications.

5. Handling, Storage and Shipment of Steel Pipe and Fittings

a. Stulling is not required for steel pipe with a D/t ratio of 120 or less. Pipe with a D/t ratio over 120 shall be stulled as required to maintain roundness of ± one percent during shipping and handling.

b. Coated steel pipe shall be shipped on padded bunks with nylon belt tie-down straps or banded bandings located approximately over stulling.

c. Coated pipe shall be stored on padded skids, sand or dirt beams, sand bags, old tires or other suitable means so that coating will not be damaged.

d. Coated steel pipe shall be handled with wide belt slings. Chains, cables or equipment likely to damage the pipe or the pipe coating shall not be used.

e. Prior to shipment, the pipe shall be visually inspected for damage to the coating by the following procedure:

1) When visual inspection shows a portion of the polyethylene tape system has sustained physical damage, the area in question may be subjected to an electrical holiday test to 11,180 volts.

2) When the area is tested and there are no holidays or no tearing of the material (only wrinkling or bruising), then the area shall be noted acceptable and shipped with no patching required.

3) When the damaged area has a tearing of the material, the damaged layer (or layers) of outerwrap shall be removed by carefully cutting with a sharp razor type utility knife. The area shall then be wiped clean and dry with a rag and a patch of

polyethylene repair tape, cut to sufficient size to overlap at least 4-inches of sound material in each direction, shall be supplied.

4) When the damaged area does not show damage going clear to steel from either a visual inspection or a beep from a holiday detector, expose the innerwrap of black polyethylene tape and cut back the damaged layers leaving a smooth surface. The area shall then be wiped clean and dry with a rag and a coat of primer shall be applied to the area. When the primer is tacky, apply a patch of polyethylene repair tape of sufficient size to completely cover the damaged area, plus a minimum lap of 4-inches on sound tape in all directions. A second patch of polyethylene repair tape shall then be put over the first patch, once again insuring a minimum overlap of 4-inches beyond the first patch on a clean, dry surface. Repair tape and primer shall conform to ANSI/AWWA C209 Standard and the tape shall be 35 mil high tack polyethylene tape compatible with the original tape system.

6. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that all steel pipe and specials were manufactured in accordance with ANSI/AWWA C200.

C. Stainless Steel Pipe (SS)

1. Stainless steel pipe in sizes 10-inches and smaller shall be seamless stainless steel pipe conforming to the requirements of ASTM A 312, Type 304.

2. Unless otherwise specified or shown, stainless steel pipe 1-1/2-inches and smaller shall be Schedule 40S with threaded joints. Stainless steel pipe in sizes 2 through 10-inches shall be Schedule 10S with welded joints. Stainless steel 12 through 28 shall be Schedule 10S 316L with welded joints.

3. Threaded fittings and unions 1-1/2-inches and smaller shall be 3,000 pound forged stainless steel conforming to ASTM A 182, Grade F304 and ANSI B16.11.

4. Welded fittings shall be of the butt-welded type of wrought stainless steel conforming to ASTM A 403, Grade WP304 and ANSI/ASME B16.9. Reducing branch connections shall be made using threadolets or weldolets.

D. Copper Tubing (C)

1. Exposed copper tubing for seal water system piping or process piping shall be seamless harddrawn copper tube conforming to the requirements of ASTM B 88, Type L. Buried copper tubing shall be seamless, annealed copper tube conforming to the requirements of ASTM B 88, Type K. Annealed copper tube may be furnished in straight lengths or coils.

2. Fittings for copper tube shall be wrought copper conforming to ASTM B 75 and ANSI B16.22 for silver brazed joints. Unions in copper piping shall be cast red bronze with bronze to bronze seats.

3. Copper tubing in sizes 5/8-inch O.D. and smaller shall be coated, seamless, bright annealed copper tube conforming to ASTM B 68, Type DHP. Unless otherwise shown, minimum size of copper instrument air tubing shall be 3/8-inch O.D. Wall thickness of copper tube shall be as follows:

Tube O.D.	Wall Thickness
1/4"	0.030"
3/8"	0.032"
1/2"	0.035"
5/8"	0.040"

4. Fittings for annealed copper tube in instrument air service shall be of the flareless, compression type, Hoke "Gyrolok", Crawford "Swagelok" or Parker "Trible-Lok", conforming to ASTM B 16 or B 124.

