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BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT

BOLINAS, CALIFORNIA

WASTEWATER TREATMENT AND DISPOSAL SYSTEM

OPERATIONS AND MAINTENANCE MANUAL

CSO INTERNATIONAL INC.
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RESEARCH & DEVELOPMENT LABORATORY - CIVIL, SANITARY, & OCEAN ENGINEERING

BOLINAS COMMUNITY PUBLIC UTILITIES DISTRICT

BOLINAS, CALIFORNIA

WASTE WATER TREATMENT AND DISPOSAL SYSTEM

OPERATIONS AND MAINTENANCE MANUAL

By

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OPERATION AND MAINTENANCE MANUAL FOR BOLINAS

I. INTRODUCTION

A. PURPOSE OF THE PROJECT

The overall objective of the Bolinas Community Wastewater System is to accomplish nuisance-free, economical and legal disposal of the water-borne, liquid wastes originating from the residential and commercial areas of the Bolinas area. The system, with a design capacity of 65,000 gallons per day, mainly consists of a raw waste pumping station, four ponds in series with a total area of about five acres to provide treatment of the wastes, and a 45-acre spray irrigation land for ultimate disposal of the treated effluent. The specific objectives of the Bolinas system are to comply with the regulatory requirements stipulated by the State of California Regional Water Quality Control Board, San Francisco Bay Region. A copy of the Board Order dated June 26, 1973 is included in the Appendix.

The collection and treatment facilities discussed in this manual were constructed in June 1975 to provide wastewater service for the present and projected population growth in the Bolinas area, and to eliminate any effluent discharge into the Bolinas Lagoon. The Board requirements prohibit any discharge from the treatment facilities other than to the spray disposal area and that the disposal shall not cause any degradation of ground water suitable for domestic use. In addition, the treatment and disposal shall be achieved in a fail-safe, nuisance-free manner. Bolinas waste treatment and disposal facilities were designed and constructed to implement the above-mentioned policies of the State.

The intent of this report is to provide a handbook specifically related to the operations and maintenance of each facility involved in the Bolinas wastewater system. The operating personnel should become familiar with the information provided herein in order to enable then to operate

each facility with its intended objectives. The manual also describes in detail special problems related to each operation and corrective measures that should be undertaken in case of malfunction of any unit. Finally, and the most important of all, the manual discusses important safety precautions and emergency procedures that should be strictly followed by the operating personnel.

The respective equipment manufacturer's manuals with their operating and maintenance instructions are an integral part of this manual and should be consulted should it become necessary. For convenience, these are bound separately and submitted to the District. A general reference list on the safety instructions and wastewater treatment operations is presented in the Appendix. The District and its employees should review and comply with all applicable, local, State and Federal safety standards as set forth by the Occupational Safety and Health Administration.

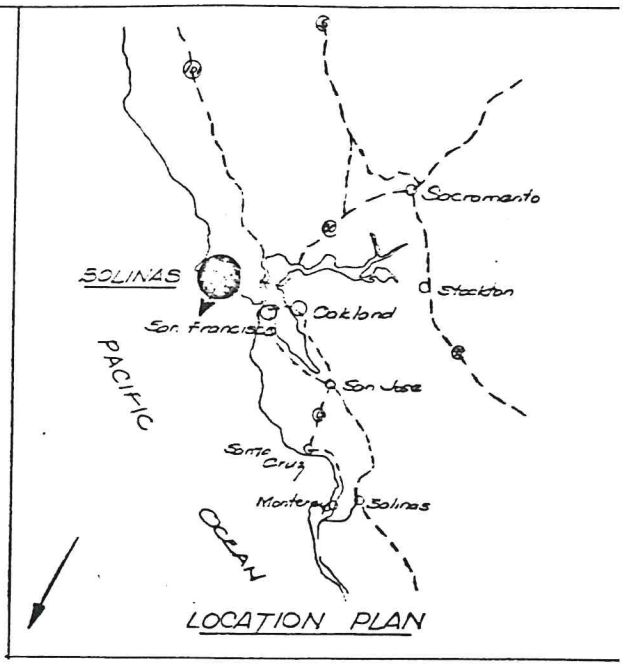
B. PROJECT DESCRIPTION

Figure 1 is a map depicting the tributary area for the Bolinas wastewater treatment facilities. As mentioned earlier, the contributing populations are the residential and commercial areas served by the sewage collection systems that consist of approximately 8,000 linear feet of 6-inch sewer and 2,400 linear feet of 8-inch sewer.

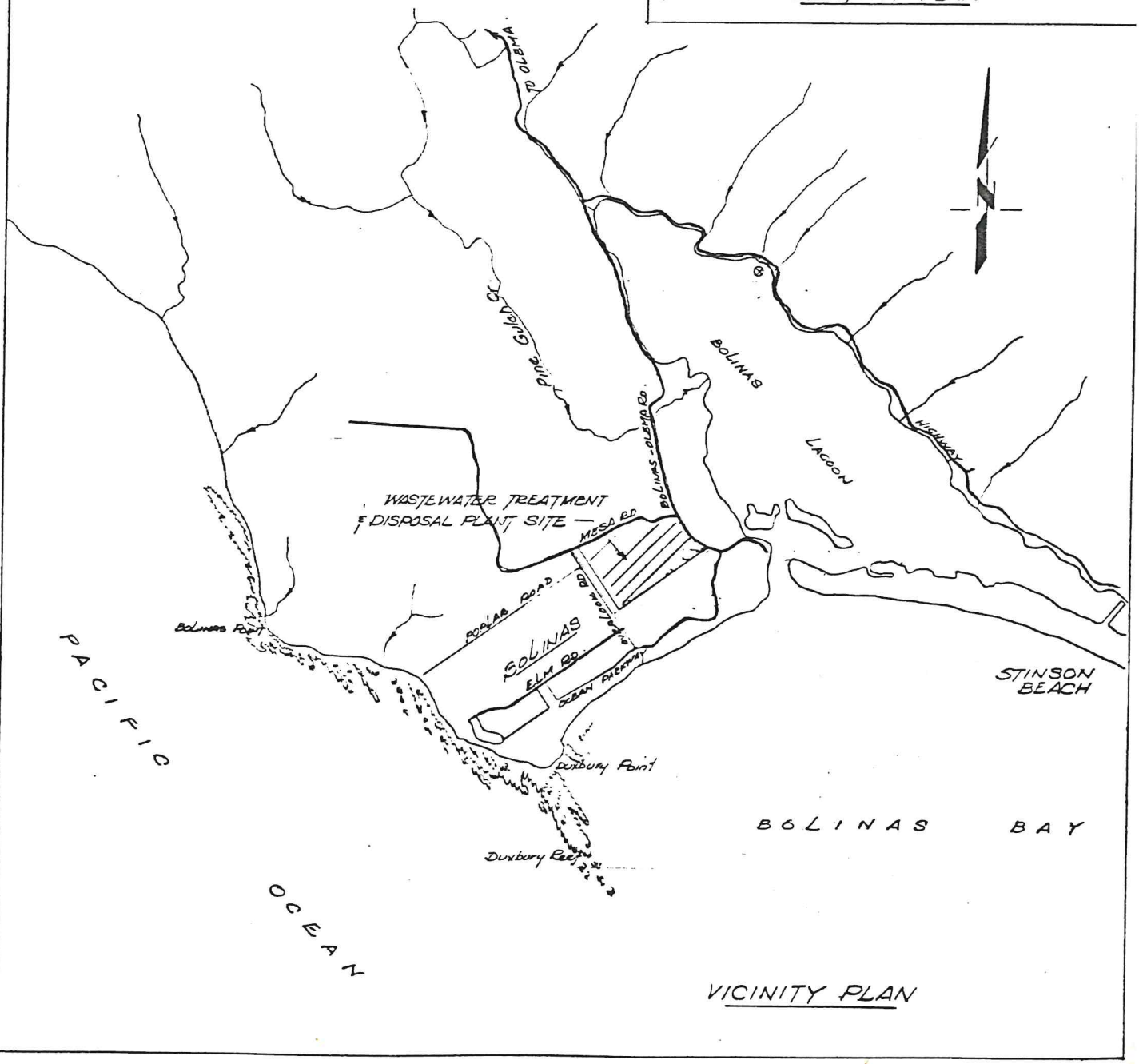
1. Wastewater Characteristics

Limited data available on the sewage flow within the Bolinas area indicate that the waste generated varies from 65-85 gpcd. A value of 100 gpcd was, however, employed as the design flow in order to allow for infiltration and expected higher per capita water use in the future. Table 1 presents the anticipated dry weather and wet weather flows for the Bolinas system. Sewage flows during summer will be highly influenced by the influx of daily, weekly and monthly vacationers, while during the winter, infiltration will cause increased hydraulic loadings to the collection and treatment system.

BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT



LOCATION PLAN



VICINITY PLAN

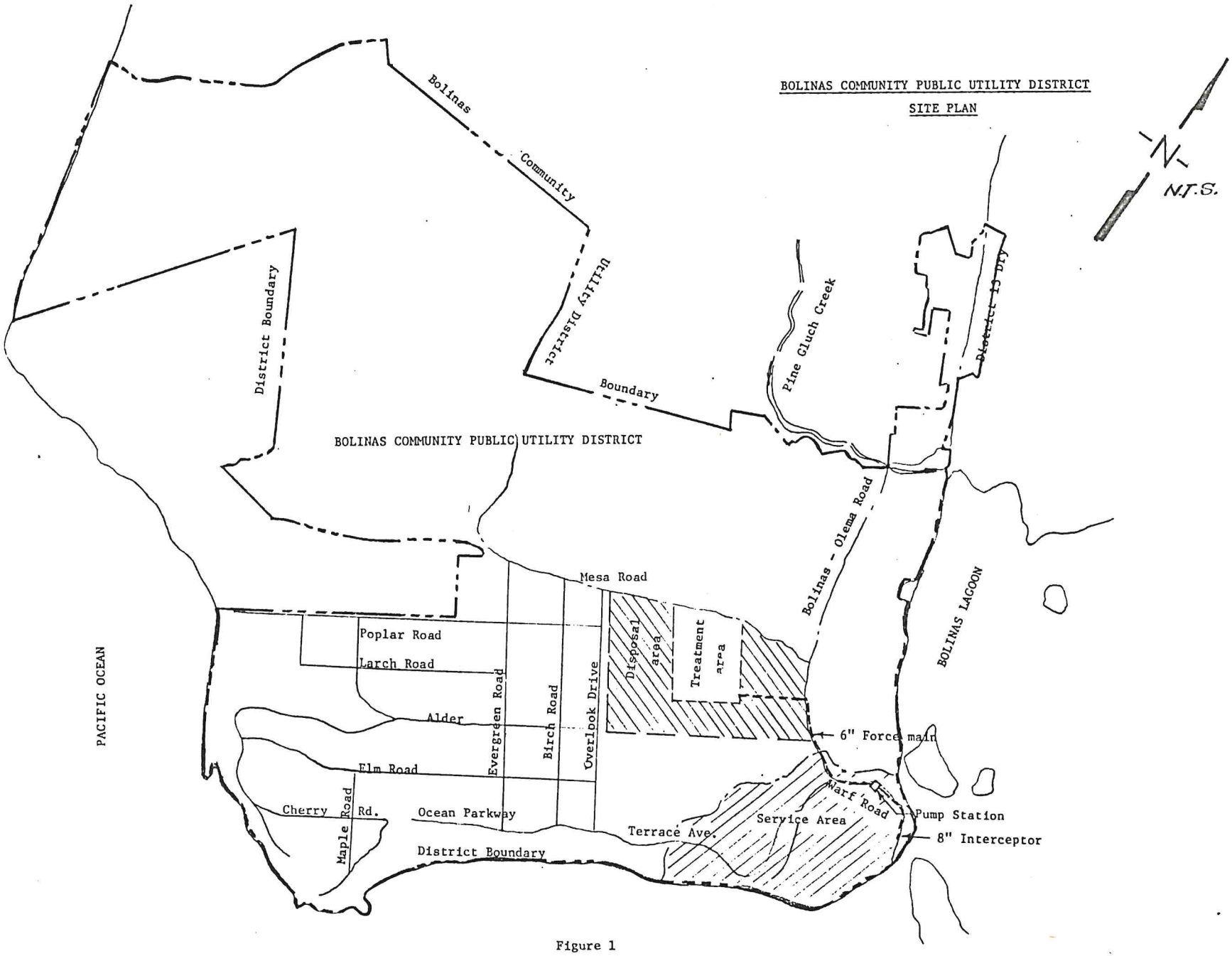

BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT
SITE PLAN
N
N.T.S.
Bolinas Community Utility District Boundary
District Boundary
BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT
Pine Gluch Creek
District #3 Dry
Bolinas - Olema Road
BOLINAS LAGOON
PACIFIC OCEAN
Mesa Road
Poplar Road
Larch Road
Alder
Elm Road
Cherry Rd.
Maple Road
Evergreen Road
Birch Road
Overlook Drive
Disposal area
Treatment area
6" Force main
Wharf Road
Pump Station
Service Area
8" Interceptor
Ocean Parkway
Terrace Ave.
District Boundary

Figure 1

TABLE I

ANTICIPATED WASTE FLOWS FOR BOLINAS

WASTEWATER SYSTEM

Description	Flow
Single Family Residential Connections	178
Population @ 2.8 persons/residence	500
Average Domestic Flow	0.050 MGD[1]
Allowance for Summer Tourists	0.010 MGD
Allowance for Septic Tanks	0.005 MGD
Total Dry Weather Flow	0.065 MGD
Infiltration @ 500 GPAPD[2] (50 acres)	0.025 MGD
Inflow @ 500 GPAPD (50 acres)	0.025 MGD
Average Wet Weather Flow	0.090 MGD
Peak Wet Weather Flow	0.21 MGD

[1] MGD - million gallons per day

[2] GPAPD - gallons per acre per day

In view of the residential nature of the Bolinas Community, the sewage strength in terms of 5-day BOD and suspended solids can be estimated at 0.17 pcd (pounds per capita per day) for BOD_5 and 0.20 pcd for suspended solids.

2. Treatment Plant Flow Scheme

Following is a brief review of the treatment and disposal process. The system incorporates the "integrated ponding" concept in which the wastewater is treated in four ponds operated in series with the effluent disposal accomplished via land disposal. The system is generally characterized by high storage capacity, minimal operation and maintenance requirements, high resistance to shock loadings and extreme flexibility. Figures 2 and 3 respectively present the schematic diagram and the hydraulic profile for the treatment plant.

Headworks

Liquid waste from the sewered area is conveyed to the downtown pumping facility located on Wharf Road. At the pumping facility, the waste passes through the comminutors where large solids are shredded and reduced to particle size in order to protect the pumps from abrasion as well as to improve the action in the ponds. Should one comminutor be out of service, a stop gate must be placed between that comminutor and the inlet pipe and the entire sewage temporarily diverted through the second comminutor until the first comminutor is back in service. Beyond the comminutor, sewage is pumped through a 6-inch force main to the treatment system against a total head of about 200 feet.

The pumped sewage collects into the energy dissipator manhole from where it flows to the monitoring manhole. Located therein is a metering device consisting of an 8-inch, Palmer-Bowles flume which is connected to an automatic flow recorder through a sensor assembly.

Wastewater then flows to the distributor manhole which directs flow to either of two primary ponds (1A and 1B) through 6-inch PVC influent lines.

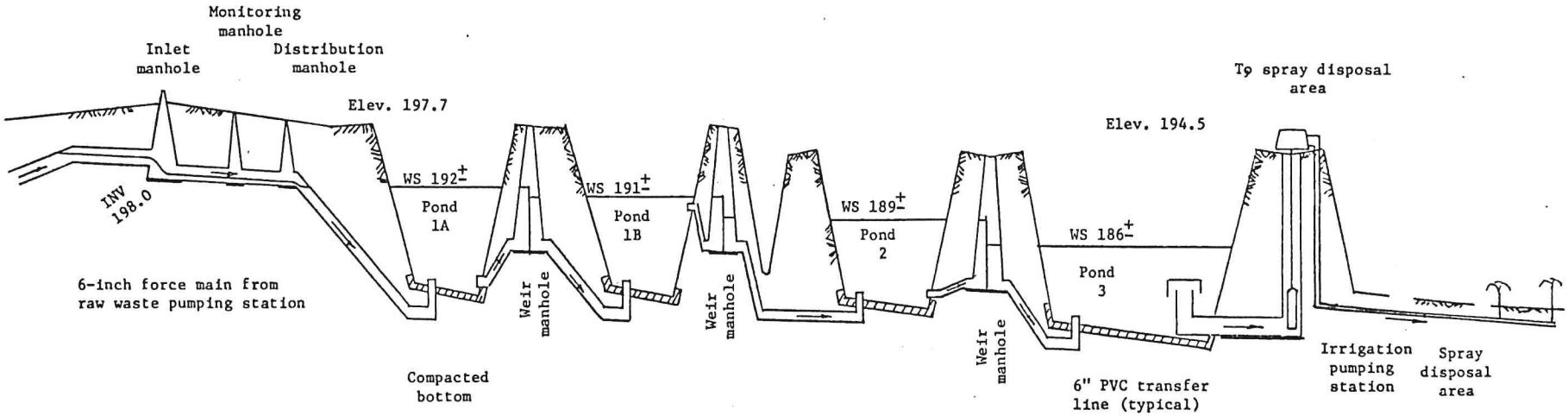


Figure - 3

Hydraulic Profile - BCPUD Waste Treatment and Disposal System

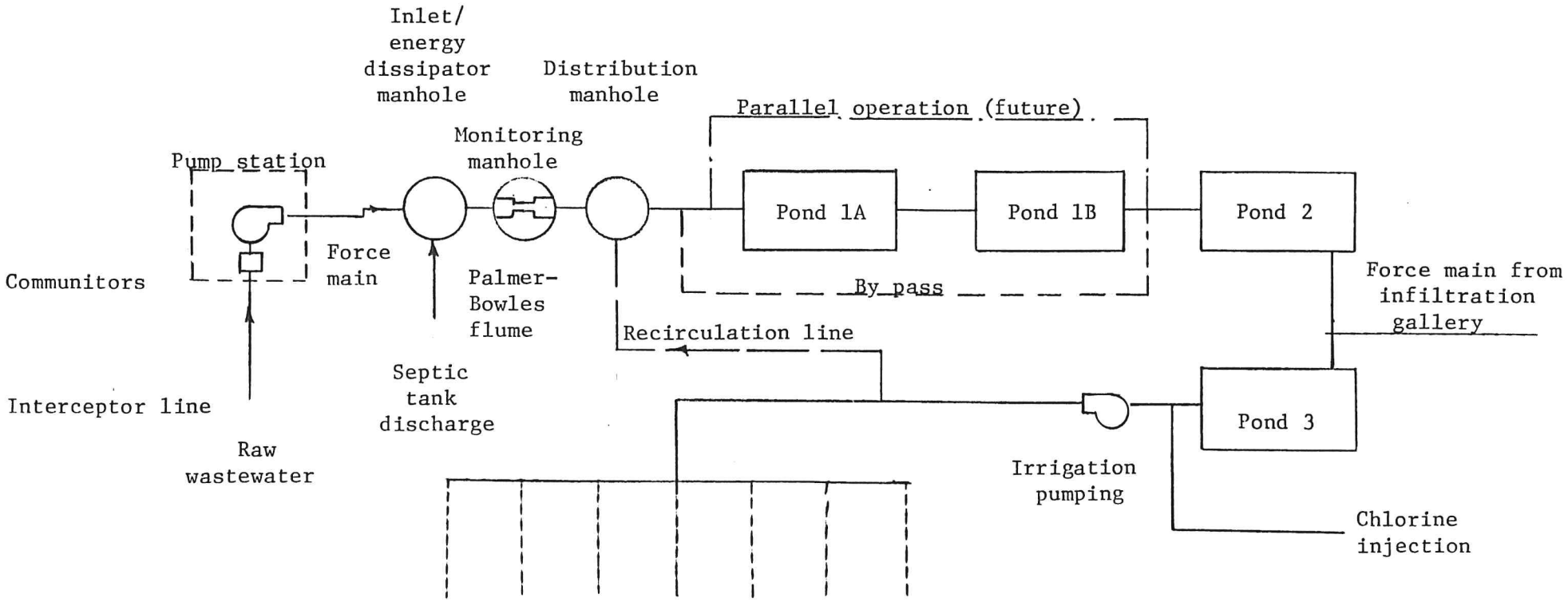


Figure - 2

Flow Diagram Schematic

BCPUD Wastewater Treatment and Disposal System

Oxidation Ponds

The ponding system is designed to provide an overall detention period of 150 days (design criterion based on winter storage requirements), and is comprised of four ponds, 1A, 1B, 2 and 3, with a total area of about five acres. Flow through ponds 1A and 1B to 3 inclusive, follows a numerical order, i.e., 1A → 1B → 2 → 3. Provisions have been included as part of the system design for operating ponds 1A and 1B in either a parallel or series mode. Normal operation will be in the series mode. Pond 3 is to be used as a reservoir for disposal purposes and is intended to be operated at a variable water level according to the time of year. In early spring, the water level of the pond will be at maximum design elevation, whereas in late fall, the pond should be nearly empty. The pond bottoms are lined with especially compacted clay to prevent contamination of ground water from percolation, seepage, etc.

The clarification of the waste takes place in the primary ponds (1A and 1B), with the BOD removal attained mainly through methane fermentation. Aerobic bacterial processes and photosynthetic oxygenation predominate in ponds 2 and 3, leading to a further purification of the wastewater.

Disinfection

The final pond effluent is expected to be of acceptable bacteriological quality achieved through pond treatment. Chlorination of the effluent is, however, available on a standby basis, should high MPN counts (most probable number) in excess of 100/ml occur. Chlorine will be introduced into the suction lines of the irrigation pumps installed in pond 3. It is emphasized that under normal operating conditions, chlorination will not be practiced. It will be practiced if bacteriological evidence shows that the spray system is contaminated with enteric bacteria of human fecal origin.

Effluent Disposal

Disposal of the treated wastewater will be accomplished via spray-irrigation during the warmer months and at all other times whenever possible.

The disposal system consists of two suction lines in the bottom of pond 3, two 40 H.P. pumps, irrigation lines, sprinkler system and control apparatus. A cr-p land of about 45 acres surrounding the pond area will be used for irrigation which will proceed at the rate of 1 to 3 inches per week.

Two 16-inch suction lines located in the bottom of pond 3 under a cover of granular material serve to conduct the treated effluent to the pumping system. The dual suction lines are also equipped with anti-vortex shields to prevent excessive vortexing when the water level in the pond is drawn down. Two 40 H.P. turbine pumps are included as part of the disposal system. Only one unit will be used at any one time, the other to remain as a stand-by unit. Irrigation is controlled by a programming device which provides timing and control for the independent zones.

During the no-discharge period (rainy months), the treated waste is stored in the ponds until irrigation can be resumed. The ponds are designed for an annual 52 acre-foot storage of which about 22 acre-feet is accounted for rainwater impoundment.

Solids Disposal

This problem does not arise in a ponding system where the rate of inert sludge accumulation will be less than 1/2 ft^3 per capita per year. The accumulation of inert matter in the bottom of ponds 1A and 1B can be dealt with by dredging the ponds periodically. It is doubtful that this will be needed more often than once in ten years. It is anticipated that dredging of ponds 2 and 3 will not be necessary in less than 25 years or more.

Specific Waste Discharge Requirements

In addition to the stringent no-surface discharge requirement stipulated by the Rgeional Board (cf. Section A), the following specific regulations apply to the Bolinas wastewater treatment and disposal system:

1. The mean daily waste flow (7-day average) to the treatment facilities shall not exceed 65,000 gallons per day.

2. At the pond water surface, maximum dissolved sulfide concentration shall be 0.1 mg/l and the minimum dissolved oxygen concentration shall be 2.0 mg/l.

3. The 5-day BOD of the treated effluent discharged to the spray disposal area shall be within 40 mg/l in any grab sample.

The above requirements as well as the discharge prohibitions stated in the Board Order were used as basis in the design of the Bolinas system.

C. DESIGN CRITERIA

Unit design criteria and the sizing for the various components are summarized in Table 2. The treatment plant was designed to provide a high treatment efficiency with a minimum of operational control. Because of the planned low density and restricted community growth for the Bolinas area, the design period was limited to 23 years or the year 1995. The gravity sewer, force mains, and pump stations were sized to carry the maximum design flow of 0.20 MGD while the treatment plant facilities were designed to treat an average flow of 0.065 MGD.

Land requirements for ponds and spray disposal were based on a detailed analysis of input-output flow volumes. Because of the stipulation that runoff across or from the waste treatment and spray areas should be prohibited, it is essential to retain all wastewaters and all rain water on District property even during the years of most intense rainfall. This was most critical to the system design. Retention of rain water imposed a need for a significant amount of percolation of rain water, as well as treated wastewater, into the soil. The sustainable rate of percolation, together with factors such as waste volume, rainfall, evaporation and transpiration by plants, all contributed to land requirements. Four ponds--two primary, one secondary and one tertiary--were designed to provide the required surface area and volume (about five acres and 52 acre-feet total). The design also includes provision for addition of three more ponds, should further expansion be required in the future.

TABLE 2

DESIGN CRITERIA FOR BCPUD WASTEWATER

TREATMENT AND DISPOSAL SYSTEM

Description	Quantity
Design Flows	
Design Population, number	500
Per Capita Contribution, GPCD	100
Average Dry Weather Flow, MGD	0.065
Average Wet Weather Flow, MGD	0.090
Peak Wet Weather Flow, MGD	0.20
Unit Design Factors	
Biochemical Oxygen Demand, PCPD	0.20
Total Suspended Solids, PCPD	0.22
Sewage Lift Station	
Comminutor Unit, number	2
Comminutor Size, inches	7
Wastewater Pumps, number	2
Size, HP	25
Maximum Pump Capacity, GPM	225
Flow Metering	
Palmer-Bowles Flume, number	1
Flume size, inches	8
Flow Measurement Range, MGD	0-0.5
Treatment Ponds*	
BOD Loading Rate,	20-130**
Number of Ponds	4
Total Area, acres	5.1
Operational Depth, ft	8-12
Total Annual Storage, acre-ft	52
Nominal Detention Period at Average Flow, Days	150

TABLE 2 (cont.)

DESIGN CRITERIA FOR BCPUD WASTEWATER

TREATMENT AND DISPOSAL SYSTEM

Description	Quantity
Aeration Equipment (Pond 2)	
Number of Units	3
Size, HP	5
Oxygen Output per Unit, lbs O_2/ HP/hour at 20°C	2.5
Inert Sludge Accumulation	
Per Capita Accumulation Rate, ft^3/yr	1/2
Rate of Accumulation in Primary Ponds ft^3/yr	250
Rate of Accumulation in Ponds 2 and 3 ft^3/yr	10
Chlorination***	
Chlorination Unit	1
Total Chlorinator Capacity, lbs	300
Anticipated Chlorine Dose, mg/l	5-12
Spray Irrigation System	
Total Area, acres	45
Application Rate, inch/week	1-3
+Irrigation Period (Apr-Oct), days	180

*Detailed information on ponds are available from Table

**Higher limits for primary ponds and lower limits for tertiary pond .5 x 500.

***Practiced only when high coliform counts (100/ml) are encountered.

+Irrigation will also be practiced during the remainder of the year when possible without runoff.

GPCD - Gallons per capita per day

MGD - Million gallons per day

PCPD - Pounds per capita per day

During the warmer months, the final effluent will be disposed by crop irrigation on the 45-acre lot surrounding the ponds. It is anticipated that the reclamation potential of the effluent in growing crops will be realized to the fullest degree. As stated earlier, the treated waste will be stored in the ponds during the rainy months (November through March).

II. UNIT PROCESSES

This chapter deals with the unit processes involved in the collection, treatment and disposal of the wastewater. Descriptions also include instructions for the satisfactory operation and maintenance of each unit, as well as details related to the auxiliary systems such as the electrical system, alarm system and water system, etc. The various units are presented herein in the order of their flow sequence from the headworks to the discharge.

