APPENDIX A

Instrumentation and Control Process Narrative

1.1 SUMMARY

The Water Reuse System processes secondary effluent for reuse as: plant water to hose clarifiers, provide seal water for equipment and supply water used for flushing piping, etc. To serve these purposes, it will be screened with rotating microscreens, disinfected with ultraviolet (UV) radiation and pumped to 100 psi pressure into the existing plant water piping.

This section covers the Process Narrative for the Instrumentation and Control of the water reuse system.

1.2 GENERAL

A. The entire water reuse system shall be controlled by one PLC located in the Effluent Pump House (EFPH is the COMA designation).

B. All gates and valves shall be manually operated.

C. Owner shall furnish complete PLC operator interface enclosure; Contractor to install in accordance with the Plans and Specifications.

D. Contractor shall perform calibration and set points as specified in the section.

E. All panels shall be UL approved, or equal.

1.3 DESCRIPTION

A. The following are brief descriptions of the equipment, instruments, and controls in the water reuse system.

1. Influent (Supply) Pumps (EFPU-WW.INF01 & 02):
   a. The purpose of these pumps is to pump reuse-water from the source to the Reuse Water Facility for treatment. One pump will be variable speed @ 40 hp. and the other pump will be fixed speed @ 30 hp. These pumps will be controlled by the level sensor in the pump wet well (downstream of the W disinfection system).

b. Under normal conditions, the variable speed pump would be running based on the level in the pump wet well. When the water level in the pump wet well rises, the fixed speed pump will come on, making the two pumps run simultaneously. When the water demand drops and the level in the pump wet well is back to the previous level, the fixed speed pump will be turned off.

c. When the variable speed pump is down for maintenance, the fixed speed pump will be running by itself. Any excess water pumped to the Reuse Water Facility will then overflow back to the source by an overflow drop box in the system.

2. Microscreens (WASH-SCREEN01 & 02):

a. The purpose of the microscreens is to screen out the fine solids, so as to minimize wear and plugging problems with equipment located downstream, and also to increase the performance of the UV system.

b. The microscreen equipment will be supplied complete by the manufacturer, including backwash pumps, level sensors, and control panels. The microscreening system consists of the screening media and the backwash system to clean the solids trapped on the screening media.

c. The maximum differential head across the screens is 2 feet. The differential is detected by level sensors upstream and downstream of the microscreens. Normally, the screens rotate at a speed of 1.0 rpm. When the differential head increases, the speed controller sends signals to the drive motor to increase the speed of the screens. The speed of the screens range from 1.0 to 2.0 rpm.

d. When the differential head increases, while in the Auto mode, the screen backwash system switches to a higher pressure. The pump for backwash water is a fixed speed pump, but the system has two pressures which are controlled by a pressure valve. The backwash system can also be controlled manually with selection of: High Pressure, Low Pressure, and Auto.

e. The nozzles in the backwash system are self cleaning. They will backwash or purge themselves after a preset period of time.

3. UV Equipment (WASH-WOlA & B.):

a. The Ultraviolet (UV) system is Trojan Technologies, Inc. The system is controlled by the PLC. The control program for the PLC to run this system was written by Trojan. See their equipment

O&M manuals for details.

4. Pump Wet Well Level Sensors (Captive Air):
    a. Level sensors in the pump wet well will be Captive Air. These sensors will control the Influent (supply) pumps upstream and turn off the reuse water pumps.

    b. Captive air level sensors will be provided by the Owner, including the controls, in the PLC enclosure. The contractor is to provide tubing to the PLC enclosure as well as all installation.

5. Reuse Water Discharge Pumps (WASH-WW.EFF01 & 02):
    a. The purpose of the reuse water discharge pumps is to pump reuse water to the plant for use with high pressure, 100 psig is typical. The pumps are vertical turbine type, 250 hp each, and both are variable speed drives (VFD's). The pumps are controlled by the system pressure with the pressure element installed downstream.

    b. Under normal conditions, one pump will be running. When system pressure drops to a certain value, the other pump will come on. The pumps can be set to alternate and both will be turned off when system pressure is at highest or lowest.

    c. Preset system pressure can be manually set at the PLC operator interface.

