Combe Fill South
O&M Manual

Revised
September 1, 2016

TABLE OF CONTENTS

Table of Contents i

List of Appendices v

List of Figures vi

FOREWORD 1

SITE BACKGROUND 2

PLANT & SITE STRUCTURES 4
- Process Equipment Building 4
- Gas Extraction Building 5
- Exterior Process Tanks 5
- Collection System 5

PROCESS DESCRIPTION 7
- Recovery Wells 7
- Ground Water Force Mains 11
- Ground Water Equalization Tank 13
- Ground Water Equalization Pumps 13
- Plant Drainage Pumping Station 14

CHEMICAL FEED 17
- System A 17
- System B 18
- Supplemental Microbes 20

METALS REMOVAL SYSTEM 22
- Thickened Sludge Tank 22

SEQUENCING BATCH REACTOR(S) 24
- Phase 1: Mix Fill 24
- Phase 2: React Fill 25
- Phase 3: React 26
- Phase 4: Settle 26
- Phase 5: Decant 26
- Phase 6: Waste 27
- Blowers 28
- Decanter 28
- Diffusers 29

Mixers 29
SBR Pumping Systems 30
SBR Screen Displays 30
Changing SBR Timer Settings 31
General SBR System Comments 31
SBR System Alarm Sequence 32

SAND FILTRATION SYSTEM 33
Filtrate Holding Tank 33
Filtrate Pumps 34

CARBON ADSORPTION SYSTEM 35
Carbon Transfer System 36
Carbon Filter Backwash System 36
Carbon Backwash Tank (T-110) 37

SLUDGE MANAGEMENT 38
Sludge Process Description 38
Sludge Conditioning Tank 38
Conditioning Polymer 38
Precoat System 39
Sludge Filter Press 39
Filtrate 42
Filter Press Operation 43

INSTRUMENTATION AND CONTROL SYSTEM 47
Computer System 47
Instrumentation 47
Hand Switches 51

SYSTEM PREPARATION FOR START-UP 55

SAMPLING AND LABORATORY TESTING 58
Sample Collection and Handling Procedures 58
Sample Collection, Handling, and Analysis 58
Tap Sampling 59
SBR Reactor Tank Sampling 59
Outfall Sampling 60
Using a Laboratory Cleaned Sample Bottle 60
Using and ISCO Automatic Sampler 60

MONITORING 61
Process Control Monitoring 61

Compliance Monitoring 61

TREATMENT SYSTEM WASTE STORAGE, TRANSPORTATION & DISPOSAL 62
Spent Carbon 62
Sludge 62
Biological Sludges 62
Metals Sludges 62
Laboratory Wastes 63
Lubricating and Hydraulic Fluids 63
Protective Coatings 63

TREATMENT SYSTEM SHUTDOWN AND STORAGE 65
Shutdown 65
Storage 65
Pre-operational Check 65

PLUMBING SYSTEMS 66
Potable Water 66
Plant Water 66
Plant Process Drains 66
Sanitary Drains 67

ELECTRICAL SYSTEM 68
Three Phase System 68
Power Outage/Failure 69
Single Phase System 70
Heat Trace Schedule 70
Lighting System 70

HEATING AND VENTILATING SYSTEM 72

HEALTH AND SAFETY 76
Right to Know 76
Confined Space Entry 76
Plant Safety 77
Chemical Safety 77
Equipment Safety Requirements 78
Training Requirements 78
Landfill Safety 78

SECURITY 79
Security System Operation 80
Fire Protection 82

Autodialer 82
Programming Phone Numbers 83
Station ID 83
Acknowledging Alarms 83
Alarm Response: Response Time 84
Gas Detection 86

MAINTENANCE MANAGEMENT PROGRAM 88
Description of Maintenance Management Software 88
Nameplate Information 88
Maintenance Schedules 88
Lubrication Schedules 88
Spare Parts Information 88
Calibration Schedules 88

LANDFILL 89
Detention Basins 89
Access Road 90
Fence 90
Passive Venting System 90
Piezometers and Monitoring Wells 91
Cap Maintenance 92
Retention Basins Maintenance 92
Access Road Maintenance 92
Fence Maintenance 92

APPENDICES LIST 94

A Protective Coatings: Profiles and Descriptions

B Engineering Plan Views and Elevations, Structural & Mechanical

C P & ID's, Electrical Details

D Process Material Safety Data Sheets

E Power Conduit and Wire Schedule

F Equipment Manufacturer's List

G Equipment List

H Instrumentation List/Manufacturer/Vendor

K PLC Ladder Diagrams: Filter Press & SBR

L SBR Panel Terminal Strip As-Built

M Control Wiring and Conduit Schedule

N Personal Computer Screen Displays/Alarms

O System Alarm List

P Permits

Q Groundwater Recovery Well Inspection Report - Form

R Equipment Maintenance Data - Instrument Sensors

S Equipment Data Forms and Selected Mfg. O&M Info

T MP-2® Enterprise , Weblink®, Lookout Direct® User's Guides

U Selected System Details, P & ID's, Tables, and Schedules

LIST OF FIGURES

Figure 1 - Treatment Plant Layout 6
Figure 2 Groundwater Extraction Well Locations 7
Figure 3 Recovery Well Pump Control 7
Figure 4 Well Control Panel Interior 8
Figure 5 Well Control Box Exterior 10
Figure 6 Flow Control Manifold, the Meter is on the right and the Actuator and Control Valve are on the left. 13
Figure 7 Combe Fill South Wastewater Treatment Process Flow Schematic 16
Figure 8 Sodium Hydroxide Bulk Storage Tank (T-103)& Metering Pumps (P-111 A/B) 17
Figure 9 Ferric Sulfate Debagger and Mixing on the Right of Platform in Filter Press Room. Filter Pre-coat Debagger and Mixer on Left 17
Figure 10 Process Polymer Pump P-113 is on the Left Sludge Conditioning Polymer Pump P-119 on Right 18
Figure 11 Left to Right, Ammonium Hydroxide, Phosphoric Acid, and Sulfuric Acid Metering Pump Stations 18
Figure 12 Powdered Activated Carbon System Presently Used for Sugar Addition 20
Figure 13 Plate Settler Flocculator and Sludge Rake Each Have Remote Operator Controls as Shown Above. 22
Figure 14 Settler Thickening Tank Sample Ports 23

Pump Stations 18
Figure 12 Powdered Activated Carbon System Presently Used for Sugar Addition 20
Figure 13 Plate Settler Flocculator and Sludge Rake Each Have Remote Operator Controls as Shown Above. 22
Figure 14 Settler Thickening Tank Sample Ports 23
Figure 15 P-107 A & B HOA Switches Between Settler and Pumps in Lower Carbon Room 23
Figure 16 SBR Tank Simplified Plan View 24
Figure 17 SBR Phase 1 Mix Fill 24
Figure 18 SBR Phase 2 React Fix 25
Figure 19 SBR Phase 3 React 26
Figure 20 SBR Phase 4 Settle 26
Figure 21 SBR Phase 5 Decant 27
Figure 22 SBR Phase 6 Waste 27
Figure 23 Sand Filter Process 33
Figure 24 Carbon Unit Valve Manifold To Select Flow configurations. 35
Figure 25 Carbon Transfer Schematic The Backwash Valves Are Closed During Transfer. 36
Figure 26 Carbon Backwash Tank Flow Schematic 37
Figure 27 Sludge Management Process Schematic 41
Figure 28 Sludge Press Valves. Six at the Head End and two at the Tail End Near D.E. Tank. 43

FOREWORD

In accordance with USEPA and NJDEP regulations this manual provides the facility staff with site information, guidelines, standard operating procedures, and references necessary to effectively operate the treatment systems. It is supplemented with appendices that are referenced throughout. The appendices are listed in the Table of Contents . The reader is encouraged to review the list.

This manual presents descriptions for **normal operating conditions**. For troubleshooting and repair guidance, the appropriate manufacturer's literature should be consulted. These equipment manuals are contained in twenty-four numbered binders and are located on the plant library shelf.

BINDER No.	EQUIPMENT or PROCESS COMPONENT
1	Filter Press
2	Recovery Well Specifications
3	Grundfos Well Pumps
4	Plant Drainage Pump Station
5	Plumbing Fixtures and Back Flow Preventer
6	ISCO Sampler
7	Heating and Ventilation
8	Polymer Mixers
9	Sludge Tank and Sugar Mixers
10	Air Compressor
11	Plate Srettler
12	Sand Filters
13	WT Ferric Sulfate and Sodium Hydroxide Feed Pumps
14	LMI Chemical Feed Pumps
15	Process Pumps 101, 104, 107, and 109
16	Pump Variable Frequency Drives (VFD) 104 & 106
17	Carbon Columns
18	Carbon Columns (continued)
19	Sequencing Batch Reactor (SBR) Operation & Maintenance
20	SBR Drawings
21	Debaggers: Ferric Sulfate, Diatomaceous Earth, Carbon
22	MCC Controls
23	(Reserved)
24	Manual Valves

SITE BACKGROUND

The Combe Fill South Landfill is located north of Parker Road in Chester and Washington Townships, Morris County, New Jersey. The inactive landfill consists of three separate disposal areas covering approximately sixty-five (65) acres. Tanners Brook is located to the northwest of the site and flows northeast towards its junction with the Black River. Trout Brook is located to the southeast of the site and flows southeast toward its junction with the Lamington River. Trout Brook receives the discharge from the ground water treatment facility. Land use in the vicinity of the landfill consists primarily of low-density residential housing among large parcels of cleared rolling hills. A few commercial establishments and a local nursery school are located on Parker Road near the landfill. A series of county and state run park segments, including those of the Black River County Park and Hacklebarney State Park, lie to the east and south of the site along the Black River. The aquifer system that underlies and surrounds the Combe Fill South Landfill consists of fractured granitic bedrock and an overlying layer of soil and saprolite.

The Combe Fill South Landfill accepted municipal and industrial wastes from the 1940's through 1981. Approximately five million cubic yards of waste materials are buried within the Combe Fill South Landfill. The majority of the waste includes household waste and non-hazardous industrial waste. The Combe Fill South Landfill was listed on the National Priority List in September, 1983. Subsequently, a Remedial Investigation/Feasibility Study (RIFS) was conducted from 1984 through 1985 under the direction of the New Jersey Department of Environmental Protection (NJDEP). The RIFS conducted at the site revealed the presence of a wide range of contaminants consistent with the known uses of the site and the variety of wastes accepted. The presence of volatile organic compounds has been identified within both the shallow and deep aquifer at the site. Additionally, contamination has been detected within nearby residential wells.

A Record of Decision (ROD) was signed by USEPA on September 29, 1986 and identified the following areas to be encompassed within the Remedial Design: (1)an active gas collection and treatment system for methane and any other landfill generated gases; (2)expanded environmental monitoring of water, air, soils, and leachate; (3) a multilayered cap that covers the landfill areas and extends under the utility company right of way; (4) pumping and on-site treatment of shallow ground water with discharge to Trout Brook; (5) surface water controls to accommodate runoff from both normal precipitation and severe storms; (6) security fencing, an access road and general site preparation.

In July 1987, the NJDEP completed the Remedial Design of the Combe Fill South Landfill as mandated within the ROD. This work included the following:

> An engineered landfill cap system to minimize infiltration into the landfill including a cap drainage system incorporating pipe drains within the cap drainage layer, and a vegetative cover;

A shallow ground water recovery and treatment system;

An active gas collection and extraction system, gas treatment by flaring and a gas condensate collection and treatment system;

A site access road and site perimeter road;

A security fence enclosing the site;

Off-site ground water monitoring wells

The Combe Fill South Landfill treatment facilities commenced processing of ground water in June 1997. Landfill gas produced at the site was found to be minimal therefore the active gas collection and extraction system, and the gas condensate collection system was not installed.

PLANT & SITE STRUCTURES

The Process Equipment Building (PEB) and the Gas Extraction Building (GEB) were fabricated by Varco-Pruden Buildings according to design shop drawings to meet applicable codes, standards, specifications and regulatory requirements. If service or repair of the buildings is required, contact Varco-Pruden Buildings at (901) 767-5910 for a list of authorized service representatives.

Process Equipment Building

The Process Equipment Building is a steel framed, enclosed and heated structure with aluminum siding and roof panels to house the following components and systems:

Metals removal system	Continuous upflow sand filters
Carbon adsorption units	Intermediate process tanks
Hydropneumatic tanks	Process pumps
Process blowers	Chemical storage and feed equipment (partial)
Sludge filter press	Plant water systems
Power distribution and control	Storage of chemicals
Plant control room	Office space
Control testing laboratory	Lavatory/shower/locker room
Miscellaneous storage	

The southern half of the PEB houses the blower room, the plant water system and liquid treatment process systems including the metals removal system, continuous upflow sand filters, filtrate holding tank, sludge conditioning tank and carbon adsorption units.

The northern half of the building houses the sludge filter press, potable water system, air compressor, control room, electrical room, laboratory, lavatory/shower/locker room, equipment storage and some of the facility's chemical feed equipment (ferric sulfate system, currently not being used, and storage, filter press pre-coat system and storage, process and conditioning polymer feed systems).

The control room equipment includes the main control panel, SBR control panel, autodialer, PEB security panel, security intrinsic barrier panel, economy current and voltage alarm panel, turbidity

meter digital readout display, desks with personal computers and printer, room air conditioner and telephones.

Gas Extraction Building

The gas extraction building (GEB) is located adjacent to the PEB to house the following items in a centrally located, secure, weather-proof and explosion-proof environment: sodium hydroxide storage tank and pumping system; sugar storage, debagger, mix tank, and pumping system,; chemical storage and feed equipment systems for ammonium hydroxide (currently not in use), phosphoric and sulfuric acid (currently not in use); and high pressure carbon dioxide fire extinguishing system.

The GEB building is a pre-engineered metal structure designed with blow-off panels in case of an explosion. According to the New Jersey Uniform Building Code, which references the BOCA National Building Code, this structure is classified as "Use Group "H" - High Hazard" (Section 306.1 of BOCA). Both BOCA and the New Jersey Uniform Building Code (Section 1002.7) require that buildings classified in Use Group "H" have an automatic fire suppression system, such as a carbon dioxide fire suppression system. The building should be routinely checked to maintain the various controls and items housed in the building. The fire suppression (oxygen-displacing carbon dioxide) system should be routinely monitored to insure it remains activated.

Exterior Process Tanks

Between the Process Equipment Building and the Gas Extraction Building are four steel tanks. The two largest tanks each contain a biological treatment process called Sequencing Batch Reactor (SBR). The tank next to the two SBR's is the Groundwater Equalization Tank, and next to that tank, at the back of the plant is the plant effluent holding tank. The effluent holding tank is called the Filter Backwash Tank since the clean process effluent water is used to backwash two carbon adsorption filters located in the PEB.

Collection System

Ground water within the Combe Fill South Landfill is collected by a shallow ground water collection and conveyance system. Ground water is collected from a series of nineteen (19) wells with submersible pumps. This recovered ground water contains "leachate" or water which has been directly exposed to landfilled materials. The ground water well pump controls, timers and valving are located locally at each well. The ground water collected from the wells is pumped to a force main header which discharges to the ground water equalization tank at the treatment plant.

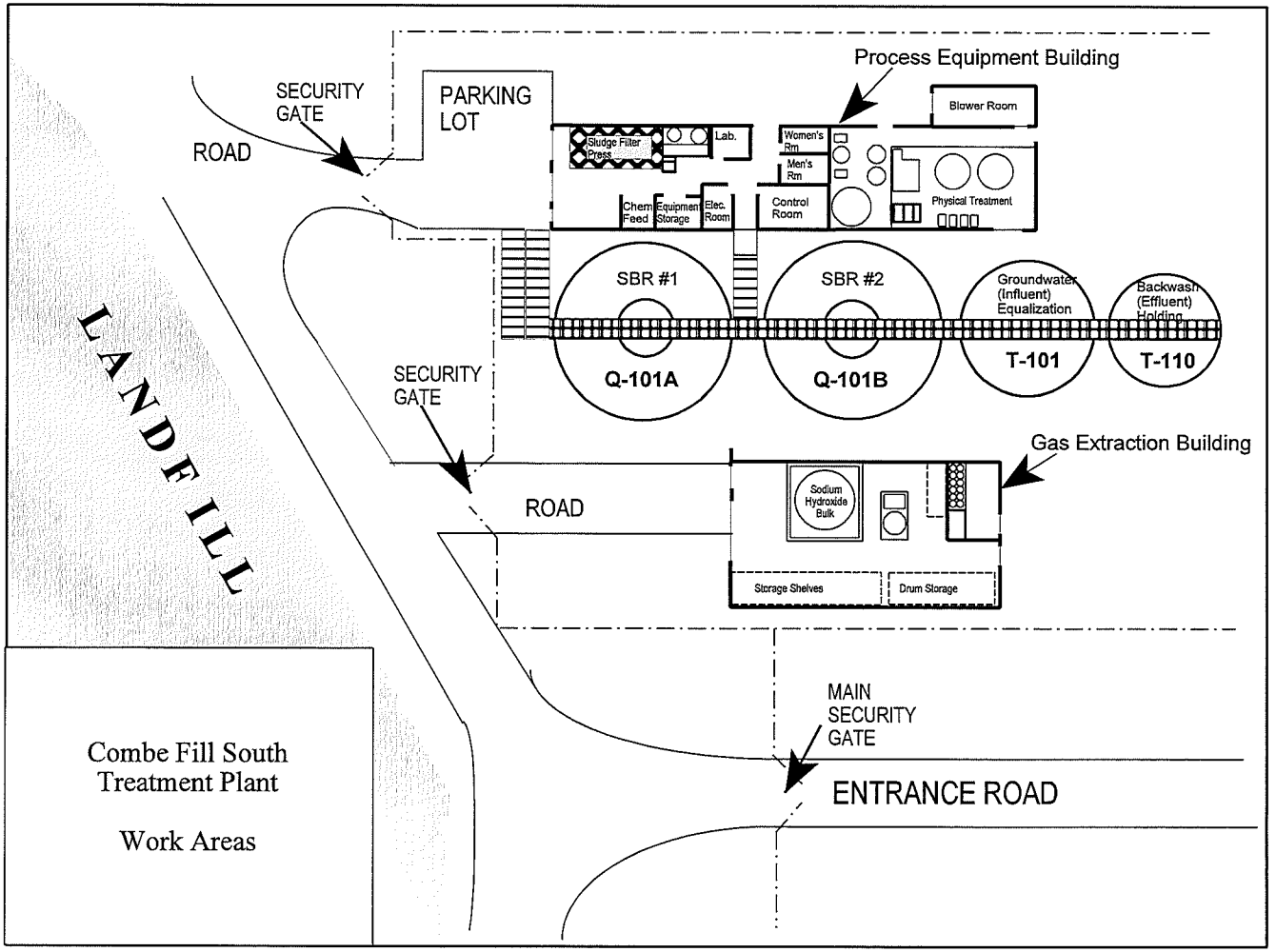

Figure 1 - Treatment Plant Layout

PROCESS DESCRIPTION

The process begins with the groundwater collection system, which consists of a series of recovery wells which are located along the perimeter of the landfill and are designed to collect the ground water which has been exposed to landfill waste. The recovery wells pump through connected piping to the force main headers. These headers combine to discharge into the Ground Water Equalization Tank (T-101), which is located at the front end of the treatment facility. At this point the treatment process begins. The four-step process is : heavy metals removal, biological treatment to remove dissolved organics and ammonia, filtration to remove suspended solids, and carbon adsorption to complete the organic removal.

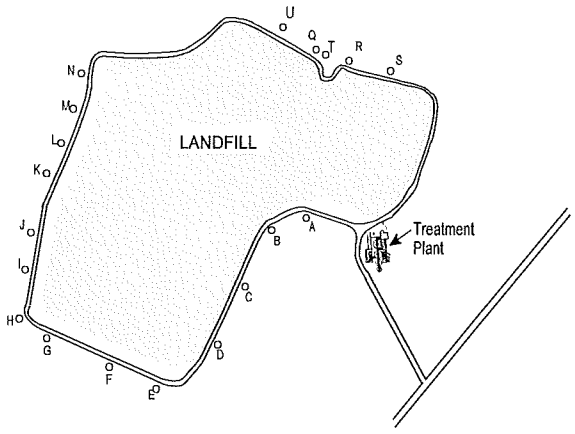

Figure 2 Groundwater Extraction Well Locations

Recovery Wells

Each of the nineteen (19) Recovery Wells are controlled at the well head. There is a capacitance type water level sensor in each well and a control unit in the control cabinet at each well. (See Figures 3 and 4.)

There are three setpoints for each well as shown in Figure 3 and a timer. Two of the setpoints, (#1 and #3) determine the "pump off" and "pump on" water levels in the well

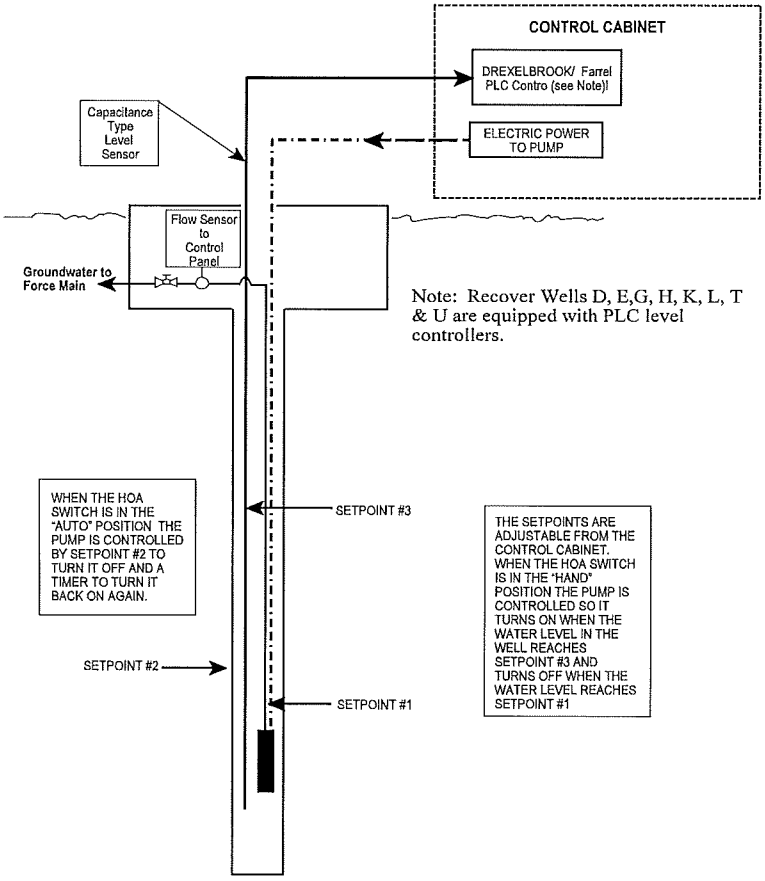

Figure 3 Recovery Well Pump Control

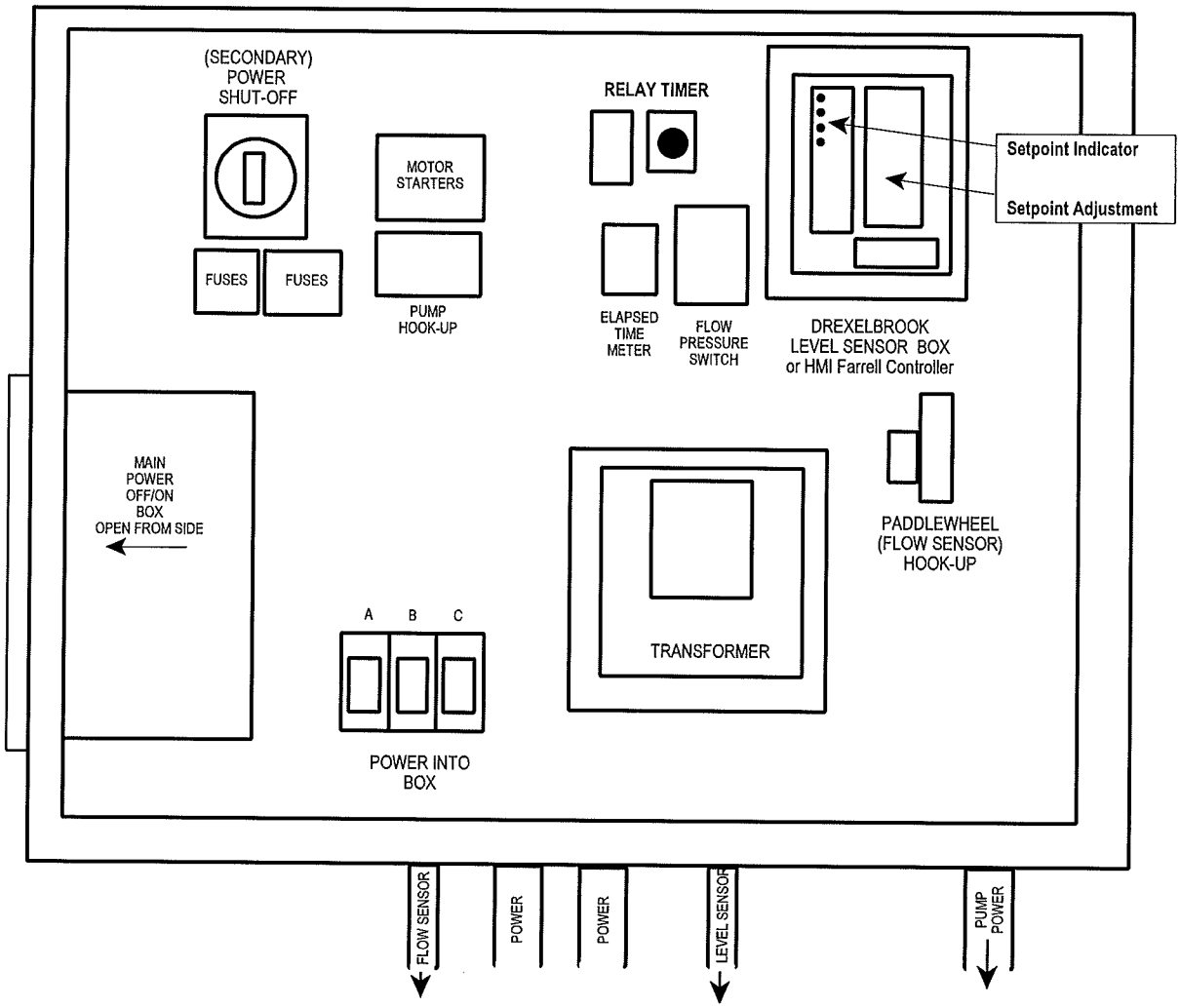

Figure 4 Well Control Panel Interior

when the hand-off-auto (HOA) switch on the front of the control cabinet is in the "Auto" position. (See Figure 5.) When the switch is in the "Hand" position the pump will turn on after an operator selected time on the relay timer inside the cabinet and will turn off when the water level reaches the Setpoint #2 level. The setpoints may be adjusted using a nonconductive plastic hex-key. The paddlewheel flow sensors are located in a concrete vault underground. The flowmeter indicator and totalizer are on the outside of the control cabinet behind the small access door. The pumps are sized to handle slightly more than design flow, (except for wells J, K, L and N). Each pump can be throttled back using the valve in the well vault to achieve design starts/stops (designed for 2-3/hr; maximum 6/hr). However it is better to make effective use of the setpoints and timer. Full flow through the riser pipe can reduce the rate of scale build-up from the groundwater. For wells J, K, L and N the design pump flow rate is below the estimated well yield and should be set at the design flow of 25 gpm. To maximize pump life, all pumps are adjusted via the ball valve in the discharge line to achieve a particular design flow for that well

pump to maximize pump life. Each recovery well pump has a Timer Controller (KC-GW (A through S) that acts as backup to the level controls (LIC-GW (A thru S)) to prevent excessive start/stops. The timers are set so that once a pump draws down and shuts off, the pump cannot turn on for a minimum of 10 minutes. The flows will decrease over time and therefore the pumping rates and control elevations will require periodic adjustment. Since the pumps can only be adjusted within the operating range of the specific pump, some of the pumps may have to be replaced as the flows decrease.