A. WASTEWATER PUMP STATION

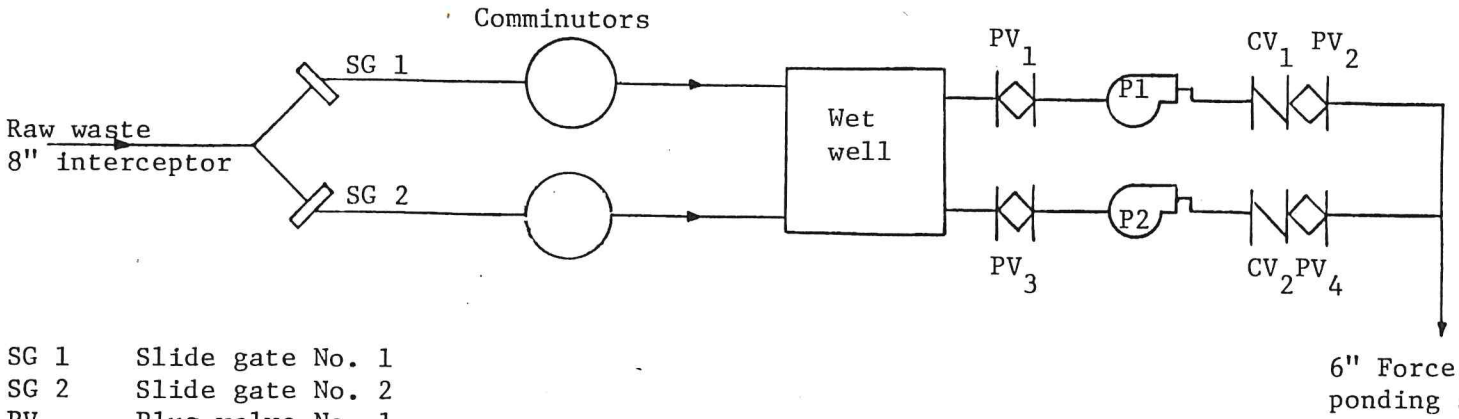
The wastewater pump station contains the first two-unit processes of the system, namely, comminution and wastewater pumping to the treatment plant. As shown in Figure 4, raw waste enters the pump station through an 8-inch interceptor line and is comminuted before being pumped to the treatment plant site via a 6-inch force main. A description of all the major unit processes involved is provided in the following narrative.

1. Comminution

Purpose

The purpose of a comminutor is to continuously and automatically screen and cut the solids and coarse material in the raw wastewater without removing the screenings from the flow. Comminution mainly serves to protect the wastewater pumps and pipelines against clogging and damages caused by materials such as rags, plastic and paper, metal, sticks and bricks.

Two comminutors are located in the raw wastewater channels at the pump station (cf. Figure 4).



SG 1	Slide gate No. 1
SG 2	Slide gate No. 2
PV_1	Plug valve No. 1
CV_1	Check valve No. 1
P 1	Pump No. 1

Figure - 4

Schematic Diagram of Raw Water Pump Station

Description

Each comminutor is a Model 7C "Chicago Pump" unit, designed to handle a design flow of 0.1 MGD and a peak flow of 0.3 MGD. It consists of a stationary housing, a vertical revolving cylinder mounted on a vertical shaft and driven by a gear motor, three types of cutting elements, stationary combs mounted on the housing, shear bars and teeth mounted on the revolving drum. The drum which is 7 inches in diameter, revolves at a speed of 56 RPM. The revolving action of the drum creates a cutting and shearing action between the teeth and combs. Comminuted wastewater enters the wet well through the bottom outlet.

The unit is provided with a 1/4 HP explosion-proof gear motor.

Operation

As mentioned earlier, each of the two channels at the pump station is provided with a comminutor. Normal operation of the plant requires that all sewage flow be diverted through one comminutor channel (SG 1 in Figure 4) with the comminutor running continuously. The slide gates are used to restrict flow to the desired channels. Once each week the other inlet channel, with the standby comminutor, should be flushed out with sewage by removing the appropriate slide gate. Any large solids that escape the comminutor and accumulate on the floor slab should be hand-picked. Aluminum grating will be provided to prevent these solids from falling into the wet well.

The switches for the comminutors are located on the control panel at the lift station. A disconnect switch is provided adjacent to the motor and should be open whenever maintenance is performed. The comminutors should be operated continuously to prevent buildup of solids and excessive head losses. The unit should never run dry.

Maintenance

The comminutor should be maintained according to the manufacturer's

and engineer's instructions. The screen and the cutter blades should be hosed down daily. It must be kept rigorously cleaned and lubricated and the damaged cutting surfaces should be repaired or replaced. Conditions which cause frequent clogging of the comminutor must be corrected immediately. The machine should be thoroughly inspected after heavy storms.

Special Problems

1. In the event of a power failure, the standby generator (Kohler Model) will supply power to the comminutors as well as other equipment.

2. Should it become necessary to put the comminutor out of service temporarily, the flow should be bypassed through the standby comminutor channel. Otherwise, the large objects in the waste would get lodged against the drum causing obstruction and subsequent flooding of the inlet channel. To prevent this, the normally open slide gate SG 1, should be closed while slide gate SG 2 should remain open.

To restart the unit, gate SG 1 should be opened to allow waste flow in the channel and the appropriate comminutor switch on the control panel should be placed in the "start" position under these circumstances. Once this comminutor is in operation, slide gate SG 2 will be closed.

3. Accumulation of difficult-to-cut materials near the blades should not be allowed. These materials should be periodically removed from the unit to maintain effective operation.

Safety

The comminutor should always be turned off at the control panel during cleaning, repairs and lubrication operations. In an emergency, the disconnect switch on the motor can be used to shut off the unit.

Before entering the wet well area where the comminutors are located, care should be taken to see that the area is adequately ventilated and that the floor is not slippery.

Manufacturer's brochures:

Type: Chicago Pump, Comminutor FMC Corporation

Hydraulic Characteristics: Section 7611-4, Chicago Pump Publication.

2. Raw Waste Pumping

Purpose

The raw waste pumps are intended to convey the incoming waste to the ponding treatment site via the 6-inch force main.

Description

Two Moyno positive displacement pumps (Model 2 SWG 12H), each with a capacity to pump 225 gpm against a total dynamic head of 100 psi, are employed. Each pump is driven by a constant speed, 25 HP, 1140 RPM drip-proof motor (220 V/30/60 cycle) manufactured by U.S. Motors. The maximum particle size that can be handled by the pump is one inch.

The pumps are automatically operated by depth sensors in the wet well, known as the Bubbltrol. This Autocon device measures liquid level by sensing the back pressure of compressed air which is constantly bubbled at the bottom of the well through a tube. Sensitive pressure sensors measure this back pressure in terms of liquid level, and translate the pressure variations into electrical signals that control the start and stop operations for the motor. The pressure range employed is 0.2 to 10 psi for which the Bubbltron accurately measures liquid levels between 6 inches and 23 feet.

The pump can also be operated manually. The required motor starters, circuit breakers, and other auxiliary controls are located on the control panel (cf. Figure 8). An Autocon duplex air compressor assembly consisting of two air compressors (1/12 HP), pressure control, common air receiver, bleed valve, relief valve and pressure gauge is installed near the control panel with the necessary tubing.

Operation

Operation of the pumps is automatic with the control provided by the Bubbltrol level sensors. The hydraulic layout of the system is schematically shown in Figure 5 and the control levels in the wet well are indicated in Figure 6. A brief description of the operations is as follows. When level rises to -4.90 feet, the start switch closes the alternator circuit through the relay contact, thereby starting Pump 1. If this pump cannot handle the load, the water level will continue to rise and at elevation -3.90 feet, the alternator circuit starts Pump 2. As the level continues to fall, both the pumps are ON until an elevation of -7.90 feet is reached. At this level, the stop switches for both the pumps open the circuit, thus de-energizing the relays which control the alternator circuit.

The above cycle is repeated when the water level rises again. It is seen from Figure 5 that the pumps will not run dry under the above operating conditions. As a rule, the Moyno pumps should be started with water in the system. This water serves as a lubricant rather than a prime. The wet well is also provided with a high-water alarm (NEMA 7) located two inches (elevation- 2.5 feet) above the floor slab. Both an audible alarm and a red light are activated when both pumps fail, thus causing the water level to rise. The audible alarm can be manually silenced, but the light stays bright until the high level drops and the switch opens. The occurrence of the above situation is, however, extremely remote in view of the provision of a standby pump.

The characteristics of the Moyno pumps are illustrated in Figure 7. The discharge line from the pump has a pressure gauge from which the flow through the pump can be calculated as shown below.

Total dynamic head on pump = pressure gauge reading -
elevation in wet well above pressure gauge.

The flow for the above calculated head (expressed in psi unit) can be estimated from the performance curves in Figure 6.

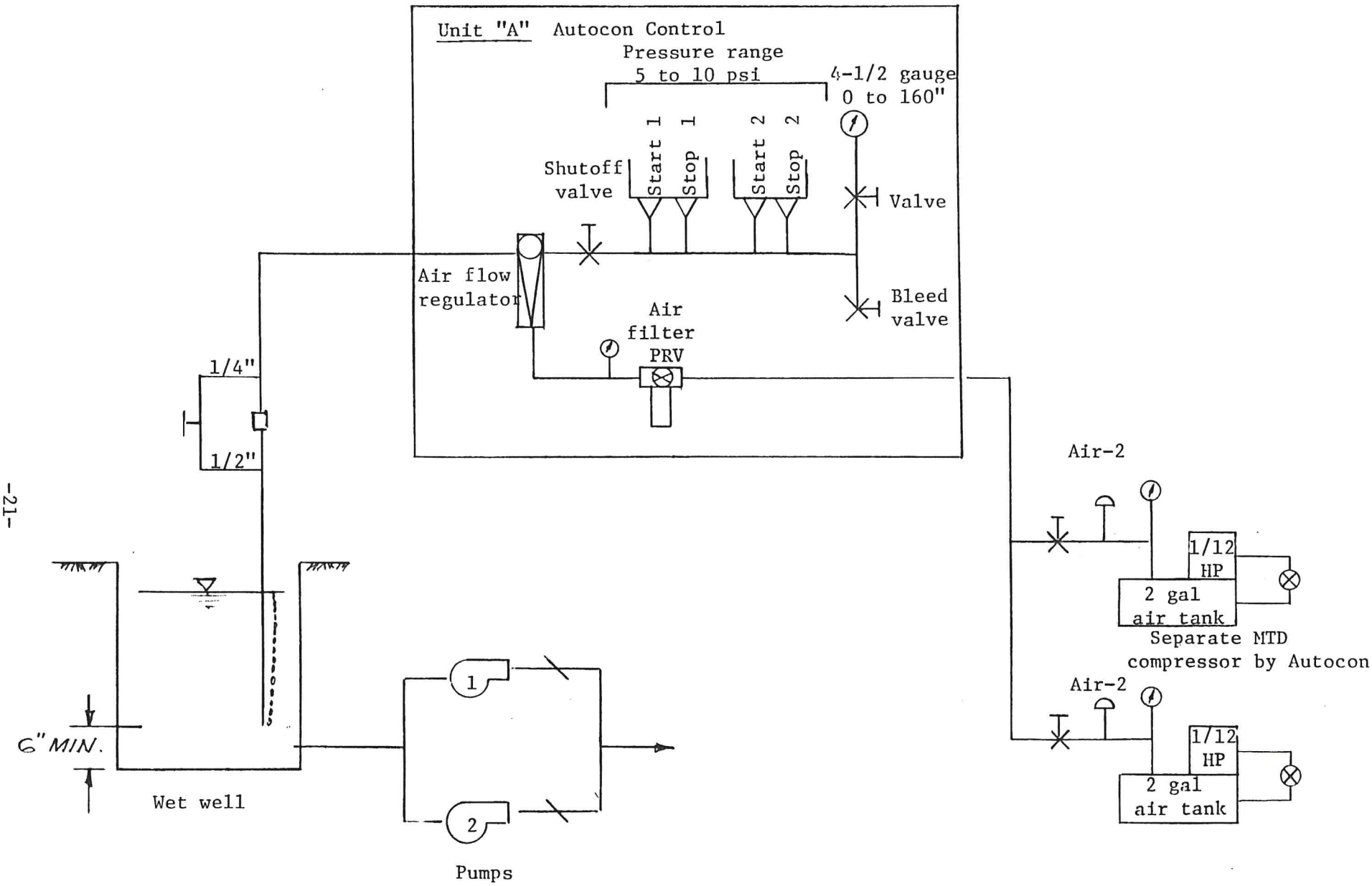


Figure - 5

Hydraulic Layout of Pump Controls

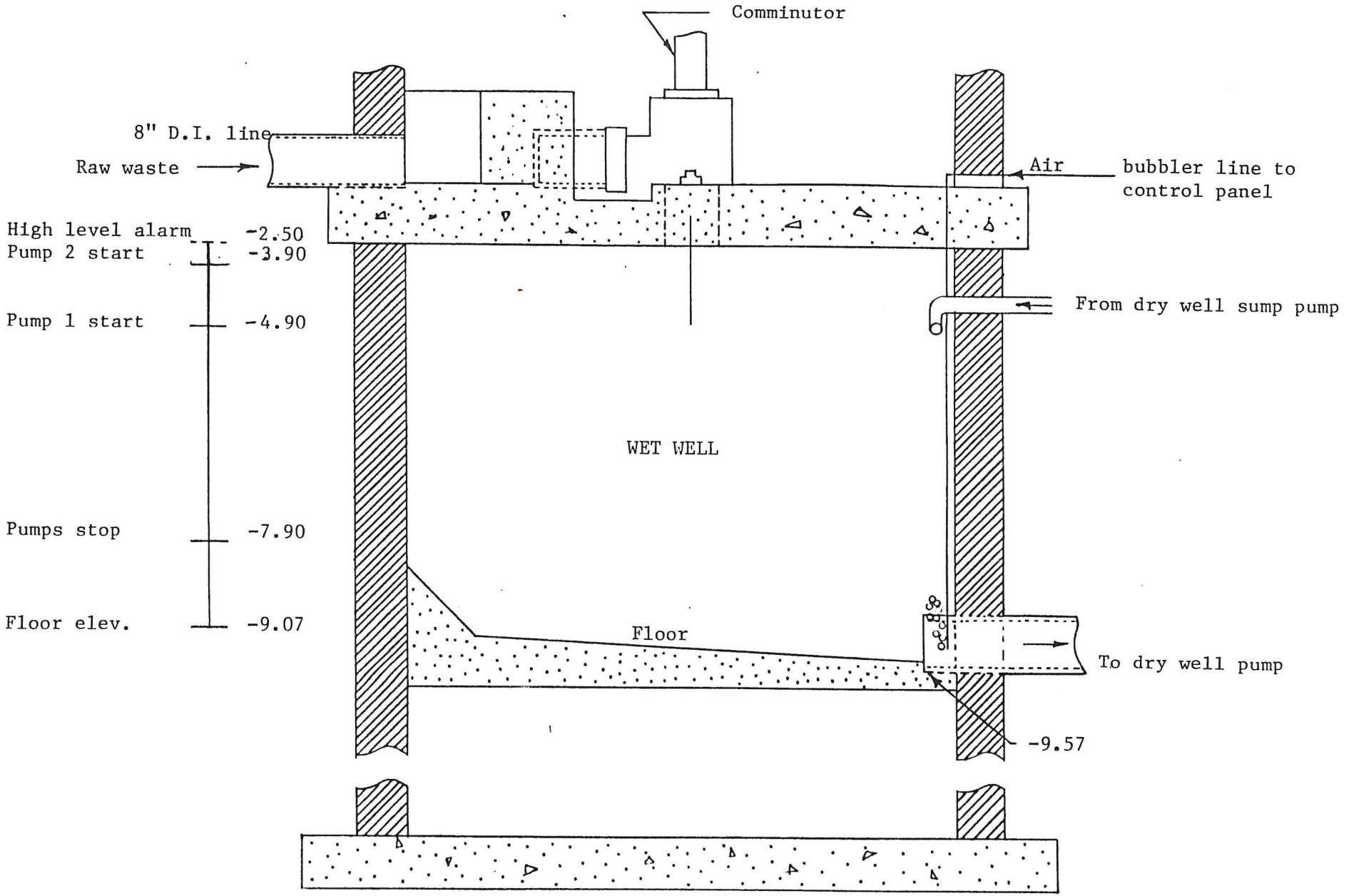

Comminutor
8" D.I. line
Raw waste
Air
bubbler line to
control panel
High level alarm
-2.50
Pump 2 start
-3.90
Pump 1 start
-4.90
From dry well sump pump
WET WELL
Pumps stop
-7.90
Floor elev.
-9.07
Floor
To dry well pump
-9.57

Figure - 6

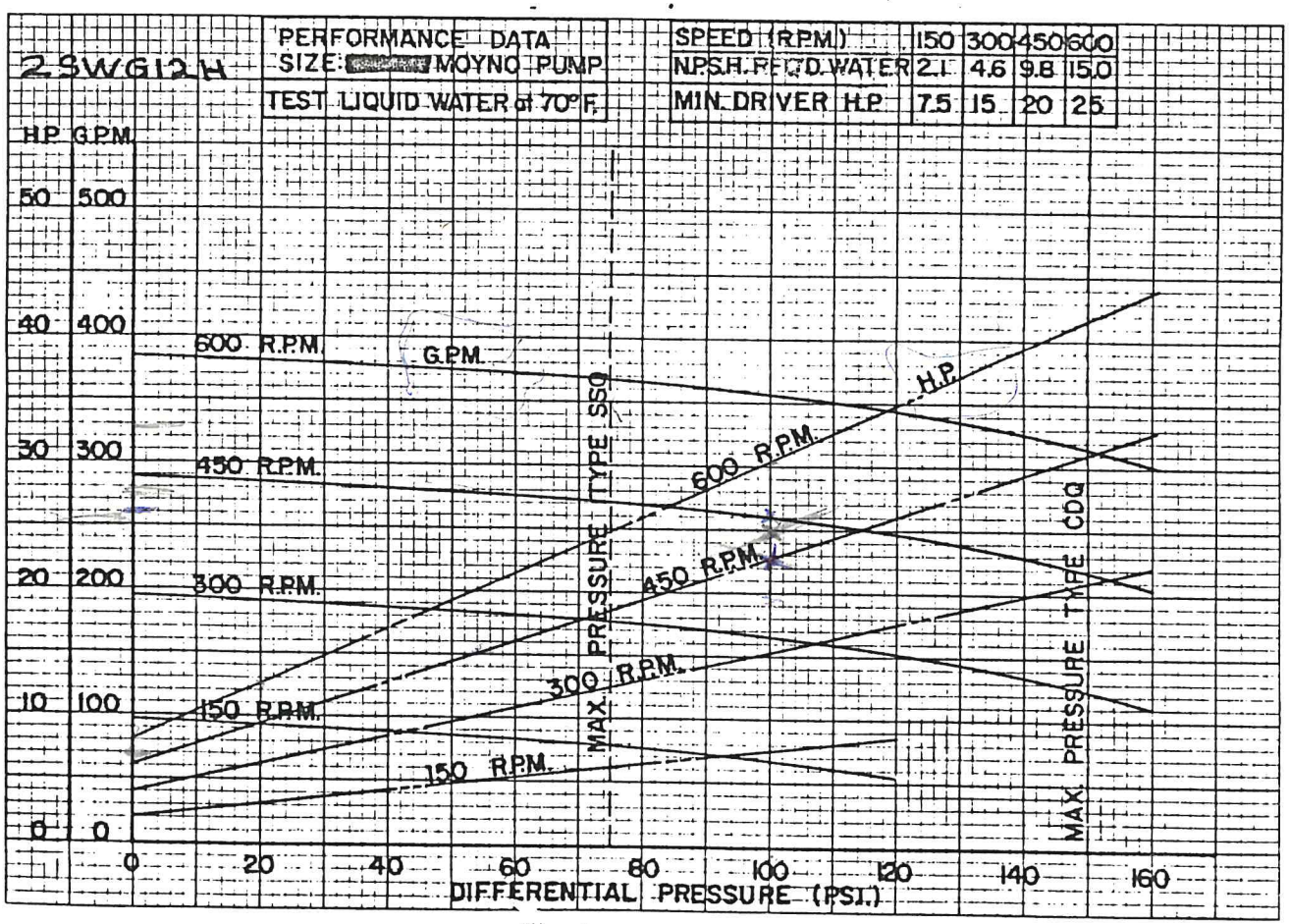


Figure - 7

Performance Curves for Moyno Pumps

Maintenance

Pumps: Should the automatic operation fail, manual operation of the pumps should be restored by turning the switch to "hand" position. The panel circuit should be checked only by a qualified electrician. Lubrication of pump bearings and the packings should be done periodically in accordance with the pump manual instructions. Once a week, the standby pump should be started manually and allowed to run for a few minutes.

Level Control: Bubbltrol is essentially maintenance-free even through on occasions it may get clogged. Purging air at a high pressure will remedy this problem. The needle valve should also be checked for the presence of any clogging material.

If the level gauge is not functioning, visually inspect the level in the wet well frequently until the gauge is fixed.

Safety

The pump should be turned off before it can be worked on. Should the automatic pumping operation fail, the matter should be referred to a well-qualified electrician.

Manufacturer's Brochures

Moyno Type SWG Pumps: Bulletin 130-D
(Robbin & Myers) Operation: Form 3045-C
Repair Part List: Section 29, page 21, Moyno Water Pollution Control Pumps.
Autocon Industries: Techni Data Sheet on Bubbltrol Section 3,000

Maintenance

Pumps: Should the automatic operation fail, manual operation of the pumps should be restored by turning the switch to "hand" position. The panel circuit should be checked only by a qualified electrician. Lubrication of pump bearings and the packings should be done periodically in accordance with the pump manual instructions. Once a week, the standby pump should be started manually and allowed to run for a few minutes.

Should there be a power failure, the diesel generator will automatically be turned on.

Level Control: Bubbltrol is essentially maintenance-free even through on occasions it may get clogged. Purging air at a high pressure will remedy this problem. The needle valve should also be checked for the presence of any clogging materials.

If the level gauge is not functioning, visually inspect the level in the wet well frequently until the gauge is fixed.

Safety

The pump should be turned off before it can be worked on. Should the automatic pumping operation fail, the matter should be referred to a well-qualified electrician. The operator should always be accompanied by a record person while performing any maintenance task on the pumps.

Manufacturer's Brochures

Moyno Type SWG Pumps: Bulletin 130-D
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Repair Part List: Section 29, Page 21, Moyno Water Pollution Control Pumps
Autocon Industries: Techni Data Sheet on Bubbltrol Section 3,000

3. Emergency Power Supply

Purpose

The pump station draws power from P.G. & E. high voltage transmission (240/120 V, 3 Ø, 4W) lines. In the event of a power failure, a standby engine generator supplies full power to the pump station. The control panel on the unit includes necessary relays and components to automatically start and stop the engine generator.

Description

The generating unit consists of a diesel engine and a 60 KW generator designed to operate at 1800 RPM. The engine is a 6 cyclinder, 112 HP, Hercules Model D-3000 T with a four-stroke cycle. The generator is a Kohler Make, 60 ROH 71, rated to produce 60 KW continuous power at 120/240 vac, 3 phase, 4 wire, 60 HZ, voltage regulation within $\pm$ 2% from no load to full load. A 12-volt automatic battery charger (La Marche Model A-5) rated at 5 amps, 120 volts is available to maintain a charge on the engine starting battery.

The engine is equipped with the following accessories:

Low oil pressure cutout switch
High temperature cutout switch
Overspeed cutout
Lub oil filter and cooler
32 amp battery charging alternator with voltage regulator
1000 watt, 120 vac engine block heater with thermostat.

The control panel includes a starting timer adjustable from 45 seconds to 2 minutes which will continue to crank the engine for a preset time interval. The panel has all the necessary instruments, gauges, and reset switches for the proper operation of the unit. (Refer to the manufacturer's brochure for the complete list). The entire generator set is encased in a weather protective housing.

The diesel fuel supply system consists of an underground tank of 280 gallons capacity equipped with an electric feed pump.

Operation and Maintenance

The manufacturer's manuals should be referred to for the proper operation and maintenance of the diesel unit. Even though the unit is designed for automatic operation, manual checks are necessary to insure the same. The three position selector switch, off--test--automatic, is used for testing the unit. The unit should be checked out in accordance with the manufacturer's operation guide. The battery charging system should also be checked out once a week.

Manufacturer's Brochures

Diesel Generator: KOEHLER 60 ROH 71
Battery Charger: LA MARCHE, Model A-5
Data Sheet #5503-4

4. Ventilation and Dehumidification

Purpose

Ventilation of the wet well is extremely important to prevent the buildup of gases formed by the raw waste including those which are flamable. The dry well is also ventilated to keep the circulation of fresh air in the room.

A dehumidifier assembly is needed to prevent condensation on the walls of the control room and to keep the electrical equipment dry.

Description and Operation

The wet well is equipped with a 4-inch exhaust blower. The control room has an exhaust blower and an air intake (8-inch) for ventilation and cooling of the pump motors. The exhaust blowers in the wet and dry well

are respectively powered by a 1/6 HP, 1150 RPM motor (390 CFM), and by a 1/3 HP, 1750 RPM motor (1150 CFM).

Humidity control is by an adjustable humidstat (Honeywell) which is capable of removing 13 pints of water within 24 hours at 80°F and 60% relative humidity.

The fans operate on a continuous basis.

Manufacturer's Brochures:

Direct Drive Blowers: Peerless Electric Division, Portor Company
Catalogue No. 36-050.

6. Floor Drainage

Purpose

The drainage pump is located at the bottom of the dry well and its function is to drain the floor of any spills, pump leaks or wash water that collects on the floor.

Description

The sump pump is a submersible, heavy duty, Weil SS-805-HD type and is powered by a 1/3 HP, 1750 RPM motor with automatic reset thermal protection. It is capable of delivering 20 gpm at a total dynamic head of 20 feet. The pump discharges into the wet well through a gate valve, a check valve and a 1-1/4-inch galvanized iron pipe. A high pressure rubber hose, capable of withstanding pressure in excess of 150 psi connects the delivery end of the pump to the galvanized iron pipe through appropriate fittings.

The pump unit is surrounded by a 1/4-inch galvanized steel mesh for protection against debris. It is installed in a sump that is 15-inches square and 12 inches deep. The gate valve on the pump discharge line

provides protection against leak-back from the wet well in the case of check valve failure.

Operation and Maintenance

The pump can operate even after long periods of idleness and can run continuously without overheating. Pump control is by a specially designed Micro Switch which is protected against any damage in a heavy molded housing. Unit assembly also includes a 10-foot vented, waterproof cord, grounded plug and manual control button.

The unit has pre-set, cut-in and cut-out levels. The screen around the pump is flushed in every operation by backflow below the check valve in the discharge pipe.

Manufacturer's Brochures

Heavy duty submersible sump pump: Weil Company, Model SS-805-HD

6. Alarm System

Purpose

The alarm system provides a visual as well as an audible warning if the water level in the wet well rises one inch above the floor. The dry well is also provided with a high-water alarm to warn against the flooding of the floor.

Description

The alarms are of the Autocon (vigitrols) type, NEMA-4 mount for the dry well and NEMA 7 mount for the wet well. When the two pumps are unable to handle the load, or in the event of a pump failure, the water level will continue to rise in the wet well. The high-level alarm is energized when the circuit is clogged by the rising water level. The audible alarm can be manually silenced, but the light stays bright until the

high level drops and the switch opens. (Manual operation of the Moyno pumps should be restored in the event of any failure in the automatic mechanism). In the case of the dry well, malfunctioning of the drain pump can occur and the rising water level will then trigger an audible alarm connected to NEMA-4 circuitry. Under these conditions, manual pumping of the water can be undertaken with the use of the 3 HP portable pump.

Safety

Any malfunction in the alarm system should be fixed by a licensed electrician.

Manufacturer's Brochure

Refer to Autocon drawings bound in a separate folder.

7. Control Panel

Purpose

The control panel contains all necessary controls for the programming of the two 20-HP raw wastewater pumps, water level alarms and other controls for the pump house.

Description

The panel is an Autocon S4844-F type installed with the following components: a main circuit breaker, a generator circuit breaker, an automatic transfer switch for the emergency generator power, combination starters with 3 overload relays, hand--off--automatic selector switches and elapsed time meters for the two 25 HP pumps, a 12 circuit lighting panel, comminutor starters, a blower timer, humidistat, thermostat, duplex receptacle and all necessary Autocon Model 1600 bubble liquid level sensing controls for operation on 240-volt, 3-phase grounded. Controls are of the solid state design utilizing plug-on relays and solid state timers.

Figure 8 presents a schematic of the control panel.

Operation

The operator should thoroughly familiarize himself with the operational features of the panel. Whereas the normal operations of the pumping station facilities are automatic, manual operation is necessary during emergency or testing of the unit for routine maintenance.

Safety

Only a certified electrician should be allowed to correct any problems related to the circuitry of the control panel. The panel circuit diagrams are available with the operator.

Manufacturer's Brochures

Panel Circuit Drawings: Autocon Industries, Inc. Drawing No. D151116-1
Automatic Transfer Switches: ASCO-940
Water Level Sensors: Bubbltrol, Autocon, Inc. Techni-Data Sheet 3-1620

B. WASTEWATER TREATMENT FACILITIES

As noted earlier, wastewater is conveyed through a 6-inch D.I. force main from the pumping station to the treatment site. After metering, the flow is diverted to a series of four oxidation ponds that provide stabilization of the waste matter through various biological/biochemical reactions. Major unit processes occurring at the treatment site include flow metering and diversion, waste purification through aerobic and anaerobic processes, and disinfection. These unit processes, together with their associated unit operations and the physical system involved, are described in this chapter.