5. Instrument air tubing shall be factory coated with a layer of black PVC meeting the requirements of ASTM D 1047, IPCEA S-61-402, and applicable UL standards. Minimum coating thickness shall be 0.032-inch.

E. Stainless Steel Tubing

1. Stainless steel tubing for sample and process leads shall be seamless, bright annealed stainless steel tube conforming to ASTM A 269, Type 316 with minimum 3/8-inch O.D. and 0.035-inch wall thickness.

2. Fittings for stainless steel tubing shall be of the flareless, compression type of 316 stainless steel.

F. Pipe Dope

1. All threaded connections shall be made up using teflon pipe dope applied to the male threads only.

2. Virgin teflon thread tape shall be Hercules Packing Company "Herculon", 3-M Company "Scotch No. 48" or Crane Packing Company "Teflon Thread Tape".

3. Teflon thread paste may be used in place of tape on very large or very small joints.

G. Service Clamps and Saddles: Service clamps and saddles shall be ductile iron, double strap clamps, equal to Smith-Blair.

H. Linings: All stainless steel piping, copper tubing, and stainless steel tubing shall be unlined.

I. Coatings

1. All buried stainless steel piping, copper tubing, and stainless steel tubing shall be uncoated.

2. All exposed or submerged steel and alloy steel piping shall be cleaned and painted

3. Buried steel and alloy steel pipe shall be coated and wrapped outside with prefabricated multi-layer, cold-applied polyethylene tape coating in accordance with AWWA C214 Standard. The total thickness of coating shall be 50 mils consisting of primer, 20 mil inner layer for corrosion protection and one 30 mil outer layer for mechanical protection. Fittings shall be coated and wrapped outside with prefabricated multi-layer, cold-applied polyethylene tape coating in accordance with AWWA C209

Standard. The total thickness of coating shall be 70 mils, consisting of a primer and two wraps of 35 mil tape.

4. Buried steel and alloy steel pipe and fittings for air service piping shall be cleaned and have a factory applied exterior coating system.

5. Shop applied outside coatings shall be held back 4-1/2-inches from joints to be welded. Coatings shall be field applied after welding has been completed.

J. Wall Sleeves and Wall Pipes

1. Where piping passes through concrete structures, furnish and install wall sleeves.

2. Wall Sleeves: For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. Sleeves and seal shall be Link Seal.

3. Wall Pipes: Wall pipes shall have a continuously welded waterstop collar. The welded-on collar shall be attached to the pipe by the manufacturer. The waterstop collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished coated on the outside and inside. Unless specified otherwise, wall pipes shall be flange-plain end type.

3.01 Installation

A. All exposed piping shall be firmly anchored and supported by pipe supports or anchors as required.

B. Full lengths of pipe shall be used wherever possible. Short lengths of pipe with couplings will not be permitted. Pipe shall be cut to exact measurement and shall be installed without forcing or springing. Proper and suitable tools and appliances for safe and convenient handling and lying of pipe and fittings shall be used.

C. Lines which slope shall have the right-of-way over lines whose elevations can be changed. Offsets, transitions, and changes in direction in pipes shall be made as required to maintain proper head room, slope, etc.

D. Except for annealed tubing, all changes in direction in piping systems shall be made with suitable fittings. Annealed tubing shall be bent using suitable bending tools.

E. When storing and installing pipe, care shall be taken to prevent damage to the pipe coatings or linings. Do not drop or roll pipe into trenches. Steel pipe with an exterior bituminous or plastic coating or wrapping shall be handled using rubber or canvas slings. All damaged coatings shall be repaired to the satisfaction of the Engineer.

F. Installed piping shall not interfere with the operation of or accessibility to doors and/or windows shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment.

G. Changes in pipe size shall be made using reducing fittings, not bushings. If centerline elevation is not specified, use eccentric reducers in horizontal piping. On liquid lines, eccentricity shall be down with top of pipe level. On vapor and gas lines, eccentricity shall be up with bottom level.