The recovery wells are constructed of 6-inch I.D. stainless steel with well screen and riser. Stainless steel was selected because it provides increased corrosion resistance. These wells are installed in 12-inch borings with the three inch annular space being filled with filter pack Morie sand #00 to a minimum of two feet above the top of the screen. The annulus is lined with filter pack to enhance ground water recovery and to protect the recovery well from infiltration of fine particles. Since a 90 percent retained grain size for Morie #00 is 0.012 inch, a 0.010 inch screen size is appropriate for the recovery wells. Screening the wells enhances ground water recovery.

The submersible pumps are controlled by level sensors which were installed with high and low level switches, redundant low water shutoff, and an interlock to stop the pumps when there are high water levels in the Ground Water Equalization Tank (T-101). **NOTE:** If the groundwater recovery wells are disabled due to high level in tank T-101, the loops must be restarted at the MCC-1 and each well checked. Once the well recharges to the preset water level and the equalization tank can accept the volume of water, the level sensor or timer will reactivate the pump.

Typical Operation

Turn on 480V Power at MCC #1

Manual Operation (all wells)

Turn local switch to hand; if water level is above run level the pump will start. Pumps will operate until water level reaches shutoff level.

Exterior of Well Control Cabinet with small door open

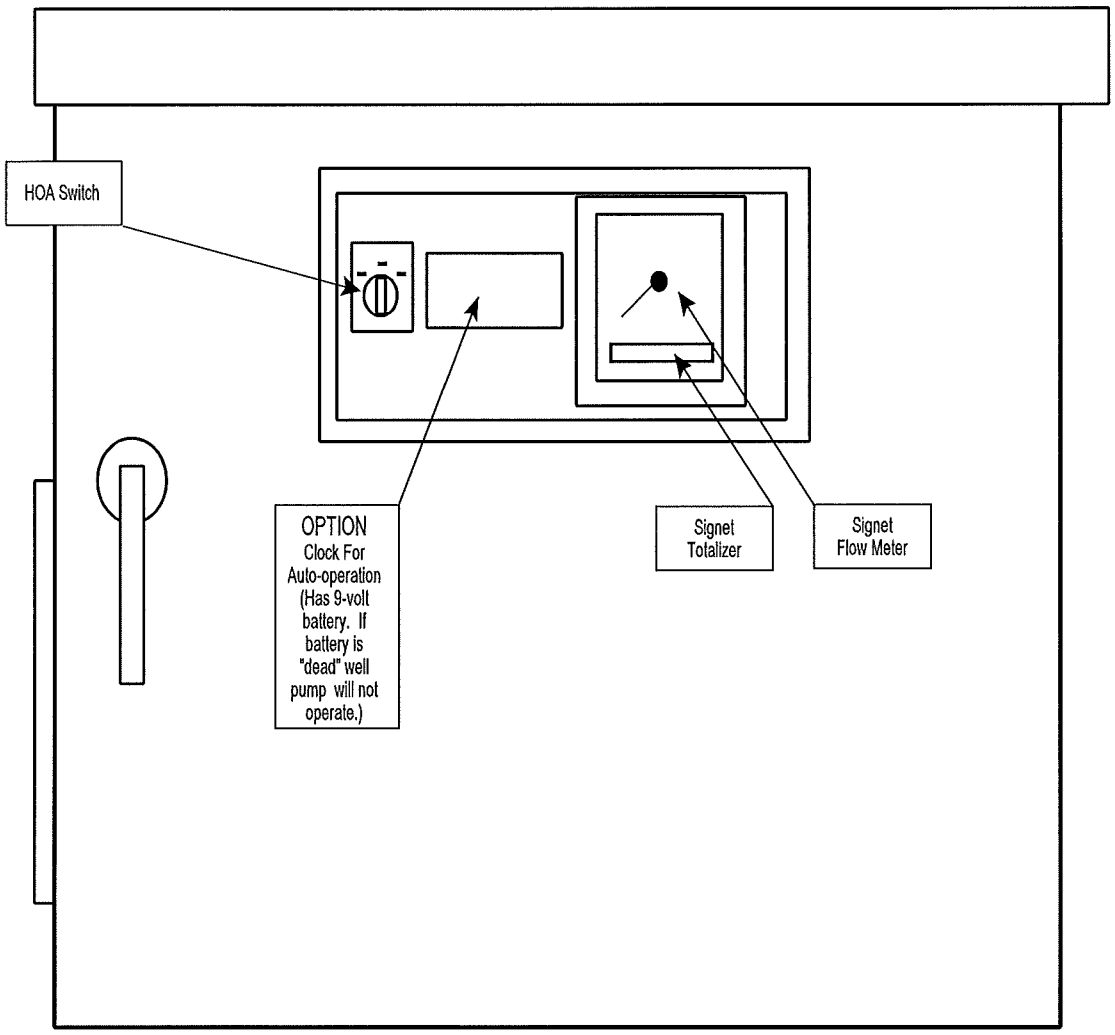

Figure 5 Well Control Box Exterior

Automatic Operation

- Turn switch to automatic, if well level is above low level and the programmable timer calls for the pump to operate, the pump will start. **NOTE: All of the timers have been by-passed to expedite restarting after power failures**. The pump will run until the low level switch opens after a time delay as controlled by timing relay (CR1-TD1, 1 minute min.). This keeps the pump in operation after the low level switch opens.
- To stop pumps turn hand-off-automatic switch to off. If it is a long term shutdown, open 480V disconnect switch.
- Weekly, perform the tasks as defined in the maintenance management program.

Ground Water Force Mains

The ground water force mains provide a conduit through which the contaminated ground water will flow to the treatment facility. They are constructed of HDPE and combine prior to discharge into the Ground Water Equalization Tank (T-101) at the front end of the treatment plant. Also included in the force main system are five (5) combination air release/vacuum valves which act to minimize the amount of air in the collection system lines in order to maintain optimum pump performance. These air valves are housed inside precast concrete vaults with manholes which allow access to the valves. Each size ground water recovery force main has a corresponding size air release/vacuum valve. They are as follows:

- ½" air/vacuum valve for force main less than or equal to 2"
- 1" air/vacuum valve for force mains greater than 2" and less than or equal to 6"
- 2" air/vacuum valve for force mains equal to 8"

Typical Operation

Visually inspect any exposed parts of the system for breaks, bad connections, and loose fittings. Air Release/Vacuum valves - remove manhole cover and visually inspect valve for significant water release and/or other signs of degradation. Weekly, inspect along the pipeline observing wet and eroded areas, check air release/vacuum valves, look for animal intrusion and complete inspection forms. Also refer to the maintenance management program for further details.

Table 1. Combe Fill South Landfill Recovery Well Summary

Well Designation	Well Depth (Feet)	Pump Rating (GPM)	Pump Number of Stages	Motor HP
A	43	10	8	1/2
B	62	10	11	3/4
C	39	5	8	1/2
D	47	10	5	1/2
E	42	10	5	1/2
F	18	5	5	1/2
G	32	10	5	1/2
H	25	5	5	1/2
I	42	10	11	3/4
J	43	25	8	1 1/2
K	52	25	8	1 1/2
L	60	25	8	1 1/2
M	43	16	7	3/4
N	60	25	8	1 1/2
Q	58	10	8	1/2
R	56	10	8	1/2
S	62	10	8	1/2
T	115	60	9	5
U	89	10	8	3/4

Ground Water Equalization Tank

The Ground Water Equalization Tank (T-101) is a circular, above grade, open top, aerated, welded steel tank. The purpose of this tank is to: provide short-term storage; dampen the effects on downstream processes resulting from variations in loadings and flow; and provide a location to add and mix sodium hydroxide. The capacity of this 17-foot high, 34-foot diameter tank with 1-foot freeboard is 100,000 gallons. It was sized in order to provide 12 hours of ground water detention time at the design flow rate of 170,000 gpd. This allows for batch (one shift) operation of the treatment facility as flows reduce over time. Mixing of T101 is accomplished using air from the plant aeration blower delivered through a PVC header submerged in T101. The mixing is necessary to prevent solids settling, septicity, and NaOH addition for pH adjustment. Sodium hydroxide (NaOH) is added to increase the pH of the ground water thereby reducing the solubility of heavy metals in the groundwater for the metals removal process.

The Groundwater Equalization Tank's effluent is pumped by one of two constant speed pumps (P-101 A/B), to the downstream metals removal process. The flow rate is measured by a magnetic flow meter that transmits a signal to the programmable logic controller (PLC) in the main control panel (MCP.) The PLC returns a signal to a valve actuator that adjusts the valve to allow the desired flow. The desired flow is selected by the operator and entered at the computer in the Control Room. The equalization tank is fitted with level indicators; high level alarms, and switches; and an overflow pipe that directs water back to the plant drainage pump station.

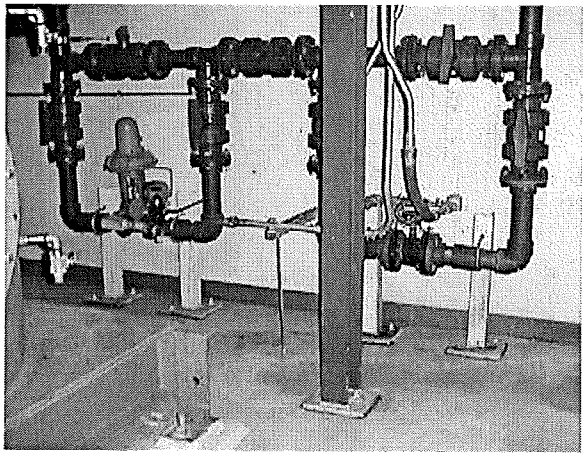

Figure 6 Original Flow Control Manifold, the Meter is on the right and the Actuator and Control Valve are on the left. Functionally equivalent to currwent setup

Typical Operation

Turn on 480V power at MCC #1
When the tank volume level in tank T-101 has reached Level Sensor (LE-01), turn on Blower B-102 located in the Plant Blower Room. (This will mix influent groundwater in T101.) Ground water from the recovery well collection system enters T-101 until a high level shut off stops the recovery well pumps. The flow out of tank T-101 should be balanced with the total of groundwater flow plus all flows that come from the Plant Drainage Pumping Station. Balancing the flow rate will prevent unnecessary shutdowns.

Ground Water Equalization Pumps

The Ground Water Equalization Pumps (P-101 A/B) transfer ground water from the Ground Water Equalization Tank (T-101) to the Metals Removal Unit (M-101). These pumps are

horizontal, centrifugal pumps capable of pumping 120 gpm with 5 hp at 1725 rpm maximum speed. The system has been provided with 100% standby capacity. The term "100% standby capacity" refers to the fact that there are two identical pumps that alternate responsibility for the same function to ensure even wear. Additionally, in the event of a failure there will be a backup.

These pumps are manufactured by Berkeley (Model #B2-1/2ZRMS) while the motors are manufactured by U.S. Electric (Model #GS0050). The equipment specifics can be found in Appendix G and the manufacturer's O & M manuals.

Typical Operation

Turn on 480V power at MCC #1. For automatic operation: the equalization tank level will rise to the "pump-on" float setting, 25% (4.0'), initiating pump P-101 A/B. If the influent flow to the equalization tank is less than the pumping rate, the level will drop until the "pump-off" float setting is reached, 13% (2.0'), and the pump will shut off. When the low-low level is reached, a redundant "pump-stop" is initiated. If the influent flow to the equalization tank is greater than the pumping rate, the level will rise to the high level setting and a "high level" alarm is actuated. When a high level alarm is actuated for tank T-101, the ground water recovery pumps turn off via the ground water pump loop output contactors. When each pump P-101 A or B reaches a "low level pump-stop", it alternates lead-lag operation with the opposite pump.
Pump P-101 A and B is interlocked with the level at the SBR influent holding tank. If the tank level rises in the SBR influent holding tank to the "high level" float setting, a "high level" alarm is actuated and pump P-101 A or B turn off. Daily, examine pumps and complete inspection forms and perform required maintenance as set forth in the maintenance management program.

For manual operation (**not typical**): turn hand/off/automatic switch located at MCC #1, to the hand position. Pump will stop on the low level set point (13% level) in T-101. The SBR Influent Tank interlock would not shut down P-101 A/B; therefore, the SBR Influent Tank could overflow. To stop pump, turn hand/off/automatic switch to off.

Plant Drainage Pumping Station

The Plant Drainage Pumping Station (PDPS) receives: all treatment process overflows; in-plant drainage; sand filter reject water; and sludge filter press filtrate. Any treatment process water that spills, overflows, or leaks to the floor, including water used to clean equipment, is collected by a series of floor drains and flows to the PDPS. Recycle streams in the GWTF are also routed to this pump station The pumps (P-124 A/B) transfer drainage water to the Ground Water Equalization Tank (T-101). The Pump Station also provides limited emergency storage capacity for any overflows that might occur. Equipment specifics can be found in manufacturer's O & M manuals.

Typical Operation

- Turn on 480V power at MCC #1

Manual Operation

- Turn disable/off/enable switch, located inside the stainless steel enclosure, adjacent to the pump station, to the enable position.
- Pump will operate until a "pump-off" low level is reached or a high level in T-101 is reached.
- To stop pump, turn hand/off/automatic switch to off.

Automatic Operation

- Turn disable/off/enable switch, located in the stainless steel enclosure to disable.
- When a "pump-on" level is reached, either pump will operate.
- Alarms indicating low and high levels will alert operator.
- Pumps alternate by a lag/lead pump selector when all pumps have stopped.
- Pump will shut off after high level in T-101 or a low level shutoff in the plant drainage pumping station is reached.
- If a long-term shutdown is desired, open 480V disconnect switch.
- Daily, examine the pump station and complete inspection form as defined in the maintenance management program.

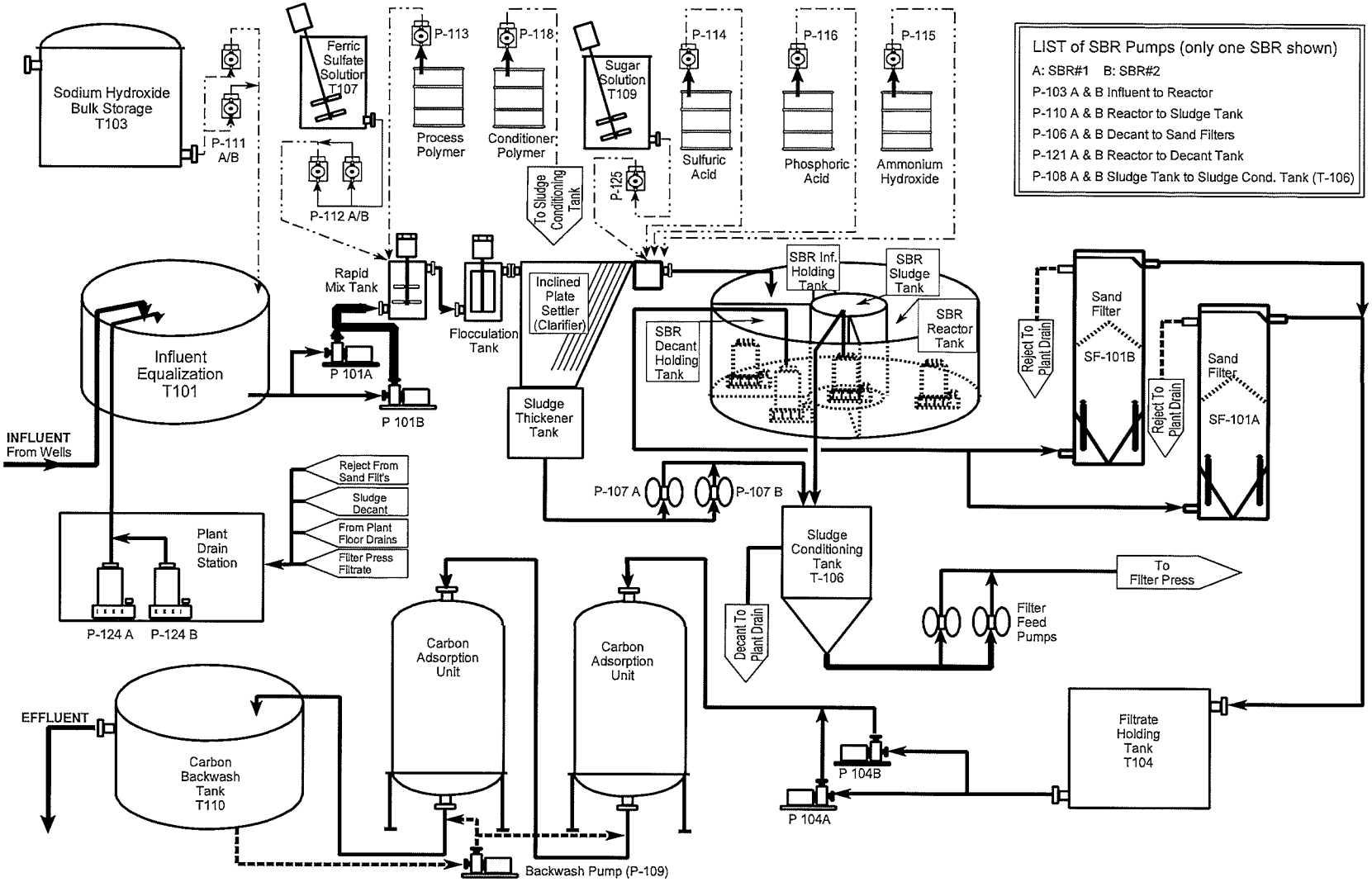

Figure 7 Combe Fill South Wastewater Treatment Process Flow Schematic

CHEMICAL FEED

System A- (To enhance metals removal.)

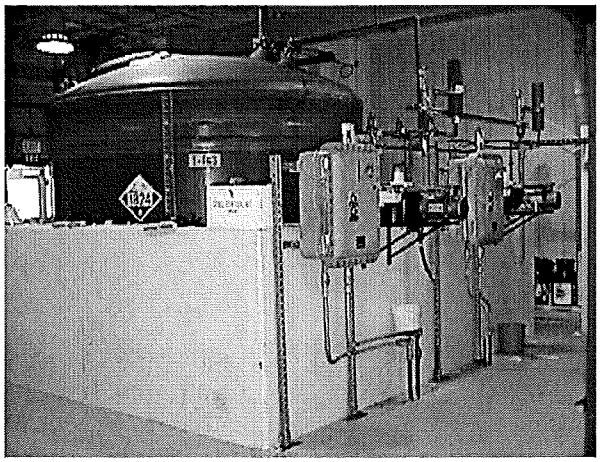

Figure 8 Sodium Hydroxide Bulk Storage Tank (T-103)& Metering Pumps (P-111 A/B)

Sodium Hydroxide: The ground water pH is increased in the Ground Water Equalization Tank (T-101) with 50 % sodium hydroxide which is pumped from the Sodium Hydroxide Storage Tank (T-103) via Sodium Hydroxide Metering Pumps (P-111A/B). Tank T-103 is a 4000-gallon capacity tank located in the GEB. The tank is enclosed by a 54" high by 12" thick retaining wall to capture overflows, leaks or possible spills. Pumps P-111 A/B are controlled by variable frequency drives and the pumping rate is based on a signal from pH Sensing Electrode (AE-01) which is located in the pipe between P-101 A/B and the Plate Settler. The incoming ground water pH range will likely be 6.0 - 6.5 and needs to be increased to a target pH of 8.5. Increasing the pH facilitates the reactions necessary for metal hydroxide formation (co-precipitation of metals). When the pH is above the target value, the pump will decrease its speed and in effect reduce the pH. Conversely, when the pH is below the target value, the pump will increase its speed raising the ground water pH. Fifty percent sodium hydroxide is delivered by truck in bulk and stored in tank T-103. The pumping system is explosion proof to meet the building code.

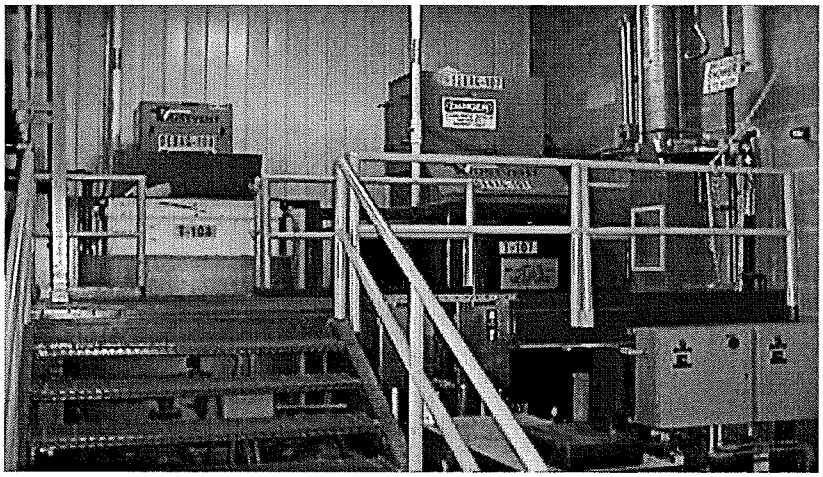

Figure 9 Out of Service Ferric Sulfate Debagger and Mixing on the Right of Platform in Filter Press Room. Filter Pre-coat Debagger and Mixer on Left

Ferric Sulfate: Fifty pound bags of Ferri Floc, containing ferric sulfate ($Fe_2(SO_4)_3$), are added to the dustless debagger (Debag-107) attached above the out of service Ferric Sulfate Mix Tank (T-107) and are mixed with plant water to form a 1 percent solution. An external, portable Lightnin Vektor mixer with a quill shaft and impeller provides the mixing.

Currently not being used Process Polymer: Since metal hydroxide precipitates are often a colloidal type of suspended solid, a process polymer is added to the flocculation tank via the Process Polymer Pump (P-113). The polymer, Magnifloc 1820A Flocculant (CYTEC Industries), is an anionic polyacrylamide in water-in-oil emulsion polymer which is mixed with the ground water and acts to destabilize the surface charge on the co-precipitated metal hydroxides and promotes coagulation, flocculation and settling of the metal sludge particles. A Stranco polymer feed system is installed as a unit with feed connections for polymer and plant water to achieve proper polymer activation and concentrations. Included in this unit are a mixing/aging chamber, rotometer, and a flowmeter. (See Manufacturer's O & M Manual). The proper pumping rate is based on jar test data on process water taken from the flocculation tank flash mixer. The internal speed pumping rate setting (strokes per minute) is calculated from the value of the most effective jar test dosage rate value in parts per million. Using the specifications from Process Polymer Pump (P-113) the equation is:

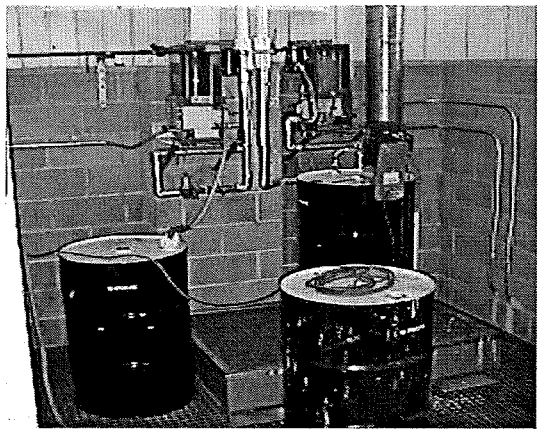

Figure 10 Currently not being used Process Polymer Pump P-113 is on the Left Sludge Currently not being used Conditioning Polymer Pump P-119 on Right

$$\textit{Internal Setting (strokes per minute)} = 0.015\ \frac{\textit{ppm x process flow rate (gpm)}}{\textit{polymer specific gravity}}$$

The
pump and mixer settings are 100% stroke 0.4 spm internal speed and 16 gph mixing water rate. The polymer drum is equipped with a mixer to keep the product from separating.

System B- (For pH adjustment and to add nutrients for biological treatment.)

A chemical feed system is needed to promote microorganism growth since these nutrient chemicals may not be found in desired concentrations (i.e., proportion to organic loading) in the landfill ground water. The nutrient chemical feed addition occurs at the end of the metals removal process -- the inclined

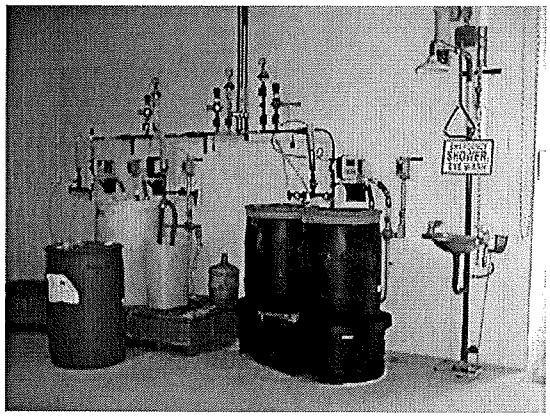

Figure 11 Left to Right, Ammonium Hydroxide (currently not in use), Phosphoric Acid, and Sulfuric Acid (also currently not in use) Metering Pump Stations

plate settler effluent box. Nutrient chemicals are provided in the form of phosphoric acid (H_3-PO_4), ammonium hydroxide (NH_4-OH), and sugar. Sulfuric acid (H_2SO_4) is added (if needed) for pH adjustment. Each of these chemicals and associated explosion-proof pumping systems are located in the GEB and enter the PEB through a 6" PVC insulated and heat traced containment pipe. These chemicals are provided from the supplier in 55 gallon drums and are labeled with pertinent reactivity, spill/leak prevention, safety and handling information. Chemical drums are set on elevated platforms and drumsticks are connected to respective pumps for drum suction.

Phosphoric Acid: Phosphorus, in the form of phosphoric acid (H_3-PO_4), is a chemical nutrient that is needed by the aerobic microbes, and its addition is based upon an expected five day Biological Oxygen Demand (BOD_5) concentration of 100 mg/l, a BOD_5 to Phosphorus ratio of 100:1, and a hydraulic retention period of 24 hours. One gallon of 25% phosphoric acid contains 570,900 mg of phosphorus. The phosphoric acid is added by Phosphoric Acid Feed Pump (P-116) which is manually controlled for speed via local speed control potentiometers. Adjust the pump stroke length based upon the ground water BOD_5 values. This pump is permitted to operate only when Equalization Pumps P-101 A or B is in operation
Ammonium Hydroxide: Nitrogen, in the form of Ammonium Hydroxide (NH_4-OH), is a chemical nutrient needed by the aerobic microbes, and its addition is based on a BOD_5 concentration of 100 mg/l, a BOD_5 to Nitrogen ratio of 20:1, and a hydraulic retention period of 24 hours. One gallon of 30% ammonium hydroxide contains 0.83 kg (830,000 mg) of nitrogen. Ammonium hydroxide is added by Ammonium Hydroxide Feed Pump (P-115) which is manually controlled for speed via local speed potentiometers. There may be some nitrogen in the ground water leachate and the supplemental addition of ammonium hydroxide is based on the BOD_5 values. Adjust the pump stroke length based upon the BOD_5 values.

Sulfuric Acid: Sulfuric acid, ($H_2(SO_4)$), is added, as needed, to the metals removal effluent for pH adjustment. The metals removal effluent has a pH of 8.5 and needs to be neutralized to a target pH of 7.5 for the biological treatment process. Ninety-three percent (93%) sulfuric acid is added by a variable speed metering pump, Sulfuric Acid Feed Pump (P-114), which is governed by a Micropace analog to digital converter module for pump speed control. The pump output is tailored using the control module input signal and by manually setting the pump stroke length adjustment to achieve the target value.