The ponding system is designed to provide an effluent with a BOD of less than or equal to 40 mg/l and which is suitable for disposal through spray irrigation during the warmer months. In order to attain the highly

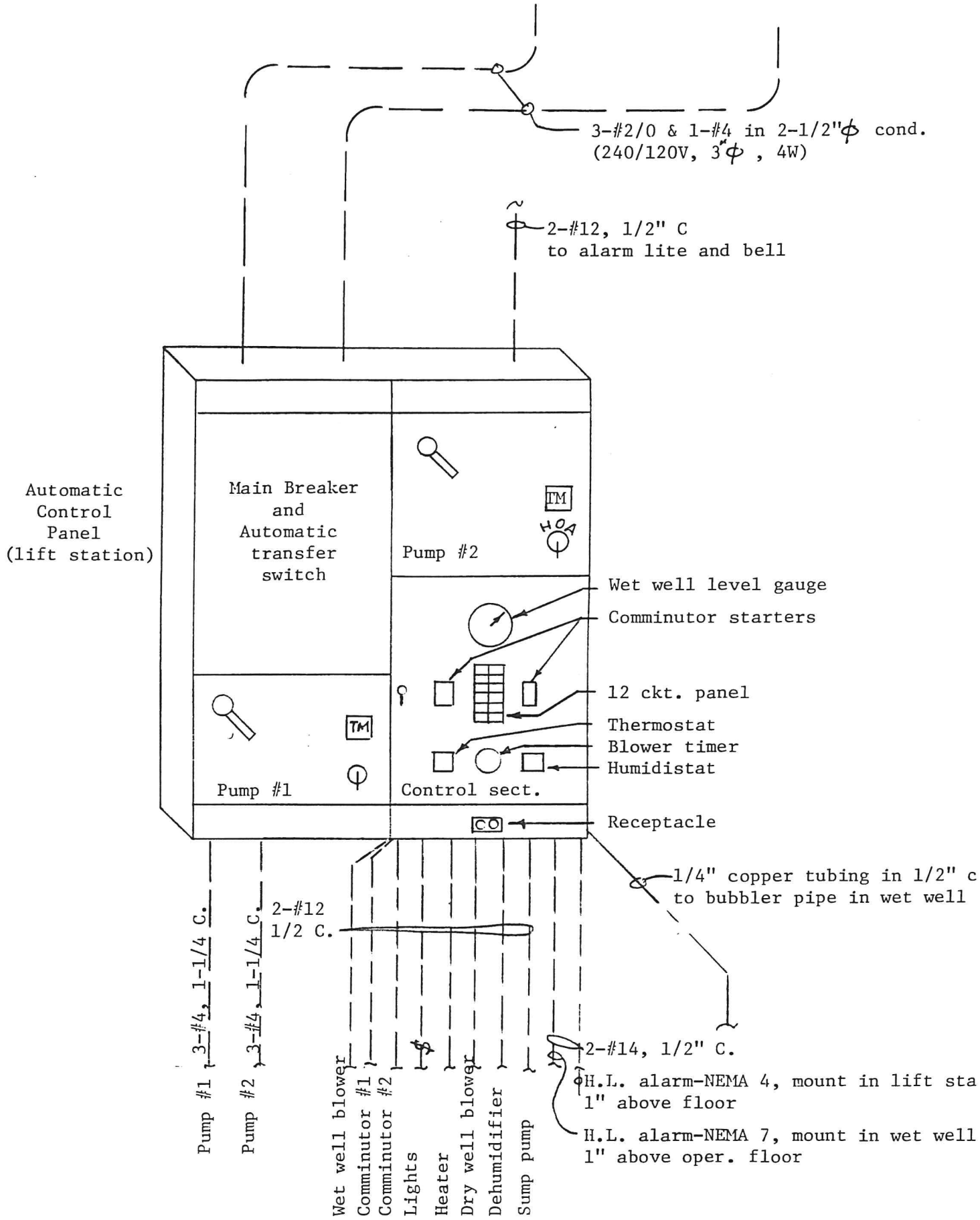


Figure - 8

Control Panel Schematic

stringent requirements of the Regional Board--namely, no pollution seepage and no discharge from the treatment site except to the spray area--it is imperative that the operational features of the ponding system should be given the utmost attention. The fail-safety and the nuisance-free characteristics of the treatment system can be insured only through a proper understanding of the unit processes involved.

1. Flow Distribution/Diversion

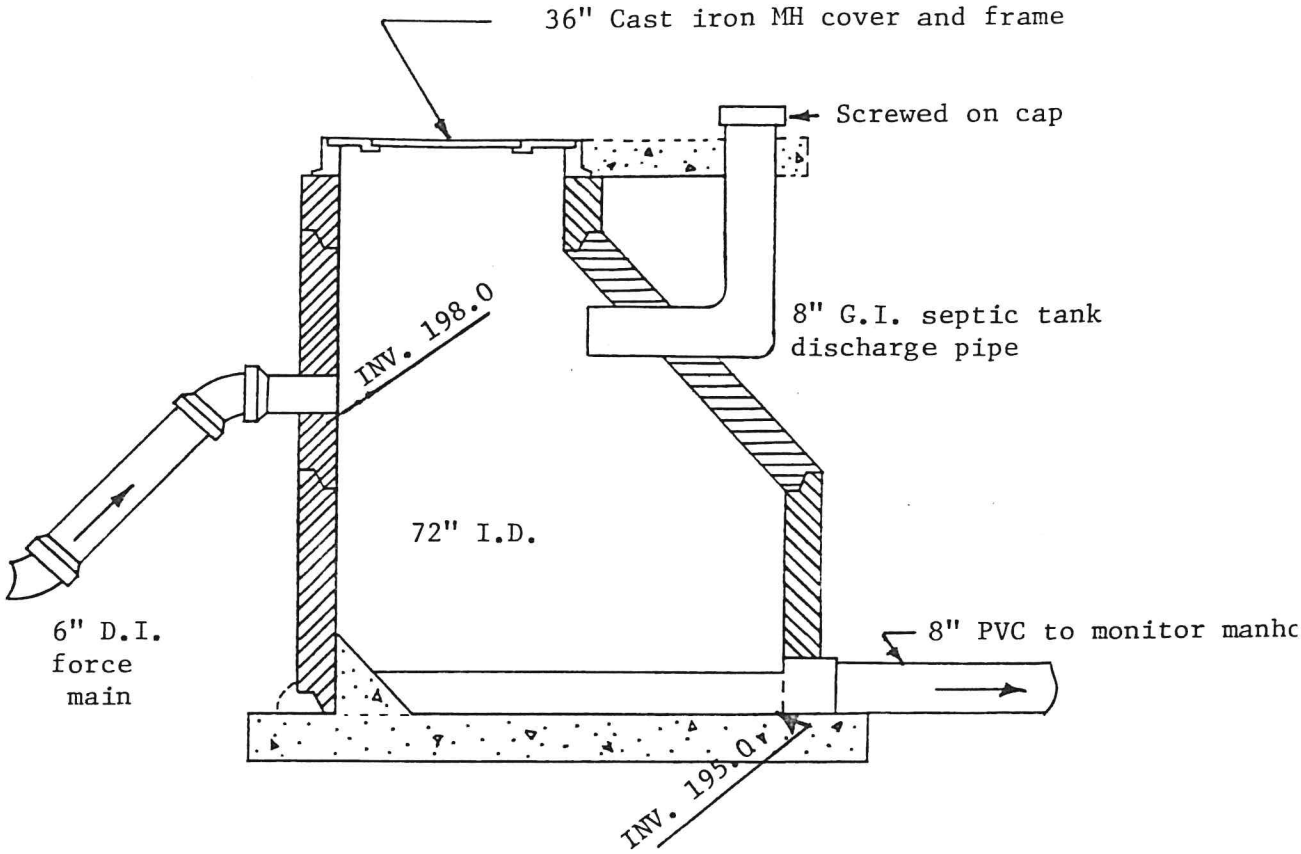
Purpose and Description

Three manholes are provided ahead of the ponding system to act as inlet and distribution/diversion structures for the incoming waste flow. The first manhole known as the energy dissipator manhole receives the waste from the pumping station through a 6-inch force main. It also has inlets to receive occasional septic tank discharge as well as the 3-inch force main from the service building wastewater ejector. The second manhole, called the monitoring manhole, is equipped with an 8-inch Palmer-Bowles flow meter with depth sensors. (See next section on flow metering). The outlet from the monitoring manhole enters the distribution manhole in which is discharged the recirculation flow from pond 3. Two 6-inch lines exit from the above manhole to distribute the waste flow in pond 1A and 1B. These operation lines are provided with stop gates to facilitate flow diversion into either or both of the above ponds.

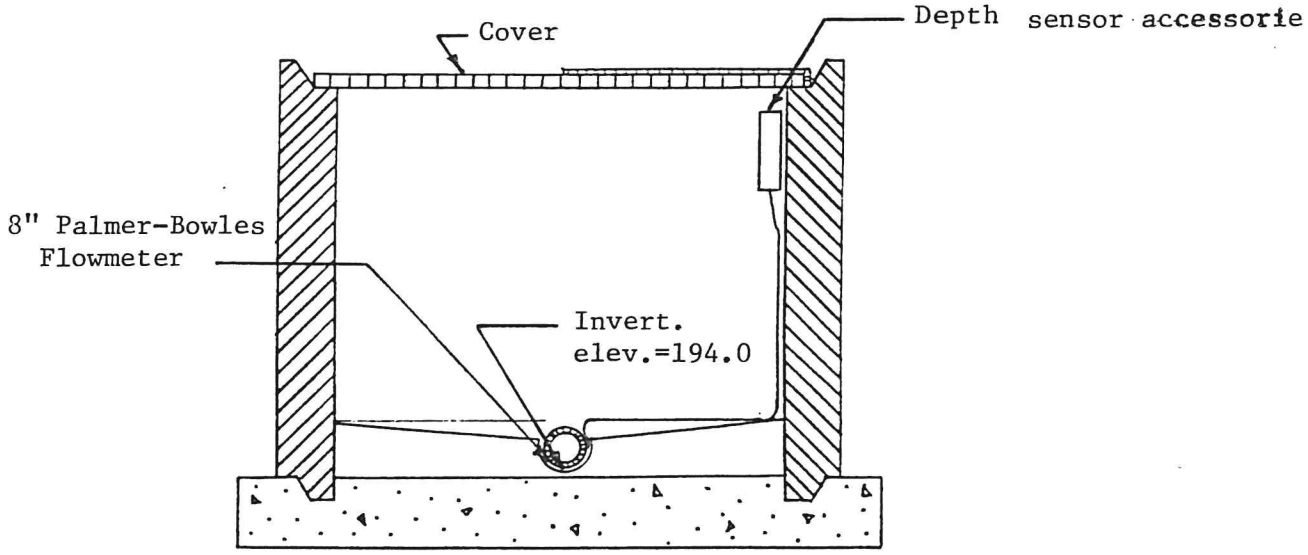
Pertinent details regarding the above three manholes are presented in Figures 9 and 10.

Operation

During the normal operation, the stop gate controlling the waste flow to pond 1B remains closed so that the flow follows the sequence, pond 1A → pond 1B → pond 2 → pond 3. In the parallel operation, both the stop gates are left open. Should pond 1A or 1B require cleaning, the appropriate stop gate is closed, leaving the other open to carry the waste.



Inlet/Energy Dissipation Manhole



Monitoring Manhole

Figure - 9

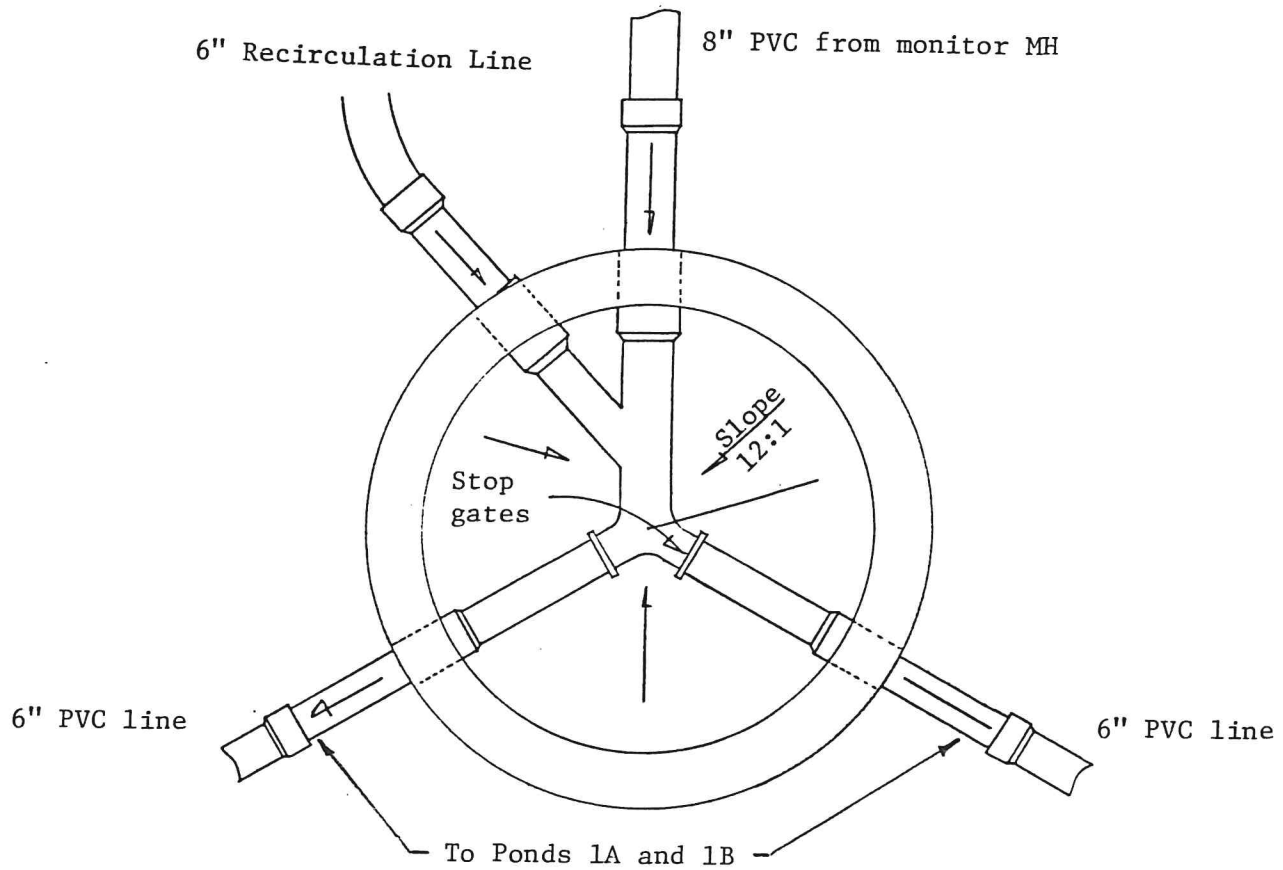


Figure - 10

Distribution Manhole

Maintenance

The manholes should be periodically checked for excessive deposition of solid matter. This is important especially during the run-off season. Feed lines from the distribution manhole to ponds should be flushed monthly to assure that excessive sand deposition does not occur within them. Flushing may be accomplished by closing all the gates in the distribution box until volume builds up so that several feet of sewage are in the box. Then, the gate controlling the line to be flushed is quickly opened permitting the surcharged flow to surge at cleansing velocity through the line to be cleaned.

Safety

Care should be taken while cleaning manholes to avoid falls and asphixiation. This is done by using safety ropes and by providing adequate ventilation.

2. Flow Metering

Purpose

The flow-metering device is used to continuously record the wastewater flow entering the ponding system. One of the most important variables in the system, the wastewater flow, is frequently used to characterize the hydraulic conditions of the wastewater facilities. A knowledge of the flow is also very important in the operational control of several unit processes in the system and to estimate costs. Flow monitoring is mandatory under the regulatory requirements of the Regional Board.

Description

The flow meter with Palmer-Bowles configuration is located in the monitoring manhole which receives waste flow from the energy dissipation manhole (cf. Figure 9). The flow calibration curve for the 8-inch wide flume is presented in Figure 11. It is seen that the waste flow is proportional to the depth of flow in the flume.

Maintenance

The manholes should be periodically checked for excessive deposition of solid matter. This is important especially during the run-off season. Feed lines from the distribution manhole to ponds should be flushed monthly to assure that excessive sand deposition does not occur within them. Flushing may be accomplished by closing all the gates in the distribution box until volume builds up so that several feet of sewage are in the box. Then, the gate controlling the line to be flushed is quickly opened permitting the surcharged flow to surge at cleansing velocity through the line to be cleaned.

Safety

Care should be taken while cleaning manholes to avoid falls and asphixiation. This is done by using safety ropes and by providing adequate ventilation. It is strongly recommended that for safety reasons manhole inspection and cleaning should be carried out in the presence of a record person.

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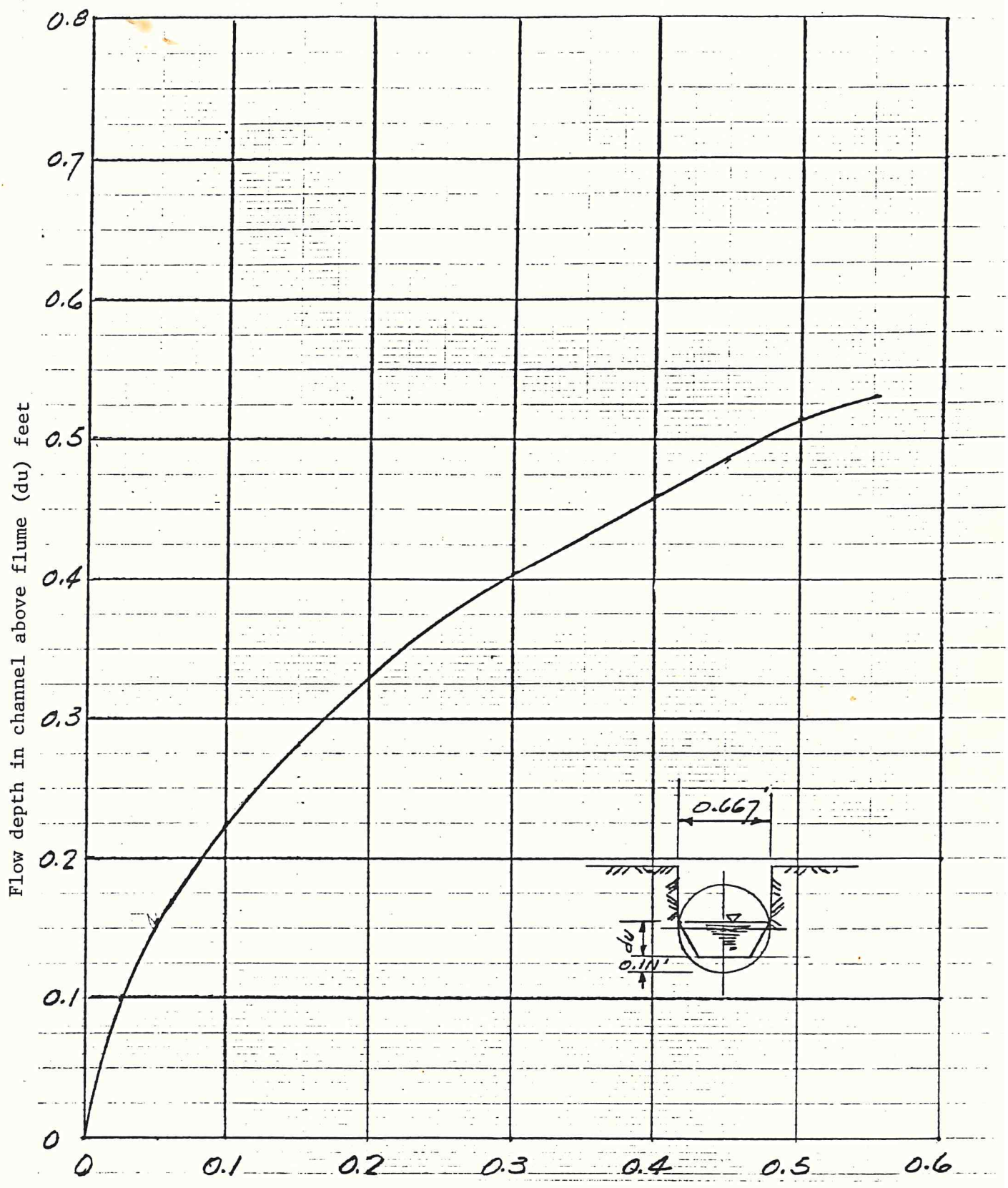


Figure - 11
Rating Curve, Palmer-Bowles Flume

Metering is by means of a sensing device embedded into the Palmer-Bowles flume wall and connected to a 20-foot shielded cable with a plug. This device is activated by changes in the depth immediately upstream from the 8" flume, and its deviations are telemetered to a timer-recorder display which, when activated, will produce a record of flow passing through the Palmer-Bowles flume. The above operations are accomplished in a unit called Flo-Monitor (Model 8092, Universal Engineered Systems, Inc.) which contains the remote display unit, flow rate recorder, total flow totalizer, adjustable high and low flow rate alarms with red alarm lights and the logical circuits. Flow readouts will be in MGD for the strip chart recorder, and in total gallons (one thousand to one billion) for the totalizer.

The metering system is said to be accurate ($\pm$ 4% full scale) for flows up to 0.5 MGD.

Operation

Operation of the flow metering system is automatic except for changing the charts and filling the stylus with ink. The chart lasts about 50 days, at the end of which it should be replaced with a new one. Instructions regarding chart replacement can be found in the manufacturer's brochures.

Periodical calibration of the flow meter is recommended to insure accuracy of flow measurement. This is done by manually measuring the depth of flow in the flume and obtaining the actual flow from the head-discharge rating curve shown in Figure 11. If the recorded flow differs from the actual flow, the necessary adjustment can be made in the unit in accordance with the manufacturer's instructions.

Maintenance

The embedded sensor and the shielded cable are relatively maintenance-free. The remote display unit, on the other hand, may require maintenance for which the equipment manufacturer should be consulted.

Manufacturer's Brochures

Universal Engineered Systems, Inc.: Flow/Monitor Mo-el 8092
Components: Remote display unit Model 000110 Flow/Computer Model 000109.

3. Ponding System

Purpose and Intent

Several natural processes occur in ponds that lead to the stabilization of the organic waste matter. Table 3 lists the various unit processes occurring successively or simultaneously in the primary, secondary and tertiary ponds. BOD removal in the primary pond is mainly via methane fermentation in which the waste matter or the organic carbon is converted to methane and carbon dioxide. In contrast, in the secondary pond, BOD is converted into algal cells through the symbiotic relationship between aerobic bacteria and algae. In this process, the bacteria oxidize the organic matter to CO_2 which is utilized by algae in the presence of sunlight for synthesizing more cells, resulting in the liberation of oxygen. This oxygen in turn is used by the aerobic bacteria in the oxidation of waste organics. In a tertiary pond, further waste treatment takes place, accompanied by the settling of algae and the predatory suspended solids. This results in a "polished" high-quality effluent which can be disposed of by spraying without hazard or nuisance.

Besides treating the wastes, the ponds can also provide storage during the runoff season when disposal of the effluent via spray irrigation cannot be accomplished. Bolinas' ponding system is operated on a total

TABLE 3

UNIT PROCESSES IN PONDS

Component	Major Unit Processes	Purpose
Pond 1A or 1B (primary)	Primary sedimentation	Removal of settleable solids
	Flotation	Removal of floatables (from rising gas bubbles)
	Methane Fermentation	Removal of carbon & nitrogen
	Saponification of fats and oils	Solution & oxidation of grease
	Bacterial oxidation (top layers)	Oxidation of suspended and soluble organics to CO_2 and water
Pond 2 (secondary)	Secondary sedimentation	Removal of organic floc and algal sludge
	Photosynthetic oxygenation	Algal growth and oxygen production
	Bacterial oxidation	Oxidation of soluble organic carbon to CO_2 and water
	Anaerobic digestion (bottom layers)	Settled sludge is decomposed anaerobically
Pond 3 (tertiary)	Predation of algae & bacteria	Decrease in algal suspended solids
	Sedimentation of predators	Decrease in predatory suspended solids
	Photosynthesis	Oxygen production
All Ponds	Atmospheric reaeration	Reabsorption of oxygen and CO_2
	Natural disinfection	Die-away of *E. coli* & viruses; destruction of pathogens
	Evaporation	Water disposal

Note: Ponds 1 and 2 have especially compacted bottom to prevent the percolation of untreated or partially treated wastewater.

retention basis during the rainy months, with disposal of effluent by irrigation during the spring and summer seasons, and the warmer days of the fall season.

Description

The configuration of the four ponds is schematically represented in Figure 12 with the typical pond profiles and transfer structures shown respectively in Figures 13 and 14. Table 4 provides physical details for the individual unit.

Ponds 1A and 1B have equal surface area of one acre and a depth of 9 to 9.5 feet. The volumes are approximately 6.4 and 6.6 ac-ft respectively. They are divided along the bottom with an approximate 5-foot high concrete wall. (See Figure 12). This wall is entirely covered by water when the pond contains more than 5 feet of water and acts to prevent the intrusion of cold surface water into the pond bottom during windy and turbulent periods. It also provides for an area of relatively intensive sludge sedimentation and digestion in primary ponds 1A or 1B. The inlets to ponds 1A and 1B are located near the center bottom where it is intended that sludge should accumulate and ferment. During start-up, when the wall is not submerged, the contents of the inner sections of ponds 1A or 1B pass through into the remainder of these ponds through "weep holes". These prevent excess load on the dividing walls. After wall submergence, the two cells are continuous over the wall, creating what appears from the surface to be a single expanse of water. When it attains a depth of about nine feet, ponds 1A or 1B discharge into pond 2 through a submerged port. The discharge from pond 1A is submerged and located several feet below the surface which, in effect, retains floating solids or grease within the primary ponds. It also prevents warm, fresh sewage which may float on colder water from overflowing into pond 1B, producing short-circuiting. Pond 1B normally acts as a secondary pond and discharges to pond 2 by means of a surface discharge.