6. Sump Pumps (WASH-SUMP01 & 02):
    a. The purpose for the sump pumps is to pump backwash water from the microscreens and floor drains to mixed-liquor channels in the secondary clarifiers. The pumps are fixed speed @ 5 hp each, and are submersible. The pumps will be controlled by a captive air level sensors in the sump. During normal conditions, one pump will be running and the other one will serve as a backup.

7. Chlorinator (CHLO-CHLOR05):
    a. This is a new chlorinator, added during this project, to the existing chlorination system. It will be a 500 lbs/day unit. The chlorinator will be controlled by the system flowrate with a magnetic flowmeter at the end of the reuse water system. It will be flow proportional based on the reuse water system flowrate.

    b. The new chlorinator will be located next to the existing chlorinators in the Chlorination Bldg.. and the magnetic flowmeter will be located in the Effluent Pump House. Flowrate signals will be transmitted to the Reuse Water PLC in the Effluent Pump House. This PLC will then communicate with the PLC in the

Chlorination Bldg. The PLC in the Chlorination Bldg. will then send control signals to the chlorinator.

B. The following are ranges and set points for the reuse water system:

1. Influent (Supply) Pumps (VFD, Lead; Fixed Speed, Lag):

   a. These pumps will be controlled by the level (captive air) in the pump wet well.

      Bottom of pump wet well = El 22. 00'
      Emergency overflow in wet well = El 29. 50'
      Min. liquid level req'd in wet well = El 25.75'
      Pump wet well area = 334 square feet

Lead pump (VFD) on	El 28.83'
Lag pump (fixed) on	El 27.50'
Low level alarm on	El 26.50'
Low Level shut-off	El 26.00'
Lag pump off	El 28.50'
High level alarm on	El 29.33'

2. Microscreens:

   a. Most controls on the microscreens will be local, at the control panels. The PLC will have the capability of turning on/off and high level differential monitoring.

   b. Set points for microscreens are included in the Manufacturers' Shop Drawings Section.

3. UV Disinfection System:

   a. The entire UV system will be controlled by the PLC. All set points will be included in the program provided by the Manufacturer.

   b. There will be manual override switches at the channels.

4. Reuse Water Discharge Pumps:

   a. These pumps will be controlled by the system pressure (100 psi, typically). System pressure can be manually set by operators at the operator interface.

      Bottom of pump wet well = E1 22.00'
      Emergency overflow in wet well = El 29.50'
      Min. liquid level req'd in wet well = E1 25.75'
      Pump wet well area = 334 square feet

Delta P From Set System Pressure

Lead pump on	set pressure (100 psi)
Lag pump on	-10 psi delta P or at 80 psi
Low pressure alarm on	at 75 psi
High pressure alarm on	at 115 psi
System shut-off	at 120 psi
System shut-off Liquid level in wet well at EL 25.75'	

5. Sump Pumps:
   a. These pumps will be controlled by liquid level (captive air) in the sump.

      Bottom of sump = El 19.00'
      Top of sump = El 33.00'
      Min liquid level required in sump = 20.17'
      Sump area = 49 square feet

      When floor drain valves are closed:

Lead pump on	El 28.50'
Lead pump off	El 20.25'
Lag pump on	El 29.00'
Lag pump off	El 20.25'

      When floor drain valves are open:

Lead pump on	El.28.50'
Lead pump off	El 20.25'

6. Chlorinator:
   a. Chlorine dosage will be controlled by the reuse water system flow (flow paced control). No chlorine analyzing will be required.

      Chlorine will be used only to provide residual (not disinfect) to eliminate bacteria regrowth problem if it arises. Chlorine may never be used at all. Do not use chlorine without the use of W because chlorine alone will not provide appropriate disinfection in this system.

   b. Automatic control: Set default chlorine dosage at 100 ppd (pounds per day)..