The pump feed rate is controlled by a signal from the pH meter AE-02 located in the influent pipe between the Plate Settler and the SBR Influent Tank. If the measured pH is less than the selected target value, the P-114 speed is slowed down. If the measured pH is greater than the selected value, P-114 transfers sulfuric acid at a faster rate. Indication of pH values for the SBR influent appears on the PLC graphics screen #9 "Sequencing Batch Reactor" . Caution, P-114 will operate even when the Groundwater Equalization Pumps P-101 A/B are not.

Sugar: What was originally the Powdered Activated Carbon system is now used to add sugar solution to the SBR Influent water. It is located in the GEB and includes: a mixer, mix tank and a pumping system. There is also a dust controlling debagger that is not used since there is no

dusting problem with the granular sugar. The sugar solution enters the PEB via the PAC feed pipe in the 6" PVC containment pipe discussed above. The solution is pumped by a 7 gph single diaphragm chemical metering pump (P-125.) P-125 replaces the original PAC pump (P-119.) The feed rate is controlled at the pump to maintain a 50 mg/l sugar concentration in the sequencing batch reactor influent tank water

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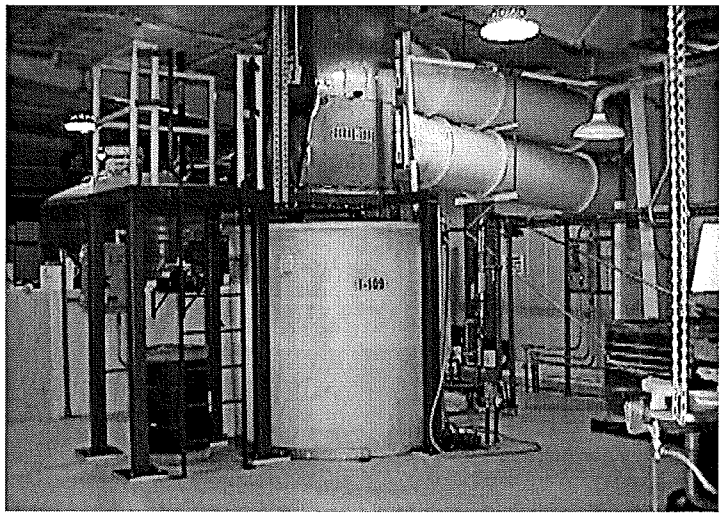

Figure 12 Powdered Activated Carbon System Presently Used for Sugar Addition

The following paragraph is included in the event powered activated carbon is needed.

> Powdered Activated Carbon (PAC): Powdered Activated Carbon (PAC) is optionally added to the metals removal effluent to provide enhanced flexibility for treatment of unusually high strength ground water. A sudden increased shift in the strength of the ground water is determined by elevated values for parameters of influent BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand) and TOC (Total Organic Carbon). Also, treatability studies using PAC additions show improved nitrification especially during cold weather and during shortened aeration times. PAC is added to the PAC Tank (T-109) using a dustless debagger system(Debag-109) which captures fugitive dust as the operator manually loads the tank. Debag-109 consists of a stainless steel unit with an explosion proof motor with venting ductwork to the exterior of the GEB. PAC is mixed with plant water by a Lightnin Vector impeller mixer to make a 10% PAC slurry (approximately 1 lb PAC/gal water). Pilot testing has shown optimum PAC addition to be 1.25 mg/L or 200 lb/day (239-240 gallons/day of slurry). PAC slurry is pumped from tank T-109 to the metals removal effluent box via Powdered Activated Carbon Pump (P-119). Operation of the pump in the automatic mode is controlled by the SBR control panel: During the fill phase of either SBR #1 or SBR #2, the PAC pump operates for **10** minutes feeding PAC slurry to the effluent box of the inclined plate settler. Alternatively, PAC may be added manually to the appropriate SBR reactor tank when necessary. Generally, one pound of PAC per day is added to the reactor when a significant reduction in nitrification is observed.

Supplemental Microbes:

It may be necessary to supplement the microbial population in the reactor with bacterial cultures. Products distributed by Sybron Chemicals, Inc. , such as BI-CHEM 1010 N and BI-CHEM DC CWT Blend, may be used for this purpose. Each product is described below.

BI-CHEM 1010 N is a liquid blend of nitrifying strains Nitrosomonas and Nitrobacter. These nitrifying strains reduce ammonium ions (NH4) and nitrite ions (NO2) to nitrate ions (NO3). According to Sybron Chemicals, Inc. literature, BI-CHEM 1010N use offers the following benefits:

- Enhances recovery from nitrification upsets caused by organic or inhibitory shocks, hydraulic

overloads, or sudden loss;

- Improves nitrification in under performing of under designed biological treatment systems;
- Provides a source of nitrifying seed material as start-up;
- Reduces chlorine consumption caused by nitrite accumulation in the system; and
  Allows equipment to be retrofitted for ammonium ion removal in low BOD streams.

BI-CHEM 1010N is available in a liquid concentrate form or in a regular liquid form. The liquid concentrate has a shelf life of 4 to 8 months and is required to be refrigerated. The regular liquid has a shelf life of 2 to 4 months and should be stored in a cool environment. The bacteria in either formulation performs within a pH range of 6.5 to 8.5. Optimum performance is typically experienced in the pH range of 7.5 to 8.0. Waste water temperature also affects performance, and the effective temperature range is 46 to 110 degrees F.

BI-CHEM DC CWT Blend may be added to enhance reactor performance in cold weather. The blend is a combination of two selectively adapted bacterial cultures, namely BI-CHEM 1008 SF and BI-CHEM 1738 CW. BI-CHEM 1008 Sf degrades hydrocarbons and enhances metabolic rates in synergism with BI-CHEM 1738 CW. BI-CHEM 1738 CW enhances BOD, COD, and ammonia reduction in temperatures ranging from 36 to 90 degrees F.

BI-CHEM DC CWT Blend is available in liquid or powder form and has a shelf life of between 6 months to 1 year. It performs best within a pH range of 6.0 to 8.0, optimally performing near 7.0 pH. Material performance is also dependent upon waste water temperature, similar to BI-CHEM 1010N.

MICROCLEAR M-100 is a proprietary formulation of micronutrients designed to enhance the performance of biological systems. It enhances biological growth, shortens lag time, increases biological activity and provides the critical building blocks necessary to maintaining a healthy floc-forming population. The formulation consists of micronutrients, trace minerals, amino acids and vitamins. There are sixteen trace minerals, including calcium, iron, magnesium, manganese and zinc. The formulation also includes twenty amino acids, such as glycine, and thirteen vitamins, including folic acid.

MICROSOLVE 400 For refinery and petrochemical wastewater. MicroSolv 400 contains several types of microorganisms which can degrade aliphatic and polynuclear aromatic hydrocarbon chemicals. MicroSolv 400 contains microflora that survives on hydrocarbon waste substances allowing it to utilize it as a source of carbon. Being extremely resistant to toxic effects of the chemical pollutant fraction and are able to multiply and metabolize in the presence of certain heavy metals. These safe, nonpathogenic microbes produce a broad spectrum of enzyme systems. Because of the diversity of the microorganisms and proprietary biological enzyme systems, this product is excellent for all types of aliphatic & aromatic hydrocarbon degradation

METALS REMOVAL SYSTEM

Operated in "hand" only, the Metals Removal System (M-101) utilizes chemical co-precipitation and gravity clarification processes with a Parkson Lamella Gravity Settler/Thickener, Model 360/55. The system consists of a rapid mixing tank, a flocculation tank, an inclined plate settler (clarifier), an integral sludge thickener hopper and sludge rake mechanism.

The Metals Removal System (M-101) is designed for up to 130 GPM. To achieve efficient metals removal the influent flow to the system must be at a continuous flow rate to allow the chemical reactions to completely occur in the co-precipitation process. In an effort to provide a continuous ground water flow to the metals removal system, the discharge from the Ground Water Equalization Pump, P-101 A/B, which feeds the metals removal system, is controlled by a Flow Control Valve FCV-01. The flow rate is operator selectable at the computer in the Control Room, and measured by Flow Meter FE-01. The flow rate is displayed at the Flow Indicating Transmitter FIT-01 which also transmits an electrical signal to the Main Control Panel PLC The PLC returns an electrical signal to the Flow Control Valve that keeps the measured flow equal to the operator selected flow. FE-01, FIT-01 and FCV-01 are shown in Figure 6.

If the heavy metal characterization of the incoming ground water decreases to concentrations that are below effluent discharge limitations, (and the suspended solids in T-101 are less than approximately 25 mg/l) then operation of the bypass of the metals removal unit can be utilized. Ground water is directed to the effluent weir box of the metals removal unit and on to one of the SBR units. An off-site certified lab will complete the heavy metal characterization of the incoming ground water and the results is evaluated by the NJDEP for approval of the treatment process change. Continued testing of the incoming ground water for heavy metals should occur to ensure that decreased concentrations persist.

Thickened Sludge Tank

Metal hydroxide sludge solids are collected in a 2000 gallon integrally-mounted sludge thickener tank beneath the inclined plate settler unit. The tank provides collection and storage of gravity settled sludge before being pumped to the Sludge Conditioning Tank (T-106). The thickened sludge tank is provided with an externally driven, full-length, picket fence sludge thickener rake. The sludge thickener rake is controlled by a remote operator control station. The rake moves sludge

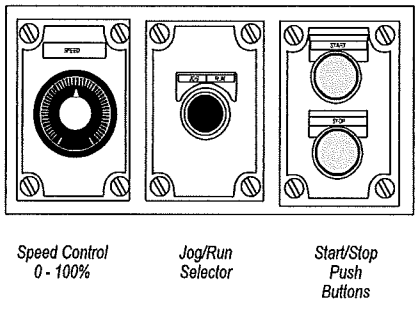

Figure 13 Plate Settler Flocculator and Sludge Rake Each Have Remote Operator Controls as Shown Above.

toward the pump suction. The drive has a visual torque indicator showing percentage of load and an electrical contact for shut down at 2300 lbs. The manufacturer has provided two (2) one-half inch sampling ports spaced at 12" and 36" from the tank bottom for obtaining sludge samples. Total suspended solids (TSS) testing can be completed at this point to determine quality of the metals sludge before it is pumped to the Sludge Conditioning Tank (T-106). The sludge thickener tank is supplied with a 24" diameter port for internal inspection of the thickener rake and a waste/empty valve is provided at the base of the tank.

Figure 14 Settler Thickening Tank Sample Ports

The metals sludge is removed by one of two Thickened Sludge Pumps (P-107 A/B), which discharge to the Sludge Conditioning Tank (T-106). The plant operator can do this manually after checking the sludge level at the two sampling ports, or on a timed basis through the desktop personal computer in the control room.

Typical Operation: Turn on 480V power at MCC #1. Turn on the Variable Speed Drive Controls for the Flocculator Mixer and Sludge Rake. (They are located on the mezzanine over the control room.) Manual operation: at the top of the Plate Settler, press start on the Rapid Tank Mixer. Using the Remote Operator Controls: press start on the Flocculation Tank Mixer and adjust the mixer speed; press start on sludge thickener rake mechanism and adjust the speed.
Turn on 120V power. After sludge has accumulated in the thickener tank, turn hand/off/automatic switch on pump P-107 A/B to hand; pump will transfer metals sludge to Sludge Conditioning Tank T-106.

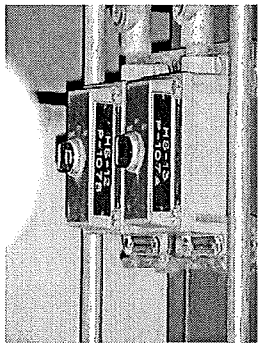

Figure 15 P-107 A & B HOA Switches Between Settler and Pumps in Lower Carbon Room

Automatic operation (not currently used) of the Metals Removal System simply means that the sludge produced will be pumped from the Sludge Thickener Tank on a computer controlled time basis. All other components are operated the same as in the Manual Mode. Turn on 120V power. Turn hand/off/automatic switch on pump P-107 A/B to automatic; pump will transfer metals sludge to Sludge Conditioning Tank T-106 until either a "high level" alarm in T-106 or the selected time run length ends. Set P-107 A/B time run length and run interval period at the main PLC via the operator interface Screen # 6 "Metals Removal and Sludge Transfer". This run cycle should be set to deliver a rate of sludge based on the volume of sludge generation by the metals removal system. Inspect Metals Removal Unit and complete inspection form as defined in the maintenance management program.

SEQUENCING BATCH REACTOR(S)

The Sequencing Batch Reactor (SBR) system, manufactured by Aqua Aerobics Systems, Inc., consists of a batch biological treatment system designed for treatment and removal of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS) and ammonia nitrogen (NH3-N). The SBR system consists of two identical, above grade, vertical cylindrical compartmentalized steel tanks SBR # 1 and SBR # 2 (Q-101 A/B). Note: Currently only one of the SBR's is being utilized. The perimeter compartments are for: influent holding, aeration (SBR Reactor), decant holding. The center tank is the waste sludge holding tank. Aeration of the SBR tank system is provided by a diffused air blower system and by four floating direct drive mixers -- two in each reactor tank. SBRs require low operator attention and are controlled by the SBR PLC.

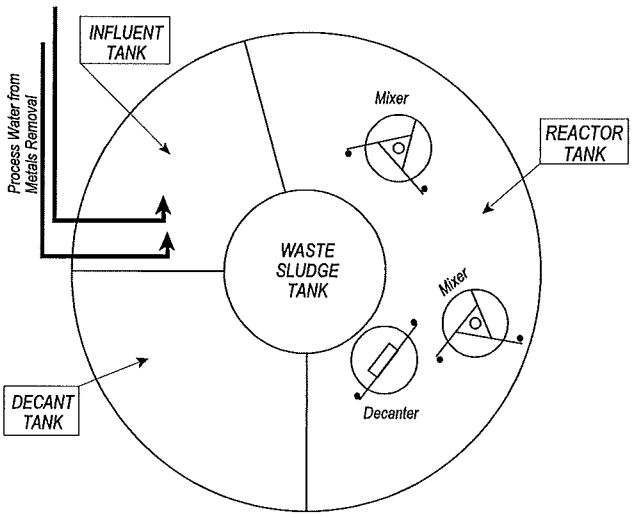

Figure 16 SBR Tank Simplified Plan View

When operating both SBR's, effluent from the inclined plate settler is directed by gravity via electrically-operated flow control valves FCV-02 and FCV-03 (located on the mezzanine above the Control Room) to an SBR influent tank selected by the SBR PLC. FCV-02 is open and FCV-03 is closed when the influent tank for SBR #1 (Q-101A) is filling; FCV-03 is open and FCV-02 is closed when the influent tank for SBR #2 (Q-101B) is filling. Each SBR processes ground water over operator selectable time periods in the following sequence of phases:

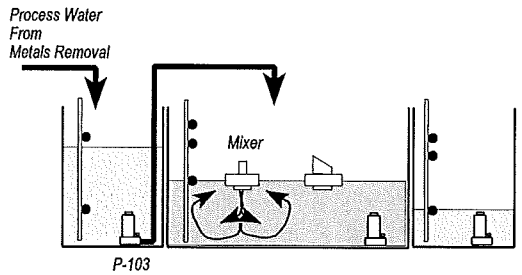

Figure 17 SBR Phase 1 Mix Fill

Phase 1: Mix Fill

Initiation of step: System reset upon system start-up. Initiation normally follows opposite basin ending REACT FILL Override mechanism: Mix Fill Float Switch stops P-103, Cycle Advance

Provided the level in the influent holding tank is above the "pump-on" float level,

Reactor Feed Pump, P-103, pumps ground water to the SBR reactor tank. Pumps P-103 A/B are controlled through the SBR PLC. This pump will continue to operate until one of the following occurs: the level in the influent holding tank drops to the "pump-off" float level; water in the reactor tank reaches the Mix Fill (limit) Float Switch; or the Mix Fill time period ends. . The feed pump is energized at the beginning of MIX FILL and de-energized at the end of REACT FILL or if the level in the influent holding tank drops below the "low-level" float switch. The reactor contents are thoroughly mixed by the high-volume Aqua-DDM mixers, which are capable of suspending all biological solids without diffused air aeration. This phase lasts about ½ hour.

Note: If the flow to the influent holding tank is greater than the capacity of pump P-103 A or B, the level will rise to the "high-level" float setting and will initiate a high level alarm. High level in the SBR influent holding tank is also interlocked to turn off the Ground Water Equalization Pumps, P-101 A/B which feed the GWTF. If during periods of low ground water flow, the level in the influent holding tank drops to a "low-level", then a "pump stop" is initiated.

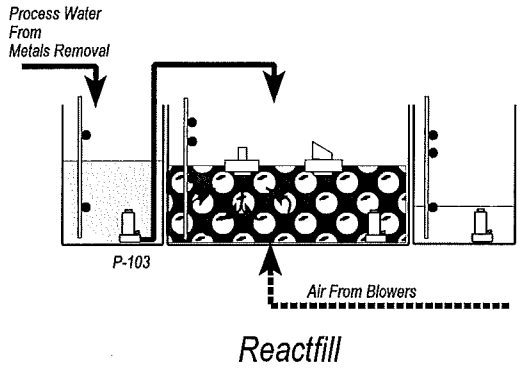

Figure 18 SBR Phase 2 React Fix

Phase 2: React Fill. Initiation of step: End of MIXED FILL Override mechanism: React Fill Float Switch will stop flow into the Reactor Tank but the Phase will continue until the end of the time period; Cycle Advance

The second phase represents a specific rise in level in the reactor basin (established at the maximum daily flow rate) and/or a specific field adjustable time period. In this phase, the Reactor Feed Pump (P-103 A or B) continues to operate, and the Aeration Blowers (B-101 and/or B-103) and Aqua DDM mixers are both on. Aeration time is operator selectable to maintain the dissolved oxygen (DO) level within a predetermined level, usually 2 to 3 milligrams per liter (mg/L). The blower is controlled by a set of five "flip-flop" timers to cycle the blower ON and OFF through the REACT FILL and REACT cycle phases. This phase lasts about 140 minutes.

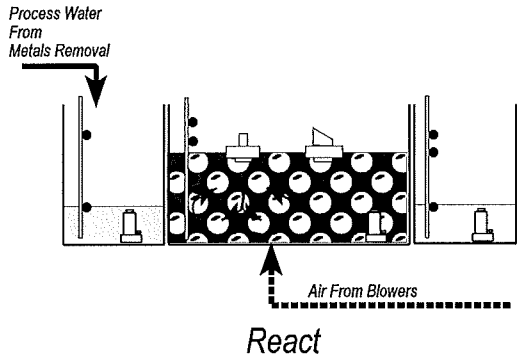

Figure 19 SBR Phase 3 React

Phase 3: React. Initiation of step: End of REACT FILL. Override mechanism: Cycle Advance

During the REACT phase there is no influent flow, and this is the time when the final portion of the react period takes place. The reactor volume level at this point remains constant. The blowers and mixers will continue to operate as described in REACT FILL. This phase lasts about 1 hours and is field adjustable.

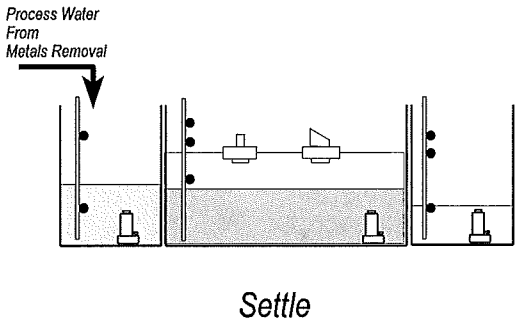

Figure 20 SBR Phase 4 Settle

Phase 4: Settle. Initiation of step: End of REACT cycle. Override mechanism: Cycle Advance

During the fourth phase, the SBR reactor level remains constant and all components are OFF or CLOSED. This quiescent atmosphere promotes settling and separation of the activated sludge from the treated ground water. This phase lasts about 1 hour.

Phase 5: Decant. Initiation of step: End of SETTLE. Override mechanism: Cycle Advance, End Decant (high level) Float Switch

During this phase the decant valve and decant weir are opened and treated ground water (decant) is pumped from the SBR reactor to the decant holding tank by Decant Pumps (P-121 A/B) and the SBR reactor fill level is reduced to a predetermined low level. The time to remove this decant varies, depending on how far the basin is filled. Since the decant rate is relatively constant, decant time will vary with volume. This phase lasts about 1 hour.

Decant from the SBR reactors is stored in the decant holding tank and is then pumped to the Continuous Sand Filters (SF-101 A/B) via Sand Filter Feed Pumps, P-106 A/B. Since the SBR treatment process is a batch operation, pumps P-106 A/B are variable speed pumps designed to equalize flow from the decant holding tank to continuously feed the sand filters. In general,

these pumps will operate in two variable speed ranges. Each pump speed range will correspond to a specific tank level range as indicated by individual level floats. Pump variable speed operations is based upon the output of a Flow Controller (FIC) which will modulate pump speed to maintain a operator selectable flow rate as sensed by Flowmeter (FE-02). Specific pump operation for P-106 A/B is outlined as follows:

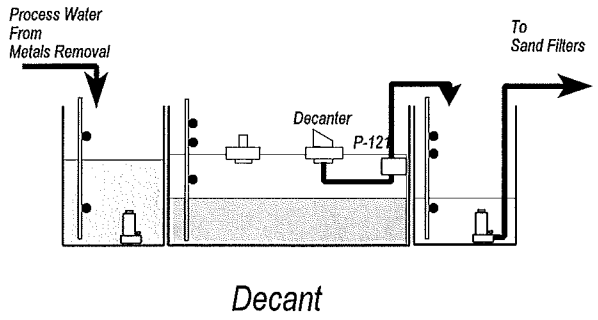

Figure 21 SBR Phase 5 Decant

1) Decant holding tank level will rise to the "pump-on" float level at which pump P-106 will run.

2) If Decant Tank level rises above the "pump full speed on" setting to the "high level" float setting, a high level alarm is actuated.

3) When either pump, P-106 A or B, reaches a "low level pump stop", the pumps will alternate operation.

4) If a "low-low level" is reached a redundant "pump stop" is initiated, and a "low level" alarm is activated. This is indicated as an alarm condition since only a level control system failure or other abnormal circumstance, such as ice conditions in the winter, should cause this condition.

5) The desired flow is an operator adjustable set point. The set point is adjustable via the main PLC operator interface (personal computer in the Control Room.)

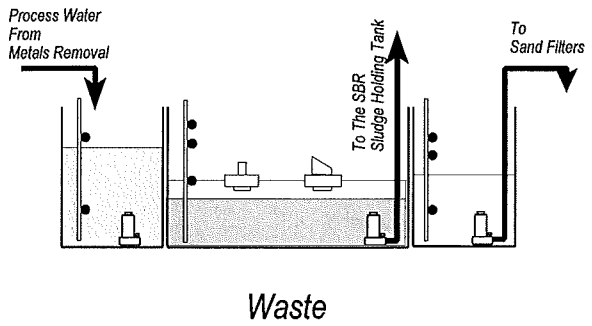

Figure 22 SBR Phase 6 Waste

Phase 6: Waste. Initiation of step: Decant Phase Timer. Override mechanism: End of Decant, low flow mode, Cycle Advance

At the end of the Decant Cycle the Waste Cycle starts and SBR Activated Sludge Pump, P-110 A/B, begins to transfer

sludge from the SBR reactor to the SBR sludge holding tank. Control of these pumps is through the SBR PLC. The cycle stops at the end of the preset time (approximately 10 - 30 seconds.) The Waste Sludge Tank is equipped with a telescoping valve for manually decanting wastewater back to the head of the plant as the sludge settles. If in the automatic mode the sludge holding basin pump (P-108 A/B)begins running when the level rises above the pump on level float switch and will stop when the level drops below the pump off level switch. It is preferable to operate the P-108's in manual mode so sludge transfer doesn't happen at the same time the Sludge Conditioning Tank (T-106) is being decanted.

If the SBR biological treatment process can consistently produce a supernatant (decant) with a suspended solids concentration below the effluent discharge limitations, and all other discharge criteria are met, then the decant can be directed to the outfall bypassing the sand filters and carbon adsorption units. The on-site lab and the off-site certified lab will complete the required discharge testing and the results is evaluated by the NJDEP for approval of the treatment process change. When the sand filters and carbon adsorption units are bypassed, each full SBR decant holding tank is tested for TSS, as well as other testing parameters, to ensure that concentrations are below discharge limitations before release to the effluent sewer.

The Aqua SBR system is controlled by a programmable logic controller (PLC), an Allen-Bradley PLC 2/05 microprocessor. The time values pertaining to each phase of the SBR process are screen displayed and entered via the Control Room SCADA Computer.

Blowers

The SBR Air Blower System (B-101 thru B-105), located in the blower room of the PEB, consists of five belt-driven, rotary, positive displacement blowers and related accessories. They are designed to operate continuously without overheating or overloading the motor at any operating discharge pressure up to and including design discharge pressure at maximum water elevation. Blower B-102 is a standby unit for the reactors. Blowers B-104 and B-105 are used to aerate the SBR inner sludge holding tank to complete the process of aerobic digestion, as well as to mix the influent holding tank or the decant holding tank if it should become necessary to do so.

Blower accessories provided for each blower consist of factory mounted inlet, inlet silencer, sleeve type flexible connector, pressure relief valves, check valves, shut-off valves, vibration isolation pads, flexible joints and gauges.

Decanter

One mechanical floating Aqua Decanter is provided for each SBR reactor tank and consists of an integral floatation unit, a stainless steel moveable weir assembly, and a motor driven, spring-loaded actuator to open and close the weir. During the decant phase the treated ground water is transferred to the decant holding tank and the filled level of the SBR reactor tank is reduced to a predetermined low level. Since the decant rate is relatively constant, the decant

time will vary with SBR fill volume.

The decanter is capable of withdrawing decant fluid from 7 inches beneath the liquid surface. The decant liquid is drawn through a weir opening of 6 inches. The weir is circular in shape and allows liquid to enter the decanter from the entire 360 degrees without obstruction. The weir actuator includes an electric reversible, motor-operated linear actuator. The actuator has a closing force capacity of 1500 pounds with a 12" stroke and is operated from a 120 volt, 1 phase, 60 Hz source. The weir is constructed of 304 stainless steel and is attached to the weir actuator through a removable single shaft which functions as the torque restraint.

The decanter float consists of a one-piece fiberglass float/seal assembly which is completely watertight with a bottom neoprene seal to receive the decanter weir, which in turn provides the necessary bubble-tight closure. The decanter is moored between two 4" vertical pylons and is attached to a mooring frame assembly which allows the decanter to move up and down following a change in liquid level, while restrained within the vertical pylons.

Diffusers

The diffused aeration system consists of a main air header and 3 distribution headers constructed of carbon steel piping which transitions to PVC piping and is interconnected with appropriate reducers, unions, motor operated butterfly valves and bypasses necessary to provide air (process oxygen) to the mixed liquor in each SBR reactor, prevent septicity in the sludge holding tank and mixing, when required, to the influent and decant holding tanks. This aeration is necessary to provide oxygen to the microbes for the biological reduction of BOD, COD and ammonia nitrogen in the SBR reactors.

Each compartment, influent holding, SBR reactor, decant holding, and sludge holding tank, is provided with coarse bubble aeration diffusers. Motorized plug valves control the air flow to each SBR tank. Valves to the reactor and sludge holding tanks will normally be open while valves to the influent and decant holding tanks will normally be closed. Each diffuser section should provide uniform air distribution. Each air diffuser consists of an orifice body, air check diaphragm, and a set of interlocking retainer rings. Forced air is discharged around the bottom periphery of the disc at a maximum flow rate of 12 CFM/diffuser.