Pond 2, shown in Figure 12 and in a typical profile in Figure 13, has a surface area of 1.5 acres, an average depth of eight feet, and a

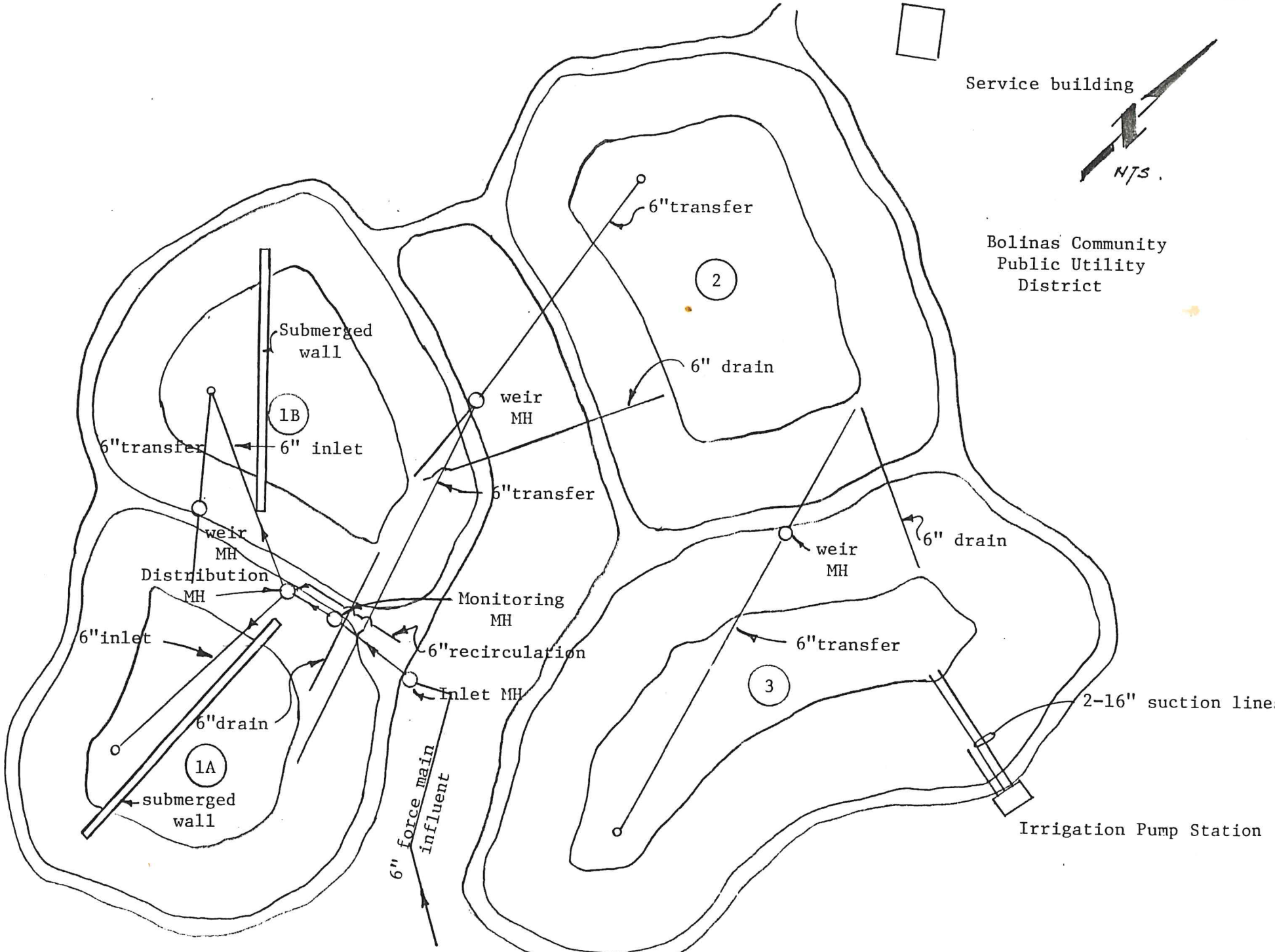
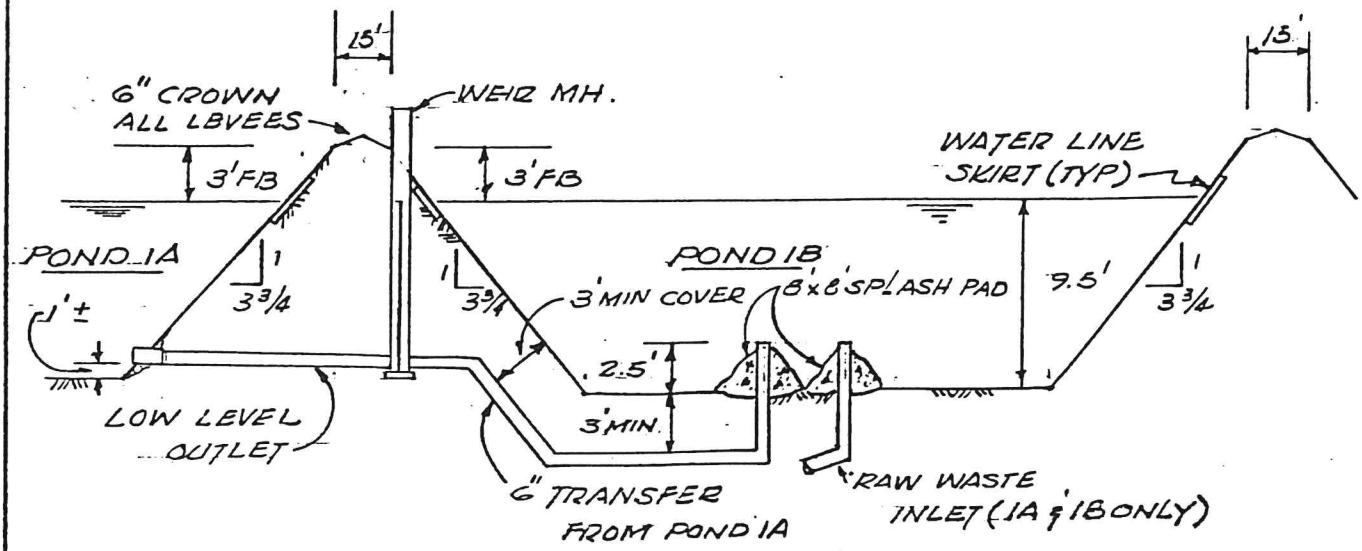
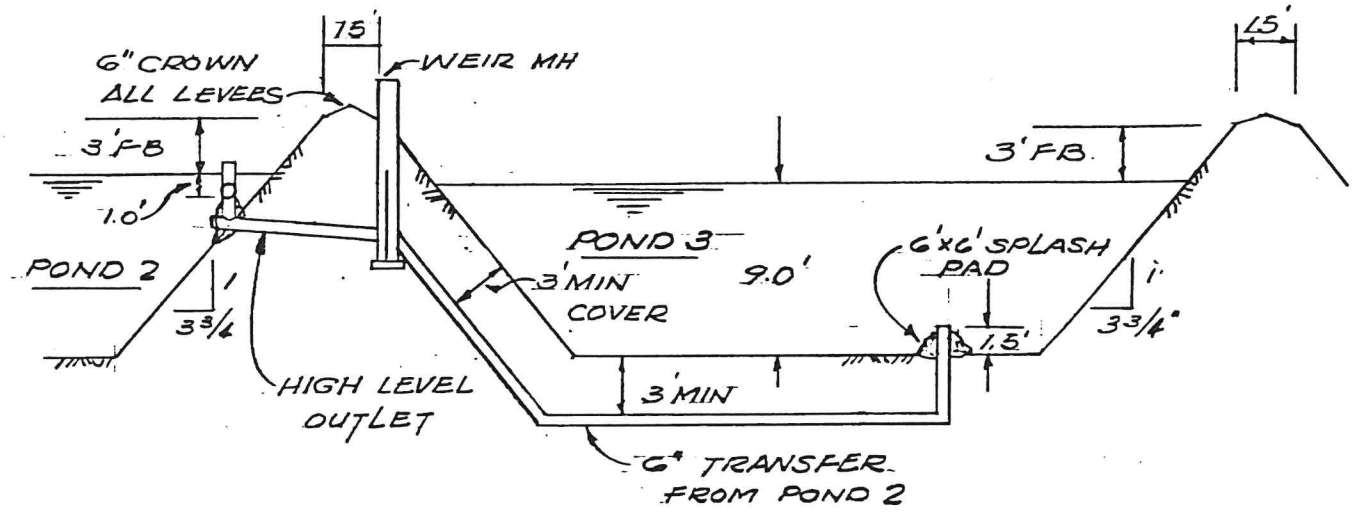

Service building
N/S
Bolinas Community
Public Utility
District
6"transfer
2
6" drain
Submerged
wall
1B
6"transfer
6" inlet
weir
MH
6"transfer
weir
MH
Distribution
MH
Monitoring
MH
6"inlet
6"recirculation
Inlet MH
6"drain
1A
submerged
wall
6" force main
influent
weir
MH
6" drain
6"transfer
3
2-16" suction line
Irrigation Pump Station

Figure - 12

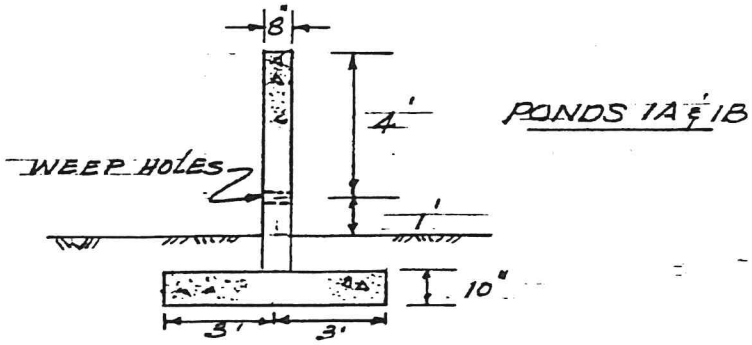
Pond Sections



Section - Ponds 1B & 2



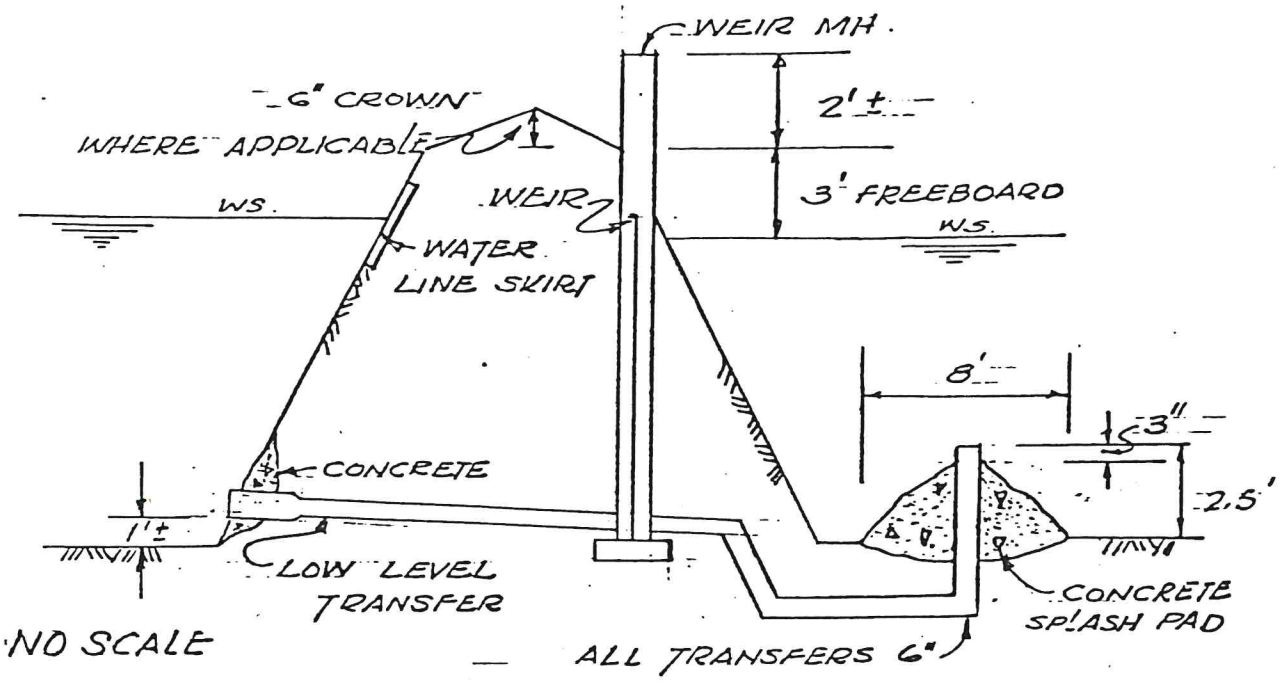
Section - Pond 3



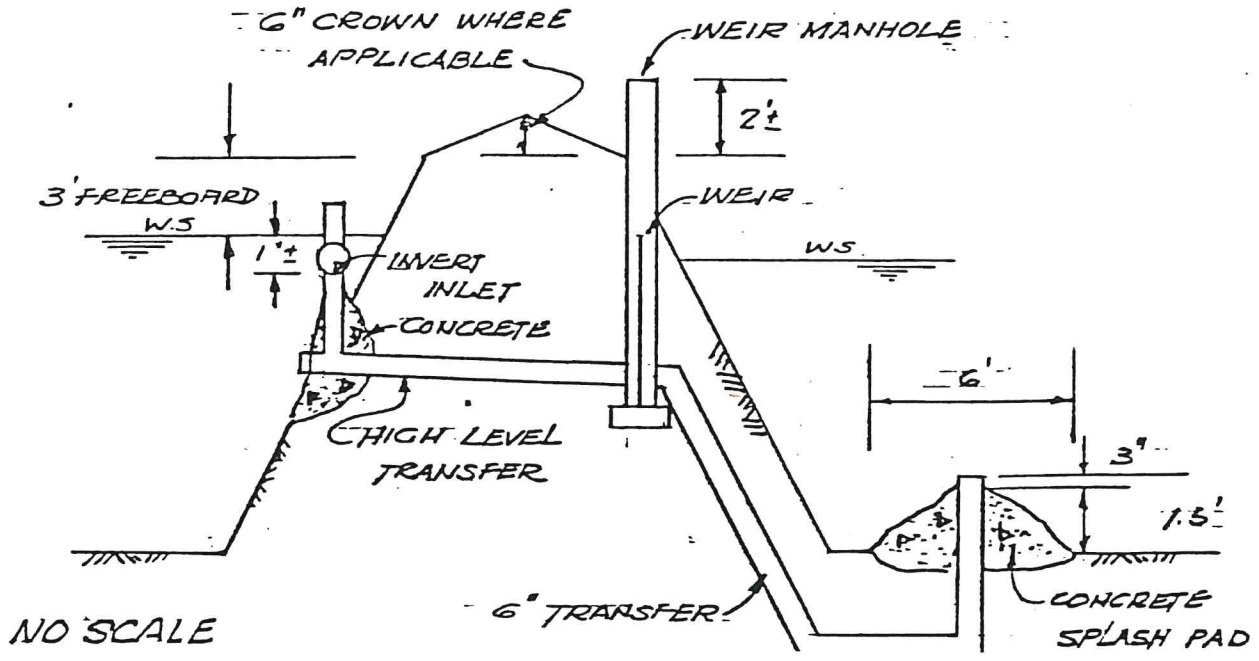
Section - Digester Wall

Figure - 13

Transfer Structures



Low Level Transfer
Pond 1A to 1B
Pond 2 to 3



High Level Transfer
Pond 1B to 2

Figure - 14

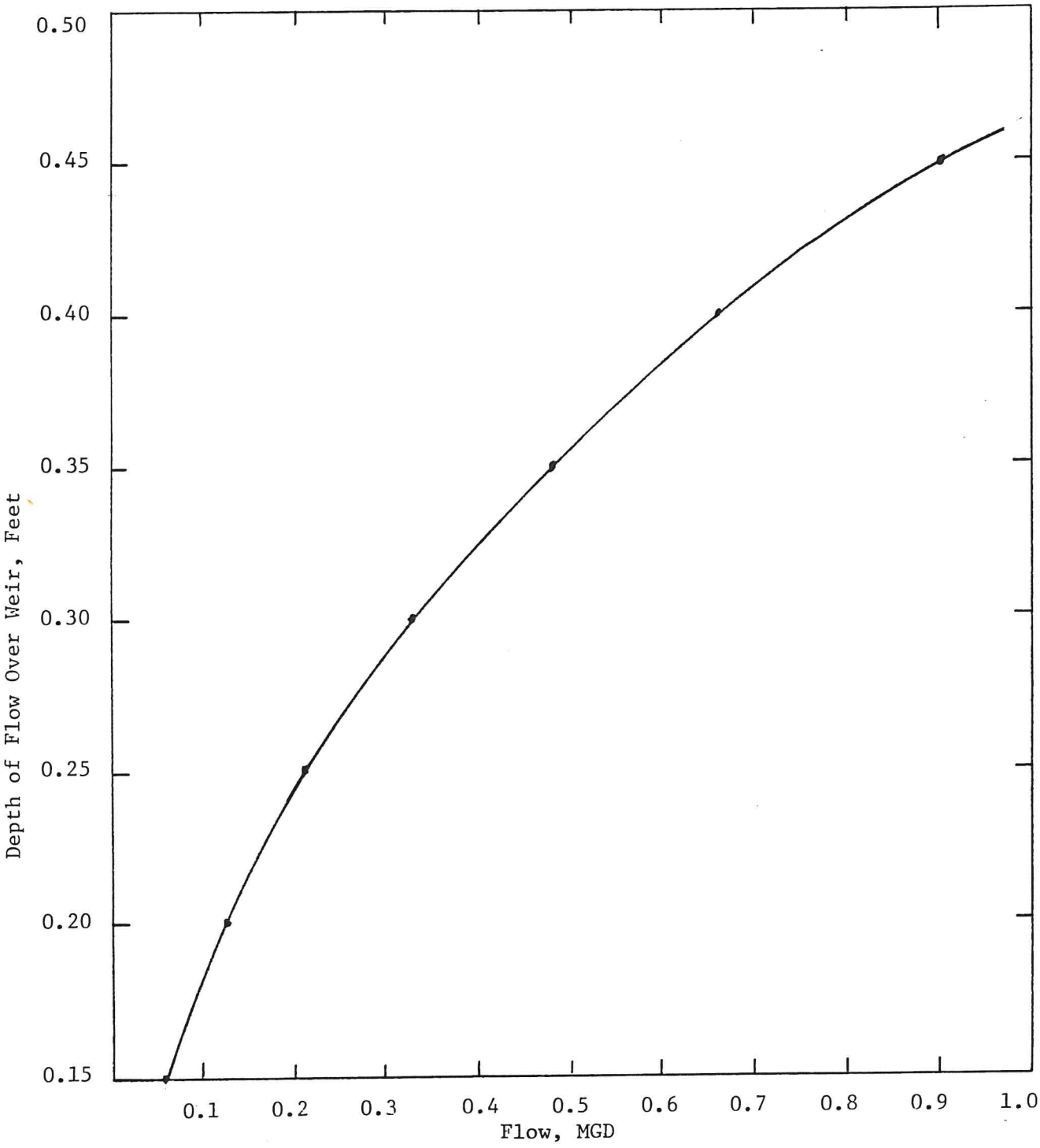


Figure - 15

Calibration Chart for Flow Over V-Notch Weirs

TABLE 4

PHYSICAL DETAILS OF BOLINAS PONDING SYSTEM

Pond No.	Water Surface		Maximum Depth Feet	Volume Ac Ft	Cumulative Volume		Theoretical Detention Period* Days
	Area Acres	Cum Area			AcFt	MG	
1A	1.0	1.0	9	6.4	6.4	2.087	32
1B	1.0	2.0	9.5	6.6	13.0	4.238	33
2	1.5	3.5	8	9.5	22.5	7.335	48
3	1.6	5.1	9	10.1	32.6	10.627	51
Total							164

*Based on an incoming flow of 0.065 MGD

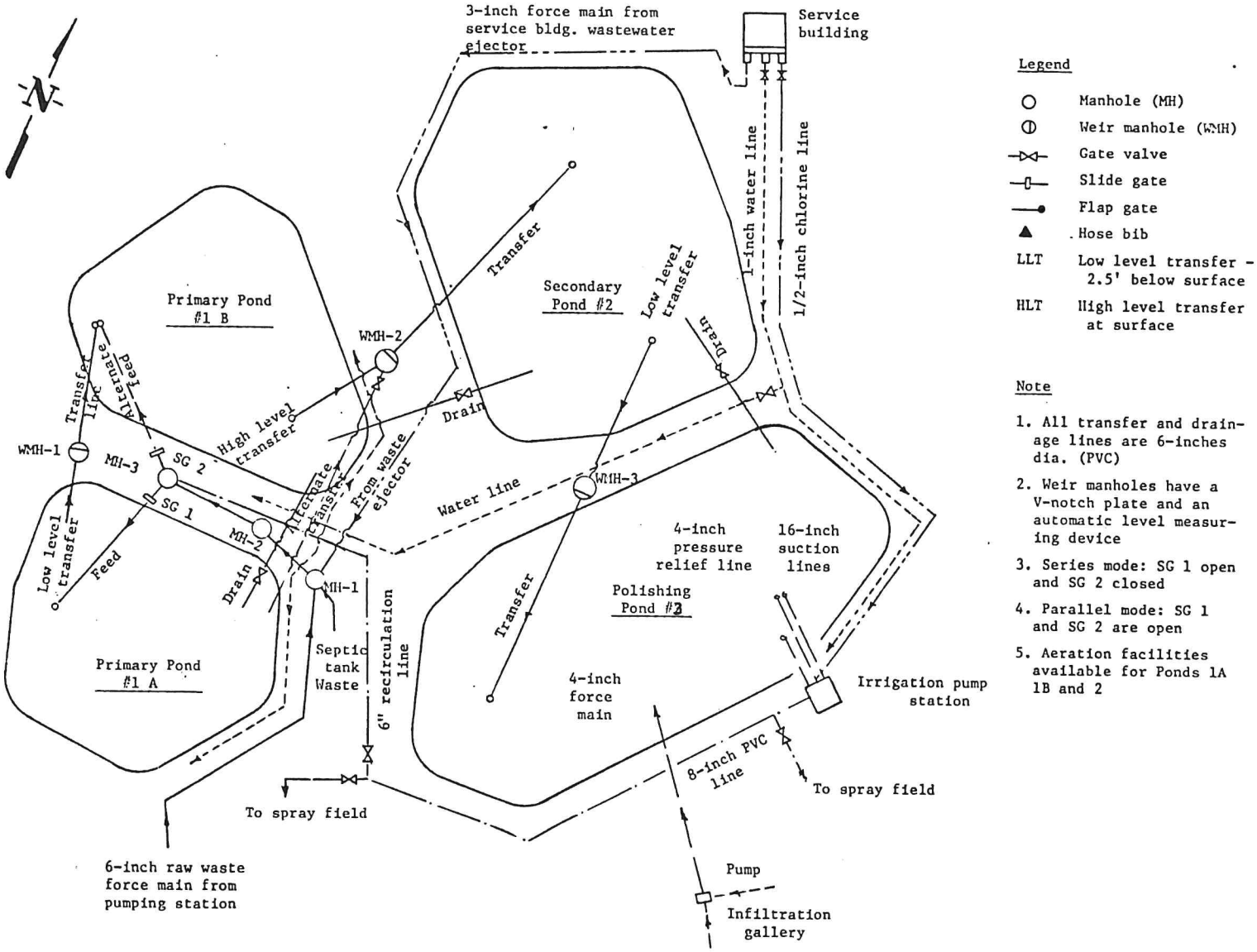
Normal detention period for series operation = 164 days

1A - 10' = 4' freeboard

1B 10' = 4' freeboard

2 7.6' = 7' freeboard

3 10' = 10' freeboard



Legend

○	Manhole (MH)
⊖	Weir manhole (WMH)
⋈	Gate valve
⊣	Slide gate
●—	Flap gate
▲	Hose bib
LLT	Low level transfer - 2.5' below surface
HLT	High level transfer at surface

Note

1. All transfer and drainage lines are 6-inches dia. (PVC)
2. Weir manholes have a V-notch plate and an automatic level measuring device
3. Series mode: SG 1 open and SG 2 closed
4. Parallel mode: SG 1 and SG 2 are open
5. Aeration facilities available for Ponds 1A 1B and 2

Figure - 16

Pond Piping Schematic

volume of about 9.5 acre-feet. In the normal configuration, wastewater enters pond 2 from the surface of pond 1B through a submerged inlet and leaves pond 2 by means of a submerged overflow of the type shown in Figure 14. Horizontal locations of the transfer structures and the weir manholes are schematically shown in Figure 16 on page 46. V-shaped weir plates are installed in these manholes to measure the flow (see Figure 15 for the flow charts) being transferred from one pond to another. The depth of flow is measured by level sensors located in the manhole. (See details in a following section). Mechanical aeration facilities are available for ponds 1A, 1B and 2. Two 5-HP, Welles aerators will be installed initially, one each in pond 1A, and 1B. The aerators in pond 1A and 1B can be interchanged whenever needed. These aerators are provided mainly to prevent any chance of a malodor problem as well as to enhance evaporation when needed. They are operated manually. Steel mooring cables and accessories and electrical power lines are provided for the three ponds.

Pond 3 has a surface area of 1.6 acres, an average depth of nine feet, and a volume of about 10.1 acre-feet. Water enters pond 3 from pond 2 through a submerged inlet of the type shown in Figure 13 and leaves pond 3 by means of a submerged outlet to the disposal system. Horizontal localities of the disposal suction lines are shown in Figure 16.

Design Criteria

The burden of waste treatment occurs in ponds 1A or 1B in the form of sedimentation, methane fermentation, and bacterial oxidation. Detention period in ponds 1A or 1B at average wet weather flow, will be 32 days each, which is more than adequate for winter conditions. During the summer, detention in the pond system will exceed 160 days. BOD load at maximum design flow, is 130 lbs. per day. Permissible loading on the primary facultative pond during summer with well-developed methane fermentation is 200 lbs per day per acre. Accordingly, two one-acre primary ponds were selected. The installation of two primary ponds greatly enhances the performance and flexibility of the treatment system. One may be shut down for solids removal while the second is

maintained for treatment purposes. These units have been designed for series or parallel operation. Loss of BOD due to methane fermentation in mid-summer will be in accordance with the equation

$$L = 40 (T - 15)$$

in which L is the BOD loss in lbs per acre per day at temperature T in degrees centigrade. Data for temperature of water in July and August indicates a mean temperature of 20°C. Accordingly, BOD loss due to methane fermentation will be 40 (20 - 15) = 200 lbs per acre per day. Thus, the loading of 130 lbs per acre may theoretically be entirely decomposed anaerobically in the primary pond. Not all of the organic matter applied to the pond will be decomposed of anaerobically, however. Indeed, anaerobic fermentation usually can decompose only 70 to 80% of the applied organic matter. Accordingly, pond 1A or 1B will discharge BOD in proportions to flow volume and residual BOD. On the average, discharge volume from ponds 1A or 1B will be 73 $\pm$ acre-feet of influent, plus 10 acre-feet of rainfall less 10 acre-feet of evaporation, or 73 acre-feet.

The concentration of BOD entering the pond with raw sewage is estimated to be 240 mg/liter. The BOD leaving the primary ponds is estimated to be 60 mg/liter. The BOD entering pond 2, accordingly, will not exceed .065 x 8.33 x .025, or about 50 lbs/day at the peak summer level and 5/6 this much or 43 lbs/day under winter conditions. Detention period in pond 2 is expected to be at least 48 days in summer and 35 days in winter.

Loadings to subsequent ponds in the series will be less than 5 lbs per acre/day. Selection of over/under discharge transfer weirs has been made to avoid the possibility of short-circuiting of fresh sewage into the final pond, thus minimizing the danger of spray-borne droplet infections and clogging in the spray disposal system.

Normal Operation

Operation of a pond system requires attention to pretreatment facilities, attention to the ponds themselves, both while full of waste

and when empty, and recognition and control of biological organisms in the pond and surrounding area. Details on the normal operation of the Bolinas ponds are summarized below. Location of manholes, pond pipings, transfers, and valving arrangements are illustrated schematically in Figure 16.

Normal operation of the pond will be in the series mode in which the waste flow follows the configuration 1A 1B 2 3. This is accomplished by opening stopgate SG1 and closing stopgate SG2. Based on the minimum detention period, and mean, water temperature, it is anticipated that the BOD of the pond contents will be about 60 mg/l for Pond 1B and about 30 mg/l for the final pond.

Transfer structures should be adjusted so that the water level in the downstream pond is sufficiently below that of the upstream pond so that the gate top acts as a weir, and metering is thus possible. Normally, this will require approximately a six-inch head difference.

The aerators in ponds 1A or 1B should not be continually operated (for details on the aerator, see page 64) but will be required in foggy periods when there is insufficient dissolved oxygen in the ponds. Low dissolved oxygen conditions will result in the reduction of sulfates to hydrogen sulfide which creates obnoxious conditions. For this reason, the surface dissolved oxygen in all the ponds should be kept at least 2 mg/liter at all times. In the event of any pond malfunction--as indicated by a low dissolved oxygen and/or low pH (less than 7.0) levels--corrective measures should be immmediately undertaken by turning on one or more aerators. Aeration should be shut down when the weather is clear and a dissolved oxygen of 2 mg/liter or more has been attained.

and when empty, and recognition and control of biological organisms in the pond and surrounding area. Details on the normal operation of the Bolinas ponds are summarized below. Location of manholes, pond pipings, transfers, and valving arrangements are illustrated schematically in Figure 16.

In the series operation, stop gate SG1 remains open and stop gate SG2 is closed so that the waste flow will follow the series configuration 1A → 1B → 2 → 3. In the parallel operation mode, both the gates SG1 and SG2 are left open so that the waste flow divides into two streams, one to pond 1A and the other to pond 1B. The effluent from these ponds is conveyed to pond 2 to pond 3. Parallel operation of ponds 1A and 1B will not be warranted until the waste flow reaches the full design capacity and an additional pond has been built to confirm to the minimum four-ponds-in-series criterion.

Transfer structures should be adjusted so that the water level in the downstream pond is sufficiently below that of the upstream pond so that the gate top acts as a weir, and metering is thus possible. Normally, this will require approximately a six-inch head difference.

The aerators in ponds 1A or 1B should not be continually operated (for details on the aerator, see page 64) but will be required in foggy periods when there is insufficient dissolved oxygen in the ponds. Low dissolved oxygen conditions will result in the reduction of sulfates to hydrogen sulfide which creates obnoxious conditions. For this reason, the surface dissolved oxygen in all the ponds should be kept at least 2 mg/liter at all times. In the event of any pond malfunction--as indicated by a low dissolved oxygen and/or low pH (less than 7.0) levels--corrective measures should be immediately undertaken by turning on one or more aerators. Aeration should be shut down when the weather is clear and a dissolved oxygen of 2 mg/liter or more has been attained.

Recommended Operational Parameters

To insure optimal performance in the ponds, the following operational

Parallel operation of the ponding system:

In the parallel operation mode, both the gates SG1 and SG2 are left open so that the waste flow divides into two streams, one to pond 1A and the other to pond 1B. The effluent from these ponds is conveyed to pond 2 and pond 3. Parallel operation of ponds 1A and 1B will not be warranted until the waste flow reaches the full design capacity and an additional pond has been built to conform to the minimum four-ponds-in-series criterion to provide stabilization and avoid possible short-circuiting of the untreated or partially treated waste.