H. Indicated locations and sizes of equipment connections are approximate; exact locations and sizes of piping, valves, etc., shall conform to approved shop drawings. Connection sizes shall not be smaller than scheduled size or equipment outlet size, whichever is larger.

3.02 Cutting

A. When new or existing pipe is required to be cut, the pipe shall be cut in such a manner as to leave a smooth end normal to the axis of the pipe.

B. All burrs shall be removed from the inside and outside edges of all cut pipe. All damaged linings and coatings shall be repaired. Tool marks and unnecessary pipe threads shall be avoided. Cuttings and other foreign material shall be removed from the inside of the pipe prior to installation.

3.03 Joints

A. Flanged Joints

1. All flanges shall be true and perpendicular to the axis of the pipe. Flanges shall be cleaned of all burrs, deformations, or other imperfections before joining. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. Where screwed flanges are used, the finished pipe edge shall not extend beyond the face of the flange, and the flange neck shall completely cover the threaded portion of the pipe. Where slip-on flanges are used, the distance from the end of the pipe to the gasket face of the flange shall not exceed "t" plus 1/4-inch, where "t" is the pipe wall thickness.

2. Connections to equipment or valves shall be made in such a way that no torque is placed on the equipment or valve flanges. Connecting flanges must be in proper position and alignment and no external force may be used to bring them together properly.

3. After installation, bolts and nuts for exposed or submerged service shall be coated in accordance with the requirements of these Specifications.

4. Flanged filler shall be used only when approved by the Engineer to make up minor differences in pipe length, less than 3-inches. Joint bolts shall be increased by the thickness of the flange filler.

5. Joints of Dissimilar Metals: When a flanged joint consists of a ductile iron flange mated to a steel or alloy flange, the steel flanges shall be flat faced and furnished with full-faced gaskets, insulating bushings.

B. Threaded Joints: Pipe threads shall be concentric with the outside of the pipe and shall conform to ANSI B2.1. When threading stainless steel pipe, dies shall have 20 to 30 degree hook. Finished joints shall have no more than three threads exposed. Before assembly, pipe ends and threads shall be inspected and any

defective pieces replaced. All joints shall be properly aligned before connection to prevent thread damage. Pipe dope shall be used on the male threads of all threaded connections. Teflon thread tape shall be applied two threads back from the end of the pipe of fitting to prevent shredding. Excess pipe dope shall be trimmed or cleaned off to provide adherence for paints or coatings.

C. Welded Joints

1. Large Diameter Steel Pipe, 6-Inches and Larger: All field welded joints shall be in accordance with the requirements of AWWA C206. Welding shall be performed to produce a joint meeting the minimum strength requirement of the base metal. The tensile strength of the weld shall be not less than the strength of the thinner of the connected sections.

2. Steel Pipe, Less Than 6-Inches: Pipe welding shall comply with the provisions of the latest revision of the applicable codes, whether ASME Boiler and Pressure Vessel Code, ANSI/ASME Code for Pressure Piping B31.1 or state or local requirements as may supersede codes aforestated. The D/B Company performing the work shall be familiar with the codes under which welder operates, own copies of these codes and understand the provisions in them. All welding shall be MIG, TIG, shielded arc or inert gas method. Weld cross sections shall be equal to or greater than the pipe wall thicknesses. Butt welds shall have full penetration to the interior surface. Welds shall be smooth and continuous and shall have interior projections no greater than 1/16-inch. Before any welding is performed, the D/B Company shall submit to the Engineer a copy of the D/B Company's welding procedure specification and welder's qualification record clearly showing that the welder has been tested and approved for welding per the D/B Company's submitted procedure.

3. Stainless Steel Pipe: Pipe welding shall comply with the provisions of the latest revision of the applicable codes, whether ASME Boiler and Pressure Vessel Code, ANSI\ASME Code for Pressure Piping B31.1 or state or local requirements as may supersede codes aforestated. The D/B Company performing the work shall be familiar with the codes under which welder operates, own copies of these codes and understand the provisions in them. All welding shall be MIG, TIG, shielded arc or inert gas method. Weld cross sections shall be equal to or greater than the pipe wall thicknesses. Butt welds shall have full penetration to the interior surface. Welds shall be smooth and continuous and shall have interior projections no greater than