Mixers

Four floating Direct Drive Mixers (DDM #1 thru 4) are provided by Aqua-Aerobic Systems to assure complete aeration and mixing of the SBR reactor tanks. During the normal SBR cycle, the mixers are placed in operation during the "MIX-FILL" and all "REACT" phases. Control of the mixers is via the SBR PLC control panel.

The three horsepower, impeller type, downflow discharge mixer is designed to provide sufficient mixing energy to resuspend and retain in suspension all normal biological solids maintained or produced in the SBR reactor(s). Continued operation of the mixers during the "REACT" or oxygenation phase not only improves the overall reactor mixing, but also

improves the efficiency of the diffused aeration process. Transfer of oxygen from the ground water to the biological floc surfaces is enhanced due to the high turbulence. The mixer action also provides for effective surface scum control. Mixer units are mounted on a floating fiberglass and metal frame and restrained to mooring posts which are anchored to the tank bottom.

A Power-House Ice-Eater™ 750 was placed in the SBR Sludge Holding Tank during the 2014 winter to keep the waste sludge suspended and free of ice. It was done again in winter 2014-2015 and winter 2015-2016. Normally used as a dockside de-icer it works well as a sludge mixer and de-icer.

SBR Pumping Systems

The SBR pumping system consists of the following pumps and their function:

Reactor Feed Pump (P103A/B)	Pumps ground water from the SBR influent holding tank to the SBR reactor tank.
Sand Filter Feed Pump (P106A/B)	Pumps decant from the SBR decant holding tank to the continuous sand filters.
Sludge Pump (P108A/B)	Pumps sludge from the SBR sludge holding tank to the plant sludge conditioning tank.
Activated Sludge Pump (P110A/B)	Pumps activated sludge from the SBR reactor to the SBR sludge holding tank.
Decanter Pump (P121A/B)	Pumps decant from the SBR reactor to the decant holding tank.

SBR Screen Displays

Phase Display Screen (F1)	Displays time remaining in each phase of the process for each tank.
Phase Timer Screen (F2)	Displays all phase and preset time values that are Operator changeable.
Aeration Timer Screen (F3)	Displays all aeration preset time values that are Operator changeable.
Auxillary Settings Screen (F4)	Displays all other Operator adjustable settings.

SBR#1 Alarm Screen (F6)	Displays all annunciated faults. When a fault occurs, that fault is highlighted.
SBR #2 Alarm Screen (F7)	Displays all annunciated faults. When a fault occurs, that fault is highlighted.

Changing SBR Timer Settings

The preset time values may be changed as required, at any time during operation of the SBR's. The procedure for changing timer presets is described below:

1. Display the appropriate timer screen.

2. Press CHANGE VALUE (F8)

3. Press the desired value and press ENTER, or if incorrect press CANCEL.

4. Press PHASE DISPLAY (F1) when changes have been completed.

General SBR System Comments

Cycle Advance: The Cycle Advance push-button is used to advance the SBR unit from one phase to the next.

Holding Tank Influent Valve: The holding tank influent valve will remain open at all times unless the level in the influent holding tank rises above the high level alarm float switch.

Sludge Holding Tank Blower: The sludge holding tank blower will cycle on and off continuously by an adjustable flip/flop timer.

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SBR System Alarm Sequence

When an alarm occurs the remote alarm contact will close. The alarm defeat push-button light begins flashing and the alarm is added to the alarm list, on the alarm screen. The remote alarm contact will open after all current alarms on the alarm screen have been acknowledged. The alarm defeat push-button light will cease flashing, becoming steadily lit after all alarms have been acknowledged. The alarm defeat push-button light is extinguished after all alarm conditions have cleared. The alarms are acknowledged by pressing the alarm defeat push-button while the alarm screen is displayed. Unacknowledged alarms is displayed in reverse video.

Filter
SBR SYSTEM ALARM MESSAGES

Decant weir	D-101A fault
Decant weir	D-101B fault
SBR feed pump	P-103Afault
SBR feed pump	P-103B fault
Decant valve	DV-101A fault
Decant valve	DV-101B fault
Decant pump	P-121A fault
Decant pump	P-121B fault
DDM mixer	M-101A1 fault
DDM mixer	M-101A2 fault
DDM mixer	M-101B1 fault
DDM mixer	M-101B2 fault
Sludge pump	P-110A fault
Sludge pump	P-110B fault
Blower	B-101 fault
Blower	B-102 fault
Blower	B-103 fault
Blower	B-104 fault
Blower	B-105 fault
Influent valve	IV-101A fault
Influent valve	IV-101B fault
Decant holding tank transfer pump	P-106A fault
Decant holding tank transfer pump	P-106B fault
Sludge holding tank transfer pump	P-108A fault
Sludge holding tank transfer pump	P-108B fault
Influent holding tank #1	high level alarm
Influent holding tank #2	high level alarm
Influent holding tank #1	low level alarm
Influent holding tank #2	low level alarm
SBR tank #1	high level alarm
SBR tank #2	high level alarm
Decant tank #1	high level alarm
Decant tank #2	high level alarm
Decant tank #1	low level alarm
Decant tank #2	low level alarm
Sludge holding tank #1	high level alarm
Sludge holding tank #2	high level alarm
Sludge holding tank #1	low level alarm
Sludge holding tank #2	low level alarm

SAND FILTRATION SYSTEM

In order to consistently meet the discharge limitation for effluent suspended solids, and to prevent blinding of the downstream carbon adsorption units, the discharge from the SBRs is filtered through two 5-foot diameter by 13-foot high upflow Parkson Dynasand® filters which operate in parallel. The Parkson Dynasand Filter, is designed as a continuous backwash, upflow, deep bed granular media filter. Silica sand, with an effective size of 0.9 mm, is continuously removed from the bottom and cleaned internally through an airlift pipe and sand washer. The sand filter control panels for SF 101 A/B are mounted on the west wall of the PEB and control air flow pressure (0-60 psi redued to the recommended pressure 20 psi) and air flow rate (recommended rate 85 SCFH.)

The SBR effluent is pumped from the decant holding tank by pumps, P-106 A/B, to the Continuous Sand Filters (SF-101 A/B). The ground water (decant) enters the bottom of each of the sand filters and flows upward through the sand beds. (In order to have equal flow to each filter flow must be balanced by manual adjustments to ball valves provided.) The filtered effluent drains into the Filtrate Holding Tank (T-104).

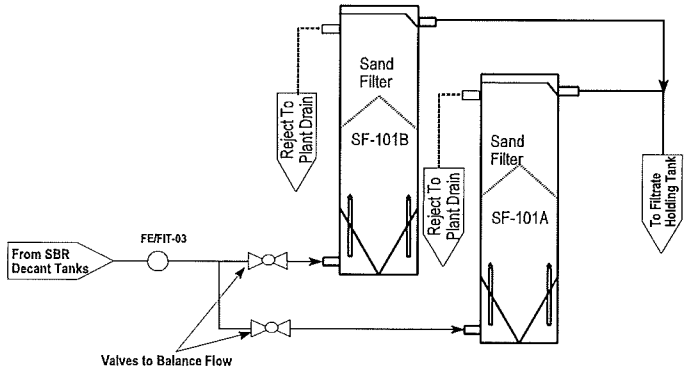

Figure 23 Sand Filter Process

Total Suspended Solids (TSS) testing is done on samples taken before passing through and after the sand filters to determine removal efficiency. Before samples are taken at the Decant Tank and Sand Filter effluent samples are taken at the P-104 A/B sample port. If the sand filters can effectively trap enough of the suspended solids to meet the discharge limitations, and all other discharge criteria are met, then the sand filter filtrate can bypass the carbon adsorption units and be pumped to the effluent tank(Carbon Filter Backwash Tank) T-110. The on-site lab and the off-site certified lab complete the required discharge testing and the results are evaluated by the NJDEP for approval of the treatment process change. When the carbon adsorption units are bypassed, the Filtrate Holding Tank (T-104) effluent is tested for TSS, as well as other testing parameters, to ensure that concentrations are below discharge limitations before release from T-110..

Filtrate Holding Tank

The Filtrate Holding Tank (T-104) is a 1000 gallon vertical, cylindrical, flat bottom fiber reinforced plastic tank with a cover. The cover has one flanged connection for the filtrate to enter the tank, and five flanged connections on the sides for: a drain and overflow drain to the Plant Drainage Pump Station, bypass to the plant outfall; supply to the Filtrate Pumps, and a pressure gauge continuous level sensor. The pressure gauge has a local read out in percent of tank depth and is also displayed in the main plant PLC graphics screen. There are four control set points for the Filtrate Holding Tank. They are high level alarm (80%), low level alarm (15%),

filtrate pump enable (20%), and turn on filtrate pump (60%).

Filtrate Pumps

The Filtrate Pumps, P-104 A/B, pump the filtrate to the Carbon Adsorption Units (C-101 A/B). Pumps P-104 A/B are provided with variable speed drives and hand/off/auto controls. When in the "auto" mode, pump operation and speed is controlled by the plant PLC. When in the "hand" mode, the pumps will operate on the operator's discretion without control interlocks and be controlled via a local manual speed control potentiometer Specific pump operation is outlined as follows:

1) The Filtrate Pumps alternate operation. When the level in the Filtrate Holding Tank (T-104) reaches 20%, the Filtrate Pump operating at the time is turned off and the other is enabled. When the level in the Filtrate Tank reaches 80% the enabled pump turns on and the electric motor driving the pump rotates at 100% speed. As the water level in the Filtrate Tank decreases the pump motor speed also decreases.

2) If the filtrate tank rises, the process flow controller will send a signal to pump P-104 to increase its speed. Likewise, if the level in the tank drops, the level sensor will send a signal to the process flow controller and the speed of pump P-104 will decrease. The process flow controller maintains a consistent flow equal to the influent flow rate to T-104 and a 40% level in the Filtrate Tank.

3) If the filtrate flow to the Filtrate Holding Tank (T-104) is greater than the pumping rate of pump P-104 A or B, the level will rise to the high level setting and a "high level" alarm is actuated and pumps P-106 A/B will stop until T-104 level is normal.

4) If the level in tank T-104 drops to the "pump-off" setting (20%), the pump will stop and the alternate pump is enabled.

CARBON ADSORPTION SYSTEM

The carbon adsorption system provides effluent polishing of any trace or refractory organics which might not be consumed by the biological treatment system. The system consists of two (2) 10-foot diameter carbon steel vessels piped to operate in parallel or series, each holding 20,000 pounds of carbon. These tanks are a dual-module, packaged adsorption system. At a flow rate of 100 gpm, each adsorber provides approximately 50 minutes of contact time. A carbon transfer tank is also included for carbon transfer of spent carbon during changeouts. The Carbon Adsorption Units (C-101 A/B) receive ground water from the Filtrate Holding Tank (T-104) via pumps P-104 A/B. The carbon units operate most often in series but can operate in parallel. Water enters at the top of each unit and exits at the bottom. The cleaned water, called filtrate, flows to a 22,000 gallon tank that serves as a source for two pumps as well as the final location in the plant prior to discharge. Although this tank serves three functions it is named for only one of them, the Carbon Filter Backwash Tank (T-110). This treated effluent is used: on occasion to backwash the carbon adsorption units; used constantly for plant water feed; and when the level is high enough flows by gravity to the plant outfall. Instructions describing start up and the proper valve operation sequence are contained in the Calgon Carbon O & M Manuals.

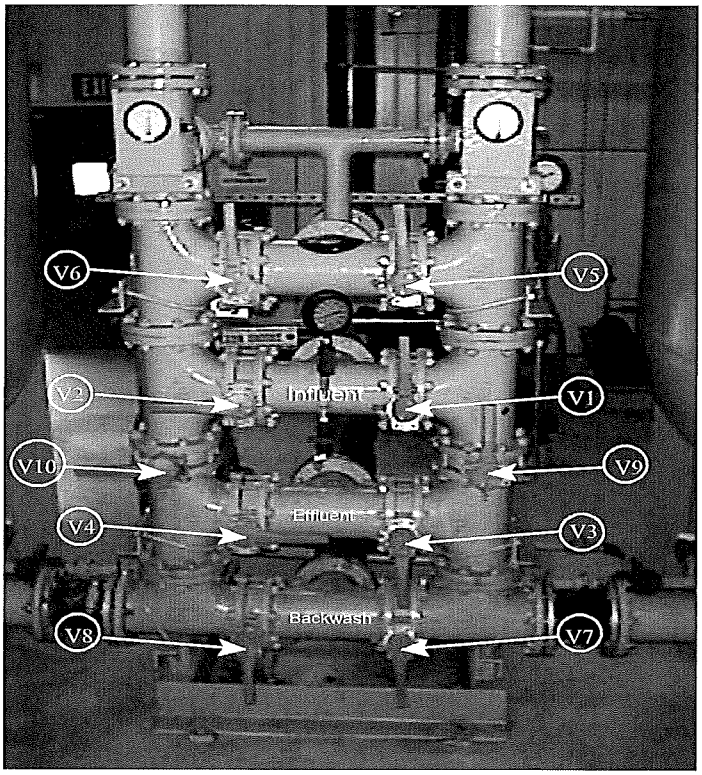

Figure 24 Carbon Unit Valve Manifold To Select Flow configurations.

Carbon Transfer System

When it is determined that the activated carbon is spent in the lead carbon adsorption unit, it is taken off line by switching valving so that the entire hydraulic flow is directed to the lag or polish carbon unit. Fresh granular activated carbon is delivered to the site by a high-pressure bulk trailer which fills the adsorber directly with carbon slurry. This slurry is created by adding plant water to the delivery trailer. Approximately 4,000 gallons of water is added if the carbon is pre-wetted or 5,000 gallons if the carbon is dry. The empty adsorber must first have approximately 3,000 gallons of water in it to cushion the underdrain system. Compressed air is used to transfer the carbon slurry to the adsorber. See Section 4.4.2 (Transfer Carbon to Adsorber) and Section 1.06-C (Carbon Supply; in Design Info.) in the Calgon Carbon O & M Manual. Any excess motive water is routed to the floor drains during the transfer procedure and is pumped to the beginning of the GWTF by the plant drainage pump station. The fresh carbon transfer procedure should take approximately one (1) hour. Carbon transfer should be scheduled so that it does not occur simultaneously with process tank drainage or operation of the filter press, so as not to overload the capacity of the plant drainage pumping station. Note: When filling the tanker truck with water to transfer carbon a 2" hose or larger is needed.

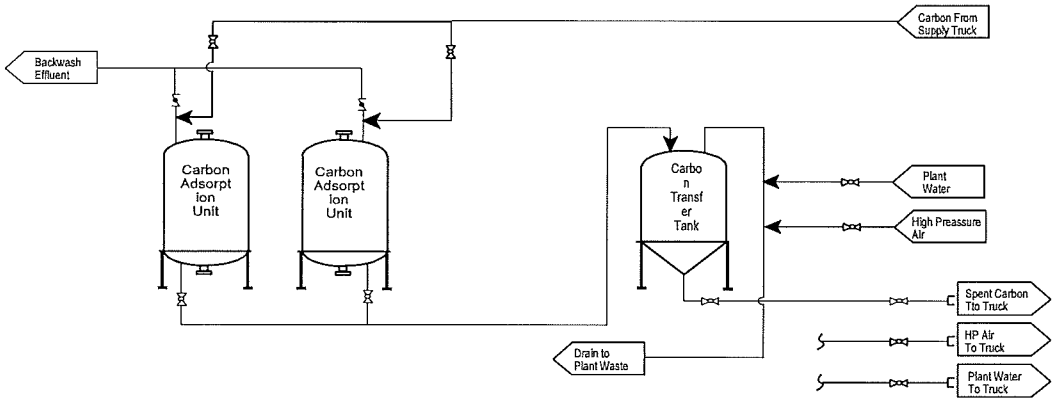

Figure 25 Carbon Transfer Schematic The Backwash Valves Are Closed During Transfer.

Carbon Filter Backwash System

Backwashing an adsorber consists of using clean external water from the Carbon Backwash Tank (T-110), to expand the carbon bed, and remove binding air, suspended solids and carbon fines that may be plugging the under drain lines. The carbon backwash process is initiated manually based on observance differential pressure greater than 3.0 psi across an adsorption unit at 90 gpm flow. A backwash rate of 1000 gpm (P-109 maximum pumping rate) and a backwash pressure drop of 7.5 psi is recommended for about 10-15 minutes or until the discharge water is clear. This carbon backwash effluent is under pressure and is routed directly back to the Ground Water Equalization Tank (T-101). For a system operating in series, it is possible for one adsorber to remain on-line at a slightly higher flow rate while the other is being backwashed. (See Calgon O & M Manual, Section 3.4.2). The adsorbers should be backwashed after fresh carbon delivery

and during operation when warranted by differential pressure drop. Daily records should be kept of pertinent data such as flow rate and differential pressure drop across each bed.

Typical Operation (Backwashing)

- Turn on 480V power at MCC #1
- Manipulate valving to route contents of T-110 to Carbon Backwash Pump, P-109.
- Press start button at MCC #1, pump P-109A will operate until T-110 is empty So the level must be monitored. The pump will transfer the treated effluent to the carbon unit requiring backwashing. Also monitor the color of the backwash entering Equalization Tank (T-101.)
- To shut off, press stop button at MCC #1.
- If long term shutdown, open 480V disconnect switch.

Carbon Backwash Tank (T-110)

The last component of the treatment process is a 22,000-gallon holding tank that is the source of clean water for: carbon filter backwashing, process water for polymer and other chemical mixing, and plant discharge. A pH Sensor/transmitter (AE/AIT-03) is located in tank T-110. If the pH high or low alarm is actuated. The pH value is indicated and recorded on the PC. The plant discharge passes through an Effluent Flow Meter (FE-03) which allows the effluent outfall flow

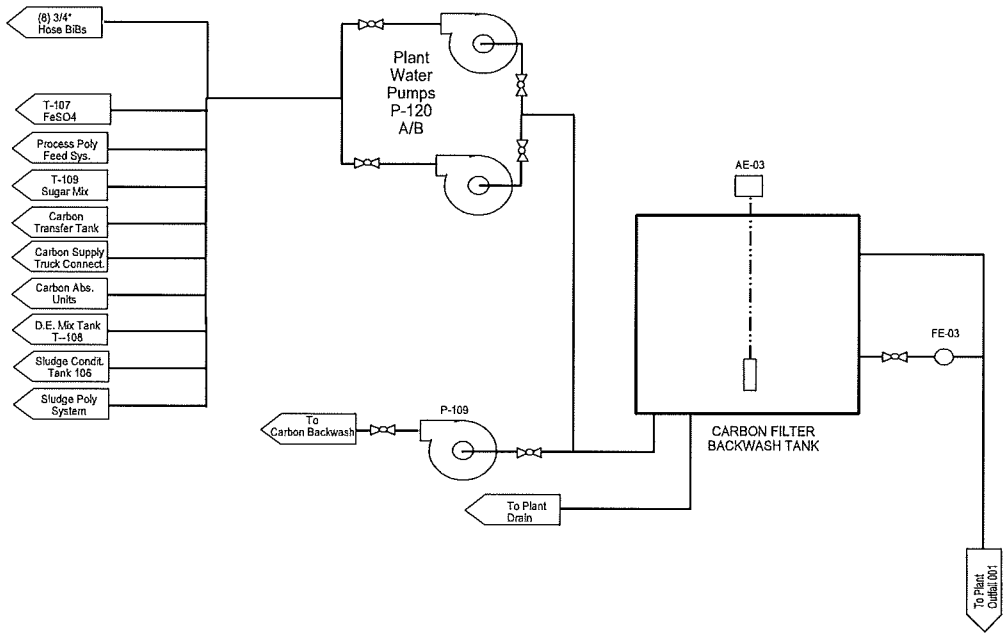

Figure 26 Carbon Backwash Tank Flow Schematic

rate to be measured and recorded on the PC.

SLUDGE MANAGEMENT

Sludge Process Description

Metals and biological sludge is generated in the Ground Water Treatment Facility. The sludge treatment system consists of conditioning and dewatering of metal and biological sludges in a sludge conditioning tank and a plate and frame filter press for off-site disposal. The metals removal system accounts for the bulk (70%-90%) of the sludge generated. In the event this sludge is determined to be hazardous, the operator can manually override the automatic pumping system to prevent combining of the metal and biological sludges. The remainder of the sludge (10%-30%) generated at the site comes from the biological treatment phase. The gravity settled thickened sludge generated in the metals removal system and the waste activated sludge generated during biological treatment from the SBRs are collected and combined in the Sludge Conditioning Tank (T-106). This sludge can be conditioned by addition of polymer Magnifloc 1839A (not currently being used) and ferric sulfate (also not currently being used) in preparation for dewatering in the Filter Press (F-101). Perlite, (a safer substitute for diatomaceous earth) (DE), slurry is mixed separately and pumped to the plate and frame filter press to precoat the membrane filter cloth prior to feeding the conditioned sludge. The sludge dewatering system was designed for three filter press cycles per day, five days per week. In practice the filter press is run intermittently. The filter press system is provided with its own PLC from which indication is provided to the main PLC control system. The plate and frame filter press operates on a four hour cycle and discharges dewatered filter cake into a twenty (20) cubic yard roll-off. The filter press filtrate is routed to a filtrate weir tank which drains to the plant drainage pump station.

Sludge Conditioning Tank

The Sludge Conditioning Tank (T-106) receives thickened metals sludge from the inclined plate settler and waste activated sludge from the SBRs. The purpose of this tank is to condition the sludge by decanting off free liquids and adding chemicals that will improve dewatering in the Filter Press (F-101). Transfer of the metals sludge from the sludge thickener tank to the Sludge Conditioning Tank (T-106) occurs via air-driven double diaphragm pumps, Thickened Sludge Pumps P-107 A/B. This can be done on an automatic timed cycle or maunally at the operator's discretion after daily inspection of the inclined plate settler sludge thickening tank. Waste SBR sludge from the SBR sludge holding tank can be transferred to the Sludge Conditioning Tank (T-106) when the sludge level climbs to the sludge "pump on" level float by Sludge Pumps (P-108 A/B) In practice it is preferable to operate the P-108 transfer pumps manually. Tank T-106 has a level sensor which provides continuous level indication with high and low set points. Tank level is displayed on the graphics screen for the main plant PLC. If the level in T-106 rises above a preset value of ninety (90)%, pump P-107 A/B and pump P-108 A/B, metals sludge and SBR sludge pumps respectively, are stopped. The tank has a conical bottom for directing sludge toward the pump suction. The Operator is responsible for monitoring water level and decanting the supernatant from the tank.

Conditioning Polymer (currently not being used)

Conditioning polymer (Magnifloc 1839A) and ferric sulfate (Currently not being used) can be

to increase the final pressed sludge solids concentration. Control of polymer addition to tank T-106 is made manually by adjusting the Conditioning Polymer Feed Pump (P-118). If the level in T-106 falls to a preset "low level" value, pump P-118 will stop pumping polymer. By manually adjusting the valves at the Ferric Sulfate Feed Pumps, P-112 A/B (Currently not being used), the plant operator can choose to direct ferric sulfate from the Rapid Mix Tank to the Sludge Conditioning Tank (T-106). Three decant ports on the side wall of the tank allow for supernatant drainage which is routed to the Plant Drainage Pumping Station. The conditioned sludge is then pumped to the filter press via air-driven diaphragm Filter Press Feed Pumps (P-105 A/B). Control of compressed air to operate these pumps is initiated by the filter press control panel. Conditioning polymer destabilizes the surface charge on the sludge particles and promotes flocculation of the sludge particles into a matrix which is more easily dewatered. A correct conditioning polymer dosage will result in a dry cake, while an incorrect dosage will produce a wet sludge cake. During startup of the filter press, Magnifloc 1839A polymer (currently not being used) and a 1% ferric solution (currently not being used) was tested in the laboratory using bench-top jar tests to determine the best chemical dosages, if the quality of sludge changes, the dosages may need to be calculated on a batch basis. Once the target settings are established the operator will monitor filter press performance by checking percent solids (TSS testing) of the finished sludge cake.

Precoat System

The precoat system consists of a Mixing Tank (T-108) where bags of pre-coat material are manually loaded into a dustless debagger and mixed with plant water to form a slurry. This slurry is pumped to the head of the filter press by Feed Pumps (P-117 A/B) and used to precoat the membrane filter cloth. A precoat is required for sludge with very fine floc and to obtain an adequate filter cake release. (Perlite or D.E. usage would be 5 lbs/100 SF of filter area.) The HEI Filter Press (F-101), Model D-39, has a filtration area of 800 SF which would require 40 lbs. of DE per press cycle. Adequacy of precoat can be monitored by checking cake release and initial press filtrate quality. The precoat is applied during six (6) five minute increments. Timing for the shutdown of P-117 A/B and initiation of the Filter Press Feed Pump, P-105A, are integrated by the filter press control panel to prevent the precoat from falling off the filter cloth prior to sludge entry to the press. All automatic valves on the filter press piping have been replaced with manual valves.

Sludge Filter Press

The Plate and Frame Filter Press (F-101), Hoffland Environmental, Inc. Model D-39, separates the conditioned sludge into a liquid filtrate and a solid filter cake utilizing a pressure filtration process. Dewatering is accomplished by pumping conditioned sludge into filter chambers surrounded by membrane filter cloth. As pumping pressure is increased, the filtrate is forced through the accumulated filter cake and membrane, leaving the chambers full of solid filter cake (30-40 % solids). The filtrate passes through the filter membrane and is directed by channels in the plates and drain ports for discharge.

The press requires an air supply (100 psi) for an air blowdown manifold and a hydraulic control panel. If the sludge is properly conditioned, and the press is properly precoated, the filter cake is easily removed by reversing the hydraulic ram thus opening the press. The plates may then be moved apart, permitting the compacted cake to fall from the chambers. A paddle -type scraper can be used to further remove any filter cake adhering to the filter membrane cloth. The filter press cycle takes approximately 4 hours.