Since the flow is divided into half before entering pond 1A or 1B, the detention time for the waste flow in these ponds is twice that for the series system (cf. Table 4). In view of further treatment taking place in the three downstream ponds, the quality of the final effluent due to parallel operation will be expected to be better than for the series system. In the absence of the additional pond needed for the parallel mode, it is doubtful whether the advantages of a high degree of treatment attained in pond 1A and 1B could outweigh the disadvantages of short circuiting due to inadequate number of ponds in series. (As noted earlier, at least four ponds in series should be employed).

Recommended Operational Parameters

To insure optimal performance in the ponds, the following operational parameters are recommended:

parameters are recommended:

Dissolved oxygen in all ponds	= 2.0 mg/l (minimum)
*Sulfides in ponds 1A and 1B	= 1.0 mg/l (maximum)
Sulfides in ponds 2 and 3	= none
Odor in all ponds	= none
BOD of ponds 1A and 1B	= less than 60 mg/l
BOD of pond 3 contents	= less than 25 mg/l
pH in all ponds (especially in 1A and 1B)	= 7.2 (minimum)
Suspended solids in pond 2	= less than 50 mg/l
Suspended solids in pond 3	= non-clogging
Weeds in ponds and on levee surfaces	= none
Maintenance of operating records and pond performance	= as specified in this manual

Achievement of Design Operating Parameters

BOD Removal: The attainment of a 60 ppm BOD in ponds 1A or 1B is ensured by the presence of a rich oxygen producing algal flora at the pond surface and a well-developed methane fermentation in the pond bottom. This was initially accomplished by seeding ponds 1A and 1B with algae and digesting seed from several septic tanks. Once initiated, photosynthesis and fermentation will continue with only seasonal variations for the foreseeable life of the ponds. Periodic measurement of BOD is indicated in the data sheet described in a following chapter. Ponds 1A or 1B should continue adequate methane fermentation until sludge accumulates to a depth of 3 feet in pond 1A. Pond 1A should be then be dried out and cleaned. During cleaning of 1A, the waste may be diverted to pond 1B on a temporary basis. It is estimated that pond 1A will require cleaning after a-proximately 10 to 20 years if design loading is not exceeded.

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*Since ponds 1A and 1B are primary ponds, the attainment of less than 1.0 mg/liter sulfide is probably very difficult. The odor problems can, however, be prevented under alkaline pH conditions.

The attainment of a 25 ppm BOD in pond 3 is ensured by arrangement of the ponds and transfer weirs. The fact that predators graze heavily on algae and bacteria once the ammonium level in the pond series decreases to less than 1 mg/liter assures that the fourth pond in the series will be very low in BOD. Substantial microbiological transformation of carbon, nitrogen and phosphorus to inert gases (CH_4, N_2 and PH_3) in ponds 1A or 1B, and also to some extent in pond 2, assures that the water reaching pond 3 will have little polluting capability. The frequency of periodic measurement of BOD in pond 3 is indicated in Chapter III.

Floatable Solids and Grease: Inasmuch as scum and grease is held in ponds 1A or 1B, provision is made for its removal by means of a scum ramp at the downwind end of ponds 1A or 1B. This scum ramp permits all-weather access for scum breakup or removal. Visual observation will indicate the presence of floatable solids in ponds 1A or 1B. These ordinarily will appear at the scum ramp where they are available for submergence utilizing a high-pressure hose nozzle or for physical removal for later burial. Plastic toys, plastic bags and rubber goods do not degrade rapidly, and are sufficiently unsightly that they should be removed periodically and buried in a small trench type sanitary land fill at the site. Floatables should not be confused with bulky sludge which is discussed under Sludge Bulking (page 54).

Pond pH: Biological reactions (methane fermentation, oxidation, photosynthesis) in ponds are highly dependent on pH conditions. Maintenance of a slightly alkaline pH range (7-7.5) in the primary ponds (1A and 1B) is essential for successfully accomplishing methane fermentation without any odor problem caused by sulfides and ammonia. The pH is an indication of photosynthetic activity in ponds. Elevation in pH levels is the result of the utilization of carbon dioxide during photosynthesis. While this increase may range from 0.2 to 2.0 units or higher in a pond, its exact value is dependent on the buffer capacity ($CO_3 \leftrightarrow HCO_3$ system) of the ponds. The lower the pond buffer capacity is, the higher is the pH increase. It will be expected for a series ponding system that the pH of the water will increase from the upper pond to the lower pond. A "healthy" pond will have a pH of 8.0 and above. Besides exerting influence on the odor aspects of the pond, pH also has considerable influence on the presence of predators such as daphnia,

and several species of rotifers which prey on algae. This is discussed in detail in a following section. Low pH conditions (<7.0) result in an increased predator activity which is related to high ammonia levels prevailing in the system.

Low pH conditions in a "sour" pond can be corrected by aeration or by the addition of lime. Care should, however, be exercised in not adding excess quantities of lime that would bring about the coagulation of algal cells, thus defeating the very purpose of the remedial action. Lime addition will not ordinarily be removed in this system.

Suspended Solids: Low suspended solids in pone 3 is likely due to predation of algae and bacteria by daphnia which will occur in the pond together with a dearth of carbon, nitrogen, and phosphorus with which to form new algae. Predacious organisms such as daphnia should be introduced into the third pond by seeding if they have not appeared spontaneously within a few months of start-up. It is not to be expected that daphnia will occur in ponds 1A or 1B because of their high ammonium content.

Sulfides in Ponds 1 and 2: The water which conveys wastes to the Bolinas ponds contains several hundred mg/liter of sulfate which, in the absence of oxygen, will be reduced by bacteria with the release of H_2S and other odorous gases. H_2S dissociates to $H^+ + HS^-$ at a high pH. The HS^- form remains in solution and hence has no odor. Hydrogen sulfide is converted by bacteria to sulfate in the presence of oxygen or to elemental sulfur in the absence of oxygen and the presence of light. Sulfur normally leaves the ponds in the form of sulfate, a normal constituent of ground water in the area. Accordingly, maintenance of high pH in the surface water of the ponds prevents the escape of H_2S. Maintenance of a high pH is provided by creating an environment that permits rapid conversion of organic acids to methane before they can accumulate and can decrease the pH. Photosynthesis also maintains a high pH in the pond surface water by converting CO_2 to organic carbon in the form of algae.

Odors, All Ponds: Objectionable odors from ponds result from H_2S or volatile organic acid emmission. Odors from the ponds are prevented by dissolved oxygen at the surface produced by microalgae in direct proportion

to their growth in the ratio 1.6 lbs. of oxygen per lb. of algae. Odor prevention is also accomplished by aeration and by other measures indicated to prevent H_2S formation as stated above. Ponds 1A, 1B and 2 are designed so that in the event that odors persist, these odors should not be a nuisance to the community because of the added provision for using supplemental aeration under these conditions. It may at times be necessary to reseed the ponds with healthy algal cultures in order to promote active photosynthetic conditions, but this is unlikely. Should this situation occur, the engineer should be consulted. Other remedial measures include addition of chemicals such as lime (to elevate the pH) and calcium nitrate (to supply oxygen) to the pond water or surface agitation by an outboard motor. The latter method will not normally be required when there is a long-term power failure and sustained cloudy or foggy condition. It is worth noting that dissolved oxygen in the primary pond can also occur through recirculation of oxygen-rich water from Pond 3 to Pond 1A.

Pond Depth: Maintenance of an appropriate pond depth is particularly important because two adverse situations related to depth may arise. One very serious problem is excessive shallowness in a pond caused by too little water to cover the pond area. When water in a pond is shallow, weed growth is likely to become established in the pond. Also, algae grow in large concentrations in shallow pond waters. These algae produce unnecessary excesses of oxygen and cause the pond temperature and pH to increase. High oxygen content and high pH are adverse to methane fermentation; consequently, fermentation cannot become well established in a shallow pond, or if previously well established, will be greatly retarded during periods when a pond becomes shallow. Without sufficient methane fermentation, organic matter accumulates in a pond, and acid production and accumulation is likely to occur. Once the pond becomes acidic, "sour" odorous conditions may begin. The remedy for problems resulting from excess algal growth is to maintain ponds at or near their maximum design depth which in this case is 9 feet or more.* Fewer algae are produced in a deep pond than in a shallow pond, and as a consequence, a deep pond has a lower pH and no free dissolved oxygen at the bottom. Methane fermentation at the anaerobic pond bottom will then destroy organic acids as quickly as they are formed.

In the event the ponds become too shallow because of lack of water, either pond 1A or 1B should be withdrawn from operation by stopping its sewage

*All ponds are furnished with a depth gauge to measure the water depth.

supply. This will tend to increase the depth of water in the remaining ponds. Pumping from a pond which is taken out of service into a pond remaining in service is sometimes beneficial. Care should be exercised that any pond receiving sewage should be at least five feet deep, and that ponds withdrawn from service dry up quickly. Maintaining a five-foot depth will sometimes require the addition of make-up water to a single pond during periods of large water losses, or during periods of low sewage flow. Water addition may be obtained by flushing out sewage lines with a fire hydrant in the community. Such a practice has the added benefit of cleansing the sewers which sometimes become fouled during periods of low flow.

Overflow Discharge Control: This operational parameter is met by factors in design such as the provision of overflow areas to the disposal area. These areas are designed to accept effluent. Whenever water reaches these holding banks, it will evaporate and slowly percolate thorugh the subsurface system. Accordingly, the disposal area, if not planted, should be kept clean by discing to maintain the ground open. The 45 acre disposal area will be utilized for disposal of approximately 170 acre-feet per year at an average rate of 1-3 inches per week. It is anticipated that at design loading, normally less than 170 acre-feet of water will be discharged from Pone 3 to the disposal area so that it will rarely, if ever, attain, the full load in the disposal areas. Indeed, it is expected that the irrigation area will quite frequently appear dry. Sections of the irrigated area may dry out entirely in late summer permitting removal of crops and additional maintenance.

Special Problems and Emergency Procedures

Sludge Bulking: The ponding system is subject to large variations in loading. As indicated in Table I, during the summer tourist influx for the period June through September, additional flow may be anticipated. This increase in load may result in sludge bulking in ponds 1A or 1B. Sludge bulking is evidenced by greyish or dark solid material rising to the pond surface caused by trapped gas in the sludge. This material will collect at the scum ramp at the north end of ponds 1A or 1B. The correct procedure with this scum is to direct a stream of water on the scum with a high pressure nozzle. Hosing the scum will cause release of trapped gas and the sludge will sink. However, during this period of sludge bulking, daily

hosing may be required. Usually, bulking will subside in about one month.

Some bulking of sludge in ponds 1A or 1B may also occur in March or April as the pond warms and sludge collected during the cold season undergoes more rapid fermentation.

Clogging of Inverted Syphons and Transfer Lines: Inverted syphons are provided in the pond transfer structures to aid in avoidance of shor-circuiting. These may fill slowly with silt during periods of very low flow and conditions where windblown dust and dirt enter the ponds or (in the case of ponds 1A or 1B), there is silty storm water flow. Clogging of the syphons is not a frequent occurrence, but since it can happen, vigilance is necessary to be sure that a clogged effluent syphone does not cause a pond to overflow. A clogged syphon is indicated whenever the water level in the pond rises significantly above the pond transfer structure. Should clogging of a syphon occur, employ normal sewer cleaning procedure with flushing or rotary routing equipment. This equipment will be available from a local roto-rooter firm or from the District.

Erosion: Because the inner portion of levees of ponds 1A and 1B must be kept free of weeds, they are especially prone to erosion. Each spring after the rainy season has ended, the entire inner embankments of the ponds above the water line should be worked over and smoothed to eliminate all evidence of erosion. If permitted to develop, erosion patterns will provide harborage for rodents and make it difficult or impossible to destroy weeds. They will also cause undue silting in the ponds and diminution of the levees.

Earthquakes: The ponding system is located rather near the San Andreas fault, but the ponds are constructed mainly in sands and sandy-clay and areunlikely to be damaged unless there is fissuring in the pond area of vicinity due to deep faulting. In this case, the ponds may drain into the fault and require reconstruction. However, it is unlikely that earthquake disruption of the ponds would add significantly to the concurrent disaster which would be caused by such an earthquake.

Flooding: The ponds are designed for the hundred-year storm. Sufficient freeboard is provided in each pond to store heavy rainfalls. Flooding of the pond is considered to be only an extremely remote possibility. As a general rule, pond 3 should be empty before the rainy season (November-March) starts. In an unforeseen situation (flooding of the spray field, for example), the portable gasoline pump (5 HP) should be on hand at the ponding site to pump as much of the water as possible into pond 3.

Shut Down: Because it is a completely gravity system within the treatment ponds, thereare no likely situations where flow would be entirely cut off. Also, there has been the added feature of including two primary ponds for operation in either pond through to ponds 2 and 3. One primary unit can be shut down for maintenance purposes without loss to the system. This primary pond operation can be accomplished by switching the fiberglass stop gates in the distribution manhole from inlet sides of flow to the primary ponds. This is only likely to be required to effect repairs in either pond 1A or 1B. Normally, all flow should go to pond 1A.

Abnormal Operating Conditions

High Flow Aeration: Should high flow conditions and/or odors occur for the ponds due to a large influx of population, it may be essential to activate the floating surface aerators in ponds 1A or 1B. These aerators are located as indicated in the drawing so as not to interfere with the facultative characteristics of the primary pnds. The engineer should be consulted if there appears to be need to relocate an aerator.

Toxicity: Because of the large buffer capacity of ponds 1A or 1B, it is unlikely that any toxic chemicals from the Bolinas system will interrupt the processes normally occurring in the ponds. However, a large spill of solvents, gasoline or oil could disrupt pond operation until the material could be removed. The scum ramp will facilitate removal of any solids or flotable oils involved.

Safety: The major danger around the ponds is children drowning. There are several built-in preventive safeguards against such accidents including the gentle slope of the inner embankments and the complete barbed wire fencing around the ponds. Frequent surveillance of the ponds is also

important. Surveillance is particularly important during weekend and school vacations when young boys are seeking adventure. Usually children coming to the ponds will come in groups of more than one (usually two or three) and may also help one another scale the fences.

Because the ponds may appear very attractive to children, signs should clearly indicate in simple words that they contain human wastewater and therefore are dangerous to health. Verbal explanations are also helpful to emphasize the danger and the fact that ponds should not be used for wading, fishing, swimming or any similar contact. At least one lifebuoy and a long rope should be maintained readily available at the pond site for use should the normal safeguards fail and someone who cannot swim flounders into a deep portion of the ponds.

Pesticides which may be required for use around the ponds are a potential hazard to workmen, to unauthorized persons and to wildlife. Accordingly, pesticides should be used only on advice of the Engineer and then strictly in accordance with manufacturers' specifications.

Ponds sometimes become occupied by ducks and other game birds which are singularly attractive to hunters. This unfortunately frequently leads to shooting around theponds and danger of injury to personnel and damage to equipment. Accordingly, "No Hunting" and "No Trespassing" signs should also be insure, if possible. The ON-OFF switches for the aerators should be protected by locks against possible misuse by the trespassers.

Maintenance

Transfer Structures: Transfer structures must be maintained free of rags and other fouling solids and should be scrubbed with a broom and rinsed with a high pressure nozzle to prevent accumulation of grease and detergent scum. Valves and gates should be inspected and operated weekly to assure that they are operating, since poorly operating valves may cause some ponds to be overloaded and other ponds to be deprived of sewage. Valves should be frequently checked for corrosion.

Pond Levees: The levees of a pond require continuous attention in order to maintain them in the most efficient condition. In addition to their

primary purpose of retaining liquid within a pond, the levees provide a roadway for mechanized observational and maintenance access to each pond, protect the pond embankments from wind erosion, provide an interface for deposition and drying of solids, and a surface for water absorption. Some protection from water erosion also results from the provision of adequate levee freeboard. The levee top is slightly crowned to permit sheet run-off of water. Maintaining the waterline free of grass and debris is necessary to prevent mosquito proliferation.

If trees are to be planted around the borders of ponds, deciduous trees should be avoided. Care should be taken that trees will not unduly shade the ponds, cut off normal wind action or shed large numbers of leaves into the ponds.

Inner Levees: Innter levees must be maintained absolutely free of weeds at the waterline. Cut weeds should be removed from the pond area, dried and burned or composted. To prevent levee erosion, the inner area immediately above and below the normal pond depth has been paved with asphalt.

Outer Levees: A long-range planting program has been initiated for the outside of the levees to eliminate erosion. Watering of these plants should be my means of a portable pump, drawing water form the adjacent pond.

Weed Control: As mentioned earlier, weeds tend to establish themselves along the edges of ponds both above, below and at the waterline. Below the waterline, the most common form expected in the Bolinas ponds will be cattail (typhus), bullrushes (cirpus), cottonwood and willow. However, many other species may appear. The most effective means to control any marginal underwater weeds is to remove them immediately by pulling when noticed, since they will increase rapidly under water by budding off roots and runners. The application of chemicals to the pond water is not recommended.

At the waterline, the most troublesome plants are wild radish, bermuda grass and johnson grass. Again, these plants must be removed immediately when noticed since they will proliferate rapidly by means of runners. Manual removal is no chore if done promptly. However, if neglected, weeds

will rapidly overtake the ponds.

Above the waterline, weeds are to be controlled by planting of fescue and clover. If it is necessary to use a herbicide, Telvar is probably the most effective long-term herbicide and is of low toxicity to fish, birds and algae. It should be used sparingly according to manufacturer's specifications and admission of the liquid or spray to the water should be avoided as much as possible. Application in the fall after the first rains, will suffice for two or three years. Certain deep rooted weeds are resistant to Telvar. These should be removed manually. Frequent manual removal of weeds at the waterline and below the waterline will prevent the need for drastic measures such as draining the ponds to accomplish control of emergent vegetation.

Should, through neglect, or sustained bad weather, serious problems with emergent vegetation occur, the infected pond should be pumped down several feet by pumping the water through the disposal system or by temporarily bypassing the pond. The offending weeds should then by physically removed and the areas smoothed over, sprayed with Dalapon, and permitted to remain without submersion for about one month. The water may then be permitted to rise to its normal level. Dalapon, as with other pesticides, should be used sparingly and strictly according to manufacturer's specifications.

Predator Control: Rotifers - These organisms are about 0.5 millimeter in length and are therefore barely discernible to the naked eye. They sometimes may be seen as colonies collected at the fringes of the pond resembling minute, yellowish or brownish sand grains. At other times, they appear on the pond surface in grey-brown or orange masses. Rotifers live on algae and therefore are called algal predators. The algal concentraion and dissolved oxygen concentration decline rapidly when rotifers appear.

Crustacea - There are also some crustaces which consume algae and bring about a drop in dissolved oxygen. Crustacea appear orange or pink and occur in swarms in the ponds. In contrast to rotifers, mature crustacea are easily seen with the naked eye, sometimes growing as large as 1 or 2 mm in diameter.

Although the chemical control of algae predators sometimes is essential to control odors, particularly in newly activated ponds, the decision to control predators with chemicals should rest with the engineer. If chemical control is deemed essential as a last resort, the use of larvicides, such as Rotenone, or insecticides, such as "Baytex" is effective.

The existence of some natural contols of predators indicates that drastic treatment such as spraying should be used only when the occurrence of predators is so large as to bring about the sudden disappearance of algae and the depletion of dissolved oxygen to such an extent and for such a long period that odors are sure to occur. If odors do not occur, it is better to foster natural processes for predator control. As noted previously, aeration is also available for odor control.

Natural control of Daphnia and rotifers comes about as a result of their starvation when they outstrip their food supply. Biological control of larger algal predators such as the Crustacea may be attained by implanting mosquito fish (Gambusia) in ponds 2 and 3.

Nuisance Insects Control: Files and Mosquitoes: Mosquito breeding is minimized in ponds which have no marginal or emergent weed growth and fly breeding is minimized if there is no scum formation. Accordingly, no weeds should be permitted to grow within, or near the waterline of the ponds. As discussed blow, these are prevented at Bolinas by paving. Mosquito fish should be introduced to the ponds each spring to prevent mosquito breeding. These may not overwinter and thus may require annual restocking. Mosquito fish are normally available from local mosquito control districts.

Troublesome quantities of scum will form only in ponds 1A or 1B and this may be removed manually at the scum ramp which is provided at the east end of these ponds. Scum removal can be accomplished by utilizing a high pressure hose from the fresh water supply provided near the scum ramp, by physical removal and by burial of the scum or both. Large accumulations of scum or grease for periods of more than a week must be avoided to prevent fly breeding. Both houseflies and carion flies will breed in scum if it accumulates excessively.

Chironomids which are winged flying knats about the size and appearance of culex mosquitoes are the most common flying nuisance organism around

ponds. They are non-biting, but are a nuisance because they sometimes emerge in enormous numbers and accumulate in light fixtures, around lighted doorways, and smash on automobile windshields and headlights during the warm dry periods of the year. Chemical control of chironomids is not recommended unless the chemical is no threat to mosquito fish. Mosquito fish do not normally eat chironomid larvae, but the larvae are eaten by young carp and catfish. Certain shore birds, such as snipe, thrive on chironomid larvae and could also be harmed by chemicals used for chironomid control. Unless there is a severe problem, the normal processes of nature will control chironomids. Provision of nesting sites for swallows may encourage this bird which may also aid in chironomid control. Should severe problems arise in spite of all provisions, the local mosquito control district or the engineer will suggest special methods for control.

Rat-Tailed Maggots - The rat-tailed maggot is a common name for the larva of the fly Tubifera tenax, which breeds in anaerobic mud or scum collected at the borders of anaerobic and occasionally of facultative ponds. The organism burrows into the anaerobic mud, breathing atmospheric oxygen through a breathing tube that may extend upward more than a foot from the pond bottom. While in the submerged stage, maggots are of little significance. However, they must emerge in order to pupate and become flies. To do this the maggot crawls out of the pond and burrows into soft earth of the levee at a distance of one or two feet from the water's edge. The presence of large numbers of such larvae in pond embankments will cause birds of all kinds to seek them as food. To dislodge the larvae, the birds do a lot of scratching and over a long period severely disrupt the continuity of the pond embankments. To avoid levee destruction, severe infestations with rat-tailed maggots should be controlled by means of light spraying with insecticides. However, mild infestations are to be expected in facultative ponds. The adult fly itself is not a nuisance since it does not frequent human habitation. It feeds on sap or juice excreted by certain trees. Rat-tailed maggot larvae are eaten by rats and mice as well as by birds. Hence, heavy infestations may bring on a rodent invasion. Because of the light loadings used at Bolinas, it is unlikely that maggots will ever occur or be a problem.

Rodent Control: Rodents are objectionable around ponds because they burrow, may cause washouts, and are unsightly. Ground squirrels, gophers, rats and muskrats are the most common offenders. In the presence of unrestricted rodent populations, badgers may severely damage levees while digging out small rodents. Because the rodents use weeds for food and harborage, the greatest deterrent to their establishment is the complete absence of weeds. If rodents appear to be establishing themselves in spite of weed control, use of carbon bisulfide in burrows is to be preferred to poisoning with grain, since birds would be harmed by the poison as well.

The small controlled embankment area between the primary and secondary ponding systems may provide a harborage for both rodents and objectionable weeds if left unmanaged. Consequently, the area should be carefully managed by removing objectionable weeds and replanting with iceplant or algerian ivy, neither of which are sought by rodents for food. The most desirable trees for this open area would be citrus or cedars of lebanon.

Odor Control: No objectionable odor is associated with properly designed, properly initiated, and properly operated stabilization ponds. Overloading, sudden increase in loading, or change in the type of waste are the most frequent causes of objectionable odors. These are to be dealt with by aeration

If an objectionable odor does occur, the operator should look for corner depositions of sludge, rotting vegetation, or dead animals. He should examine the pond to determine its color. Sludge may be skimmed or sprayed with a small amount of deodorant until it can be removed from the pond. Dead animals or birds should be buried or otherwise suitably disposed of, rotting vegetation should be dried and burned or composted.

Unexplained persistence of odors should not be tolerated. In the event malfunction of the ponds is suspected, the operator should at once bring this to the attention of the District Engineer or his consultants. Rational procedures (see page 52 for details) may then be initiated to determine the cause and method of eradication of odor before adverse

community attention is focused on the ponding operation. Uncontrolled odor is a breach of Water Quality Control Board regulations. Hence aerations are provided as certain odor control.

Preventive Maintenance List: Preventive maintenance for the ponds, weeds, insects, rodents have been set forth in the preceding paragraphs. Maintenance instructions for the various instruments and equipment used at the pond site are given under separate sections that carry their description.

Maintenance is also required for the roadway and the fences. Roads should be maintained rut-free with a minimum 6-inch center crown where applicable. They should be oiled periodically to prevent dust and to aid compaction. Fences should be inspected periodically and promptly repaired when found broken. Animal burrows under the fences should be filled in and the animals forced to move or be destroyed. Acess gates should be maintained functional, and locked at all times when the operator is absent from the ponds.

All pond-side equipment should be maintained by cleaning and painting frequently and making sure that any bullet holes and other vandalism is repaired. Test kits should be maintained adequately stocked with chemicals and should be cleaned frequently. No insects or moisture should be permitted in the monitoring equipment (to be described later). An adequate supply of monitoring forms and clean sample bottles should be kept on hand at all times.

A preventive maintenance check list is given in Appendix C .

Miscellaneous

Aerators: Purpose and Description: Mechanical aeration in ponds is needed to provide supplemental oxygen for the biological oxidation of the waste organics. Aeration also promotes good mixing in the ponds, which brings the nutrients, algal cells and bacteria in intimate contact with one another, thereby improving the efficiency of BOD removal. In addition, maintenance of dissolved oxygen in the pond at all times may be warranted

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in situations where the ponds receive excessive loadings that can cause odor problems.

Three 5 hp, 1800 RPM, Welles type Aqua-Lator models are available for aeration in the Bolinas ponds. Each unit is made of stainless steel and consists of a motor, drive shaft, impeller driven at constant speed, and an integral flotation unit. Accessories include mooring lines, neoprene-jacketed electrical power cables, and compressor fittings, etc.

Figure 17 presents diagram of the aerator. The recommended operating depth for the aerator is 8 feet minimum. The unit has a guaranteed oxygen capacity of 2.5 to 3 lbs oxygen per brake horse power-hour under 'standard' conditions.

Operation: Ponds 1A, 1B and 2 have facilities for a hook-up to the aeration system. Initially, two of the three aerators will be installed in the primary ponds on one side of the divider wall, and operated continuously or a few hours a day according to the Engineer's instructions. From the viewpoint of system performance, mixing of the pond contents is critical in the early morning and late night hours of the day when the dissolved oxygen level is at a minimum.

The aerators are operated manually. The units can be easily removed and reinstalled in any pond that may have a persistent odor problem, and/or dissolved oxygen deficiency.

Maintenance: The units are so designed as to require minimum of maintenance consisting only of a twice-yearly lubrication of the upper and lower motor bearings. The manufacturer's operation manual provides maintenance instructions which should be strictly followed.