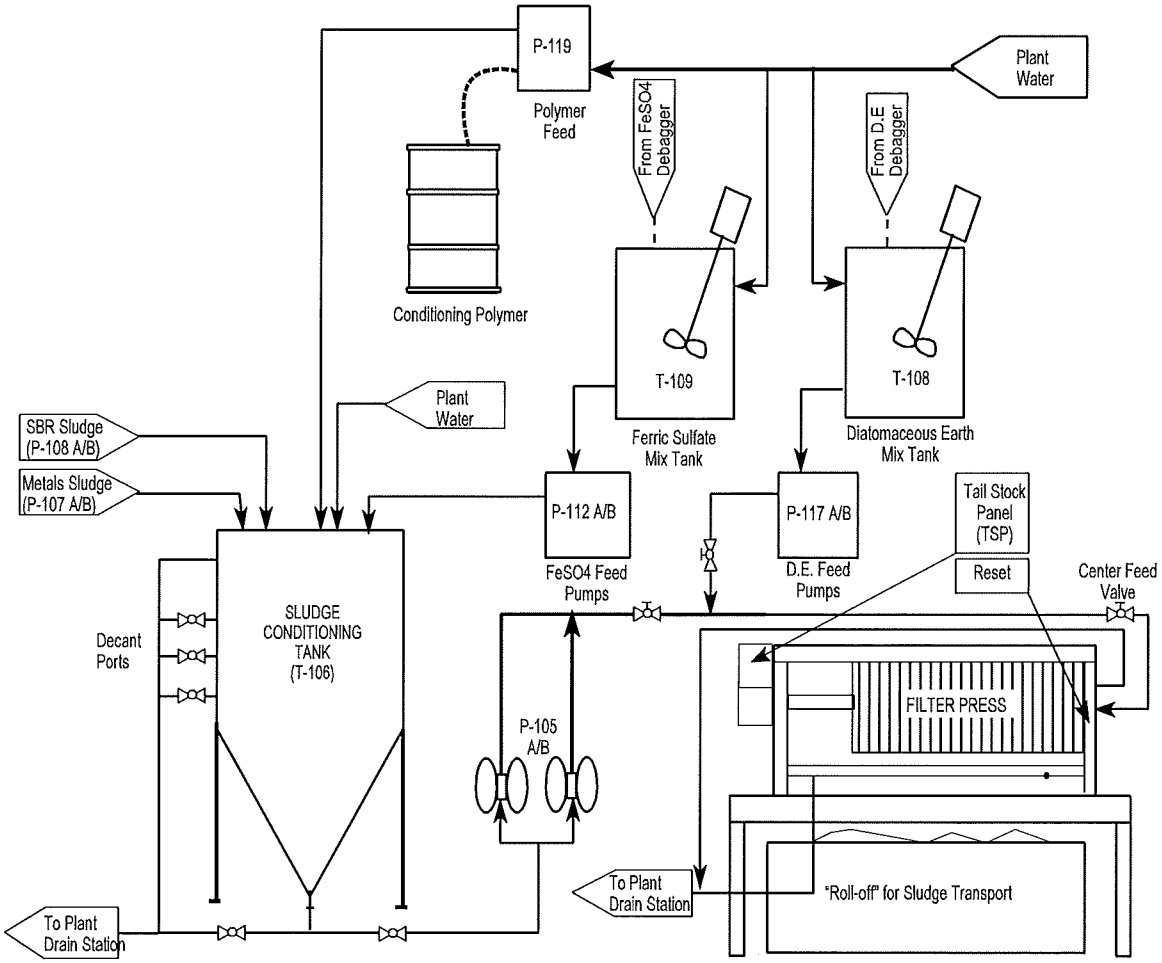

Figure 27 Sludge Management Process Schematic

To remove filter press pump discharge pulsations the HEI filter press (F-101) has a Pulse Stabilizer built into the feed piping. An air pocket in the chamber allows the press piping to receive the pressure spike caused by the air diaphragm pump discharge. While the Warren - Rupp design has a diaphragm cartridge to maintain the air pocket, the HEI chamber is recharged each time the press goes into core blow down. This insures that an air pocket damper is in the line to protect the piping. Filter press pumps P-105 A and B are plumbed in parallel. Pump P-105 A is initiated and run for one hour, filling the press with sludge. After pump P-105 A has run for one hour, pump P-105 B (high pressure pump) is initiated and will run until a "press full" condition is detected by the level probe in the weir tank." This sequence allows the press to be gradually filled with the low pressure pump insuring an even coating of the press's cloth with sludge. The high pressure pump will then do the dewatering of the sludge cake. This method reduces "blinding" of the filter cloth and extends the life of the filter cloth.

It was anticipated fopr design purposes that sludge cake production will average approximately 360 lb/day and the roll-off storage container beneath the press will hold approximately two months worth of generated sludge. In practice with one SBR operating 20 cubic yards of pressed sluge is generated in about six months.

Typical Operation

- Turn on 480V power at MCC #1
- Energize the DE mix tank mixer (MX-108) and the Sludge Conditioning Tank mixer (MX-4) on the filter press control panel.
- If needed, manually adjust valves at pump P-112 A/B in order to add ferric sulfate (currently not being used) to the Sludge Conditioning Tank T-106.
- Energize the polymer feed system (currently not being used) and manually adjust Conditioning Polymer Pump P-118 to control the amount of polymer added to tank T-106.
- Energize the DE Feed Pumps (P-117 A/B)at the filter press control panel.
- Set DE Feed Pump control switch to the "auto" position.
- Pump P-105 A (low pressure) and then B (high Pressure) will pump the sludge from the Sludge Conditioning Tank (T-106) to the Filter Press (F-101). Control of the compressed air to operate these pressure filter feed pumps is based on the filter press control panel.

Detailed operation instructions are given in the HEI Filter Press O & M Manual.

Filtrate

The filtrate generated during the filter press operation drains to the filtrate weir tank. The filtrate drains directly to the Plant Drainage Pumping Station where it is pumped to the Groundwater Equalization Tank T-101.

Filter Press Operation – Note the valves are operated manually

The following describes automatic operation. There are three separate electrical operating stations that are used to work the filter press. They are: the main control panel (FPMCP) located on the floor level ; the tail stock panel (TSP) located on the tail end of the press above the mixing platform; and the side bar mounted panel (SBP) located at the head end of the press. The tail end is closest to the mixing platform. The head end is closest to the press room overhead doors. The FPMCP includes an Allen-Bradley SLC 500 PLC. The plants main computer only monitors filter press operation and faults. The program listing for the filter press PLC is presented in the O&M Manual and Appendix K.

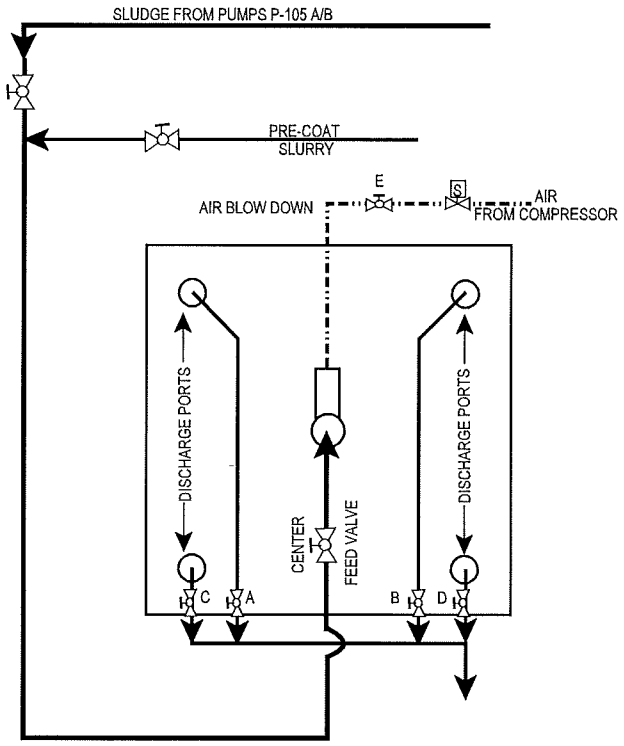

Figure 28 Sludge Press Valves. Six at the Head End and two at the Tail End Near D.E. Tank.

In addition to the electrical operating stations there are ten valves that are operated during a sludge press cycle. .

To Close the Filter Press:

1. Verify the FPMCP disconnect in MCC-1 is in the ON position.

2. Turn the hydraulic selector switch on the TSP to CLOSE. The hydraulic cylinder will push the follower and filter plates forward.

3. Once the press is fully closed, turn the hydraulic selector switch on TSP, to CLAMP/HIGH PRESSURE. Allow the hydraulic pressure to build to 4,500 to 5,000 psi before opening the inlet valve. Note: valve positions during sludge feed, air blow down valve (manual isolation valve "E") can remain open at all times during normal press operation. Air blow down rate is controlled by a manual valve located upstream of manual valve "E".

Pre-coat Sequence

1. Open valve A and the Center Feed Valve. See Figure 28.

2. Turn the TANK T-108 WATER FILL OFF/AUTO SWITCH, HS-55, to Auto at

the FPMCP.

3. Turn the T-108 FAN OFF/ON SWITCH, HS-50, to ON at the FPMCP.

4. Turn the T-108 MIXER OFF/ON SWITCH, HS-35, to ON at the FPMCP.

5. Add 1/3 of the DE (or Perlite) to be used into tank T-108.

6. Turn either P-117A HS-38 or P-117B HS-39, OFF/AUTO switches to AUTO at the FPMCP. Note: Pumps are not designed for parallel operation, one pump is for standby use.

6A. Turn P-105A HS-52 and P-105B HS-53 (sludge pumps in Upper Carbon Room) OFF/AUTO switches to the AUTO position at the FPMCP.

6B. Open the 2" manual precoat ball valve located below the press deck and behind the pre-coat mix tank; and close the 4" manual sludge feed ball valve located above the press deck at the tail end. (Note: this operational step is required to be performed to prevent pumping precoat material to the sludge filter press feed pumps).

7. Turn the PRECOAT SYSTEM OFF/AUTO HS-54 switch to AUTO at the FPMCP and press the Reset button at the head end of the Sludge Press. Open the pre-coat return valve, and close the valve to the filtrate weir tank. Turning PRECOAT SYSTEM OFF/AUTO HS-54 switch to AUTO at the FPMCP will also trigger pump P-117A or P-117B to run for a total of five (5) minutes. Repeat the Pre-coat cycle by pressing the Reset Button and again for a total of six times (30 minutes total pre-coat.)

7A. After the filtrate water starts running clear, open valve B and close valve A on the filter press discharge manifold and add 1/3 of DE to tank T-108.

7B. After the filtrate water starts running clear again, open valves A, C and D (also leaving valve B open) on the filter press discharge manifold and add the final 1/3 of DE to tank T-108.

7C. After about 5 minutes check to insure that no dust is visible and turn the T-108 FAN ON/OFF HS-50 switch to the OFF position at the FPMCP.

Filtration Sequence:

Close the 2" manual precoat ball valve located below the press deck and behind the D.E mix tank; and open the 4" manual sludge feed ball valve located above the press deck at the tail end. (Note: This prevents pumping sludge into the precoat pumps). Once the precoat sequence has been completed, the DE return valve will close and the weir valve will open (this is indicated by lights on the FPMCP). Valves A, B, C, D and the center feed valves on the filter press discharge header will already be in the open position from prior steps. Pump P-105A is initiated and will

run for one hour, filling the press with sludge. After P-105A has run for one hour, P-105B (high pressure pump) is initiated and will run until a press full condition is detected by the level probe in the weir tank. A press full condition is indicated by illumination of the PRESS FULL light at the FPMCP. At this time the air blow down sequence should be initiated.

Air Blow-down Sequence:

1. Close the center feed valve on the filter press.

2. Turn the AIR BLOW DOWN OFF/AUTO HS-56 switch to AUTO at the FPMCP and press the Reset Buton.

3. After the first 15 minutes, close valves A and B.

4. When air blow down is complete, (time cycle 10 - 15 minutes) the AIR BLOW DOWN light at the FPMCP will no longer be illuminated.

5. Close valves C and D.

To Open the Filter Press:

1. Be sure the sludge feed and air inlet valves are closed. Allow one minute for residual pressure inside the filter chambers to vent.

2. Turn the hydraulic selector switch at the TSP to the OPEN position.

3. After the ram has fully retracted, turn the hydraulic selector switch at the TSP to the OFF position.

Automatic Plate Spreader - Cleaning the Filter Press: : **NOT IN SERVICE**

1. Turn LIGHT CURTAIN OFF/ON HS-86 switch at the FPMCP to ON position. (Note: The plate shifter will not operate unless the light curtain is on).

2. Turn the PLATE SHIFTER OFF/AUTO HS-51 switch at the FPMCP to the AUTO position.

3. The plate shifter will move to the front of the press and then move to the end (tailplate) of the press. Once the shifter reaches the end of the plates, it will automatically shift the first plate and retract the shifter. After a short delay (approximately 10 seconds) the shifter will index towards the front of the press until it reaches the next plate, which it will then shift. The shifter will continue this process until all of the plates have been shifted. When the shifter reaches the front of the press, it will stop automatically.

4. If the shifter fails to pick up one side of the plate, or does not shift the plate properly, the shifter will retract, the PLATE SHIFTER ALARM light at the

FPMCP will illuminate, the alarm will sound and the shifter will wait for the Operator to respond. Realign the plate and press the RESET button at the SBP.

5. If Operator assistance is needed to remove the sludge cake from the filter plate, use the plastic spatula taking care not to damage the cloth. When the light beam is broken by Operator intervention, the plate spreader will stop automatically and will not resume operation until the RESET button at the SBP is depressed.

6. To stop the automatic plate shifter at any time, depress the EMERGENCY STOP button on either the FPMCP or SBP or break the light curtain beam.

7. The O-ring sealing surface of the gasketed plates should be thoroughly cleaned. Residues left in this area may prevent proper sealing of the plates.

8. When the plates are thoroughly cleaned, the cycle is complete and ready for temporary shutdown.

9. Turn P-117A, P-117B, P-105A, P-105B, PLATE SHIFTER, AIR BLOW DOWN, LIGHT CURTAIN AND PRECOAT SYSTEM switches to the OFF position at the FPMCP.

10. Follow the "To Close The Filter Press" instructions.

INSTRUMENTATION AND CONTROL SYSTEM

The process control and instrumentation system includes sufficient hardware to monitor system performance and control certain elements of the process. The design basis for the instrumentation and control system includes sufficient control devices to enable unattended second and third shift operation. The instrumentation and control system includes an operating system which incorporates critical alarms, system status monitoring, and key system controls.

The GWTF has a main Programmable Logic Controller (PLC), and two subsystem PLCs: one for control of the SBR biological treatment system and the other for the control of the filter press system. The computer displays data and operational schematics of the treatment processes. This data is transmitted to the computer via the main programmable logic controller (PLC). The main PLC receives and transmits data from the remote field devices as well as the two remote PLC's. The remote PLC's are located in the SBR control panel and the filter press control panel. See Appendix J for the listing of the PLC interconnections.

Computer System

The computer for the Combe Fill South Landfill (CFSL) Ground Water Treatment Facility (GWTF) system is a Dell Optiplex 755 with XP-Professional and a 19" flat screen monitor.

The SCADA software for the system is Lookout™ Direct from Automation Direct . The Program will display when the computer is booted. Using the Lookout™ Direct Program, the Operator is able to view all of the processes by selecting the appropriate screens. The Operator can move through the screens by using the mouse to select the screen he/she wishes to view.

Through the Lookout™ Direct Program, the Operator has the capability to adjust flow set points, level controllers, pH set points, high and low level alarms, turbidity alarms, temperature alarms, and observe runtime meters.

Appendix N is a list of all of the computer screens.

Instrumentation

There are 112 electrical/electronic devices that are used to measure and/or control the collection and treatment processes at the Combe Fill South Landfill project. The devices at the collection wells (designated by "GW. . . " under the Location column) have local read-outs and control and are not connected to the plant PLC's nor the operator's computer in the control room. The following table lists the devices, location used and the ranges of each. A more concise instrument list is included in Appendix H. The devices are listed by tag number and the location is listed as the location in the collection and/or treatment process.

DEVICE	TAG #	LOCATION	RANGE
pH TRANSMITTER	AE/AIT-01	LAMELLA RAPID MIX	4-10 pH
pH TRANSMITTER	AE/AIT-02	LAMELLA EFFLUENT	4-10 pH

DEVICE	TAG #	LOCATION	RANGE
pH TRANSMITTER	AE/AIT-03	EFFLUENT TO PLANT OUTFALL	4-10 pH
COMBUSTIBLE GAS SENSOR	AE/AIT-101A	UPPER PEB CARBON ROOM	0-100 LEL
COMBUSTIBLE GAS SENSOR	AE/AIT-101B	LOWER PEB CARBON ROOM	0-100 LEL
COMBUSTIBLE GAS ANALYZER	AIC-101	MAIN CONTROL ROOM PEB	0-100 LEL
FLOW CONTROL VALVE	FCV-01	INFLUENT TO LAMELLA	0-100%
FLOW CONTROL VALVE	FCV-02	SBR #1 INFLUENT (located on the mezzanine above Control room)	0-100%
FLOW CONTROL VALVE	FCV-03	SBR #2 INFLUENT (located on the mezzanine above the Control room)	0-100%
MAGNETIC FLOWMETER	FE/FIT-01	LAMELLA INFLUENT	0-200 GPM
MAGNETIC FLOWMETER	FE/FIT-02	INFLUENT TO SAND FILTERS	0-200 GPM
MAGNETIC FLOWMETER	FE/FIT-03	EFFLUENT FLOW FROM PLANT TO OUTFALL	0-200 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWA	GROUND WATER RECOVERY WELL A (GWA)	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWB	GWB	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWC	GWC	0-8 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWD	GWD	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWE	GWE	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWF	GWF	0-8 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWG	GWG	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWH	GWH	0-8 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWI	GWI	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWJ	GWJ	0-50 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWK	GWK	0-50 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWL	GWL	0-50 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWM	GWM	0-30 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWN	GWN	0-50 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWT	GWT	0-60 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWU	GWU	0-10 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWQ	GWQ	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWR	GWR	0-18 GPM
PADDLE WHEEL FLOWMETER	FE/FIT-GWS	GWS	0-18 GPM
FLOW TOTALIZER	FQI-GW A-S	TOTALIZERS FOR GROUND WATER RECOVERY WELLS A-S	
PROGRAMMABLE TIMERS	KC-GWA	GWA	60 min ON
PROGRAMMABLE TIMERS	KC-GWB	GWB	60 min ON
PROGRAMMABLE TIMERS	KC-GWC	GWC	60 min ON
PROGRAMMABLE TIMERS	KC-GWD	GWD	60 min ON

DEVICE	TAG #	LOCATION	RANGE
PROGRAMMABLE TIMERS	KC-GWE	GWE	60 min ON
PROGRAMMABLE TIMERS	KC-GWF	GWF	60 min ON
PROGRAMMABLE TIMERS	KC-GWG	GWG	60 min ON
PROGRAMMABLE TIMERS	KC-GWH	GWH	60 min ON
PROGRAMMABLE TIMERS	KC-GWI	GWI	60 min ON
PROGRAMMABLE TIMERS	KC-GWJ	GWJ	60 min ON
PROGRAMMABLE TIMERS	KC-GWK	GWK	60 min ON
PROGRAMMABLE TIMERS	KC-GWL	GWL	60 min ON
PROGRAMMABLE TIMERS	KC-GWM	GWM	60 min ON
PROGRAMMABLE TIMERS	KC-GWN	GWN	60 min ON
PROGRAMMABLE TIMERS	KC-GWQ	GWQ	60 min ON
PROGRAMMABLE TIMERS	KC-GWR	GWR	60 min ON
PROGRAMMABLE TIMERS	KC-GWS	GWS	60 min ON
PROGRAMMABLE TIMERS	KC-GWT	GWT	60 min ON
PROGRAMMABLE TIMERS	KC-GWU	GWU	60 min ON
LEVEL ELEMENTS AND CONTROLLERS	LE/LIC GWA-S	PUMP OFF =1 FOOT ABOVE PUMP	
HIGH LEVEL SWITCH	LSH-01	TANK T-101	90%
HIGH LEVEL SWITCH	LSH-01D	SBR #1 INFLUENT	91%
HIGH LEVEL SWITCH	LSH-02D	SBR #1 REACTOR	94%
HIGH LEVEL SWITCH	LSH-03	TANK T-104	90%
HIGH LEVEL SWITCH	LSH-03D	SBR #1 SLUDGE	91%
HIGH LEVEL SWITCH	LSH-04	TANK T-106	90%
HIGH LEVEL SWITCH	LSH-04F	SBR #1 DECANT	91%
HIGH LEVEL SWITCH	LSH-05D	SBR #2 INFLUENT	91%
HIGH LEVEL SWITCH	LSH-06D	SBR #2 REACTOR	94%
HIGH LEVEL SWITCH	LSH-07D	SBR #2 SLUDGE	91%
HIGH LEVEL SWITCH	LSH-08F	SBR #2 DECANT	91%
HIGH LEVEL SWITCH	LSH-10	PLANT DRAINAGE PUMP STATION	62%
TURBIDITY METER	XE/XIC-01	FILTRATE TANK T-104	10 NTU
LOW LEVEL SWITCH	LSL-01A	SBR #1 INFLUENT	18%
LOW LEVEL SWITCH	LSL-02A	SBR #1 REACTOR	52%
LOW LEVEL SWITCH	LSL-03	TANK T-104	15%
LOW LEVEL SWITCH	LSL-03A	SBR #1 SLUDGE	15%
LOW LEVEL SWITCH	LSL-04	TANK T-106	10%
LOW LEVEL SWITCH	LSL-04A	SBR #1 DECANT	18%

DEVICE	TAG #	LOCATION	RANGE
LOW LEVEL SWITCH	LSL-05A	SBR #1 INFLUENT	18%
LOW LEVEL SWITCH	LSL-06A	SBR #1 REACTOR	52%
LOW LEVEL SWITCH	LSL-07A	SBR #2 SLUDGE	15%
LOW LEVEL SWITCH	LSL-08A	SBR #2 DECANT	18%
SLUDGE FILTER PRESS INTERRUPT	EI-02	FILTER PRESS	
LOW TEMPERATURE SENSOR	TSL-01	T-110	35
LOW TEMPERATURE SENSOR	TSL-01A	GROUND WATER LINE AT T-101 INFLUENT	35
LOW TEMPERATURE SENSOR	TSL-02	NAOH LINE TO T-101	65
LOW TEMPERATURE SENSOR	TSL-03	CHEMICAL FEED BUNDLE TO PEB	35
LOW TEMPERATURE SENSOR	TSL-05	SBR #1 INFLUENT LINE	35
LOW TEMPERATURE SENSOR	TSL-06A	SBR #1 SLUDGE LINE TO T-106	35
LOW TEMPERATURE SENSOR	TSL-06AA	SBR #1 SLUDGE LINE from P108A	35
LOW TEMPERATURE SENSOR	TSL-06B	SBR #2 SLUDGE LINE TO T-106	35
LOW TEMPERATURE SENSOR	TSL-06BB	SBR #2 SLUDGE LINE from P108B	35
LOW TEMPERATURE SENSOR	TSL-07A	SBR #1 EFFLUENT LINE TO SAND FILTERS	35
LOW TEMPERATURE SENSOR	TSL-07AA	SBR #1 GROUNDWATER from P106A	35
LOW TEMPERATURE SENSOR	TSL-07B	SBR #2 EFFLUENT LINE TO SAND FILTERS	35
LOW TEMPERATURE SENSOR	TSL-07BB	SBR #1 GROUNDWATER from P106B	35
LOW TEMPERATURE SENSOR	TSL-08	SBR #2 INFLUENT LINE	35
LOW TEMPERATURE SENSOR	TSL-09	TREATED WATER LINE TO T-110	35
LOW TEMPERATURE SENSOR	TSL-10	CARBON BACKWASH WATER LINE FROM T-110	35
LOW TEMPERATURE SENSOR	TSL-11	BACKWASH WASTE LINE TO T-101	35
LOW TEMPERATURE SENSOR	TSL-12	PLANT WATER LINE FROM PEB TO GEB	35
LOW TEMPERATURE SENSOR	TSL-13	PLANT WATER LINE TO CARBON TRANSFER TANK	35
LOW TEMPERATURE SENSOR	TSL-14	PLANT DRAINAGE STATION LINE TO T-101	35
LOW TEMPERATURE SENSOR	TSL-15	POTABLE WATER LINE FROM PEB TO GEB	35
LOW TEMPERATURE SENSOR	TSL-16	PLANT INFLUENT PIPE from T101	35
LEVEL ELEMENT AND TRANSMITTER	LE/LIT-01	TANK T-101	HIGH 80% LOW 18%

DEVICE	TAG #	LOCATION	RANGE
LEVEL ELEMENT AND TRANSMITTER	LE/LIT-03	TANK T-104	HIGH 80% LOW 15%
LEVEL ELEMENT AND TRANSMITTER	LE/LIT-04	TANK T-106	HIGH 95% LOW 10%
LEVEL ELEMENT AND TRANSMITTER	LE/LIT-05	FILTRATE WEIR TANK (FILTER PRESS)	50%
LOW LEVEL SWITCH	LLS-01	TANK T-110	
PRESSURE SWITCH	PS-01	PLANT WATER PUMP SYSTEM	52 PSI ON 100 PS9I OFF
TEMPERATURE SENSOR	TE-01	TANK T-110 WATER TEMPERATURE	40° F
PRESSURE SWITCH		POTABLE WATER SYSTEM	45 ON 65 OFF
PRESSURE GAUGE	PI-AH-15	AIR COMPRESSOR DISCHARGE	0-200 PSI
PRESSURE GAUGE	PI-101 (A/B)	P-101 A/B	0-30 PSI
PRESSURE GAUGE	PI-104 (A/B)	P-104 A/B	0-60 PSI
PRESSURE GAUGE	PI-105 (A/B)	P-105 A/B	0-400 PSI
PRESSURE GAUGE	P-107 (A/B)	P-107 A/B	0-60 PSI
PRESSURE GAUGE	P-111 (A/B)	P-111 A/B	0-200 PSI
PRESSURE GAUGE	P-112 (A/B)	P-112 A/B	0-60 PSI
PRESSURE GAUGE	P-114	P-114	0-60 PSI
PRESSURE GAUGE	P-115	P-115	0-60 PSI
PRESSURE GAUGE	P-117 (A/B)	P-117 A/B	0-200 PSI
PRESSURE GAUGE	PI-GW (A THROUGH S)	GWA-GWS	0-60 PSI

Hand Switches

There are hand switches and speed controls that allow the operator to have components of the system function independently from PLC/computer control. The switches are listed in the following table. (Switch type HOA, stands for hand, off. auto.)

Hand Switch and Speed Control Schedule		
Switch Tag No.	**Switch Type**	**Location of Switch**
HS-01A	HOA	P-111A Hand Switch on Local Control Panel
HS-02A	HOA	P-111B Hand Switch on Local Control Panel
HS-03	HOA	T-101 (Previously for aerator. Now inactive)
HS-04	HOA	P-101B MCC-1 Starter Hand Switch

Hand Switch and Speed Control Schedule		
Switch Tag No.	**Switch Type**	**Location of Switch**
HS-05	HOA	P-101A MCC-1 Starter Hand Switch
HS-06A	HOA	P-112B Hand Switch on Local Control Panel
HS-07A	HOA	P-112A Hand Switch on Local Control Panel
HS-08	ON/OFF	MX-1 Mixer Manual Starter
HS-09	START/STOP	MX-5 Mixer MCC-1 Starter Hand Switch
HS-10	START/STOP	Floc. Drive Local Hand Switch START-STOP
HS-11	START/STOP	Sludge Rake Local Hand Switch START-STOP
HS-12	HOA	P-107B Hand Switch Local to Solenoid HOA
HS-13	HOA	P-107A Hand Switch Local to Solenoid HOA
HS-14	ON/OFF	P-113 Local Hand Switch ON-OFF
HS-15	ON/OFF	P-116 Local Hand Switch ON-OFF
HS-16	ON/OFF	P-115 Local Hand Switch ON-OFF
HS-17	ON/OFF	P-114 Local Hand Switch ON-OFF
HS-18	START/STOP	T-109 Debagger Local Hand Switch START-STOP
HS-19	START/STOP	T-107 Debagger Local Hand Switch START-STOP
HS-21	ON/OFF	MX-3 Mixer Local Hand Switch ON-OFF
HS-22	HOA	P-103A SBR Panel
HS-23	HOA	P-119 Local Hand Switch on Local Panel
HS-25	HOA	P-110A Local Hand Switch on Local Panel
HS-26	HOA	P-108A MCC-1 Hand Switch
HS-27	HOA	P-106A MCC-1 Hand Switch
HS-28	HOA	P-103B Local Hand Switch SBR Panel
HS-29	HOA	P-110B Local Hand Switch SBR Panel
HS-30	HOA	P-108B MCC-1 Hand Switch
HS-31	HOA	P-106B MCC-1 Hand Switch
HS-32	HOA	P-104A MCC-1 Hand Switch
HS-33	HOA	P-104B MCC-1 Hand Switch
HS-34	START/STOP	P-109A MCC-1 Hand Switch
HS-35	ON/OFF	T-108 Mixer
HS-36	ON/OFF	T-106 Mixer MCC-1 Hand Switch
HS-37	ON/OFF	P-118 Local Hand Switch
HS-38	OFF/AUTO	Filter Press Panel P-117A OFF-AUTO Switch
HS-39	OFF/AUTO	Filter Press Panel P-117B OFF-AUTO Switch
HS-40	START/STOP	EF-1 MCC-1 Starter ON-OFF
HS-41	START/STOP	EF-2 MCC-1 Starter ON-OFF
HS-42	FAST/SLOW/OFF/AUTO	EF-5 MCC-1 Starter ON-OFF

Hand Switch and Speed Control Schedule		
Switch Tag No.	**Switch Type**	**Location of Switch**
HS-43	HOA	EF-6 MCC-2 Starter HOA
HS-44	START/STOP	LOOP-1 MCC-1 Starter START-STOP
HS-45	START/STOP	LOOP-2 MCC-1 Starter START-STOP
HS-46	HOA	P-120A Hand Switch on Local Panel HOA
HS-47	HOA	P-120B Hand Switch on Local Panel HOA
HS-48	OFF/TEST/ON	SF-101A Hand Switch in Local Panel OFF-TEST-ON
HS-49	OFF/TEST/ON	SF-101B Hand Switch in Local Panel OFF-TEST-ON
HS-50	ON/OFF	Filter Press Panel T-108 Debagger ON-OFF
HS-51	OFF/AUTO	Filter Press Panel Plate Shifter OFF-AUTO
HS-52	OFF/AUTO	Filter Press Panel P-105A OFF-AUTO
HS-53	OFF/AUTO	Filter Press Panel P-105B OFF-AUTO
HS-54	OFF/AUTO	Filter Press Panel Precoat Sys. OFF-AUTO
HS-55	OFF/AUTO	Filter Press Panel T-108 Water Fill OFF-AUTO
HS-56	OFF/AUTO	Filter Press Panel Air Blow Down OFF-AUTO
HS-57	START/STOP	T-106 (MX-4) MCC-1 Starter START-STOP
HS-58	OPEN/ CLOSE/AUTO	SBR Panel D-101A Weir OPEN-CLOSE-AUTO
HS-59	OPEN/ CLOSE/AUTO	SBR Panel D-101A Valve OPEN-CLOSE-AUTO
HS-60	HOA	SBR Panel M-101A1 HOA
HS-61	HOA	SBR Panel M-101A2 HOA
HS-62	OPEN/ CLOSE/AUTO	SBR Panel IV-101A OPEN-CLOSE-AUTO
HS-63	HOA	SBR Panel B-104 HOA
HS-64	HOA	SBR Panel P-121A HOA
HS-65	OPEN/CLOSE	SBR Panel BFV-AL-3-18 OPEN-CLOSE
HS-66	OPEN/CLOSE	SBR Panel BFV-AL-3-19 OPEN-CLOSE
HS-67	OPEN/CLOSE	SBR Panel BFV-AL-3-20 OPEN-CLOSE
HS-68	OPEN/CLOSE	SBR Panel BFV-AL-3-21 OPEN-CLOSE
HS-69	OPEN/ CLOSE/AUTO	SBR Panel D-101B Weir OPEN-CLOSE-AUTO
HS-70	OPEN/ CLOSE/AUTO	SBR Panel D-101B Valve OPEN-CLOSE-AUTO
HS-71	HOA	SBR Panel M-101B1 HOA
HS-72	HOA	SBR Panel M-101B2 HOA
HS-73	OPEN/ CLOSE/AUTO	SBR Panel IV-FCV03 OPEN-CLOSE-AUTO
HS-74	HOA	SBR Panel B-105 HOA
HS-75	HOA	SBR Panel P-121B HOA
HS-76	OPEN/ CLOSE/AUTO	SBR Panel BFV-AL-3-22 OPEN-CLOSE
HS-77	OPEN/ CLOSE/AUTO	SBR Panel BFV-AL-3-23 OPEN-CLOSE
HS-78	OPEN/ CLOSE/AUTO	SBR Panel BFV-AL-3-24 OPEN-CLOSE

Hand Switch and Speed Control Schedule		
Switch Tag No.	**Switch Type**	**Location of Switch**
HS-79	OPEN/ CLOSE/AUTO	SBR Panel BFV-AL-3-25 OPEN-CLOSE
HS-80A	BYPASS/ OFF/DRIVE	B-101 Panel BYPASS-OFF-DRIVE
HS-80B	AUTO/ MANUAL	B-101 Panel AUTO-MANUAL
HS-80C	VARIABLE SD. CNTL.	B-101 Panel SPEED POT.
HS-81A	BYPASS/OFF/DRIVE	B-103 Panel BYPASS-OFF-DRIVE
HS-81B	AUTO/ MANUAL	B-103 Panel AUTO-MANUAL
HS-81C	VARIABLE SD. CNTL.	B-103 Panel SPEED POT.
HS-82	OFF/ SLOW/FAST	EF-5 Local Control Panel OFF-SLOW-FAST
HS-83	HOA	Potable Water MCC-1 Starter Hand Switch HOA
HS-84A	ON/OFF	AHU-1 MCC-1 Hand Switch
HS-84B	ON/OFF	AHU-2 MCC-1 Hand Switch
HS-85A	ON/OFF	AHU-1 Local Panel Hand Switch
HS-85B	ON/OFF	AHU-2 Local Panel Hand Switch
HS-86	ON/OFF	Light Curtain Filter Press Panel
SC-01 (HS-01B)	SPEED CONTROL POT.	P-111A Speed Control Pot. on Local Control Panel
SC-02 (HS-02B)	SPEED CONTROL POT.	P-111B Speed Control Pot. on Local Control Panel
SC-03 (HS-06B)	SPEED CONTROL POT.	P-112A Speed Control Pot. on Local Control Panel
SC-04 (HS-07B)	SPEED CONTROL POT.	P-112B Speed Control Pot. on Local Control Panel
SC-05	SPEED CONTROL POT.	Sludge Rake Speed Controller Pot. on Local Control Station
SC-06	SPEED CONTROL POT.	Floc. Drive Speed Controller Pot. on Local Control Station
SC-07	STROKE CONTROL	P-113 Speed Control Pot. on Pump
SC-08	STROKE CONTROL	P-116 Speed Control Pot. on Pump
SC-09	STROKE CONTROL	P-115 Speed Control Pot. on Pump
SC-10	STROKE CONTROL	P-114 Speed Control Pot. on Pump
SC-11	SPEED CONTROL POT.	P-106A Speed Control Pot. on MCC-1 Starter
SC-12	SPEED CONTROL POT.	P-106B Speed Control Pot. on MCC-1 Starter
SC-13	SPEED CONTROL POT.	P-104A Speed Control Pot. on MCC-1 Starter
SC-14	SPEED CONTROL POT.	P-104B Speed Control Pot. on MCC-1 Starter
SC-15	STROKE CONTROL	P-118 Speed Control Pot. on Pump

SYSTEM PREPARATION FOR START-UP:

These instructions should be used once it has been confirmed that: all components are working and where needed calibrated; and there are sufficient chemicals.

INSTRUCTION	COMMENTS
Start the personal computer	If graphics screen does not appear at end of boot sequence, type AUTOEXEC at the C:\ prompt, press return and follow the instructions on the screen.
Set all process valves to the proper position	See "Start-up Valve Position Table" in Appendix U
Confirm that each Recovery Well is operating.	At well head control panels A through S
Close all circuit breakers for the treatment system	See MCC 1 & 2 schedule and 120/277 volt distribution panels, in the Electrical section of this manual.
Set influent pH controller to 8.5	AE-01/AIT - 01 on the NaOH storage and pumps display screen
Set the influent flow rate to 100 GPM	FE-01/FIT - 01 on the metals removal and sludge transfer display screen
Set the effluent pH controller to 7.5	FE - 02/ FIT -02 on the sulfuric acid and powder activated carbon display screen
Energize the ground water recovery well loops 1 & 2	Located on MCC 1. Place the feeder breaker in the "ON" position for each of the two loops and press the "Start" buttons
At each of the nineteen recovery wells, open the main enclosure door and place the main disconnect in the ON position. Close the door and open the small door on the left side of the enclosure. Energize the panel and close and lock the door. Open the small door on the front of the main door and place the HOA switch in the AUTO position.	**ENERGIZING THE INSIDE OF THE PANEL FIRST, WILL REDUCE THE OPERATOR'S EXPOSURE TO THE VOLTAGES INSIDE THE ENCLOSURE. VERIFY THAT THE DISCHARGE VALVE INSIDE THE VAULT IS IN THE OPEN POSITION PRIOR TO PLACING THE HOA SWITCH IN AUTO.**
Place the inclined plate settler in operation.	Fill settler with clean water.
Start the flash mixer on the inclined plate settler.	Start push-button for the flash mixer is located in MCC 1, HS-09.
Energize the flocculation mixer drive.	The disconnect is located on the mezzanine above the Control room. Turn hand switch HS-10 to the ON position and adjust the drive speed using the speed pot SC-06. HS-10 and SC-06 are located on the upper inclined plate settler platform.
Energize the sludge rake drive and adjust the rake speed.	Disconnect for the sludge rake drive is located on the mezzanine above the control room. The start/stop push-button and speed control pot station is located adjacent to the inclined plate settler in the lower carbon room.
Place the SBR's in operation	Bring in "seed-sludge" to start acivated sludge process
Energize the SBR main control panel	Disconnect is on the right door of the SBR main control panel.

INSTRUCTION	COMMENTS
Confirm or set SBR cycle times and Blower times	See Aqua Aerobics Manual.
Place all SBR disconnects and hand switches in the appropriate position.	See listing of the disconnect and hand switches and their respective positions.
Place the MCC 1 hand switches in the appropriate position.	**Note: limit flow to 80 GPM for P-106 A&B by adjusting the plug valves located on the discharge lines of P-106 A&B. This adjustment will work in concert with the P-106 variable frequency drives.**
Fill tank T-109 to the 800 gallon mark and start the mixer. Start the mixer MX-3 by turning HS-21 to the ON position. Slowly add 800 pounds of sugar to the 800 gallons of water. Start the LMI feed pump by placing the local disconnect switch to the ON position and placing HS-23 in the AUTO position.	The main disconnects for these devices are located in MCC-2 in the GEB electrical room. The local disconnects and hand switches are located adjacent T-109 in the GEB process room.
Sand Filters start up	Fill with clean water
Open air supply valves for SF-101 A&B	Air valves are located at the bottom of the stainless steel enclosures on the west wall of the upper carbon room.
Open the doors on the stainless steel enclosures and place the hand switches HS-48 & HS-49 to the ON position.	
Check level in T-101. When level is above a minimum of 25%, start the aerator blower B101 or B102.	Blower room
Chemical feed systems	
Take grab sample from T-101 and test pH. If less than 8.5 start P-111 A or B in the hand mode and continue check pH until 8.5 is reached. Upon reaching a pH reading of 8.5 place the HOA switch in the auto position.	Local disconnect and HOA switch for P-111 A & B are adjacent to the pumps in the GEB process room.
Verify that the level of NaOH in T-103 is at least 2 feet, if less than 2 feet add NaOH to the tank.	T-103 is located in the GEB process room
Verify that the drums for P-114, 115 and 116 have sufficient chemicals. If needed, fill the drums or replace with full drums.	Pumps P-114, 115 and 116 are located in the GEB process room.
Verify that the drums for P-113 and 118 have sufficient chemicals. If needed refill the drums or replace with full drums.	Pumps P-113 and 118 are located in the filter press room in the PEB.
Verify that the level in T-107 is minimum 50% full. If level is less than 50% add FES as needed and press HS-19 start button, T-107 debagger. Start mixer MX-1 by turning HS-08 to the ON position.	Hand switches for the debagger and mixer are located on the debagger platform.
Refer to the chemical feed disconnect and hand switch schedule for position of switches for startup.	

START OF FORWARD FLOW THROUGH THE TREATMENT TRAIN	
Start pumps P-101 A&B	HS-04 & 05 at MMC#1 in the AUTO position
Manually sample wastewater downstream of P-101 A&B and compare to reading on AE-01, displayed on the metals removal and sludge transfer display screen.	Increase speed of P-111 as required to reach pH of 8.5
Manually sample wastewater downstream of M-101 (at SBR Influent Tank). If TSS is greater than 20 ppm adjust polymer feed if in use.	
Manually sample from the upper tap of the M-101 sludge thickener, and adjust timer as required. Place P-107 A&B hand switches in the AUTO position.	Timed operation is based on sludge buildup in the thickener
After approximately two hours of flow to the SBR's, manually sample wastewater downstream of M-101 for pH and TSS.	Adjust chemical feeds as required.
For SBR sequence of operation see SBR section of this manual.	
There is no automatic operation for the Carbon Adsorption System. However, refer to the Carbon Adsorption System section of this manual for operation of this system.	The carbon units will appear on the screen of the Main Computer to show flow path only.

SAMPLING AND LABORATORY TESTING

Sample Collection and Handling Procedures

The Sampling and Laboratory Testing Program will perform two functions at the GWTF. Effluent testing will satisfy NJPDES requirements by ensuring an acceptable discharge, while all other testing will provide the basis for process control, as well as resulting in a record of how the treatment facility is operating. Certain analyses (pH, DO, TSS, etc.) are performed in the on-site laboratory, while others is performed by an off-site NJDEP certified laboratory. The State of New Jersey has imposed monitoring requirements to insure an acceptable discharge.

The value of results from the laboratory testing is dependent upon the sample being representative of the source from which it was taken. There are two types of samples taken for analysis as follows:

Composite Sample - A combination of individual samples taken at selected time intervals, for some specified period, to minimize the effect of the variability of the individual sample.
Example: Composite sample from ten 100 ml aliquots sampled hourly.

Grab Sample - A single sample taken at neither set time nor flow.

There are five sampling locations. They are::

1) The first sampling location is the Ground Water Equalization Tank (T-101). Contract procedures require quarterly sampling of the plant influent here. The samples are taken at the influent line to tank T-101. Daily grab process samples are taken for analysis at the onsite laboratory

2) The second sampling location is taken as water enters the SBR influent tank. Daily process samples taken at this point are to determine the metals removal performance and to characterize the SBR influent ground water.

3) The third sampling location is the SBR's reactor tank. Daily samples are taken for monitoring and control of the biological processes and to determine sludge wasting requirements.

4) The fourth sampling location is the 24 hour composite twice per month sample taken at the effluent of the carbon adsorption unit. The effluent quality is monitored from this location in accordance with NJPDES. Daily samples for process control are taken at the effluent tank, as grab samples.

5) Daily process samples are taken from the fifth sampling location the SBR Decant Tank.

Sample Collection, Handling, and Analysis

The following Tables describe the sample location and respective sampling requirements for

Table S-1 Compliance Sampling & Analysis Parameters: Influent QUARTERLY at T101; and Effluent 2/MONTH at Carbon Adsorption Unit Effluent.

Parameter	Sample Size (ml)	Sample Type	Sample Preservation	Analytical Method
Ammonia	250	Aliquoit of 24-hour Composite	Hold at 4^0C, 1ml H2SO4	EPA 350.2 or EPA 350.2+.1 or EPA 350.2+.3 or SM 4500-NH3B/C or SM4500-NH3B/E or SM 4500-NH3B+F/G or SM 4500-NH3H
Total Organic Carbon TOC (mg/l)	250	Aliquoit of 24-hour Composite	Hold at 4°C, add H2SO4 to pH <2	USEPA Method 415.1; SM 5310B or SM 5310C or SM 5310D (all 19th Edition)
Total Suspended Solids TSS (mg/l)	1000	Aliquoit of 24-hour Composite	Hold at 4^0C analysis next day	USEPA Method 160.2; SM 2540D
Cyanide Total	500	Aliquoit of 24-hour Composite	Hold at 4^0C, add NaOH pH>12	USEPA Method 335.4; SM 4500-CN-E
Heavy metals (Total)	1000	Aliquoit of 24-hour Composite	Adjust pH <2, Nitric Acid	USEPA SW-846 Method 6020, for Mercury 7470A or EPA 245.1
Volatile Organics, See Discharge Permit	40 (X2)	Grab	Hold at 4^0C	EPA 5030B / 8260B
Semi-volatile Organics	500	Aliquoit of 24-hour Composite	Hold at 4^0C	USEPA SW-846 Method 8270C
Pesticides	1,000	Aliquoit of 24-hour Composite	Hold at 4^0C	USEPA SW-846 Method 8081A
Polychlorinated Biphenyls (PCBs)	500	Aliquoit of 24-hour Composite	Hold at 4^0C	USEPA SW-846 Method 8082
pH	500	Grab	Analyze Immediately	EPA 150.1 or EPA 150.2 or SM 4500-HB
Dissolved Oxygen	500	Grab	Analyze Immediately	SM 4500 O-G
Effluent Sampled Quarterly at the Carbon Column Effluent				
Acute Toxicity	18,000	24-hour Composit	Hold at 4^0C	N.J.A.C. 7:18 (fathead minnow)
Influent Sampled 2/Month at P-101 Discharge				
Total Suspended Solids TSS (mg/l)	1,000	Grab	Hold at 4^0C	EPA 160.1 or SM 2540D

Table S-2 Sampling Analysis Parameters For Plant Operation Process Monitoring

Parameter	Frequency	Location	Sample Size (ml)	Sample Type	Sample Preservation	Analytical Method	Physical Location
pH	Daily	Plant Influent	500	Grab	Analyze Immediately	EPA 150.1 or EPA 150.2 or SM 4500-HB	Tank T-101
Temperature	Daily	Plant Influent	500	Grab	Analyze Immediately	SM 2550 B-00	
Ammonia	Daily	Plant Influent	250	Grab	Analyze Immediately	Hach Test Kit NI-SA	
Ammonia	Daily	Plant Effluent	250	Grab	Annalyze Immediately	Hach Test Kit NI-SA	Tank T110
pH	Daily	Plant Effluent	500	Grab	Analyze Immediately	EPA 150.1 or EPA 150.2 or SM 4500-HB	
Temperature	Daily	Plant Effluent	500	Grab	Analyze Immediately	SM 2550 B-00	
Dissolved Oxygen	Daily	Plant Effluent	500	Grab	Analyze Immediately	USEPA Method 360.1	
Total Organic Carbon TOC (mg/l)	Weekly	Plant Effluent	250	Grab	Analyze Immediately	Hach Method 10129 Low Range; Method 10173 Mid Range	
Chemical Oxygen Demand	Weekly	Plant Effluent	50	Grab	Analyze Immediately	SM 4500-O C, Hach 8229	
Phosphorus (Orthophosphate)	Daily	SBR Influent	250	Grab	Analyze Immediately	Hach Method PO 23	SBR Influent Tank
Alkalinity	Daily	SBR Influent	125	Grab	Analyze Immediately	SM 2320 B, EPA 310.2, Hach 8203	
pH		SBR Influent	500	Grab	Analyze Immediately	EPA 150.1 or EPA 150.2 or SM 4500-HB	
Temperature		SBR Influent	500	Grab	Analyze Immediately	SM 2550 B-00	
Total Organic Carbon TOC (mg/l)	Weekly	SBR Influent	125	Grab	Analyze Immediately	Hach Method 10129 Low Range; Method 10173 Mid Range	

Table S-2 Sampling Analysis Parameters For Plant Operation Process Monitoring

Parameter	Frequency	Location	Sample Size (ml)	Sample Type	Sample Preservation	Analytical Method	Physical Location
Mixed Liquor Suspended Solids	Daily	SBR Reactor	1000	Grab	Analyze Immediately	USEPA Method 160.3	SBR Reactor Tank
Mixed Liquor Volatile Suspended Solids	Daily	SBR Reactor	1000	Grab	Analyze Immediately	USEPA Method 160.4	
pH	Daily	SBR Decant	500	Grab	Analyze Immediately	EPA 150.1 or EPA 150.2 or SM 4500-HB	SBR Decant Tank
Temperature	Daily	SBR Decant	500	Grab	Analyze Immediately	SM 2550 B-00	

regulatory compliance (Table S-1) and process control (Table S-2) . Table information includes the parameter to be tested, sample size and type, sample preservation control, analytical method for analysis and whether the analysis testing is completed on or off site.

Tap Sampling

Ground water samples are collected at the influent line of the Ground Water Equalization Tank (T-101), and at the sample tap downstream of P-101 A/B. Samples included in Tables S-1, and S-3 is collected via Tap Sampling. The tap samples are obtained using the tap sampling methods outlined in ASTM Method 3370 "Standard Practices for Sampling Water".

1) The tap is flushed thoroughly to clear the service line at a rate to remove all sediment and gas pockets.
2) Then purge a minimum quantity of ten (10) times the volume of the tap line. This volume is from the process stream to the end of the tap.
3) Hold the sample container upright near the base while it is being filled. Do not insert the sample tap into the container.
4) Do not rinse the container with the sample; fill it directly to within 1 inch of the top, except for volatile organic compound (VOC) vials.
5) Do not allow containers with preservatives to overflow. Cap the container immediately. VOC vials must be filled so that the meniscus is just over the rim of the vial. The screw cap and Teflon lined septum are tightened, and the vial inverted and checked for air bubbles (if air bubbles are present, then a new sample must be collected).
6) Caution must be used to prevent contaminating the sample with fingers, gloves or other materials.
7) Follow procedures for sample preservation and shipping.

SBR Reactor Tank Sampling

Ground water samples collected from the SBR reactor tank (Q-101 A/B) are listed in Table S-4 and are collected from the access platform on top of the tank using the following method. A clean sample jug must be used according to the procedures outlined in the most recent NJDEP Field Sampling Procedures Manual and the Compendium of ERT Waste Sampling Procedures, USEPA, January 1991.

1) Clean the sample jug according to the requirements for the analytical parameters to be tested.
2) Attach the required length of rope (braided nylon) to the sampler for lowering the sampler into the tank.
3) Lower the sample jug into the tank
4) Slowly raise the sampler to the surface.
5) Transfer the sample to the sample container. If applicable, fill VOC vials first. Securely close the lid of the sample container.
12) Decontaminate the outside of the sample container with paper towels, if necessary.
13) Follow procedures for preservation and shipping.

Outfall Sampling

All outfall sampling is collected using one of the following two methods. Effluent samples are collected using a laboratory cleaned sample bottle or an Isco automated sampler. Procedures for use of these devices are outlined in the most recent NJDEP Field Sampling Procedures Manual.

Using a Laboratory Cleaned Sample Bottle

1) Examine sample bottles for breakage and tight fitting lid.
2) Submerge the sample bottle and allow sample water to slowly fill bottle, or for flowing water, position the sample container so that the mouth of the bottle faces upstream and allow the bottle to fill. Do not allow the mouth of the bottle to contact the bottom of the pipe or basin to avoid collecting sediments.
3) Collect VOC vial samples first, if applicable.
4) Securely fasten bottle lid and decontaminate exterior of sample bottle with paper towels.
5) Follow procedures for sample preservation and shipping.

Using and ISCO Automatic Sampler

1) Follow manufacturer's instructions for assembly of the sampling system.
2) Place a laboratory cleaned bottle in the ISCO sampler
3) Program the sampler for 24 hour composite
4) Remove sample bottle at the end of the sample period and containerize the samples

MONITORING

Process Control Monitoring

The analyses that are described in Tables S-1 and S-2 as being performed on-site (pH, Dissolved Oxygen, TOC, COD, Total Nitrogen, Phosphorous, Alkalinity, Mixed Liquor Suspended Solids, and Mixed Liquor Volatile Suspended Solids, Ammonia) are the basis for process control monitoring. These tests, since they is performed on-site, will provide immediate information to the operator about individual unit processes and overall plant efficiency. These tests will thus help in predicting or troubleshooting problems occurring or developing in the system. All results are to be recorded daily in a log book (self monitoring program).

Compliance Monitoring

The New Jersey Pollutant Discharge Elimination System (NJPDES) Permit Equivalent, attached in Appendix P and briefly described in Section 2.1, contains sampling and analytical components that will ensure the treated ground water discharged from the GWTF meets regulatory requirements. The sampling and analyses required by NJPDES are also presented in Table S-5. Some of the analyses is performed on-site, while others must be performed off-site by an NJDEP certified laboratory. All test results must be summarized and reported monthly on a Discharge Monitoring Report (DMR), also presented in Appendix P.

Spent Carbon

When the activated carbon in an adsorption vessel is exhausted, the spent carbon is transferred to a transfer tank which is provided as an integral part of the Calgon Carbon Model 10 system installation. This tank is provided to facilitate carbon transfer operations and eliminates the need for, and costs associated with, an empty bulk trailer. The spent carbon is transferred from the transfer tank to the same bulk trailer which delivered the fresh carbon and is removed from the site for thermal reactivation and re-use.

Sludge

By design, biological and metals removal sludges are produced at the GWTF. Based on laboratory testing to date, the resulting sludge filter cake is not classified as a hazardous waste. Laboratory characterization for toxicity of the sludges should be completed periodically by a certified lab for all of the analytical parameters required by NJDEP for waste classification and by the disposal facility for waste acceptance. These results will dictate the disposal methods in order to comply with all applicable government regulations and disposal procedures including the Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities. If it is found that the sludge is hazardous, then EPA identification number, NJR 000015495 is required for the sludge generator and for contract negotiations with the disposal vendor.

For sites undergoing remediation by the NJDEP Site Remediation Program, N.J.A.C. 7:26E-7.1 (a)31 allows unlimited storage time.. The sludge produced from the filter press will discharge into coverable containers and then trucked to an off-site landfill that is determined and approved by NJDEP. All sampling procedures, test results, and logs associated with storage and disposal of the sludge should be maintained for the life of the plant, or as otherwise directed by NJDEP.

In the event that one of the sludges is determined to be hazardous and the other is nonhazardous, the sludges can be processed separately.

Biological Sludges

Waste activated sludge generated by the SBR biological treatment process will make up approximately 10-25 percent of the total sludge generated. Most biodegradable compounds in the ground water, including volatile organics, should render the filter cake not hazardous since biological oxidation and volatilization takes place in the biological treatment process and a very low mass transfer efficiency from the ground water to the sludge occurs. This sludge is presently being combined with the sludge from the metals removal process.

Metals Sludges

Approximately 75-90 percent of the sludge generated is a co-precipitated, metal hydroxide sludge

that may contain chromium, copper, lead and zinc and other trace metals. Through laboratory testing and proper waste classification, this sludge has been determined to be nonhazardous. It is necessary to periodically re-analyze the sludge to confirm it is nonhazardous. A Waste Classification Request form will also be required to be completed; see Appendix P.

Laboratory Wastes

It is the responsibility of all employees to follow the procedures for the proper separation and disposal of chemical wastes. Wastes should be disposed of in a manner that is safe and in accordance with applicable regulations. Operators using chemicals in the laboratory should be aware of the toxic properties of the substance, through the review of the applicable MSDS.

The laboratory sink drains to the on site septic system. Therefore no laboratory wastes from process testing nor any process samples may be disposed of down the drain. These wastes must be collected for disposal into the Groundwater Equalization Tank (T-101) for processing through the plant. Strong acids and bases should be diluted before they are added to T-101. Toxic, malodorous, flammable, corrosive or eye irritating chemicals should not be disposed of down the drain. It is unlawful to discharge these materials due to local regulations. At this site, all such laboratory wastes are collected in an approved container that is labeled according to contents. Wear appropriate personal protective equipment when handling these chemical wastes. Collection containers should be stored in well ventilated areas. Accessibility by hand truck or forklift is required to remove full containers for treatment. Appropriate documentation is necessary to verify type of contents.

The above are only general guidelines for laboratory waste disposal. To comply with the GWTF laboratory waste separation, storage, transportation and disposal consult appropriate federal, state and local regulatory agencies to ascertain proper disposal procedures.

Lubricating and Hydraulic Fluids

Spent lubricating and hydraulic fluids must be collected and stored in approved metal containers that are labeled according to contents. Appropriate personal protective equipment should be worn when handling these spent fluids. Collection containers should be stored where the fire hazard is minimal and ventilation is adequate. Access either by hand truck or forklift is necessary so appropriate personnel can remove full containers from the site for treatment. Appropriate documentation is necessary to verify container contents.