Manufacturer's Brochures: Peabody Welles Model: FLTM 5-5-SS
Aqua-Lator

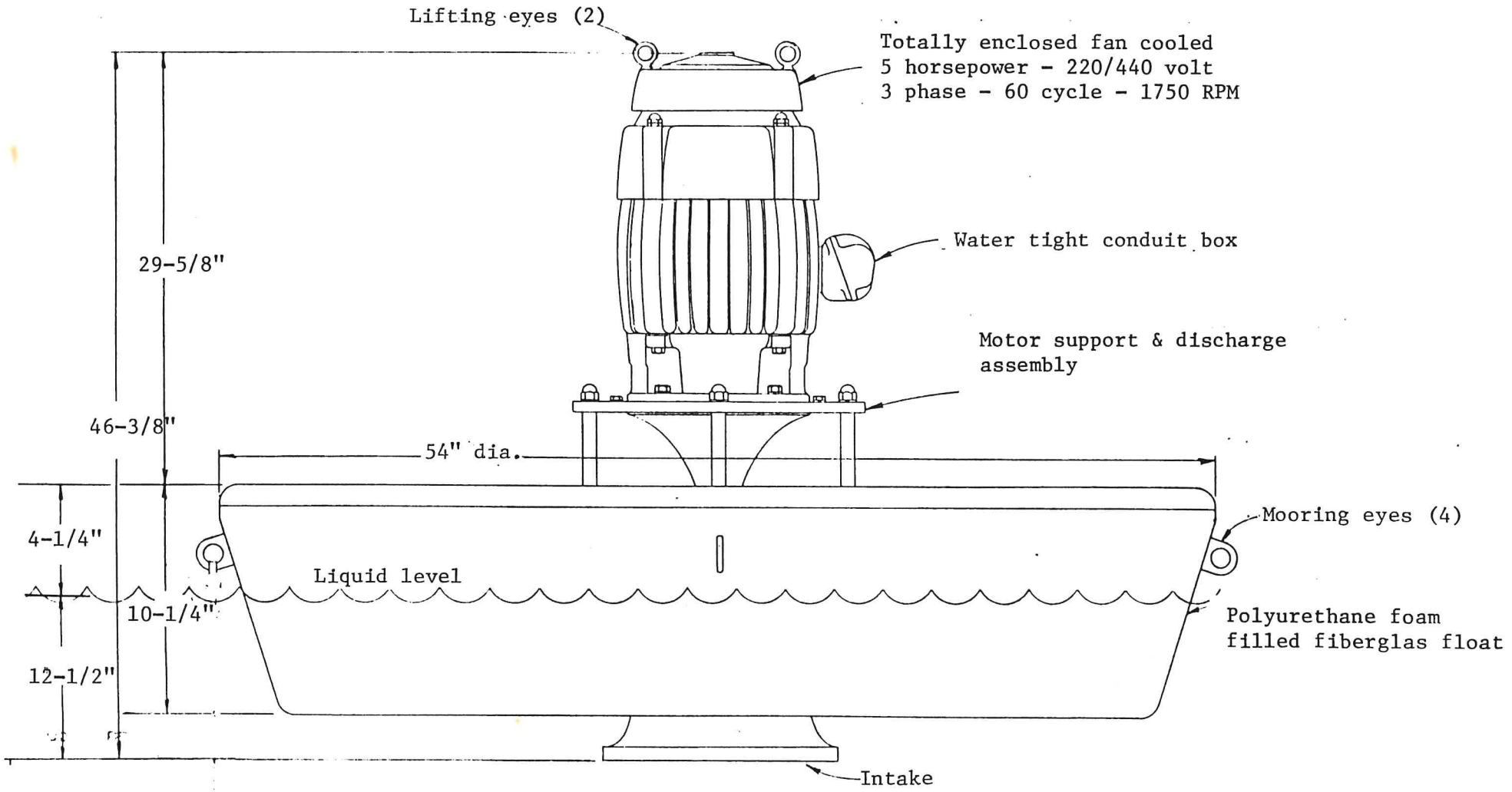

Figure - 17

Aerator Outline Diagram

Liquid Level Measurement

Purpose and Description: Liquid level sensors are installed in the weir manholes to measure the depth of water flow passing over the weir to the ponds. The level sensors manufactured by Condra Tech, Inc., consist of a unique capacitance probe system connected to a level transmitter and recorder.

Operation and Maintenance: The operation of the liquid level probe system is automatic. Level probe is corrosion resistant to most chemical applications. It should, however, be frequently checked for any solid deposition. The calibration chart should also be periodically checked for its accuracy. Routine maintenance instructions for the level probe and the recorder are outlined in the manufacturer's manuals.

Manufacturer's Brochures:

Manufacturer:	Condra Tech, Inc.
Level Probe:	CT-91-S
Level Transmitter:	CT-815 R
Level Recorder:	CT-815 MR

Recirculation

Purpose: Recirculation of the final pond effluent to the incoming raw waste is beneficial for the following major reasons:

a. To provide dilution of the incoming waste; and to improve the hydraulic characteristics of the system;

b. To provide seeding of the waste with algal cells and nutrients;

c. To prevent possible odor nuisance problems by mixing the oxygen-rich water with the raw waste that has only traces of dissolved oxygen.

Description and Operation: As shown in Figure 16, a 6-inch PVC recirculation line branches from the 8-inch irrigation pressure line and discharges into the distribution manhole (cf. Figure 12).

The flow through the recirculation line is controlled by a gate valve. The quantity of recirculation flow can be varied depending on the amount used in spray irrigation. It is thus evident that recirculation contributes to the hydraulic flexibility of the system.

Maintenance: The pressure line and the valve should be periodically checked for corrosion and water leaks.

Wash-Water Line

Purpose and Description: A 1-inch PVC water supply line is extended from the service building to the inlet manhole and to the irrigation pump station for washing operations (see Figure 16). Hose-bib outlets are provided at the above stations. Hosing will be required under the following pond maintenance conditions:

a. To break up the greyish or dark solid sludge that rises to the surface due to bulking.

b. To quickly remove scum that accumulates on the ramp, thus avoiding conditions favorable to fly and mosquito breeding.

c. To provide mixing in the quiescent zones of the pond (corners, bends, etc.)

d. To wash down the dried or deposited solid matter in manholes.

e. To augment water flow in the ponds (under abnormal operating conditions).

Operation and Maintenance: The pressure at the outlet should be high (80 psi) enough to facilitate washing operations. The system should be periodically checked for leaks.

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Maintenance: The pressure line and the valve should be periodically checked for corrosion and water leaks.

Note: When recirculation is employed, the detention period in the pond system will be calculated according to the following equation:

$$O = \frac{V}{(Q + R)}$$

Where "O" is the mean detention time in days, "V" is the volume of the pond, "R" is the recirculated flow, Q is the incoming flow. It is evident that the detention time decreases with increasing recirculation and this may result in a poor quality effluent with regard to the coliform quality.

It should be noted that in the case of Bolinas, recirculation will be used only under the following conditions:

1. When a highly variable or toxic load arrives at the plant and dilution of the waste is found necessary.

2. When algal population in the primary ponds becomes so low that re-seeding of the ponds become necessary.

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d. To wash down the dried or deposited solid matter in manholes.

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Operation and Maintenance: The pressure at the outlet should be high (80 psi) enough to facilitate washing operations. The system should be periodically checked for leaks.

Service Building Wastewater Ejector System

Purpose and Description: The wastewater that originates from the service building is collected in an ejector unit and is pumped to the inlet manhole (see Figure 16) through a 3-inch discharge main. The ejector is a Weil Model S-4662 equipped with a heavy duty, drip-proof, 1/2 hp motor. It is enclosed in a fiberglas basin of size 24 inches diameter and 30 inches deep. The discharge line is provided with a check valve.

Operation and Maintenance: The submersible pump is automatically turned on and off by a micropressure switch. The ejector is ON when the level rises to 16 inches and is OFF when the level falls below 10 inches. The performance characteristic of the unit is shown in Figure .

The unit requires minimal maintenance.

Manufacturers Brochures:

Ejector Type:	Weil Pump Company Model S-4662 (3 inches discharge). Performance curve C-240004
Basin:	FiberBasin Incorporated Engineering Data Sheet.

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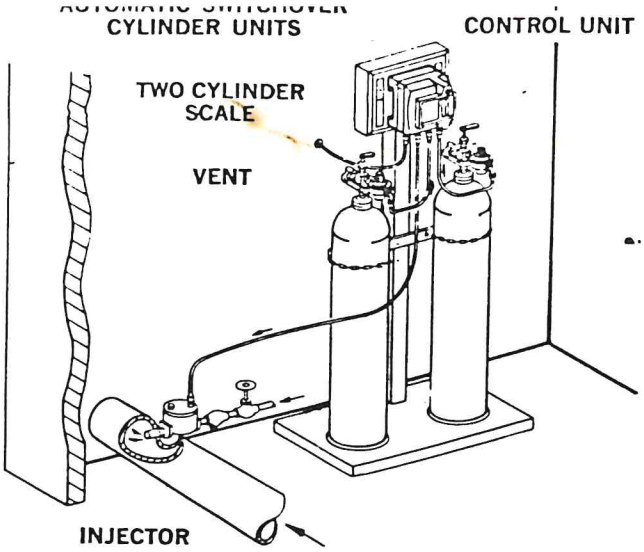

AUTOMATIC SWITCHOVER. Control unit and injector (package V-100A) and two automatic switchover cylinder units (package V-100C).

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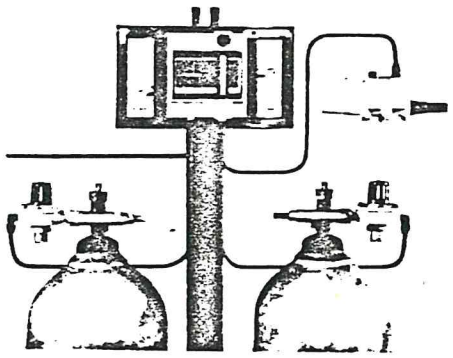
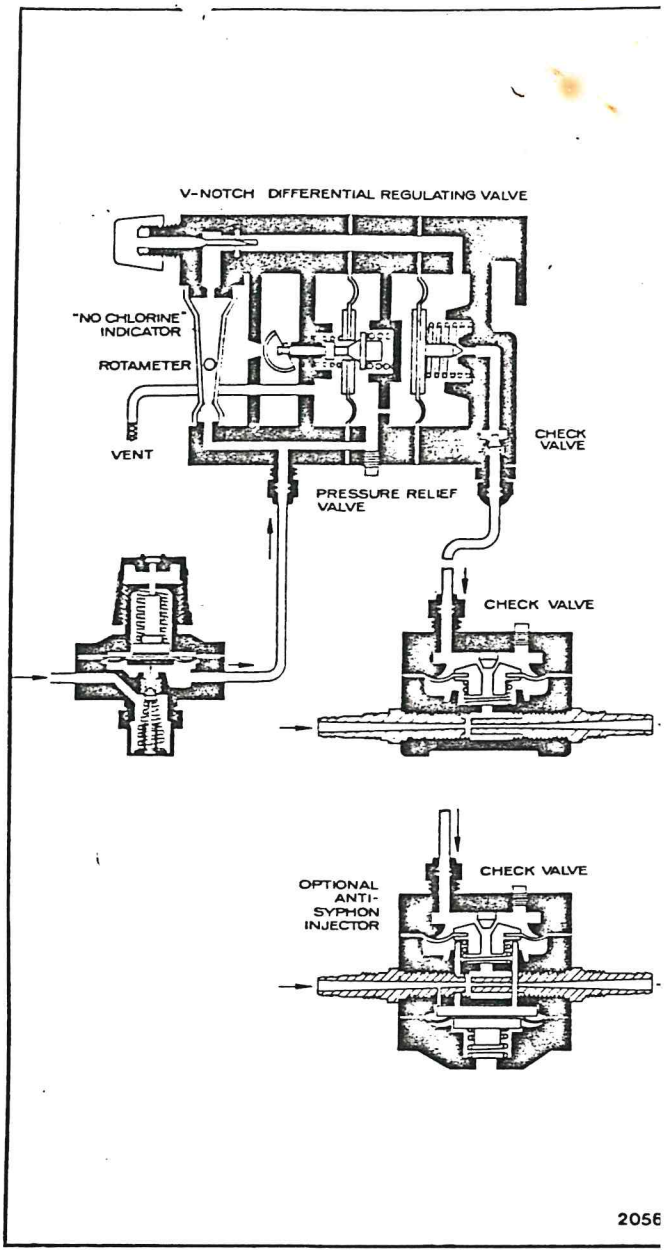


Figure - 18

Wallace & Tierman V-Notch V-100 Model Automatic Switch-over Control Unit and Injector



OPERATION

Gas leaves the cylinder through a pressure regulating valve This diaphragm-operated valve maintains the proper operat vacuum ahead of the control unit (2).

Gas next enters the control unit and passes through the rotame to the V-notch Variable Orifice. Here feed rate is changed ma ally by positioning the V-notch plug in its ring (changing ori area). The manual adjustment knob is on the front of the c trol unit.

After the orifice, gas passes through a differential regulati valve. This diaphragm-operated valve maintains the proper op ating differential across the V-notch. A pressure relief valve incorporated in the control unit. If a malfunction occurs escapes into the left hand section of the chamber and ve to atmosphere.

At the injector (3), metered gas is dissolved in water. The sultant solution is discharged to the point of application.

Two check valves, a spring-diaphragm type in the injector (wh closes the injector suction port when the injector is not operatir and a spring-loaded poppet type located in the control unit, p vent injector water from backflooding the control unit.

The anti-syphon injector (4) has a tensioned spring and an au iliary diaphragm. The spring holds the inlet valve closed until water pressure builds up to 20 psi on the diaphragm.

4. Disinfection

Facilities are available at the ponding site to add chlorine to the effluent prior to its disposal.

Purpose

Disinfection of the pond effluent reduces the number of pathogenic microorganisms (bacteria in particular) prior to its discharge to the irrigation system. Since natural disinfection takes place in ponds to a considerable extent, the effluent from a well operated ponding system with at least four ponds in series will have a low bacterial count. Even though disinfection is not required for high quality pond effluents, its continuing uses is provided for an additonal factor of safety, especially if spray areas contribute draft to residences or schools.

In view of the fact that the effluent is disposed via spray irrigation on a restricted area, the Regional Board has not stipulated any specific bacterial MPN (most probable number) requirement on the effluent, even though it will be monitored periodically to guard against high MPN values reaching the spray area. Should high MPN values (> 100/ml) occur in the effluent or should there be a bypass of untreated waste (under abnormal operating conditions) to the spray area, disinfection of the effluent will be undertaken as a remedial measure until the situation is brought under satisfactory control.

Description

The chlorination unit is a Wallace and Tierman, V-100 model that consists of an automatic switchover, two-cylinder unit, control unit and injector (Figure 18). Chlorine leaves the cylinder through a pressure regulating valve and enters the control unit which contains the rotameter and the V-notch variable orifice. The feed rate is changed manually by positioning the V-notch plug in its ring. After the orifice, the gas passes through a diaphram operated regulating valve which maintains the proper operating differential across the V-notch. Should any malfunction occur, the gas escapes through a pipe in the chamber and vents to atmosphere.

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At the injector, metered gas is dissolved in water and the resultant

(chlorine) solution is discharged to the point of application. Two check valves - one in the injector and the other in the control unit - prevent injector water from backflooding the control unit.

In the Bolinas system, the chlorine solution is prepared at the service building and conveyed through a 1- inch PVC pipe line to the disposal site where it is applied on the suction side of the irrigation pumps (cf. Figure 16).

Operating Parameters

Chlorine Addition* - Intermittent; needed only during high coliform counts

Chlorine Dosage - 5 - 12 mg/l or 3 - 8 lbs/day at a flow rate of 0.065 MGD

Residual Chlorine - 0.1 mg/l

Criterion for Maximum Permissible Coliform Count - 10,000 per 100 ml of the final effluent

*No Board requirements established; chlorination is done as a safety procedure.

Operation

Because of the nature of the operation, the chlorine unit is manually turned on and off as required. There is no interruption of the chlorination when the on-line cylinder supply runs out. The second cylinder unit switches over automatically to the gas line. Thus, it is possible to chlorinate the effluent for a long period of time without interruption. The two cylinder scale weighs the gas cylinders independently and reads out net pounds of gas remaining on separate dials.

The exact chlorine dosage is determined by trial and error. The unit is initially set (by adjusting the V-notch orifice) for a dosage rate of 5 mg/l which is gradually increased until the residual chlorine in the effluent grab samples is measured to be 0.1 mg/l. (Standard orthotolidine test is used for a quick determination of residual chlorine.) During continuous chlorination, the

effluent should be tested for residual chlorine at least twice a day. Chlorine dose is calculated as follows:

Chlorine Dose = Rate of chlorine addition x 8.34 x flow

(lbs/day) (mg/l) (conversion factor) (MGD)

Since the anticipated chlorine requirements for Bolinas waste effluent are on the order of 3 to 8 lbs. per day, it is estimated that the chlorinator can be operated for 40 to 100 days without interruption before the chlorine cylinder runs out.

Safety

The unit is designed for safe operation. The direct mounted cylinder unit reduces gas pressure to a vacuum immediately. There are no high pressure gas lines. The tubing carries dry gas to the injector. If, however, any component gets broken, air leaks in; the gas will not leak out.

In extreme cases of chlorine leakage, certain safety procedures should be followed. Since chlorine is highly corrosive, and extremely toxic in both the gaseous and liquid states, caution should be exercised to avoid any bodily contact with chlorine. If chlorine leakage is detected, steps should be taken to isolate the area and to prevent further leakage. If the leak occurs in the chlorine room, efforts should be taken to ventilate the room. A gas mask should be worn under all circumstances for protective reasons. The fire department should be notified of the gas leak as quickly as possible.

Other safety measures to be adopted in case of chlorine accidents are:

1. Do not spray water on leaking containers. It would only make it worse.

2. Never try to disperse chlorine gas from a container to an open body of water. (Chlorine is sparingly soluble in water at atmospheric pressure.)
3. Special jackets and suits should be worn while entering the chlorine affected rooms.
4. Do not store combustible or inflammable materials near chlorine containers.
5. ~~Whenever possible,~~ A second person should work with the operator in controlling chlorine leaks.

Complete details on chlorine equipment handling and the safety precautions involved are given in the book entitled "Handbook on Chlorination" by George Clifford White (Van Nostrand Company, Published in 1972). A copy of this book should be made available at the waste treatment plant office. The operator and other personnel responsible for the plant operation should familiarize themselves with the safety procedures.

Manufacturer's Brochures:

Chlorinator type:	Series V-100 Wallace & Tiernan
Cylinder:	Two - Cylinder Scale Series 50-345

C. EFFLUENT DISPOSAL SYSTEM

After treatment in ponds, the effluent from pond 3 will be disposed by spray irrigation on a 45-acre spray area surrounding the ponds. It is anticipated that the irrigation system will be operated on a continuous basis during the warm weather months and that draw down in pond 3 will be regulated so that additional storage will be available during the winter period.

Disposal of treated wastewater is by a spray disposal system consisting of suction lines in the bottom of pond 3, pumping system, irrigation lines, sprinkler system and control apparatus. A description of the above components is presented in the following sections.

1. Disposal Volume

The quantity of effluent flow that remains to be disposed can be estimated by an input-output flow analysis for the entire ponding system. In simple terms, the net volume of disposal is expressed by the following mass-balance equation:

$$Q_d = Q_i - A \underbrace{[\, E + p \,]}_{\text{Losses}} + A \underbrace{[\, P + i \,]}_{\text{Gains}}$$

Where Q_d is the disposal volume, Q_i is the influent flow, E is the evaporation rate, p is the percolation rate, P is the precipitation rate, i is the infiltration (ground water) rate, and A is the pond area. Since most of the parameters on the right hand side of the above expression may vary seasonally by a considerable margin, Q_d would also vary accordingly. If p and i can be neglected as in the case of Bolinas ponding system (due to sealing of the bottom) the expression for Q_d can be simplified as,

$$Q_d = Q_i - A\,[\, E - P \,]$$

where (E - P) is called the net evaporation rate. It is evident from the above expression that Q_d is a minimum during the warmer months ($E > P$) and a maximum during the rainy months ($P > E$). As noted earlier for the Bolinas system, the effluent will be stored in the ponds during the runoff season.

The predicted daily flow volumes to the Bolinas system are tabulated by month in Table 5 . It is observed that the total annual inflow volume amounts to about 23.7 acre feet. The disposal volume and the average required percolation rate through the spray area are calculated in Table 6 . It should, however, be realized that in view of the seasonal nature of the spray irrigation practice,

TABLE 5

PREDICTED DAILY FLOW VOLUMES BY MONTH

Month	Totals Daily 1000 G Day^{-1}*	Totals Monthly MG Yr^{-1}**	Accumulated Total MG Yr^{-1}
January	71.3	2.21	2.21
February	67.5	1.89	4.10
March	66.3	3.05	6.15
April	62.0	1.86	8.01
May	55	1.70	9.71
June	65	1.95	11.66
July	65	2.01	13.67
August	65	2.01	15.68
September	65	1.95	17.63
October	63.0	1.95	19.58
November	66.8	2.01	21.59
December	66.4	2.06	23.65

1. Assume 65 days wet weather flow
2. Assume septic tank pump-out discharged 50 MGPD
3. Assume 1 June to 30 Sept. tourist season

---

*Gallons per day

**Million gallons per year

TABLE 6

WASTE FLOW AND DISPOSAL REQUIRED

Description	Volume
Waste Flow	23.7 MG yr^{-1}*
Pump Back from Wells**	4.8 MG yr^{-1}
Precipitation	81.6 MG yr^{-1}
Total Input	110.1 MG yr^{-1}
Total Surface Output	54.7 MG yr^{-1}

Evapotranspiration = 46.5 MG yr^{-1}

Evaporation loss from ponds = $\frac{8.2 \text{ MG yr}^{-1}}{54.7 \text{ MG yr}^{-1}}$

Difference	55.4 MG yr^{-1}
Difference	169.5 Ac Ft yr^{-1}***
Difference	3.67 Ac Ft Ac^{-1}
Difference	45.1 Inches yr^{-1}
Difference	0.12 Inches Day^{-1}
Difference	+0.87 Inches $Week^{-1}$

+Minimum Disposal Rate through percolation

*Million gallons per year

**Seepage water pumped back from Infiltration gallery

***Acre feet per year

the actual disposal rates would vary somewhat from the calculated rates. Nevertheless, the provision of 45 acres spray area should meet adequately the disposal requirements.

2. Irrigation Pumping System

Purpose

Irrigation pumps are included as part of the disposal system to provide the head required to operate an effective spray system.

Description

Two 40 h.p., 1800 RPM Byron Jackson (6 stage) vertical turbine pumps are furnished at the irrigation pump station with all the necessary appurtenances. Only one unit will operate at any one time, the other to be used in emergency conditions. Two 16 inch suction lines located in the bottom of pond 3 under a cover of granular material serve to conduct the treated wastewater to the pumping system. The dual suction lines are turned up in the pond and fitted with anti-vortex shield to prevent excessive vortexing when the water level in the pond is drawn down. Two half-inch chlorine lines are connected to the suction pipes to disinfect the water if needed.

Pumping level control includes Antocon Model 4100 Probotrol(details on pg.87) for low level cut-off with automatic restoration of the pumps. The probes are suspended in a steel casing. A schematic of the pump layout is shown in Figure 19.

Operation

The pump has a total dynamic head of 295 feet at 200 gpm flow, 265 feet at 300 gpm flow, and 240 feet at 400 gpm flow. As shown in Figure 19, the discharge line from each pump has a check valve and a gate valve which are open during the pump operation. Excess pressure in the discharge line can be relieved through a 4-inch relief line which discharges water through a nozzle. Pumped effluent is conveyed through a 8-inch pre-irrigation pipeline to the spray field.

As mentioned earlier, only one unit will operate at any one time while the other serves as a standby unit. Automatic alternate operation of the pumps

the actual disposal rates would vary somewhat from the calculated rates. Nevertheless, the provision of 45 acres spray area should meet adequately the disposal requirements.

2. Pond Depth

Maintenance of proper pond depth prior to the start of the irrigation season is essential. As noted earlier, ponds can be operated at various depths by changing the elevations of the V-notch weirs. Pond 3 should be completely empty by 15th October so that rainwater can be stored in it in the following months. Operating depths for ponds 1A, 1B and 2 will be about 8 to 10 feet during the winter season. The stored water in pond 3 will be used for irrigation during the spring and summer seasons. The operating depths in pond 1A, 1B and 2 will be 6 to 8 feet, while it will be about 8 feet in pond 3. Pond depths can be measured on the staff gauge furnished for each pond.

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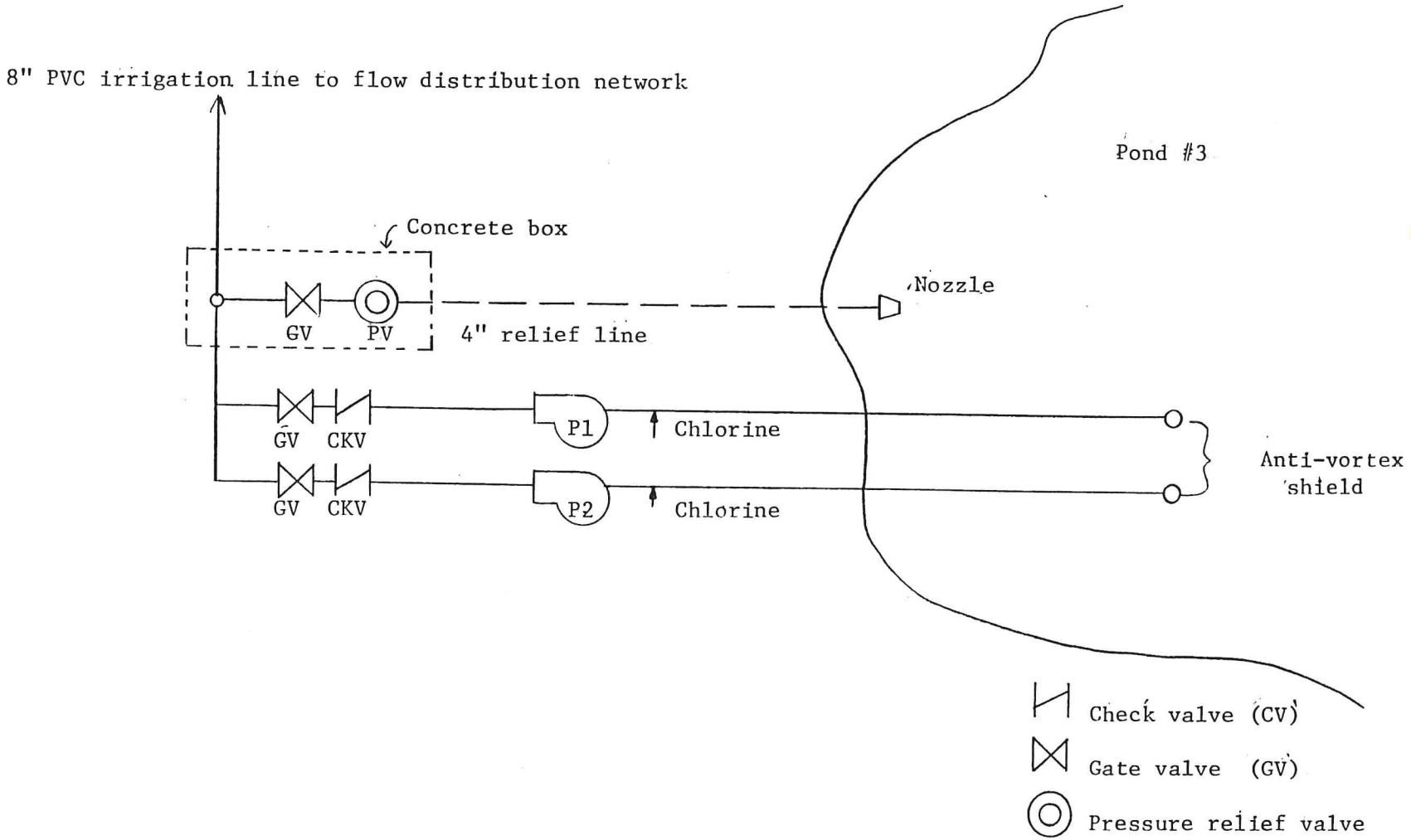

Figure - 19

Irrigation Pumping Schematic

will insure equal running time and provide early warning of possible pump failure.

Antocon designed low level sensors (Probotrol) shut off the pump when the water level in the pond becomes too low. The entire pump operation is automatic.

Performance curves for the pumps are shown in Figure 20.

Maintenance

The maintenance and inspection procedures outlined for the raw wastewater pumps are generally applicable for the irrigation pumps. The pumps are self-lubricating (water) type. Specific maintenance procedures for the pumps are outlined in the manufacturer's manuals.

Safety

Because of the high voltage (480 volts) operation, safety procedures should be strictly adhered to. In the event of any malfunction, the pump should be worked on by a qualified electrician.

Manufacturer's Brochures

Pump Type: Byron-Jackson Pump Division
Borg-Warner Corporation
10" MQ-L, b Stage

Date Sheets: Vertical Turbine Pump
Motor Drive Outline
Performance Sheet: 741-S-1388/89

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Autocon designed low level sensors (Probotrol) shut off the pump when th water level in the pond becomes too low. The entire pump operation is automati

Performance curves for the pumps are shown in Figure 20.

As shown in Table 6, an average application rate of about 1 inch per week (continuous) would be necessary to dispose an equivalent volume of the incoming waste. In terms of pumping, this would amount to about 350 gpm, allowing an 8-hour-a-day operation.

Maintenance

The maintenance and inspection procedures outlined for the raw wastewater pumps are generally applicable for the irrigation pumps. The pumps are self-lubricating (water) type. Specific maintenance procedures for the pumps are outlined in the manufacturer's manuals.

Safety

Because of the high voltage (480 volts) operation, safety procedures shou be strictly adhered to. In the event of any malfunction, the pump should be worked on by a qualified electrician.