Protective Coatings

Protective coatings, such as specialized paints and epoxy mixtures, should be treated cautiously since they contain solvents and vary in their toxicity and flammability. Appropriate personal protective equipment should be worn to prevent skin contact and inhalation of solvents and pigments. Storage and use of protective coatings pose a potential fire hazard. The low flash points of solvents could cause combustion during use or improper storage. Protective coatings should be stored in a explosion-proof, static electric controlled, labeled cabinet located in an area

with sufficient ventilation. Disposal of unused and spent coatings should be completed in accordance with label instructions.

TREATMENT SYSTEM SHUTDOWN AND STORAGE

Shutdown

Planned shutdown of the CFSL GWTF will occur only upon the direction of NJDEP. NJDEP may direct to shut down the plant for maintenance reasons or if the collected ground water, or GWTF influent, repeatedly meets or is below NJPDES Permit Equivalent discharge requirements. The analytical results obtained through sampling performed on the plant influent (see Table S-1), as well as from additional ground water sampling, is evaluated by NJDEP. If NJDEP advises that the facility may be shut down, the process of ceasing operations begins with the ground water recovery wells, force mains, and the ground water equalization tank (T-101) and continuing downstream with subsequent processes.

Storage

If NJDEP determines that the plant can be shutdown, then proper preparation steps must be taken to ensure protection of electrical and mechanical equipment should startup or reuse be necessary. All mechanical equipment should be throughly cleaned, lubricated, and covered where possible. Water used to clean equipment is pumped to the Ground Water Equalization Tank (T-101) and pumped offsite for treatment. All process plumbing and piping should be depressurized and drained. Electrical power is to be turned off to all treatment system components except those needed for heating and site security.

Pre-operational Check

Prior to restarting the GWTF pre-operational testing of all equipment and instrumentation is completed and a Equipment Testing Report is generated, see Appendix Q

PLUMBING SYSTEMS

Potable Water

The potable water for the CFSL site is supplied from Washington Township MUA to the process equipment building. A backflow preventer valve is on the water pipe at the entrance to the PEB. Quarterly back flow preventer test arem performed by a certified technician. A potable water line exits the south end of the PEB to supply the GEB and is installed with applicable explosion-proof atmosphere requirements and is insulated and heat traced. A control thermostat and an alarm thermostat are provided to operate and monitor the heat trace.

Plant Water

The GWTF is equipped with a plant water system which consists of duplex vertical multistage centrifugal pumps driven by constant speed electric motors. Plant water is used for chemical mixing and plant washdown. **THIS WATER IS NOT POTABLE AND MUST NOT BE USED FOR DRINKING.** The Plant Water Pumps (P-120 A/B) are connected by a 6" PVC suction pipe to the Carbon Filter Backwash Tank (T-110) which receives and stores treated plant effluent and they discharge to a hydropneumatic tank upon demand. When required, the pumps can be used to supply water directly to the plant in addition to the hydropneumatic tank. Also included are valves, a control panel, and accessories needed for a complete operating system.
The pumps are activated on low system pressure (50 psi) in the hydropneumatic tank and deactivated on high pressure (100 psi) by a NEMA 7 pressure switch mounted on the tank feed/discharge line. The hydropneumatic tank is used to minimize pump cycling by releasing water to the system after pump shutoff. A flow control valve limits the feed rate to the hydropneumatic tank to approximately 30 gpm. Plant water lines are connected to the following:

- Ferric sulfate mix tank (T-107)
- Sugar mix tank (T-109)
- Carbon supply truck connection
- D.E. mix tank (T-108)
- Sludge polymer feed system (P-118)
- Process polymer feed system (P-113)
- Carbon transfer tank (CT-101)
- Carbon adsorption units (C-101 A/B)
- Sludge conditioning tank (T-106)
- Six (6) hose bibs

Plant Process Drains

The floor drains in the treatment plant are piped to the plant drainage pumping station and ultimately pumped to tank T-101 for treatment. These drains, if not used regularly, should be filled with water monthly to keep the traps full and eliminate odors from entering the building from the plant drainage pumping station. All tank overflow pipes are also routed to the plant drainage pumping station.

Sanitary Drains

The sanitary drains flow to a septic tank located approximately 50 feet due north of SBR #1. The sanitary drain system consists of the laboratory sink, mop sink, vanity sinks, urinal and water closets. Periodic pumping of the septic tank may be required. The laboratory sink has no neutralization sump, therefore, all chemicals must be stored in carboys for ultimate treatment by the plant treatment system.

ELECTRICAL SYSTEM

Three Phase System

Electric power for the site is supplied by Jersey Central Power & Light (JCP&L). The service for the site is fed underground from Parker Road to the pad mounted 500 KVA transformer, located at the northeast corner of the PEB. There is one manhole located on the east side of the access road approximately 400 feet north of Parker Road. The 480 Volt, 800 ampere power is a four wire service. The power is fed from the pad mounted transformer to a disconnect switch and meter panel located on the east side of the PEB. The power is then fed to MCC-1. These wires are in a 4" rigid steel conduit (see power and conduit schedule) Appendix A. The three-phase power is used to control most of the process equipment for the site. Refer to the MCC schedule in Appendix A for the listing of equipment powered by the 480 volt system.

There are two motor control centers for the facility. MCC-1 supplies power for all of the 480 volt equipment in the PEB and powers transformer T-1 which supplies power to the subpanels, TPP-1, TPP-1A and TLP-1. MCC-1 also feeds power to MCC-2 which is the power distribution center for the GEB. MCC-2 supplies power to the 480 volt equipment in the GEB and to the transformer T-2, which powers the distribution panel GPP-1. GPP-1 supplies power to all of the 277 volt and 120 volt equipment in the GEB.

There are two rotary, four position switches on each of the MCC's. The rotary switches are used to check the incoming voltage and the current draw on each of the legs. To check the incoming voltage, turn the rotary switch labeled voltage to the following three positions and record the reading at each position: L1 L2, L2 L3, and L3 L1. The voltages should read within ± 10 %. If the readings are greater than ± 10 %, call JCP&L and report the imbalance of phases. To check the current draw on each of the three legs, place the Ammeter switch to the 1, 2, and 3 positions and record the readings. The current draw on each of the three legs should be within ± 10% of each other. If there is a load imbalance, and the voltage is not imbalanced, check for loose electrical connections on the three phase equipment. **POWER TO EACH OF THE DEVICES BEING CHECKED MUST BE DE-ENERGIZED PRIOR TO STARTING THIS WORK.**

Power Outage/Failure

Not all process apparatus re-start after an electrical power interruption. Therefore, after a power interruption:

1. Turn on the power to Well Loops #1 and #2 at the control panel in the Electrical Room
2. Turn on the Plate Settler Flocculator Mixer at the top of the Plate Settler and the Rake at the base of the Sludge Thickening Tank.
3. Re-start the compressor in the Filter Press Room. The compressor starts automatically.
4. Re-start the Sugar Tank Mixer in the G.E.B.
5. Re-set the Carbon Dioxide Fire Alarm in the G.E. B.
6. Check each groundwater extraction well to confirm that it has returned to normal operation.
7. Turn on any other appartaus that have "Start/Stop" operator control switches that are needed, such as the Press Room exhaust fans in the Electrical Room.

Some power outages or fluctuations to the plant cause the Main Breaker at MCC#1 to shut off. When that happens there is no power to the entire facility until someone re-set the Main Breaker. That means there is no heat, especially important in winter.

Power for the security system is monitored and loss of power is transmitted as a trouble signal to the Central Monitoring Station. There are no provisions for monitoring the incoming power to the facility, however the autodialer does monitor incoming power to the autodialer and therefore will notify the Operator of power problems. The loss of power may be only to the autodialer and not the incoming power.

Phase loss and surge protection devices are connected to the main incoming power. The phase loss protection device consist of the following components, which are mounted in MCC #1 in the PEB electric room: General Electric #9T58K0048 300 VA control transformer, General Electric phase loss protective relay #SPVR -480-0 featuring over and under voltage protection, and Timemark #295-120 shunt trip breaker capacitive trip device. The phase loss protective relay trips within a field adjustable 1 to 10 seconds under the following circumstances:

- 12% or greater phase imbalance
- phase loss
- voltage exceeds 115% or is below 80% for a preset time

The relay contains a bi-colored LED status indicator. When the indicator is green, the output relay is de-energized and in it's normal state. When the indicator is red, the output relay is energized, indicating a fault has occurred. The surge protection device is installed adjacent to section 10 of MCC #1 and is a Zone Master 150 distributed by Atlantic Scientific Corporation. The unit is rated for a maximum surge current capacity of 150,000 amps per phase and a maximum continuous operating voltage of 25% above the nominal voltage. Similar to the phase loss protective device, the surge suppressor contains an LED status indicator. A green LED indicates active surge protection and a red LED indicates a high voltage neutral to ground condition. A mechanical fuse link operated flag provides a fault warning.

Be aware that some of the equipment fed from the MCC's is dual powered. This means that

although the 480 volt power has been disconnected there may still be control (foreign) power present. Each of the dual powered systems are labeled on the face of the MCC. Refer to the P&ID drawings in Appendix C, for the source of the foreign power.

All of the MCC compartments have provisions for lockout. Always follow the lockout/tagout procedures set forth in the site health and safety plan and the O&M manuals. NOTE: Whenever troubleshooting electrical problems check the interlocks first.

Single Phase System

There are two voltages associated with the single phase power system, 277 volt power for the lighting systems and 120 volt for the remainder of the equipment and receptacles. There are three distribution panels for the single phase power in the PEB; they are TPP-1, TLP-1 and TPP-1A. TPP-1A is a subpanel fed from panel TPP-1. TPP-1A is the power panel used for the heat trace system, flowmeters FE-01, FE-02, FE-03, and sand filter panels SF-101A and SF-101B. TPP-1 is the 120/240 volt panel and TLP-1 is the 277 volt lighting panel. There is one single phase power panel in the GEB, GPP-1.

All of the single phase circuit breakers are lockable. Whenever working on any equipment powered by a single phase power panel ensure that the circuit is locked out and tagged prior to commencing work. There are some circuits that are locked in the ON position to ensure that they are not accidentally opened. The circuit breaker will still trip even though the breaker is locked. To reset the circuit breaker, remove the lock, place the breaker in the OFF and then the ON position and place the lock back on the breaker.

NOTE: Whenever troubleshooting electrical problems always check interlocks first.

Heat Trace Schedule

The heat trace system is powered from TPP-1A in the electric room of the PEB, and and GPP-1. The signal wires from each field device are located in the main control panel in the control room. Each positive wire of the field devices goes through an in-line fuse for ease of troubleshooting the device. These fuses are prior to the signal entering the input cards of the PLC.

To check the operation of the heat trace system, remove the cover on the thermostat housing and lower the temperature setting until the alarm sounds at the computer terminal. Then reset the thermostat to its original setting if it is functioning properly. If the alarm fails to sound, check the fuse for that circuit and replace if blown. If alarm still fails to sound replace the thermostat.

Lighting System

There are four types of lighting installed for the CFSL treatment facility. They are fluorescent, high pressure sodium, LED lamps, and battery powered emergency lights.

The PEB Filter press room, the carbon room, and the GEB process room have high pressure sodium lights. It should be noted that these lights take a few minutes to gain full lighting capacity. The remainder of the areas have fluorescent lighting which is "instant on" lighting. All of the above lighting is controlled by wall mounted light switches, which are fed from lighting panel TLP-1 in the PEB and GPP-1 in the GEB. The outside lighting for the plant is also high pressure sodium and is controlled by photoelectric cells. The photoelectric cells for the lights on the tank farm and catwalk can be overridden by means of a wall mounted switch adjacent to the tank farm exit door in the main vestibule of the PEB. In the event of a power failure, the emergency lights sense loss of power and illuminate by the internal batteries. There are interior and exterior emergency lights in both buildings.It is anticipated that during a one year period, one case of fluorescent tubes and six high pressure sodium bulbs may need to be replaced.

The lighting schedule is presented in Appendix R.

HEATING AND VENTILATING SYSTEM

Natural gas service is provided to the GWTF via an on-site gas line connected to the utility along Parker Road. Four natural gas fired Duct Heaters (DH-1 through DH-4), are located in the PEB to heat the building and ensure the proper operation of all the process equipment as well as provide comfort for the operators during shift operation. Heat in the GEB is provided via three (3) Electric Unit Heaters (EUH-1 through EUH-3), which are ceiling mounted and explosion proof which include sealed elements, non-sparking fan, adjustable discharge grille and a NEMA-7 control panel.

The ventilation system consists of propeller wall and roof exhausters, ceiling and in-line exhaust fans, air handling units and coils, room air conditioning units, temperature controls, ductwork and accessories. See the manufacturer's O & M Manuals for maintenance and troubleshooting. A listing of the heating and ventilation equipment is presented below.

AHU-1 Air Handling Unit / Process Equip. Bldg

Type:	Draw-thru unit, single zone
Make:	McQuay/Snyder General
Model No.:	LYF111CH
Serial No.:	3ZJ01841-06
Motor Size:	2 hp, open drip proof
Fan Speed:	680 RPM
Design ACFM:	2650
AHU characteristics:	floor mounted, horizontally arranged, top horizontal fan discharge

AHU-2 Air Handling Unit / Process Equip. Bldg

Type:	Draw-thru unit, single zone
Make:	McQuay International
Model No.:	LYF114DH
Serial No.:	3ZJ01840-04
Motor Size:	10 hp, open drip proof
Fan Speed:	849 RPM
Design ACFM:	11630
AHU characteristics:	floor mounted, horizontally arranged, top horizontal fan discharge

DH-1 Gas Fired Duct Heater Process Equip. Bldg. (AHU-1)

Type:	Natural gas duct furnace (M86)
Make:	Sterling Radiator, QV2
Model:	QVD-150S
Serial No.:	Q9515328
Normal Input:	150,000 BTU/HR
Output:	120,000 BTU/HR
Efficiency:	80%
Max/Min CFM:	3704/1389 CFM
Min. Gas Supply Pressure:	5.0" W.C.

DH-2 Gas Fired Duct Heater Process Equip. Bldg. (AHU-1)

Type:	Natural gas duct furnace (M86)
Make:	Sterling Radiator, QV2
Model:	QVD-300S
Serial No.:	Q9515329
Normal Input:	300,000 BTU/HR
Output:	240,000 BTU/HR
Efficiency:	80%
Max/Min CFM:	7407/2778 CFM
Min. Gas Supply Pressure:	5.0" W.C.

DH-3 Gas Fired Duct Heater Process Equip. Bldg. (AHU-2)

Type:	Natural gas duct furnace (M86)
Make:	Sterling Radiator, QV2
Model:	QVD-400S
Serial No.:	Q9515759
Normal Input:	400,000 BTU/HR
Output:	320,000 BTU/HR
Efficiency:	80%
Max/Min CFM:	9877/3704 CFM
Min. Gas Supply Pressure:	5.0" W.C.

DH-4 Gas Fired Duct Heater Process Equip. Bldg. (AHU-2)

Type:	Natural gas duct furnace (M86)
Make:	Sterling Radiator, QV2
Model:	QVD-400S
Serial No.:	Q9515330
Normal Input:	400,000 BTU/HR
Output:	320,000 BTU/HR
Efficiency:	80%
Max/Min CFM:	9877/3704 CFM
Min. Gas Supply Pressure:	5.0" W.C.

EF-1 Inline Centrifugal Exhaust Fan/ Process Equip. Bldg.

Type:	High Efficiency
Make:	Cook
Model:	20CVB
Motor Size:	2 hp, high eff. ODP motor
Motor Speed:	1197 RPM
Motor Power:	460 V/3 ph/60 hz
Drive Type:	Belt, CVB Blower
Characteristics:	3025 CFM, vibration isolators, belt guard

EF-2 Inline Centrifugal Exhaust Fan/ Process Equip. Bldg.

Type:	Explosion proof
Make:	Cook
Model:	28CVB
Motor Size:	10 hp, explosion proof
Motor Speed:	1100 RPM
Motor Power:	460 V/3 ph/60 hz
Drive Type:	Belt, CVB Blower
Characteristics:	8700 CFM, vibration isolators, belt guard

EF-3 Ceiling Exhaust Fan/ Process Equip. Bldg.

Type:	Standard
Make:	Cook
Model:	GEM 5-10
Motor Size:	0.02 hp
Motor Speed:	1050 RPM
Motor Power:	115 V/1 ph/60 hz
Drive Type:	Direct GEM Blower
Characteristics:	210 CFM

EF-4 Ceiling Exhaust Fan/ Process Equip. Bldg.

Type:	Standard
Make:	Cook
Model:	GEM 5-10
Motor Size:	0.02 hp
Motor Speed:	1050 RPM
Motor Power:	115 V/1 ph/60 hz
Drive Type:	Direct GEM Blower
Characteristics:	210 CFM

EF-5 Centrifugal Roof Exhauster/ Process Equip. Bldg.

Type:	High Efficiency
Make:	Cook
Model:	365R7B
Motor Size:	1 hp, high eff. Motor
Motor Speed:	362 RPM, 2-speed 2- winding, 1800/1220
Motor Power:	460 V/3 ph/60 hz
Drive Type:	Belt, ACRUB Fan
Characteristics:	9785 CFM, 12" steel roof curb, disconnect switch, back draft damper

EF-6 Inline Centrifugal Exhaust Fan/ Gas Extraction Bldg.

Type:	Explosion proof
Make:	Cook
Model:	16 CVB
Motor Size:	1 hp, explosion proof
Motor Speed:	1256 RPM
Motor Power:	460 V/3 ph/60 hz
Drive Type:	Belt, CVB Blower
Characteristics:	1350 CFM, vibration isolators, belt guard

EF-7 Propeller Wall Exhauster/ Gas Extraction Bldg.

Type:	Standard
Make:	Cook
Model:	8SP15D
Motor Size:	0.04 hp, ODP motor
Motor Speed:	1453 RPM
Motor Power:	115 V/1 ph/60 hz
Drive Type:	Direct, SPD Fan
Characteristics:	75 CFM, auto louver, wall housing/screen

EF-9 Power Roof Exhauster/ Process Equip. Bldg.

Type:	Explosion proof
Make:	Cook
Model:	90R15DH
Motor Size:	0.13 hp, explosion proof
Motor Speed:	1550 RPM
Motor Power:	115 V/1 ph/60 hz
Drive Type:	Direct, ACRUD Fan
Characteristics:	534 CFM, 12" sloped roof curb, disconnect switch, back draft damper

EUH-1 Electric Unit Heater/Gas Extraction Bldg.

Type:	Electric forced air
Make:	Chromalox
Cat. No.:	CUH-1002EP-A
Part No.:	004-550518-011
Motor size:	1/3 hp
Motor speed:	1725 RPM
Motor power:	460 V/3 ph/60 hz
EUH characteristics:	Explosion proof control panel, heater rating 480, KW 10

EUH-2 Electric Unit Heater/Gas Extraction Bldg.

Type:	Electric forced air
Make:	Chromalox
Cat. No.:	CUH-1002EP-A
Part No.:	004-550518-011
Motor size:	1/3 hp
Motor speed:	1725 RPM
Motor power:	460 V/3 ph/60 hz
EUH characteristics:	Explosion proof control panel, heater rating 480, KW 10

EUH-3 Electric Unit Heater/Gas Extraction Bldg.

Type:	Electric forced air
Make:	Chromalox
Cat. No.:	CUH-1002EP-A
Part No.:	004-550518-011
Motor size:	1/3 hp
Motor speed:	1725 RPM
Motor power:	460 V/3 ph/60 hz
EUH characteristics:	Explosion proof control panel, heater rating 480, KW 10

EUH-4 Electric Unit Heater/Gas Extraction Bldg.

Type:	Electric forced air
Make:	Chromalox
Model No.:	LUH-B-04-43
Motor size:	1/3 hp
Motor speed:	1725 RPM
Motor power:	460 V/3 ph/60 hz
EUH characteristics:	Explosion proof control panel, heater rating 480, KW 5, 13,700 BTU/Hr

HEALTH AND SAFETY

Health and safety is of utmost importance for all personnel and visitors associated with the CFSL GWTF. The responsibility of safety belongs to each and everyone but the responsibility of development, implementation and enforcement of a Health and Safety Plan (HSP) for the plant lies with the manager of the GWTF and the Health and Safety Officer (HSO). Regular safety inspections should be performed to ensure that a safe work environment is maintained. Safety programs for employee training should include topics for accident prevention, personnel protection, emergency response and contingency planning and reviewed as necessary to avoid health hazards and safety risks. OSHA has numerous requirements, policies and procedures as they relate to health and safety.

Operations personnel should be throughly familiar with the Water Environment Federation's Safety and Health in Wastewater Systems, Manual of Practice No. I, 1994, which should be located on site.

Right to Know

Employee "Right to Know" legislation has been implemented to require employers to inform employees (operators) of the possible health effects resulting from contact with hazardous substances. Employers must provide operators with information regarding any hazardous substances which the operators might be exposed to under either normal work conditions or reasonably foreseeable emergency conditions resulting from workplace conditions. Information regarding hazardous substances is available from manufacturers in the form of Material Safety Data Sheets (MSDS) for hazardous substances. Employers must provide operators with a copy of MSDSs upon request and also must train operators to work safely with the hazardous substances that are encountered in the workplace.

The GWTF Health and Safety Officer is responsible for 1) notifying operators of any hazardous substances in the workplace, 2) providing easy access to MSDSs and 3) training operators to work safely with these substances. Additional information on "Right To Know" legislation can be provided by the GWTF Health and Safety Officer.

Confined Space Entry

For activities within confined spaces, the GWTF manager and HSO should develop and implement standard operating procedures in accordance with the NIOSH "Guide to Safety in Confined Spaces", NIOSH Publication No. 87-113 (Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402). The HSO should be responsible for informing personnel on the hazards associated with confined spaces and to train employees to an acceptable degree of proficiency for entering and working in confined spaces. An example of confined space entry work is the entrance into an empty tank for maintenance or repair work or entrance into the ground water recovery vaults located around the landfill.

Plant Safety

Each member of the operational staff should be familiar with OSHA enforced safety rules, regulations, procedures, practices and available safety equipment. Qualified instructors should conduct safety meetings periodically with all operational staff in attendance. The date of the safety presentation and the topics discussed should be properly documented.

At the Combe Fill South Landfill site, methane, hydrogen sulfide and vinyl chloride were identified in the preliminary design report as being components of the gases within the landfill. These gases may be released at levels at or above Permissible Exposure Levels (PEL) and, if found at these levels, may present an inhalation hazard. Benzene, ethylbenzene, toluene, tetrachloroethylene and trichloroethylene were identified in the water and air effluent from the site. The potential for their release also exists, although it is anticipated that the levels do not present an inhalation or skin contact hazard.

The materials may be released in a gaseous state and/or in splash from the pipelines or other liquid system components. Adequate health protection may be provided by use of chemical resistant splash suits, eye protection and chemical resistant gloves. Air purifying respirators with vinyl chloride cartridges may be necessary. These cartridges do not provide protection against hydrogen sulfide. A continuous air monitoring device for hydrogen sulfide may be necessary to accompany each line inspector.

Chemical Safety

Safety during chemical use can only be achieved through good judgement by informed, conscientious employees who learn to work with and to accept the responsibility of working with hazardous materials. It is the responsibility of each employee to utilize chemical safety training and understand the proper methods of safely handling hazardous materials.

The chemicals to be used at the GWTF are either prepared in their respective storage tanks or they are supplied pre-diluted at the required solution strength before dosing to the appropriate points. It is important to refer to the plant health and safety plan and MSDSs before handling any chemicals. All chemicals used on the site should be accompanied by Material Safety Data Sheets. MSDSs supply important information regarding the properties of the chemicals, handling precautions and use of proper safety equipment. MSDSs should be kept in a notebook and made readily available for all employees working with these chemicals.

A program of chemical control should incorporate purchasing procedures, handling, storing, dispensing, labeling, use, disposal, first aid and emergency procedures. Good chemical safety practices require mandatory safety rules and training programs. Personnel must wear required Personal Protective Equipment (PPE) when handling hazardous chemicals. Minimum PPE requirements are presented in both the Health and Safety Plan and MSDS's. Emergency showers and eyewash stations are provided in areas of chemical usage. Be sure to know the emergency response procedures should a accident or chemical spill occur.

Equipment Safety Requirements

While working near electrically controlled machinery such a pumps, compressors, motors, gear drives, spinning shafts, circulating belts, mixers with propellers/paddles, consideration must be given to the potential hazards. To reduce the possibilities of injury the following suggestions are recommended:

- Follow Lockout/Tagout procedures for machinery motor controls and local switches before servicing.
- Clear away all tools, manuals and extraneous parts before restarting machine.
- Do not wear loose clothing around rotating or moving equipment.
- Do not wear large rings or loose jewelry chains.
- Tuck long hair inside hardhat.
- Wear safety glasses, gloves, hardhats, hearing protection, safety shoes, boots, aprons, respiratory masks, and chemical resistant splash suits and any other personnel protective equipment when needed.
- Keep area around machines, pumps and compressors clean and free of debris.
- Make sure all safety shrouds are in place around shafts and belts.
- Safety lines should be painted on the floor around the perimeter of dangerous equipment.
- Never attempt to lubricate or adjust machinery that is in operation.
- Use proper lifting techniques to prevent unnecessary back injuries. Always get help if the load is too heavy. Use hoists, overhead cranes and power equipment when possible.
- Any unsafe equipment problems should be reported and repaired.

Training Requirements

To ensure the safe operation of the CFSL GWTF, all individuals involved in the operation and maintenance of the facility must complete all required training and safety programs that are established by the plant Health and Safety Officer (HSO). All training must be done by qualified instructors and properly documented. Copies of training records of operations personnel must be maintained on site. The Health and Safety Training Requirements are located in the Health and Safety Plan which list the training programs and OSHA regulatory reference.

Landfill Safety

The Health and Safety Officer (HSO) will evaluate all safety data and make necessary decisions regarding landfill site health and safety procedures. Since a full time HSO will not be employed on site during the GWTF operational phase, the lead operator or site manager must have HSO training in order to coordinate necessary safety programs for the site. The site manager and the HSO will establish a Health and Safety Plan (HSP) which will include an emergency response and evacuation plan appropriate for the landfill site.

SECURITY

Site security is necessary to prevent the exposure of unauthorized, unprotected people to the site, to avoid the increased hazards of vandals, to prevent theft, and to avoid interference with safe working practices.

An 8-foot high chain-linked security fence topped with one foot of barbed wire has been installed to restrict site access, as per the Record of Decision (ROD). This fence surrounds the remediated site area, the ground water treatment facility, and other treatment support structures. Access to the site is controlled by a locking gate located at the north end of the access road which branches off of Parker Road. Appropriate signs warning that the site is a hazardous waste site undergoing remediation are located on the fence around the site perimeter at 50 foot intervals, or as often as required depending on the line of sight to discourage trespassers.

An alarm system is provided for both the Process Equipment and the Gas Extraction Buildings with Master Control Panels for each. Magnetic contact switches are installed on all doors. There are four (4) smoke detectors for the CFSL Treatment Plant. Smoke detectors are located in the PEB Control Room, PEB-AHU-1 Duct, PEB AHU-2 Duct, and the GEB Electric Room. Internal and external tamper-proof audible alarms are connected to the autodialer and to a 24-hour central monitoring service. Electrical backup is provided by a 12 volt 7-AMP-Hr battery.

The security system for the Combe Fill South Facility consists of two NAPCO MA3000 Combination Commercial Burglary/Fire control communicators, photoelectric smoke detectors, and reed switch type door switches for both passage and overhead doors. Appendix F lists each of the individual components of the security system.

There are four alarms that are monitored at the Central Monitoring Station, retained by the Contractor. They are as follows:

- FIRE
- BURGLARY
- RESTORE
- TROUBLE

Upon receipt of a fire and/or burglary alarm, the Dispatcher at the Central Monitoring Station will call the site first, to verify that the alarm is not false. If no one answers or if the person who answers cannot give the appropriate code, the authorities is alerted by the Dispatcher. In the event that the alarm is after normal working hours, the Central Monitoring station will first page the Project Manager and if the page is not responded to a call is placed to the N-4 Operator.

The trouble alarm is an indication of either loss of power and/or loss of telephone line communications. The Central Monitoring Station is unable to differentiate between the loss of power and loss of phone. In the event either of these alarms are received at the Central Monitoring Station, the Operator at the Central Monitoring Station will contact the persons listed for the CFSL site.

Security System Operation

ARMING THE SYSTEM WHEN LEAVING THE PREMISES

1. Check the keypad display to determine if all zones are secure. If the green LED is off, the faulted zones is displayed. Check the faulted doors and secure where necessary. If the fault still exists, repair the faulted zone, or if not possible at this time, bypass the zone. To bypass the zone, press the zone number and then press the bypass button.

   NOTE: Bypassing zones leaves the zone unprotected.

2. With the green LED displayed, enter the access code, xxxx, press the ON/OFF button and the green LED light will go off and the red LED ARMED light will come on and the window will display EXIT TIME 60 seconds/ PLEASE LEAVE NOW. Leave through the exit door before the exit time expires.

B. INSTANT PROTECTION WHILE REMAINING ON THE PREMISES

1. If the Operator so chooses he may arm the system while within the building for protection against intruders. To program the Instant Protection, press the INSTANT button either before or after arming the system. When armed, the window will display SYSTEM ARMED and the red ARMED light will flicker to indicate instant protection. To disarm the Instant Protection function, enter the access code xxxx then press the ON/OFF button and the ARMED light will go out.

C. DISARMING SYSTEM WHEN RETURNING

1. Upon entry the keypad module will emit a beeping sound as a reminder to disarm the system and the red ALARM light is lit.

2. Immediately enter the access code, xxxx then press the ON/OFF button and then RESET. The beeping will stop and the red ARMED light will go out.

3. If the red ALARM light is flashing and ALARM is displayed, an alarm occurred while you were out. **Proceed with caution!** If you suspect that an intruder may still be on the premises, leave immediately and call the Police.

4. To silence an audible alarm, enter the access code, xxxx, and press the ON/OFF button and then RESET. After the system has been disarmed, the window will continue to display ALARM followed by the zone(s) violated. To reset the display, note the zones violated, then press the RESET button.

5. The AMBUSH code is a two digit code that is entered just prior to your disarm code. If an intruder forces you to disarm your system, (a) enter your AMBUSH code "99"; (b) enter your access code xxxx and press the ON/OFF button, this will send a silent alarm to the Central Monitoring Station. The red ARMED light will go out and the window will display SYSTEM READY, as if the system were merely disarmed. There is no indication

that an alarm has been sent.

6. For specific instruction on changing the access and ambush codes for the security system, reference the manufacturer's manual in Appendix F.

SECURITY SYSTEM TELEPHONE LIST	
CHESTER TOWNSHIP POLICE	(908) 879-5514
CENTRAL MONITORING STATION RECEIVER PHONE #	(800) 834-1663
A.C. DAUGHTRY, CO. INC.	(973) 932-3822

ALARM CODE NUMBERS	
1	FIRE
3	BURGLARY
9	RESTORE
OTHER	TROUBLE

Fire Protection

On site fire protection is provided in the form of multi-purpose dry chemical extinguishers throughout the PEB and GEB and an **oxygen-displacing** carbon dioxide extinguishing system in the GEB. THE FIRE SUPPRESSION SYSTEM IN THE G.E.B. CAN BE A HAZARD TO HEALTH. THIS SYSTEM DISPLACES THE OXYGEN IN THE BUILDING. EXIT IMMEDIATELY! The two fire hydrants that are located along the site access road and outside the PEB are not functional because there is no public water supply to the site. Supplemental fire protection is provided by the local fire department with use of tanker trucks.

All fire extinguishers, except the one located in the PEB laboratory, are of the dry chemical type 20A - 120 B:C (Amerex Model A411). They are housed in wall-mounted, stainless steel cabinets with identification signs. There are a total of five fire extinguishers in the PEB and one fire extinguisher in the GEB. In the northern half of the PEB, one extinguisher is located immediately to the right of the filter press control panel and another is located to the right of the entrance to the mens restroom. Two fire extinguishers are located in the southern half of the PEB; one each to the inside left of the east and west entrance doors and must be accessible at all times including ASAP after heavy snowfall. One carbon dioxide fire extinguisher, rated 5 BC (Amerex Model 322), is located in the laboratory. The portable fire extinguisher in the GEB is located in the electric room. All fire extinguishers will require periodic inspections to assure operational readiness.

The high pressure carbon dioxide fire extinguishing system in the GEB is controlled automatically and releases carbon dioxide 30 seconds after heat detection. There is also a pull-box located in the GEB electrical room which will instantaneously activate the CO_2 system. ACTIVATION OF THE CO2 SYSTEM SHUTS DOWN ALL POWER TO THE GEB. The system consists of automatic thermal detectors, a pressure switch, a hazard alarm, a 30 second discharge delay after automatic release, and 14, 100# carbon dioxide cylinders, piping, nozzles, hoses and discharge heads. The system is inspected , tested and maintained by a qualified Contractor. A minimum of two inspections and testings per year are required. Refer to the manufacturer's O & M Manual for the manual testing procedure and further information.

Autodialer

The autodialer used at the Combe Fill South Facility is a RACO, Chatterbox, model # CB-4. The CB-4 is powered by a 120 volt circuit, with battery back up. There are eight (8), unpowered dry contact input channels. The autodialer monitors process alarms, smoke detector alarms, combustible gas alarms, and burglary alarms. The carbon dioxide extinguishing system located in the GEB is connected directly to the security system alarm panel; therefore, activation of the carbon dioxide extinguishing system is registered by the security panel and the carbon dioxide system alarm panel, rather than the autodialer.

The purpose of the autodialer is to signal the Operator of alarm conditions during periods of unmanned operation of the CFSL treatment facility. Alarm response times are either immediate (3 hours) or 24 hours, and is announced by the autodialer as respond now or within 24 hours. A complete list of operating instructions can be found in the RACO O&M manual.

The autodialer may be programmed to dial up to eight phone numbers.

Programming Phone Numbers

With the power on and the NORMAL LED on, and the SPEAKER/MIKE switch set on SPEAKER, press the PROGRAM key. The PROGRAM LED will turn on , and the CB-4 will say "PROGRAM. NO FIRST PHONE NUMBER, AND NO MORE PHONE NUMBERS ENTERED."

Enter the desired phone number on the keyboard one digit at a time, including any "1" prefix or area code necessary to complete the call.

When you have entered the last digit, press the ENTRY COMPLETE key. The CB-4 will recite back the phone number you have entered and then wait for you to press the PROGRAM key to advance to the next phone number. The CB-4 will then say, "NO SECOND PHONE NUMBER, AND NO MORE PHONE NUMBERS ENTERED". Again enter the desired phone number, then press the ENTRY COMPLETE key. The CB-4 will continue in this mode until all eight phone numbers have been entered. If you do not desire to program all eight phone numbers simply hold down the PROGRAM key until it advances to the next program item, STATION ID. Delays may be programmed as needed by pressing the MINUS key, each time you press the MINUS key a one second delay is entered.

Station ID

The station ID message is the first thing the user hears when either receiving a call or calling into the autodialer. A list of the words that are available for voice programming can be found in the RACO O&M manual.

Acknowledging Alarms

Upon receipt of an alarm, by telephone, the alarm must be acknowledged by pressing "9". The autodialer will respond by saying, "ALARM IS ACKNOWLEDGED. GOOD-BYE". The alarms may also be acknowledged at the autodialer, by pressing the CHECK STATUS key until the UNACKNOWLEDGED ALARM LED goes off and the ACKNOWLEDGED ALARM LED turns on.

Alarm Response: Response Time

ALARM DEVICE	ALARM CONDITION	RESPONSE TIME
LSH-01	TANK T-101 HIGH LEVEL	IMMEDIATE
LSH-01D	SBR #1 INFLUENT HIGH LEVEL	IMMEDIATE
LSH-02D	SBR #1 REACTOR HIGH LEVEL	IMMEDIATE
LSH-03	TANK T-104 HIGH LEVEL	IMMEDIATE
LSH-03D	SBR #1 SLUDGE TANK HIGH LEVEL	IMMEDIATE
LSH-04	TANK T-106 HIGH LEVEL	IMMEDIATE
LSH-04F	SBR #1 DECANT TANK HIGH LEVEL	IMMEDIATE
LSH-05D	SBR #2 INFLUENT HIGH LEVEL	IMMEDIATE
LSH-06D	SBR #2 REACTOR HIGH LEVEL	IMMEDIATE
LSH-07D	SBR #2 SLUDGE TANK HIGH LEVEL	IMMEDIATE
LSH-08F	SBR #2 DECANT TANK HIGH LEVEL	IMMEDIATE
LSH-10	PLANT DRAINAGE PUMP STATION HIGH LEVEL	IMMEDIATE
XSH-01	TURBIDITY HIGH	IMMEDIATE
LSL-03	TANK T-104 LOW LEVEL	24 HOURS
LSL-03A	SBR #1 SLUDGE TANK LOW LEVEL	24 HOURS
LSL-04	TANK T-106 LOW LEVEL	24 HOURS
LSL-04A	SBR #1 DECANT TANK LOW LEVEL	24 HOURS
LSL-07A	SBR #2 SLUDGE TANK LOW LEVEL	24 HOURS
LSL-08A	SBR #2 DECANT TANK LOW LEVEL	24 HOURS
EI-02	FILTER PRESS INTERRUPT	24 HOURS

ALARM DEVICE	ALARM CONDITION	RESPONSE TIME
TSL-01	T-110 LOW TEMPERATURE	IMMEDIATE
TSL-1A	T-101 INFLUENT LOW TEMPERATURE	IMMEDIATE
TSL-2	NAOH LINE LOW TEMPERATURE	IMMEDIATE
TSL-3	CHEMICAL FEED BUNDLE LOW TEMPERATURE	IMMEDIATE
TSL-5	SBR 1 INFLUENT LINE LOW TEMPERATURE	IMMEDIATE
TSL-6A	SBR 1 SLUDGE LINE LOW TEMPERATURE	IMMEDIATE
TSL-6AA	SBR#1 SLUDGE LINE ROM P108A	IMMEDIATE
TSL-6B	SBR 2 SLUDGE LINE LOW TEMPERATURE	IMMEDIATE
TSL-6BB	SBR #2 SLUDGE LINE FROM P108B	IMMEDIATE
TSL-7A	SBR 1 EFFLUENT LINE LOW TEMPERATURE	IMMEDIATE
TSL-7AA	SBR#1GW FROM P106A	IMMEDIATE
TSL-7B	SBR 2 EFFLUENT LINE LOW TEMPERATURE	IMMEDIATE
TSL-7BB	SBR #2 GW FROM 106B	IMMEDIATE
TSL-8	SBR 2 INFLUENT LINE LOW TEMPERATURE	IMMEDIATE
TSL-9	FINISHED WATER LINE TO T-110 LOW TEMPERATURE	IMMEDIATE
TSL-10	CARBON BACKWASH WATER LINE LOW TEMPERATURE	IMMEDIATE
TSL-11	BACKWASH WASTE LINE LOW TEMPERATURE	IMMEDIATE
TSL-12	PLANT WATER LINE PEB TO GEB LOW TEMPERATURE	IMMEDIATE

ALARM DEVICE	ALARM CONDITION	RESPONSE TIME
TSL-13	PLANT WATER LINE TO CARBON TRANSFER TANK LOW TEMPERATURE	IMMEDIATE
TSL-14	PLANT DRAINAGE PUMP STATION TO T-101 LOW TEMPERATURE	IMMEDIATE
TSL-15	POTABLE WATER LINE FROM PEB TO GEB LOW TEMPERATURE	IMMEDIATE
TSL-16	PLANT INFLUENT FROM T101	IMMEDIATE
SECURITY PANEL	FIRE ALARM	IMMEDIATE
SECURITY PANEL	BURGLARY ALARM	IMMEDIATE
COMBUSTIBLE GAS PANEL	COMBUSTIBLE GAS ALARM	IMMEDIATE
COMPRESSOR	LOW AIR PRESSURE	IMMEDIATE
AAH-03	PLANT EFFLUENT pH HIGH	24 HOURS
AAL-03	PLANT EFFLUENT pH LOW	24 HOURS
	LOSS OF POWER	IMMEDIATE

Gas Detection

The combustible gas detector for the CFSL facility consists of two (2) MSA Series 5000 gas sensors and one (1) MSA Model 5100 gas monitor. The gas sensors are located in the lower and upper carbon room of the PEB. The gas monitor is located in the control room of the PEB.

There is one spare circuit in the gas monitor. The monitor has a three digit LED display to indicate concentrations of combustible gases in the monitored area. The LEDs are displayed in three different colors based on concentration levels: yellow for caution, amber for warning, and red for alarm. The alarm setpoints are adjustable from the monitor select/display push-button and the recessed select button located on the main circuit board inside the enclosure. To check the alarm setpoints, open the enclosure door and press the raised display push-button twice. The display will indicate the caution setpoint and light the "C" indicator. Pressing the display

push-button a third time will indicate the warning setpoint and light the "W" indicator. Pressing the display push-button a fourth time will indicate the alarm setpoint and light the "R" indicator. Press the display push-button four times and the display will return to the monitoring state. To change setpoints, follow the instructions above and when the point that is to be changed (i.e., C, W, or R) is displayed, press the recessed button to the desired setting.

Whenever combustible gas levels reach 10% of the LEL in the PEB carbon room, the monitor will initiate a low level alarm (yellow LED) and activate the exhaust fans for the carbon room. At 40% concentrations, the red alarm LED will illuminate and the autodialer is initiated and call-out as an immediate response alarm.

MAINTENANCE MANAGEMENT PROGRAM

Description of Maintenance Management Software

The software currently utilized for the Combe Fill South Treatment Facility is MP-2 Enterprise™, developed by Infor Corp formerly Data Stream, Inc. This software is designed for use with Windows XP. MP-2 Enterprise™ generates work orders on a daily basis for preventive maintenance as well as emergency repairs. The software program tracks manpower costs, equipment replacement costs, parts costs, and inventory of spare parts.

Nameplate Information

The nameplate data for each piece of equipment has been entered into the maintenance management program. The data lists name of the manufacturer of the equipment, the motor manufacturer, the horsepower, voltage, amperage, model and serial numbers, etc.

Maintenance Schedules

The maintenance management program generates preventive maintenance work orders on a daily basis, to ensure that all of the manufacturers recommended PM's are performed at the intervals recommended. A more comprehensive detail of the schedules is in the MP-2 Enterprise™ users manual.

Additional maintenance procedures and troubleshooting information are outlined in the maintenance documentation provided in the equipment manufacturers O&M manuals.

Lubrication Schedules

The list of lubricants required for each piece of equipment and the quantities have been entered into the program. To reduce the potential of mechanical problems due to improper lubrication, the scheduled lubrication must be followed.

Spare Parts Information

The inventory of spare parts has been entered into the program, and is updated each time of part has been used from the inventory. A listing of spare parts and special tools is included in Appendix W

Calibration Schedules

Detailed instructions for the calibration of each piece of equipment has been entered into the program. For troubleshooting and additional details consult the equipment manufacturers O&M manuals.

LANDFILL

The ROD required the landfill to be capped in accordance with Federal regulations contained in 40 CFR Part 264.310, State of New Jersey Regulations set forth in NJAC Subchapter 11, Section 7:26-11.4, and technical guidelines developed by the USEPA. The regulations listed in 40 CFR 264.310 require that a final cover system be designed and constructed to :

- minimize migration of liquids through the closed landfill;
- function with minimum maintenance;
- promote drainage and minimize erosion or abrasion of cover;
- accommodate settling or subsidence so that the integrity of the cover is maintained;
- and has permeability less than or equal to any bottom layer or natural subsoils present, and be repairable to correct settling, subsidence, erosion, etc.

Based on performance analyses of ten (10) proposed cap designs, two systems which met the site and regulatory requirements were selected. Additional modifications were incorporated at the direction of the NJDEP. The first system, Cap E, from the top down, consists of six inches of top soil, an 18 inch vegetative layer, a geotextile filter, a 12 inch drainage layer, a 40 mil synthetic liner, a 24 inch soil barrier layer and a 12 inch embankment layer in those areas where the slopes are 10 percent or less. The second system, Cap F, is identical to Cap E with the exceptions that the synthetic liner is eliminated and a geotextile filter is incorporated between both the soil barrier layer and the drainage layer. This cap design was recommended for installation on site locations where slopes were greater than 10 percent. Due to site constraints imposed by property boundaries, a power line right of way, and wetlands, a gabion retaining wall was designed in order to allow grading criteria to be met while minimizing refuse grading and off-site embankment material.

The cap design meets all regulatory requirements, and has acceptable safety factors against sliding of cap system components, slope, and deep foundation failure.

Detention Basins

In order to control the runoff from the site caused by the cap development, a total of five (5) on-site detention ponds have been constructed. (See Site Plans, Appendix A). These ponds have been designed to handle a 25 year - 24 hour storm event. Runoff is directed through lined open channels to the basins. Detention Basin "A" is located on the west side of the landfill site and detains 4.97 acre feet (AF). Discharge from Basin "A" is directed through a 12" diameter reinforced concrete pipe to an unnamed tributary to Tanners Brook. This discharge point is designated as NJPDES 001.

The second and third detention basins, Detention Basins "B" and "C", are interconnected by a 36" diameter reinforced concrete pipe. These basins are located on the southeastern side of the landfill and detain a total of 4.5 AF of water. Basin "B" has 1.5 AF capacity, and Basin "C" has 3.0 AF capacity. Discharge from Basin "C" is directed through a 36" diameter reinforced concrete pipe to an eastern branch of Trout Brook. This discharge point is designated as NJPDES 002.

There is also a discharge from Basin "B" through a 21" diameter reinforced concrete pipe which discharges to the eastern branch of Trout Brook. This discharge point is designated as NJPDES 004. The purpose of the "split " facility is to provide for adequate storage while maintaining a 50' easement from power line towers without requiring construction activities on private property or designated wetlands.

The fourth detention basin, Detention Basin "D", is located on the north side of the landfill and detains 0.80 AF of water. Discharge is directed through a 12" diameter reinforced concrete pipe to an unnamed tributary of Tanners Brook. This discharge point is designated as NJPDES 003.

The fifth detention basin, Parker Road Detention Basin, is located at the intersection of Parker Road and the Landfill Access Road. The basin's location is west of Parker Road and north of the Access Road. The Parker Road detention basin detains 0.70 AF of water and is connected through subterranean piping to the municipal storm water drainage system under Parker Road.

Access Road

The Combe Fill South Landfill lies immediately to the north of Parker Road, which is a municipal road in Chester Township, Morris County, New Jersey. Access to the landfill is provided by a twenty four-foot wide access road as shown on the Site Plans in Appendix A. At the end of the access road lies the Gas Extraction Building and the Process Equipment Building with access and parking available along the north sides of the Buildings . A 12-foot wide gravel perimeter road surrounds the landfill to provide access to the cover system and gas wells and ground water recovery wells.

Fence

An 8-foot high chain-linked security fence topped with one foot of barbed wire has been installed to restrict site access, as per the Record of Decision (ROD). This fence surrounds the remediated site areas, the ground water treatment facility (GWTF), and other treatment support structures. Access to the site is controlled by a locking gate located at the north end of the access road which branches off of Parker Road.

Appropriate signs warning that the site is a hazardous waste site undergoing remediation are located on the fence around the site perimeter at 100 foot intervals, or as often as required depending on the line of sight to discourage trespassers.

Passive Venting System

Initially, an active landfill gas treatment system was designed for the collection and treatment of landfill gases. Treatment of landfill gas condensate was also included in the GWTF. The system was designed to use enclosed flare combustion for the treatment of collected landfill gases, while

the condensate was to be sent to the beginning of the ground water treatment process.

Following installation of landfill gas recovery wells, sampling and analysis of representative wells revealed that methane was no longer being generated at the rate anticipated during design of the system. Additionally, it was determined that the emissions from the landfill were below regulatory limits and guidlines; therefore, the landfill gas treatment system was not constructed.

Gas is passively vented from the landfill via sixty-five (65) gas wells. Twenty-seven (27) of these wells are located along the perimeter of the landfill, spaced at 200 foot centers and no closer than 50 feet to the edge of refuse. The remaining thirty-eight (38) passive gas wells are installed in the interior of the landfill, (see Appendix A for location of gas wells). Each gas well is installed to two-thirds the total depth of refuse or to the top of the ground water table, whichever is shallower. A geosynthetic filter fabric is placed around the gravel gas venting zone to limit clogging of the zone with soil fines and to limit intrusion of the gravel into the underlying refuse.

Piezometers and Monitoring Wells

The monitoring of ground water provides documentation of the effectiveness of the ground water recovery system. Plant influent is sampled on a quarterly basis to determine actual contaminant concentrations collected by the recovery system. This is discussed in greater detail in Section 9. Additional sampling of site groundwater is performed by the NJDEP as part of the Post Construction Environmental Monitoring Plan (PCEMP). This plan is included in Appendix P.

The monitoring well system consists of 17 wells; wells in bedrock are 6 inches in diameter and constructed of steel and shallow wells are constructed of 4-inch I.D. PVC screen and riser. The piezometer system consists of 27 wells in various locations throughout the facility. Some of the piezometers are constructed of 2-inch I.D. PVC screen and riser, while the piezometers located on the landfill face are constructed of 6-inch I.D. PVC screen and riser. There are also a number of deep and shallow wells located on or within close proximity to the property, and there are nine wells located some distance from the property. As-built drawings for the wells are included in Appendix A.

Cap Maintenance

A routine inspection of the cap should be performed monthly for the first year and quarterly thereafter. The inspector should look for signs of erosion, settling and shifting. The grass covering the cap should also be mowed at least two (2) times a year and areas without grass need attention to curb erosion and limit weed growth until new grass is established. Cap inspections should be completed after every major storm event. Notes pertaining to any cap problem is maintained.

The landfill cap is comprised of a 12 inch embankment layer, a 24 inch clay layer, a 12 inch drainage layer, an 18 inch vegetative layer, a 6 inch topsoil layer, synthetic liner, and geotextile fabric. In some locations, the cap ditches are lined with rip-rap or erosion control matting. The materials specified for cap construction should be used for cap repairs whenever possible. The specifications are in the table on the following page.

Retention Basins Maintenance

Inspections of all the retention basins are conducted monthly. Unscheduled inspections should be completed after unusually heavy rain storms, persistent rains with possible flooding, and during the spring thaws. Each basin should be inspected for any berm settling, clogged riser pipes, culverts and manholes, or excessive erosion and deposition buildup. The rip-rap associated with the drainage structures should also be inspected for washing. Notes pertaining to these inspections is maintained.

Access Road Maintenance

Both the access road and landfill perimeter road are inspected monthly. Each road should be inspected for obstructions, uneven wear, unusual settling, and erosion. During the winter months, the roads should be plowed after snow falls, and the snow banks arranged to promote offsite drainage when thawing occurs. Notes pertaining to any problem is maintained.

Fence Maintenance

A monthly fence inspection should include looking for evidence of vandalism, fence damage, and animal entry. Any animals entering the site could pose a problem to the cap structure. Make sure all warning signs are posted and visible to discourage trespassers. Notes pertaining to any problem is maintained.

Embankment Layer Material
- 90-100% passing 3" sieve
- 80-100% passing 1" sieve
- 70-100% passing 3/8" sieve
- 30-80% passing No. 20 sieve
- 5-35% passing No. 200 sieve
- Stones shall not exceed 6 inches in greatest dimension and shall be well distributed through the soil
- Classified as clavey-gravel or calvey-sand

Clay Layer Material Specifications
- Minimum 30% of particle sizes finer than No. 200 sieve
- Compacted in-place permeability greater than or equal to 1.0 x 10 -7 cm/sec
- Free of debris, roots, organic, frozen materials, or materials 2" or more in greatest dimension

Drainage Layer Material Specifications
- Minimum permeability of 1 X 10 -2 cm/sec
- 100% passing 3/8" sieve
- Less than 5% passing No. 200 sieve
- Uniform in composition and texture, free from debris, organic material, and stones

Vegetative Layer Material Specifications
- pH greater than or equal to 5.5
- Classified as silty sand (SM), clavey sand (SC), or SM-SC
- 100% passing 4" sieve
- 85-100% passing 2" sieve
- 75-85% passing No. 4 sieve
- 45-55% passing No. 40 sieve
- 12-30% passing No. 200 sieve
- Free of debris, roots, organic, frozen materials, or materials 2 inches or more in greatest dimension

Topsoil Layer Material Specifications
- Natural friable loam
- Contains at least 5% decayed organic matter
- pH 5.5 to 7.5
- Free of subsoil, stones, and earth clod, roots, debris and similar substances 2 inches or more in greatest dimension
- Soluble salts less than or equal to 0.5 millimhos per cm
- 20% or less larger than No.10 sieve
- 40-80% sand (2.00mm to 0.005mm)
- 0-30% silt (0.005mm and smaller)

Seed Specifications
- Apply at rate of 100 pounds per acre
- 80% fine fescues mixture, 10% Kentucky bluegrass, 5% perennial ryegrass, 4% red top, 1% clover

Synthetic Liner Material Specifications
- 40 mil VLDPE-A
- Density of 0.900 to 0.935
- Maximum melt index of 0.6 grams per 10 minutes
- 2-3% carbon black content
- 15,000 psi modulus of elasticity
- Minimum 14 lb. Tear resistance
- 49 lb. Puncture resistance

Geotextile Material Specifications
- Long-chain geosynthetic polymer composed of at least 85% by weight of propylene, ethylene, ester, amides, or vinylidene chloride
- Minimum mass of 12 oz. Per square yard
- Minimum permittivity of 0.2 sec-1
- 300 lb. Grab tensile strength
- 60% grab tensile elongation
- 125 lbs. Trapezoid tear
- 150 lbs. Puncture strength
- 600 psi burst strength

Rip Rap Material Specifications
- Light rip rap: 90-100% lighter than 100 lbs., 50-100% larger than 6 inches and 1-10% smaller than ½ inch
- Medium rip rap: 50-100% heavier than 100 lbs. And 1-10% smaller than 4 inches
- Heavy rip rap: 50-100% heavier than 600 lbs
- Rip rap bedding: 3/8 inch to 3/4 inch crushed gravel

Erosion Control Matting Material Specifications
- Miramat by Mirafi or equal
- Maximum flexibility of 20 mg-cm
- Minimum weight of 24 oz per cy
- 1/4 inch thickness

Appendix A	Protective Coatings: Profiles and Descriptions
Appendix B	Engineering Plan Views and Elevations, Structural & Mechanical
Appendix C	P & ID's, Electrical Details
Appendix D	Process Material Safety Data Sheets
Appendix E	Power Conduit and Wire Schedule
Appendix F	Equipment Manufacturer's List
Appendix G	Equipment List
Appendix H	Instrumentation List/Manufacturer/Vendor
Appendix I	Process and Alarm Setpoints
Appendix J	Main Control Panel (MPC): Inputs/Outputs
Appendix K	PLC Ladder Diagrams: Filter Press & SBR
Appendix L	SBR Panel Terminal Strip As-Built
Appendix M	Control Wiring and Conduit Schedule
Appendix N	Personal Computer Screen Displays/Alarms
Appendix O	System Alarm List
Appendix P	Permits
Appendix Q	Groundwater Recovery Well Inspection Report - Form
Appendix R	Equipment Maintenance Data - Instrument Sensors
Appendix S	Equipment Data Forms and Selected Mfg. O&M Info.
Appendix T	MaintainIt Pro User's Guide
Appendix U	Selected System Details, P & ID's, Tables, and Schedules