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10" MQ-L, Stage

Date Sheets: Vertical Turbine Pump
Motor Drive Outline
Performance Sheet: 741-S-1388/89

P200R

BYRON JACKSON

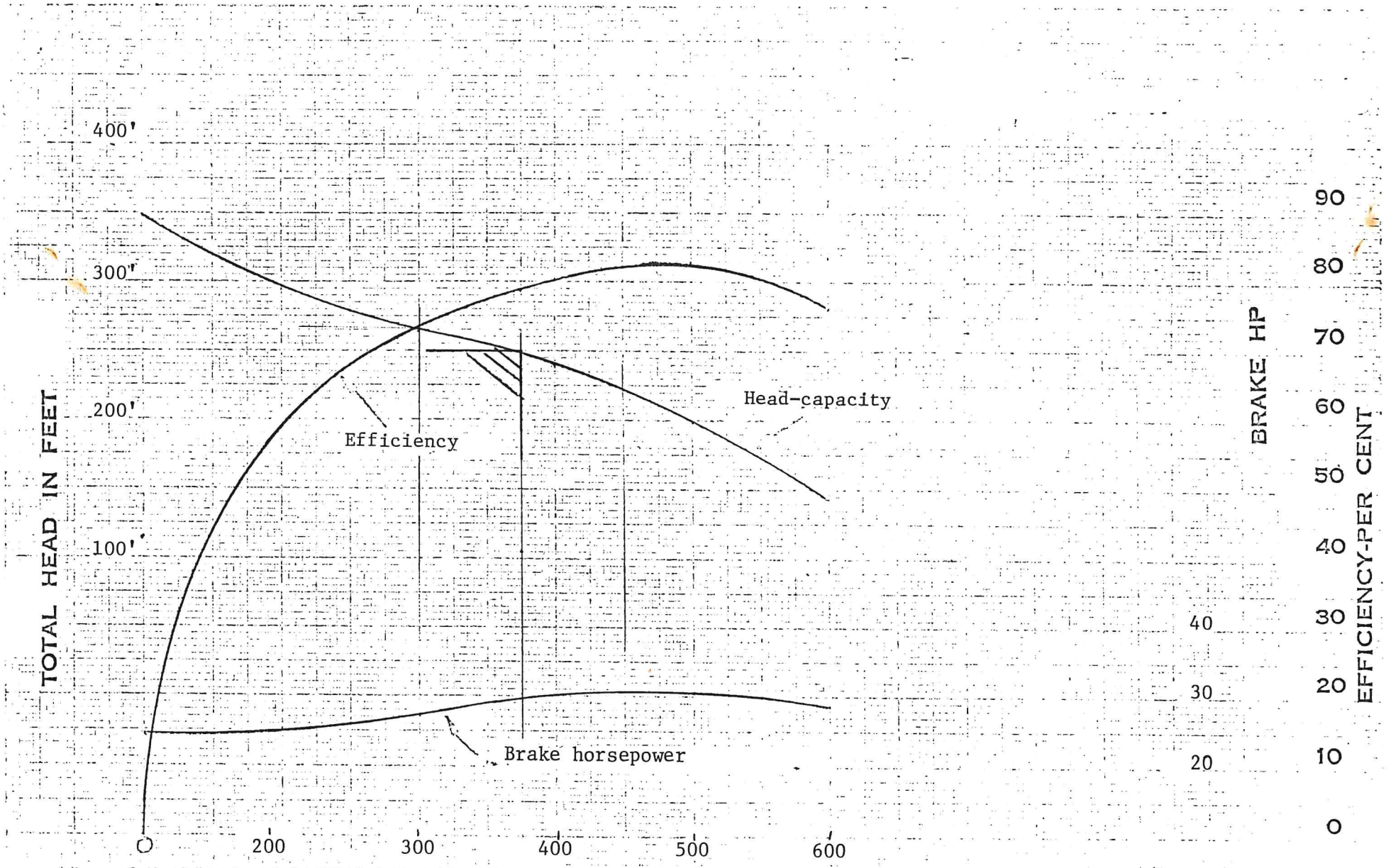

Figure - 20

Spray Irrigation Pumps

PUMP SIZE AND TYPE	RPM	CUSTOMER NO.	IMPELLER NO.	BASED ON	DATE	BYRON-JACKSON NUMBER

3. Spray Irrigation Distribution System

Purpose and Description

The distribution network conveys the pumped effluent to the sprinkler heads for spraying operations. A typical layout of the network is shown in Figure 21. The network consists of the following.

Mains and Laterals: These are made of polyvinyl chloride (PVC) pipelines capable of withstanding pressures up to 200 psi. The mains are 6 inches or 8 inches in diameter and the laterals are 1-1/4 inches to 4 inches in diameter. The pipelines are provided with appropriate fittings.

Valves: Remote control valves (Hydro-rain, Series 100) are provided in the system as shown in Figure 21. Valve control is accomplished by an automatic controller designed by Autocon Industries (Autocon Planpak). The solenoid-operated valves are made of synthetic, non-corrosive material and have a self cleaning control system, and a manual flow adjustment.

Sprinklers: The sprinklers are "Rainbird" Model 14600 W-TNT full circle type with a rated spray diameter of 116 feet. The nozzle is 13/64-inch diameter and is rated for 9.2 G.P.M. at 60 psi.

Zone Control Programmer: The programmer (Griswold Controls, Series 2300) provides all timing and control for individual spray zones or for the entire irrigation system. The unit can be connected to 12 separate control stations. The essential features of the unit are:

a. Automatic, semi-automatic or manual operation.
b. Three independent watering schedules for day-of-week operation with an OFF, ONCE or REPEAT selection on each day.
c. Waters for 0-60 minutes on each station.
d. Repeats as many times a day as desired.

Operation

The disposal system operates on an automatic time clock basis. Each

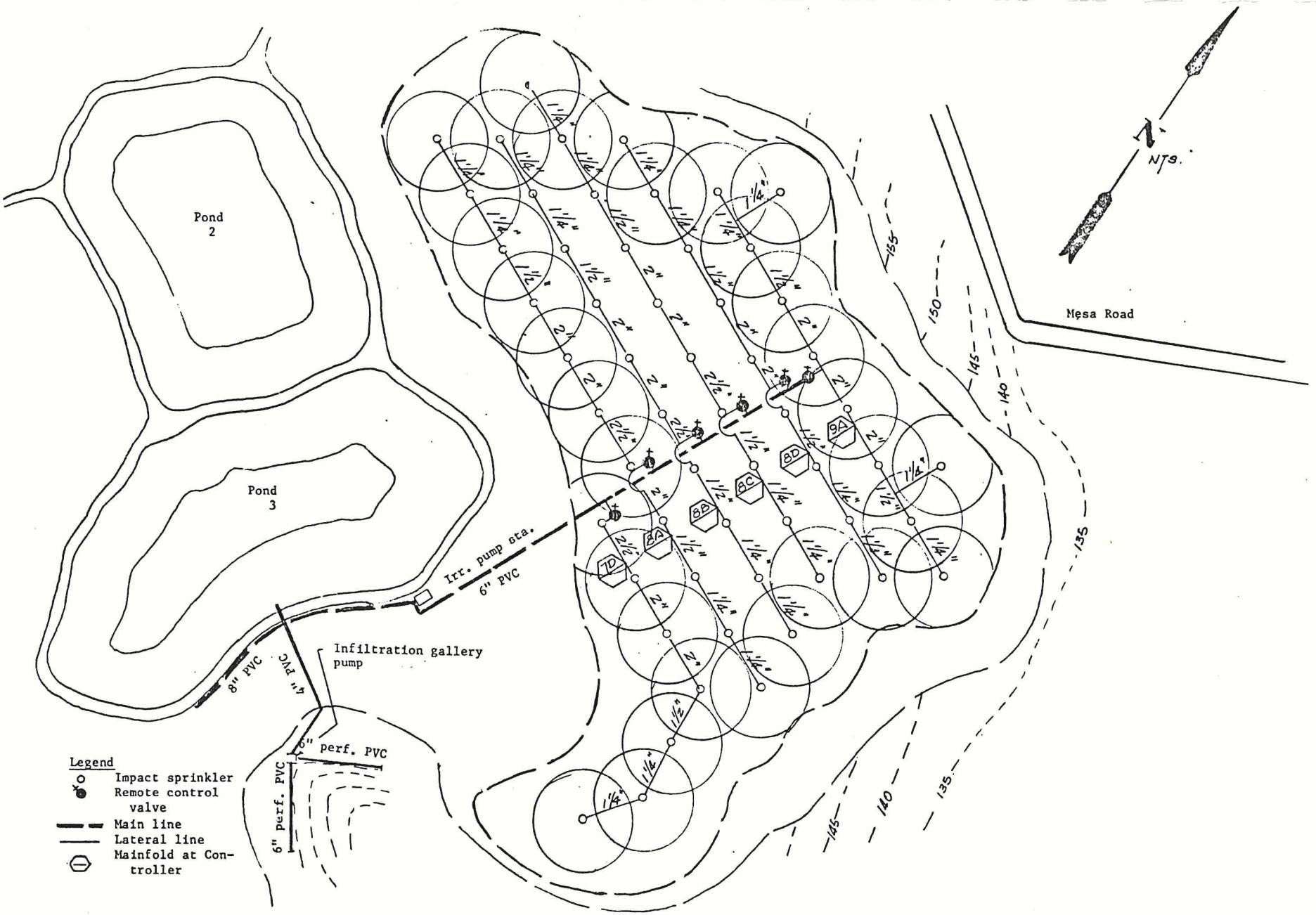

Figure - 21

Irrigation Piping and Network (typical)

day a new section of the spray disposal system is activated by the time device and automatic Solenoid valving system. The timing device is programmed to handle twelve individual systems; nine systems will be included as part of the initial plan. Sequential operation of segments of the spray system will insure an even application of treated waste over the irrigation area. The land application rates and alternate area operation may be varied to suit disposal requirements and the rotation of areas to be sprayed. It is anticipated that the spray system will operate on a daily sequential basis. A new area will be irrigated each day throughout the week returning to the original area the first day of each week. The rate of irrigation will depend on the crop, but an application rate at least one inch per week will be necessary to insure complete disposal of all waste generated. It is expected that pond 3 will be operated at different water levels throughout the year - at near empty levels at the start of the rainy season and at high levels in late spring.

The degree to which the spray system can be operated and the intensity will also depend on the type of crop planted in the disposal areas. Some species of ground cover are susceptible to flooding and therefore some degree of caution must be exercised to prevent damage to this crop. Added information regarding the suitability of various crops for seeding the disposal area may be obtained from the Soil Conservation District offices in Petaluma.

Pressure in the system should be adjusted to ensure minimum wind carry of the spray from the system. This will depend on the wind intensity and direction during the spray period. The intensity of disposal must be regulated to prevent flooding of areas and during marginal disposal periods operation may be for only short periods. Periodic inspection of the timing device is essential. Spare Solenoid control valves maintained in stock is desirable.

Maintenance

The treated wastewater from pond 3 should be free of most suspended material and therefore be suitable for spray disposal purposes. Occasionally leaves, sticks, paper and in some instances, fish and other biological specimens may enter the suction lines and thence be pumped through the system. This material will cause some sprinkler heads to plug on occasion, requiring head removal and cleaning. Solenoid control valves may be affected in like manner.

A periodic program should be systematically followed to inspect and clean the spray nozzles to insure proper functioning. In some cases, the nozzles may have to be removed temporarily and cleaned in the shop. It is therefore advisable to maintain a number of spare heads in stock for replacement purposes.

The spray area must be inspected from time to time to make certain that irrigation lines are not leaking and that spray heads are functioning properly. This is of vital importance if mechanized equipment is used for farming purposes on this spray disposal area. Caution must be exercised to prevent unnecessary damage to the spray heads, valving and irrigation lines.

The entire disposal site should be critically examined on a periodic basis to make certain erosion is minimized and flooding is prevented. The shallow retentive basins within the disposal area berms to direct and retain stormwater should be inspected periodically to prevent future problems.

Manufacturer's Brochures:

Valves: Hydro-Rain, Series 100

Sprinklers: Rainbird, Model 14600 W-TNT

Irrigation Programmers: Griswold Controls, Model 2300 Data Sheet F-250D

4. Irrigation Control Panel

Purpose and Description

The control panel contains all the necessary controls (switches, starters, safety lights, etc.) to operate the disposal facilities. A schematic of the control panel is shown in Figure 22. Following is a list of the controls furnished in the panel:

1. Main circuit breaker
2. Motor starters and circuit breakers for the two 40 h.p. irrigation pumps
3. Hand-off-auto switches for the above pumps
4. Elapsed time meters for the pumps
5. Motor starter and circuit breaker for the 3 h.p. infiltration gallery pump
6. Autocon 4100 Probotrol for low level cut-off with automatic restoration and PBX-2 Autocon Probe holder
7. Irrigation Programmers (twelve removal valve controls, Griswold type)
8. Twelve overriding selector switches for manual control of each valve
9. Duplex Receptacle

Operation

The operator should familizrize himself with the control features of the panel. Whereas the normal operations of the disposal system are automatic, manual operation is necessary during emergency or testing of the pumping unit for routine maintenance.

Safety

Should there be any malfunction related to the circuiting of the control panel, it should be referenced to a licensed electrician. The panel circuit diagrams are available at the pumping station.

Manufacturer's Brochures:

Irrigation Panel Circuit Drawing: Autocon Industries, Inc., Drawing No. C6844-1

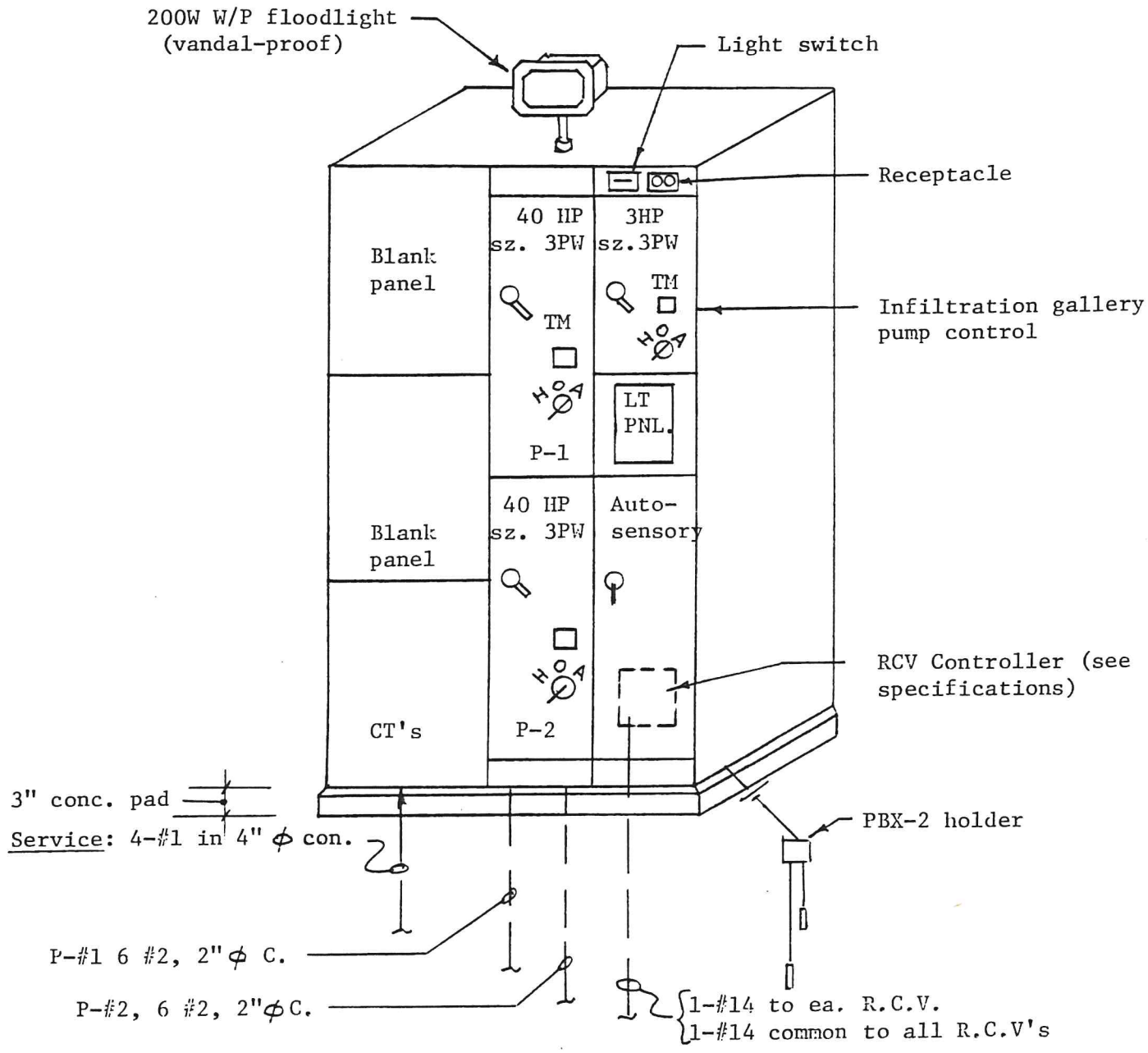

Figure - 22

Control Panel Schematic

5. Miscellaneous

Low Water Level Sensors: Purpose and Description: Autocon designed Probotrols are used to sense liquid levels electrically and shut off the irrigation pumps when the level in the pond becomes too low, thus avoiding pumping of muddy water to the spray field. The unit consists of a probe relay assembly, probe rod, a probe housing and interconnecting wire from probe to relay enclosure. The "autosensory" portion of the assembly is connected to the motor starters.

Operation: The operation of the probotrol is essentially automatic. When the water level in pond 3 falls below the tip of the probe, the motor is automatically switched off. When rising liquid level touches the probe tip, current flows through the liquid, and completes the circuit.

Maintenance: The probes are essentially maintenance-free. However, the probe tip should be occasionally checked for any solid deposits.

Manufacturer's Brochures: Probe: Induction Probotrol, Autocon Industries Techni-Data Sheet 3-4120

Built-in Motor Controls: Planpak, Autocon Industries

Infiltration Gallery and Pump: Purpose and Description: An infiltration gallery is provided to collect underground seepage water from the areas of treatment and disposal and to pump it back to the pond. The gallery consists of two perforated 6-inch lines, 100 feet long and a 3 h.p. vertical turbine pump. The pump, manufactured by Byron-Jackson Pump Division, has two stages and discharges into pond 3 through a 4-inch PVC line (Figure 16). The infiltration gallery details are shown in Figure 23.

Operation: A Probotrol (see previous section) level sensor automatically controls the operation of the pump. The pump can also be operated manually by turning the switch selector from "auto" position to "hand" position. The performance characteristics of the pump are shown in Figure 24.

Maintenance: The pump is self-lubricated with water, and requires minimal

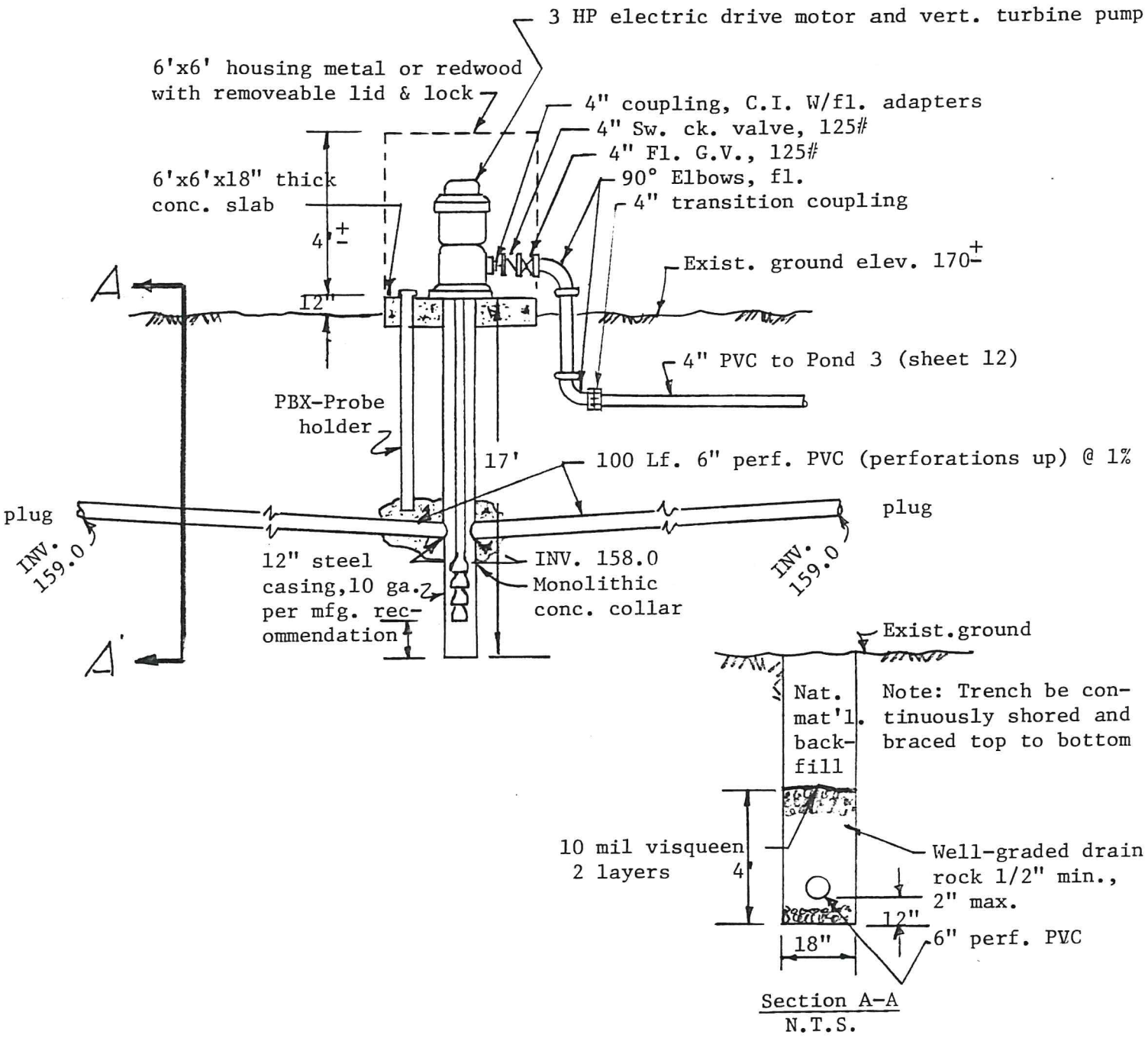

Figure - 23

Infiltration Gallery Pump Detail

BYRON JACKSON

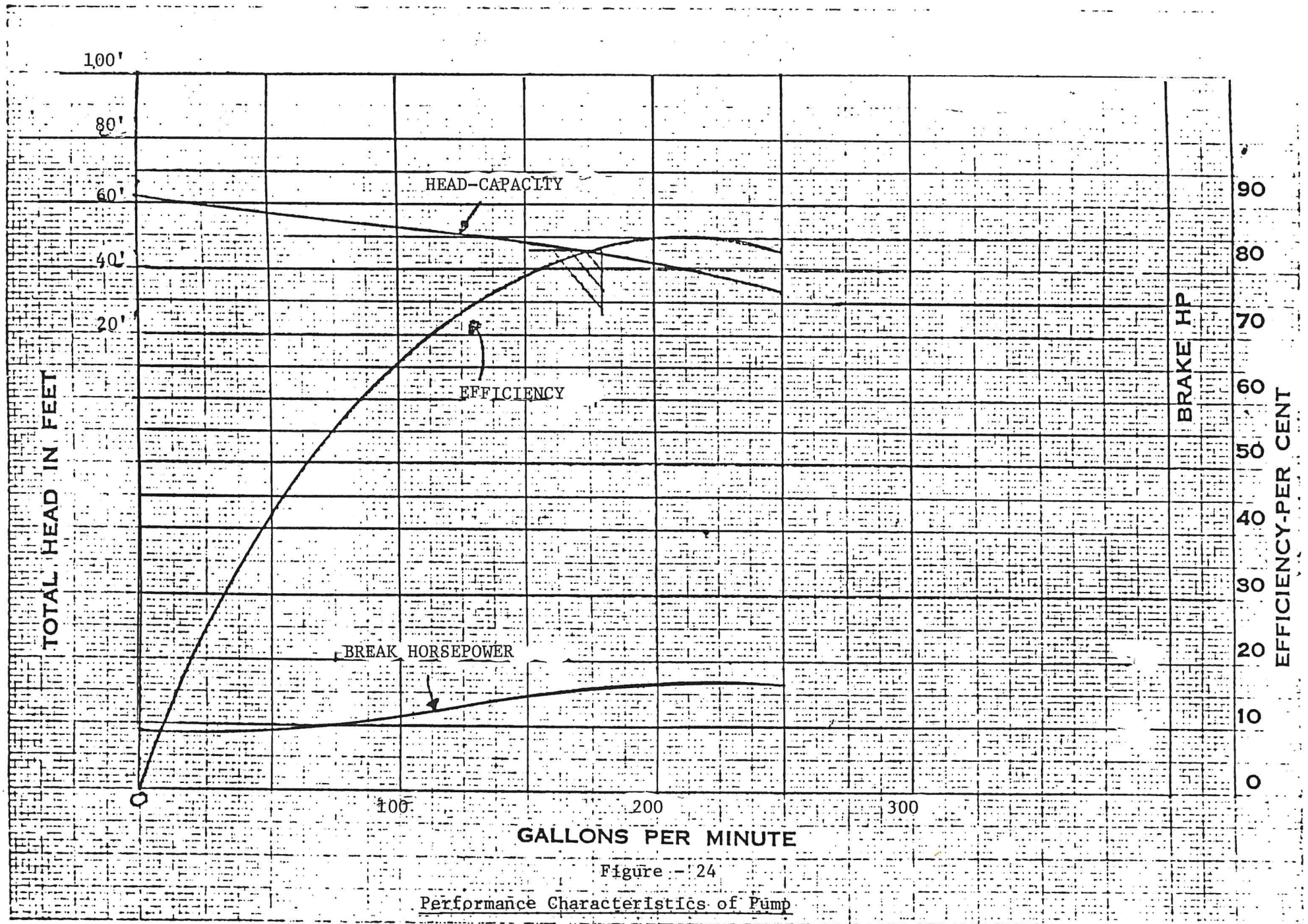

Figure - 24

Performance Characteristics of Pump

PUMP SIZE AND TYPE	RPM	CUSTOMER NO.	IMPELLER NO.	BASED ON	DATE	BYRON JACKSON NUMBER
7" MQ-H, 2 STAGE	1750	G. S.	BRANCH NO.	3437	4-29-74	PC 73289-SF
				DATA BY JCA	DRAWN BY JCA	

maintenance. Manual operation of the pump should be done periodically as a routine check.

Manufacturer's Brochures: Vertical Turbine Pump: Byron Jackson Pump Division, Borg-Warner Corporation

Type: MQ-H, 2 Stages

III. MONITORING AND RECORD KEEPING

A. OPERATING RECORDS

Adequate record of operation and maintenance procedures are necessary not only to evaluate the plant performance but also to help minimize expenditures of labor, power and replacement parts. Daily records provide detailed reporting of all operations and events which are summarized on monthly records. Concerning the latter, trends which may lead to malfunctioning of the plant can be detected and the effect of changes in operating procedure can be ascertained.

A record of lubrication and other preventive maintenance services for each item of equipment is also necessary. Such a record reduces the possibility of oversight or neglect and serves as a guide in determining causes of normal wear and breakdown. Preventive maintenance records are discussed in detail in the Appendix.

1. Daily Log

A well-kept daily log contains all data pertinent to the conditioning of the plant as well as notes pertaining to unusual conditions in plant and sewage, and a record of visitors to the plant. It is well to keep in mind that the daily log is occasionally used as a legal record of plant operation and performance. In general, daily recordings should be made of such items as weather conditions, operators in attendance, sewage flows, facilities in operation, and the occurrence of odors or other nuisance conditions. Records should be kept also of the out-of-the-ordinary happenings such as unusual insect infestation, the presence in sewage of unusual amounts of oil or grease or other deterious substances and any other disturbances.

An example of the daily log sheet is shown in Appendix D .

2. Monthly Log

Pertinent information on plant operation and performance should be summarized monthly and submitted to the City and other interested parties in report form. The form that the monthly report takes is largely a matter of personal preference of the Plant Superintendent or the Engineer. Some operators prefer a monthly report summarizing and analyzing the month's operations, while others simply present the monthly data in brief tabular form. Keep in mind the fact that for persons other than the plant operating personnel, the monthly report represents the only source of information of on-the-job plant performance. Most of the data to be reported on these forms can be summarized from the daily reports and laboratory data. An example of the monthly log is shown in Appendix D .

3. Annual Report

It is strongly recommended that the Plant Operator prepare an annual report which summarizes monthly operating performance data. A well-prepared annual report is an excellent public relations medium and should be given the widest effective distribution.

B. SELF-MONITORING PROGRAM AND REPORTING REQUIREMENTS

1. Monitoring Program

Under the resolutions established for discharge requirements for the Bolinas Community Public Utility District by the Regional Board, the Community is obligated to routinely perform self-monitoring of the wastewater system performance and file a compliance evaluation report with the Board. A copy of the Board Requirements is presented in the appendix. Table 7 provides an overview of the sampling schedule and the analyses required under the prescribed monitoring program. Both the operator and the laboratory personnel should familiarize themselves with the above schedule which is also categorized according to task in Table 8. In order to implement the monitoring program and to simplify the maintenance of records, data sheets 1 through 6 shown in Appendix Dhave been prepared.

It is the responsibility of the District to maintain all data sheets

TABLE 7

AN OVERVIEW OF THE SCHEDULE OF SAMPLING AND ANALYSES

BOLINAS MONITORING PROGRAM

Sampling Station	Influent		Final Effluent		Pond		Levee	Seepage	Groundwater	Perimeter
	'A'Stn.		'ESD'Stn.		'PP'Stns.		'L'Stns.	'S'Stns.	'G'Stns.	'P'Stns.
Type of Sample → / Analysis ↓	Cont	C-24	Cont	G	G	O	O	G	G	O
Flow rate, MGD	D		D					2W		
BOD_5 (20°C), mg/l & lb/day		3M		W						
* Chlorine residual, mg/l										
Dosage, lb/day										
pH, units				D	W[a]					
Dissolved oxygen, mg/l				D	W					
Total Suspended solids, mg/l & lb/day		3M		3M	3M[a]					
[a] volatile suspended solids, mg/l		3M		3M	3M					
[a] total & volatile dissolved solids, mg/l		3M		3M						
[a] settleable solids, ml/l/hr		3M		3M	3M					
Oil & grease, mg/l & lb/day		3M		3M						
Total & dissolved sulfides (if DO ≤ 5 mg/l), mg/l				D	W					
Total & fecal coliforms, MPN/100 ml				W				2W	2M	
Chloride, mg/l								2W	2M	
Nitrate nitrogen, mg/l								2W	2M	
Chlorophyll[b], µgm/l				3M	M					
All applicable standard observations						3/W[c]	W[d]			W[e]

Note: a. Not specified by the Board; but strongly recommended to evaluate pond performance

b. Optional

c. Involves detection of H_2S using lead acetate paper

d. Standard observation include the following: presence or absence of odor, characterization of odor and its source, height of free board, runoff or leaching from ponds, and an estimate of waterfowl and water-associated birds

e. Standard observations include the following: Presence or absence of odor, type of odor, its source, wind direction and estimated velocity, evidence of runoff or seepage from the waste treatment facilities or spray pond disposal area.

* Chlorination only during high coliform MPN periods; dose monitored during those periods.

Types of Samples:

G - grab
O - observation
C-24 - Twenty-four hour composite samp
Cont - continuous

Frequency of Sampling:

D - daily
W - weekly
M - monthly
2W - once every two weeks
2M - once every two months
3M - once every 3 months (quarterly)
2/D - twice daily
2/W - twice weekly
3/W - thrice weekly

TABLE 8

TASK SCHEDULE

BOLINAS SELF-MONITORING PROGRAM

Frequency	Analyses Specified by the Regional Board		*Additional Tests Recommended	
	Sample	Analyses	Sample	Analyses
Daily	Basic Data Final Effluent	Influent & effluent flow, air & water temp., wind velocity & direction, rain fall & evaporation, pH, D.O., total & dissolved sulfides, chlorine dose & residual chlorine		
Thrice/wk	Pond Samples	Evidence of H_2S		
Weekly	Final Effluent Pond Samples Levee stations perimeter stations	BOD_5 DO, total & dissolved sulfide Presence of odor, evidence of seepage or runoff, bird activity, etc.	Pond Samples Final Effluent	pH Total fecal coliform
Bi-Weekly	Seepage stations	Est. flow, total & fecal coliforms, chlorides & nitrate-nitrogen		
Bi-Monthly	Ground water stations	Total & fecal coliforms, chloride & nitrate-nitrogen		
Quarterly	Influent Final Effluent	BOD_5, TSS, oil & grease TSS^5, oil & grease	Influent ------ Final Effluent- Pond Samples---	VSS, settleable solids, TDS, alk VSS, TDS, chlorophyll, alkalinity, TSS, VSS, chlorophyll, settleable solids, microscopic identification of algae

*Needed to evaluate pond performance on a routine basis.

Note: Sulfide measurements are made if DO ≤ 5 mg/l.

Abbreviations: BOD_5 - 5-day, 20°C biochemical oxygen demand; DO - dissolved oxygen; TSS - total suspended solids; VSS^5- volatile suspended solids; TDS - total dissolved solies.

current and complete. The District should provide three-ring binders for filing and protection of the completed data sheets at the plant.

2. Reporting

Monitoring reports should be filed monthly as well as annually as described below. Tables 1 through 6 (Appendix D) can be used for this purpose, or, alternatively, the "standard" forms provided by the Regional Board can be filled in and sent to the Board. It is strongly recommended that three copies of all the data sheets should be maintained-- one at the plant, the second at the District Office, and the third to be filed with the Engineer.

Monthly Reports: These are to be filed for every month by the fifteenth day of the following month. The reports shall contain the following:

1. Letter of Transmittal: This includes a brief discussion of compliance or non-compliance with the discharge requirements, and actions taken or planned for correcting any violations. The letter shall contain a statment by the signing official that to the best of the signer's knowledge, the report is true and correct.

2. Compliance Evaluation Summary

3. Map showing the location of the sample stations. (The Community is furnished with a map showing sampling station locations).

4. Results of analyses and observations for each station.

5. Data summary showing maximum, minimum, and average values for each parameter.

6. Daily flow data and weekly and monthly average flows. The table should also list the dates and magnitude of flows which exceeded 80% of the design capacity.

7. Demonstration of adequate disinfection for the effluent.

Annual Report: This should be filed by January 30 of each year. The report shall contain the previous year's monitoring data in graphical as well as tabular forms. It will also include the compliance record relative to the applicable discharge requirements. If non-compliance is reported, the corrective actions taken or planned should be outlined. (Note: While interpreting the non-compliance data, it is important to compare them with the base line data acquired prior to the construction of the ponds).

Other Reports: Bypass reporting shall be included in each monitoring report. (The Board should be informed by phone of any planned and/or unplanned bypassing.) The report shall contain information regarding the volume of waste bypassed, and the cause, time, and duration of the bypass.

The Board should also be notified by phone of any accidental spill of wastes or pollutants. A written report shall be filed within five days after the occurrence and shall contain the following information:

1. Nature of waste or pollutant
2. Cause of spilling
4. Estimated size of affected area
5. Nature of effects (i.e., fish kill, bird kill, etc.)
6. Corrective measures that have been taken, or planned, and a schedule of these activities.

3. Observations and Analyses

Inflow: Flow entering the ponds passes through a calibrated 8" Palmer-Bowles flume. A chart for this flume is shown in Figure 11. As indicated on the chart, the volume of flow is proportional to the depth in the flume. The greater the depth, the greater the flow. The flume depth may be read with a dip stick or recorded on a motordriven chart. The chart should then be taken to the engineer for interpretation and determinations of daily flow entered on the daily log sheet.

Weather Observations: Pond performance is, to a considerable extent, dependent on the weather and, consequently, space for weather observations

is provided in the daily and semi-monthly log. There is space for the type of weather--clear, cloudy, etc.--for wind direction and speed. An inexpensive wind direction and speed indicator should be provided for this purpose as well as a standard rainfall gauge (6-inch depth). The evaporation gauge is a 6-inch diameter by 6-inch deep cylinder with calibration in 1/100 inches. This gauge should be read and filled to overflowing with demineralized water each time. It should be covered with a rain shield located at least one foot above the opening and should be located so that it cannot be knocked over by animals or be reached by direct sunlight. Pond water and air temperature should be read by use of direct reading dial thermometers.

Pond water depth should be read directly on staff gauges located in the ponds.

Pond water pH may be determined by a direct reading portable pH meter, or by means of hydrion pH paper. If paper is used, it must be kept in a sealed container and maintained fresh.

Pond_Water_Color: Normally, the ponds will be green, but occasionally will be darker or lighter and rarely clear or brownish. Enter the apparent color as seen by the observer at midday (between 10 AM and 2PM).

Dissolved oxygen may be determined by a direct reading meter or with a Winkler DO test kit. The meter is most convenient, but should be calibrated frequently to ensure accuracy. Clean tap water, aerated by an aquarium pump for at least two hours may be used for calibration. A table of temperature versus saturated dissolved oxygen is given in Appendix F . Determine the temperature of the aerated water and consult the chart to determine the saturation dissolved oxygen concentration. This concentration should be equal to that indicated by a properly calibrated DO meter.

Sulfides_Concentrations: Hydrogen sulfide will be emitted from ponds when, for a variety of reasons, the surface becomes anaerobic. Hopefully, anaerobic conditions will never occur in these ponds, but should they occur, it is necessary to determine the degree of anaerobiosis and the nuisance potential. This is best determined by sulfide analysis. Sulfide determinations

should be performed with the sulfide test kit provided. The test kit is complete with detailed instructions.

All analyses--physical, chemical and biological--will be performed in accordance with the procedures outlined in Standard Methods (see reference list in the Appendix).

4. Sample Collection

Sewage influent samples should be composited over a a period of 8 hrs (8 AM to 4 PM) at the rate of one sample her half hour. The volumes of portions of the composite samples should be proportional to the volume of flow. (About 5 cubic centimeters of sample for each gallon per minute of flow). Due to long detention periods in the ponds, changes in BOD and suspended solids are small with respect to time so that composite sampling is unnecessary and grab samples are satisfactory. Grab samples should be collected from ponds at about 10 AM on the sample day when variables such as pH, temperature, and DO are at about their average daily level. Pond samples should be collected from the open leg of the effluent pipe or from a point near the effluent in non-overflowing ponds. Collect samples in clean plastic bottles, stopper completely, refrigerate or ice immediately and transport to the laboratory as soon as possible.

Details on the conditions of storage of samples for various analyses are described in Standard Methods.

should be performed with the sulfide test kit provided. The test kit is complete with detailed instructions.

All analyses--physical, chemical and biological--will be performed in accordance with the procedures outlined in Standard Methods (see reference list in the Appendix). The interpretation of the results in relation to the ponds performance will be made according to Table 9.

4. Sample Collection

Sewage influent samples should be composited over a period of 8 hours (8 AM to 4 PM) at the rate of one sample per half hour. The volumes of portions of the composite samples should be proportional to the volume of flow. (About 5 cubic centimeters of sample for each gallon per minute of flow). Due to long detention periods in the ponds, changes in BOD and suspended solids are small with respect to time so that composite sampling is unnecessary and grab samples are satisfactory. Grab samples should be collected from ponds at about 10 AM on the sample day when variables such as pH, temperature, and DO are at about their average daily level. Pond samples should be collected from the open leg of the effluent pipe or from a point near the effluent in non-overflowing ponds. Collect samples in clean plastic bottles, stopper completely, refrigerate or ice immediately and transport to the laboratory as soon as possible.

Details on the conditions of storage of samples for various analyses are described in Standard Methods.

Parameter	Indicates Poor Treatment	Indicates Good Treatment	Corrective Measures in Case of Poor Treatment (reference)
Dissolved oxygen, mg/l			
all ponds	less than 0.5 mg/l	greater than 2.0 mg/l	Page 48
pH			
ponds 1A and 1B	less than 7.0 mg/l	greater than 7.5 mg/l	Page 51
ponds 2 and 3	less than 7.0 mg/l	greater than 7.5 mg/l	
BOD, mg/l			
ponds 1A and 1B	greater than 60-65 mg/l	less than 60 mg/l	
pond 2	greater than 50 mg/l	less than 40 mg/l	Page 50
pond 3	greater than 40 mg/l	less than 25-30 mg/l	
Sulfide, mg/l			
ponds 1A and 1B	greater than 1 mg/l	absence or trace	
ponds 2 and 3	greater than 0.5 mg/l	absence or trace	Page 52
Odors ("pigpen")			
all ponds	presistent	absence	Page 52 and 62
Total coliforms, MPN/100 ml			
pond 3	greater than 10,000/100 ml	less than 1,000/100 ml	Disinfection with chlorine Page 69

APPENDIX A

REGIONAL BOARD'S DISCHARGE REQUIREMENTS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 72-33

WASTE DISCHARGE REQUIREMENTS
FOR
BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT
MARIN COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region, finds that:

A. The Bolinas Community Public Utility District, called the discharger below, submitted a report of waste discharge dated May 13, 1972, information entitled "Water Quality and Beneficial Uses", a geologist's report, and other reports on the project.

B. Those reports describe the discharger's proposal for handling the present waste flow estimated at 0.04 million gallons per day (mgd) of sewage, only, from 400 people. Facilities with a design capacity of 0.065 mgd to serve 500 people will utilize 43 acres of land for treatment and disposal of the waste through percolation basins and a spray area located on the hill opposite the intersections of Mesa and Brighton with Bolinas-to-Olema Roads. Waste that surfaces after percolating through the soil from the basins or spray area will be collected in a drain system. There will be no direct discharge of effluent to surface waters.

C. The Board adopted an Interim Water Quality Control Plan for the San Francisco Bay Basin on June 14, 1971, and amended its Bolinas-Stinson Beach Conceptual Sewage Plan on April 25, 1972.

D. The beneficial uses of unnamed streams adjacent to disposal area, Bolinas Lagoon, Bolinas Bay and contiguous waters are:

Swimming, surfing, skin-diving, wading, pleasure boating and marinas

Fishing and Shell fishing

Fish, shellfish, and wildlife propagation and sustenance, waterfowl and migratory birds habitat and resting

Aesthetic enjoyment

Recharge of the recreational lagoon in Seadrift Subdivision

E. The Board has notified the discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the proposed discharge.

F. The Board, in a public meeting on June 27, 1972, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, the discharger shall comply with the following:

A. Discharge Specifications

1. The treatment or disposal of waste shall not create a nuisance as defined in Section 13050(m) of the California Water Code.

2. The discharge shall not cause:

   a. Floating, suspended or deposited macroscopic particulate matter or foam in waters of the State at any place;

   b. Bottom deposits or aquatic growths at any place outside the percolation basins and spray disposal area;

   c. Alteration of temperature, turbidity, or apparent color beyond present natural background levels in waters of the State at any place;

   d. Visible, floating, suspended or deposited oil or other products of petroleum origin in waters of the State at any place;

   e. Surface waters of the State to exceed the following limits of quality at any place:

Dissolved Oxygen	90% saturation, Minimum When natural factors cause lesser concentrations, then this dischar shall not cause further reduction in the concentration of dissolved oxygen.
Dissolved Sulfide	0.1 mg/l Maximum
Other Substances	Any one or more substances in con centrations that impair any of the protected beneficial water uses or make aquatic life or wildlife unfit or unpalatable for consumption.
pH	6.5 Minimum 8.5 Maximum

3. Seepage outside the treatment facilities, percolation basins and/or spray disposal area from the disposal of waste shall be collected and discharged to the treatment, percolation or disposal facilities.

4. Waste at the surface of treatment ponds and/or percolation basins shall meet the following quality limits at all times:

In any grab sample:

Dissolved Sulfide	0.1 mg/l maximum
Dissolved Oxygen	2.0 mg/l minimum

5. Waste as discharged to the percolation basins and/or spray disposal area shall meet the following quality limits at all times:

In any grab sample:

5-day BOD	40 mg/l maximum

6. The disposal of waste shall not cause degradation of groundwater suitable for domestic use.

7. The public shall be effectively excluded from the waste treatment, percolation and spray disposal areas.

8. Fail-safe treatment shall be provided and include duplicate facilities where needed to assure continuous compliance with requirements.

9. The mean daily discharge of waste to the treatment facilities for any seven consecutive days shall not exceed 65,000 gallons per day.

B. Discharge Prohibitions

1. Bypassing of sewage is prohibited. If bypassing should occur, the discharger shall notify the Marin County Health Department, California State Department of Public Health and this Board's Executive Officer as soon as possible of said bypass.

2. Discharge from the treatment facilities other than to the percolation basins and/or spray disposal area is prohibited.

3. Runoff across or from the waste treatment, percolation and spray areas is prohibited.

C. Provisions

1. This Order includes items numbered 1, 2, 6 and 7 of the attached "Reporting Requirements" dated August 28, 1970.

2. This Order includes items numbered 1, 2, 3, 4, 5, and 6 of the attached "Notifications" dated January 6, 1970. Waters of the State do not include those in the treatment ponds and percolation basins where the District has maintained control.

I, Fred H. Dierker, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on June 27, 1972.

Executive Officer

APPENDIX B

REGIONAL BOARD'S MONITORING REQUIREMENTS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

SELF-MONITORING PROGRAM
FOR
BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT
MARIN COUNTY

AUGUST 1973

PART A

I. GENERAL

Pursuant to Sections 13267 and 13268 of the California Water Code, any perso discharging sewage or other waste within this Region is required to furnish such technical or monitoring program reports as this Regional Board may specify; and pursuant to this Regional Board's Resolutions Nos. 70-43 and 70- detailed specifications for subject discharger's Self-Monitoring Program are prescribed in the following sections.

Reporting responsibilities of waste dischargers as specified by Resolution No. 70-43 and Resolution No. 70-44 include the following:

1. Resolution No. 70-43

   a. A discharger agreeing to do the work specified by the Executive Officer is expected to complete all of the work according to the schedule contained in those specifications, and failure to complete the work may be considered as "failure" or "refusal" to furnish a self-monitoring program or technical report pursuant to Section 13268 of the California Water Code.

   b. Section 13268 of the California Water Code states that any person failing or refusing to furnish technical or monitoring program report as required by subdivision (b) of Section 13267 or falsifying any information provided therein is guilty of a misdemeanor.

2. Resolution No. 70-44

   a. All analyses specified in the self-monitoring program are to be performed by a laboratory certified by the State Department of Health, and analysis reports shall be signed by the director of such certified laboratory.

   b. All waste dischargers under self-monitoring programs shall routinely perform self-evaluation of requirement violations and take appropriat actions to correct violations where requirement violations are found. (An example tabulation of self-evaluation of requirement violations is attached.)

   c. All waste dischargers, at the time of submittal of self-monitoring reports to this Regional Board, shall report on (1) their requirement violations and (2) corrective actions undertaken or planned by incorporating such information in their self-monitoring program reports.

d. All letters transmitting self-monitoring and technical reports shall (1) be signed by the official of the discharger who has the overall responsibility for the self-monitoring program and (2) include a statement by such official, under penalty of perjury, that to the best of the signer's knowledge the reports are true and correct.

The purposes of this Self-Monitoring Program are: (1) to document subject waste discharger's compliance with this Regional Board's waste discharge and receiving water requirements, and (2) to facilitate self-policing by the wast discharger in the prevention and abatement of pollution arising from waste discharge.

This program shall be initiated on the effective date shown on the last page of this document.

II. SAMPLING AND ANALYTICAL METHODS

Sample collection, storage, and analyses shall be performed according to the latest edition of Standard Methods for the Examination of Water and Wastewate prepared and published jointly by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation, or other methods approved by the Executive Officer of this Regional Board.

Water and waste analyses shall be performed by a laboratory approved for thes analyses by the State Department of Health or a laboratory approved by the Executive Officer. The director of the laboratory whose name appears on the certification shall supervise all analytical work in his laboratory and shall sign all reports of such work submitted to the Regional Board.

III. DEFINITION OF TERMS

A. 24-hour composite sample means a sample composed of individual grab sampl mixed in proportions varying not more than plus or minus 5% from the instantaneous rate of waste flow corresponding to each grab sample, collected at regular intervals, not greater than one hour, throughout any period of 24 consecutive hours, or collected by the use of continuous automatic sampling devices capable of attaining the proportional accuracy stipulated above.

B. Grab sample means a sample collected at any time.

C. Depth-integrated sample means a water or waste sample collected by allowi a sampling device to fill during a vertical traverse in the waste or receiving water body being sampled, and shall be collected in such a manner that the collected sample will be representative of the waste or water body at that sampling point.

D. Bottom sediment composite sample means a bottom sediment sample composed of four or more grab samples collected from different locations in the immediate vicinity of a sampling station location and thoroughly mixed on equal volume or weight basis.

E. Standard Observations

1. Receiving Water

a. Floating and suspended materials of waste origin (to include oil grease, algae, and other macroscopic particulate matter): Prese or absence, source and size of affected area.

b. Discoloration and turbidity: Description of color, source, and size of affected area.

c. Odor: Presence or absence, characterization, source, distance o travel.

d. Evidence of beneficial water use: Presence of water-associated wildlife, fishermen, and other recreational activities in the vicinity of sampling stations.

e. Hydrographic condition:

(1) Time and height of high and low tides corrected to nearest location for the sampling date and time of sample collectio
(2) Water and sampling depths.

f. Weather condition:

(1) Air temperatures.
(2) Wind - direction and estimated velocity.
(3) Precipitation - total precipitation during the previous fiv days and on the day of observation.

2. Waste Effluent

a. Floating and suspended material of waste origin (to include oil, grease, algae, and other macroscopic particulate matter): Prese or absence.

b. Odor: Presence or absence, characterization; source, distance o travel.

3. Beach

a. Material of waste origin: Presence or absence, description of material, estimated size of affected area and source.

b. Beneficial use: Estimated number of people sunbathing, swimming water skiing, surfing, etc.

4. Land Retention or Disposal Area

This applies both to liquid and solid wastes confined or unconfined.

a. Determine height of the freeboard at lowest point of dikes confi liquid wastes.

b. Evidence of leaching liquid from area of confinement and estimat size of affected area. (Show affected area on a sketch.)

c. Odor: Presence or absence, characterization, source, and distan of travel.

d. Estimated number of waterfowl and other water-associated birds i the disposal area and vicinity.

5. Periphery of Waste Treatment and/or Disposal Facilities

a. Odor: Presence or absence, characterization, source, and distance of travel.

b. Weather condition: Wind - direction and estimated velocity.

IV. SCHEDULE OF SAMPLING, ANALYSIS, AND OBSERVATIONS

The discharger is required to perform observations, sampling, and analyses according to the schedule in Part B with the following conditions:

A. Influent

1. Composite samples of influent shall be collected on varying days selected at random.

B. Effluent

1. Composite samples of effluent shall be collected on days coincident with influent composite sampling, or on varying days selected at random
2. Grab samples of effluent shall be collected during periods of maximum peak flows, unless otherwise stipulated.

C. Receiving Waters

1. Receiving water sampling shall be done on days coincident with composite sampling of effluent.
2. Receiving water samples shall be collected at each station on each sampling day during the period of lower slack water. Where sampling at lower slack water periods is not practical, sampling shall be performed during higher slack water period.
3. All samples shall be collected within one foot below the surface of the receiving water body, unless otherwise stipulated.

D. Observations

1. Land disposal sites shall be inspected for evidence of leaching or surfacing waste and all other applicable standard observations.
2. Ponds shall be inspected and available freeboard of each shall be measured and recorded; odors detected shall be noted.

E. General Requirements

1. Bypass reporting shall be an integral part of regular monitoring progra reporting and a report on bypassing of untreated waste or bypassing of any treatment unit(s) shall be made which will include cause, time, and date, duration and estimated volume of waste bypassed, and method used in estimating volume. Any planned and/or unplanned bypassing sha be reported to the Regional Board office immediately by telephone.
2. A report shall be made of any accidental spill of waste or other pollutants. Accidental spills shall be reported to this Regional Board b telephone immediately after it occurs. The subsequent written report shall be filed within five (5) days and shall contain information rela tive to:
   a. Nature of waste or pollutant,
   b. Quantity involved,
   c. Cause of spilling,
   d. Estimated size of affected area,
   e. Nature of effects (i.e., fish kill, discoloration of receiving wat etc.), and
   f. Corrective measures that have been taken, or planned, and a schedule of these activities.

V. RECORDS TO BE MAINTAINED

A. Written records shall be maintained at the waste treatment plant showing the following for each sample:

1. Identity of sampling and observation stations by number.
2. Date and time of sampling and/or observations.
3. Date and time that analyses are started and completed and name of personnel performing the analyses.
4. Complete procedure used, including method of preserving sample, and identity and volumes of reagents used. A reference to specific section of Standard Methods is satisfactory.
5. Calculations of results.
6. Results of analyses and/or observations.

B. A tabulation shall be maintained showing the following flow data for influent and effluent stations and disposal areas:

1. Total waste flow or volume for each day.
2. Maximum and minimum flow rates for each day and the times of their occurrences.
3. The average, maximum, and minimum daily flows for each month.

C. A tabulation relative to bypassing and accidental waste spills shall be maintained showing information items listed in Section IV-E, General Requirements, for each occurrence.

D. A chronological log for each month shall be maintained of the effluent disinfection and bacterial analyses, showing the following:

1. Date and time each sample is collected and waste flow rate at time of collection.
2. Chlorine residual, contact time, and dosage (in pounds per day and parts per million).
3. Coliform count for each sample.
4. Moving median Coliform of the number of samples specified by waste discharge requirements.

VI. REPORTS TO BE FILED WITH THE REGIONAL BOARD

A. Reports on accidental spills shall be filed at each occurrence as specified in Section IV-E-2.

B. Written reports shall be filed for each calendar month (unless specified otherwise in Part B) by the fifteenth day of the following month. In addition, an annual report shall be filed as indicated in VI-B-9. The reports shall be comprised of the following:

1. Letter of Transmittal

A letter transmitting self-monitoring reports should accompany each report. Such a letter shall include a discussion of requirement violations found during the past month and actions taken or planned for correcting violations, such as plant operation modifications and/or plant facilities expansion. If the discharger has previously submitted a detailed time schedule for correcting requirement violations, a reference to the correspondence transmitting such schedule will be

satisfactory. The letter should be signed by the official of the discharger who has the overall responsibility for the self-monitoring program, and the letter shall contain a statement by the official, under penalty of perjury, that to the best of the signer's knowledge the report is true and correct.

2. Compliance Evaluation Summary

Each report shall be accompanied by a compliance evaluation summary sheet prepared by the discharger.

3. Map or Aerial Photograph

A map or aerial photograph shall accompany the report showing sampling and observation station locations.

4. Results of Analyses and Observations

Tabulations of the results from each required analysis specified in Part B by date, time, type of sample, and station signed by the laboratory director.

5. Data Summary

Summary tabulations of the data to include for each constituent the total number of analyses, maximum, minimum, and average values for each month.

6. Lists of Approved Analyses

a. Listing of analyses for which the discharger is approved by State Department of Public Health.
b. List of analyses performed for the discharger by another approved laboratory (and copies of reports signed by the laboratory director of that laboratory shall also be submitted as part of the report.)

7. Flow Data

a. The tabulation pursuant to Section V-B.
b. Listing of the dates and the magnitudes of the flows which exceeded 80% of the design capacity of the treatment and/or disposal facilit

8. Demonstration of Adequate Disinfection

If the discharger elects to demonstrate adequate disinfection by determining chlorine residual, the discharger shall file a written report with the third monthly report, and annually thereafter, demonstrating the correlation between chlorine residual and contact time, and MPN Coliform organisms at the point of discharge. The discharger's correlation shall become applicable upon written approval of the Executive Officer.

9. Annual Report

By January 30 of each year, the discharger shall submit an annual repor to the Regional Board covering the previous calendar year. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the report shall contain a comprehensive discussion of the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.

C. LAND OBSERVATIONS (continued)

Station	Description
L-1 through L-'n'	Located along the perimeter levee at equidistant intervals not to exceed 50 feet. (A sketch showing the location of these stations will accompany each report.)
PP1-1 through PP'm'-'n'	Located at the quarter points along the edge of each pond.
S-1 through S-'n'	Located in the largest seepage stream in each 500 foot interval along the perimeter of the discharger's property. (A sketch showing the above shall be submitted with each report.)

Station	Type of Sample & Frequency	Observations, Analyses & Units	
All P Stations	Observations, weekly throughout the year.	All applicable Standard Observations; evidence of runoff across or from the waste treatment, percolation, and spray areas; and evidence of seepage outside the facilities, percolation basins, and/or spray disposal area.	
All L Stations	Observations, weekly throughout the year.	All applicable Standard Observations.	
PP1-1 through PP'm'-'n'	Observations, three times per week throughout the year.	H_2S, using lead acetate strips	mg/l
	Grab sample, weekly throughout the year.	Dissolved Oxygen	mg/l
		Total Sulfides*	mg/l
		Dissolved Sulfides*	mg/l
	*To be anlyzed if DO≤5.0 ppm.		
S-1 through S-'n'	Grab samples, every other week, throughout the year.	Total Coliform	MPN/100 ml
		Fecal Coliform	MPN/100 ml
		Chloride	mg/l
		Nitrate Nitrogen	mg/l
		Estimated Flow	gallons/min.

D. GROUNDWATER MONITORING

Station	Description
G-1	A well located approximately 300' south of Mesa Road and 900' west of Bolinas-Olema Road.

Station	Description
G-2	A well located in a defined drainage area approximately 1100 feet south of Mesa Road and 1200' west of Bolinas-Olema Road.

(A sketch shall be submitted with each report showing the locations and depths of the above wells.)

Station	Type of Sample and Frequency	Analyses	Units
All G Stations	Grab samples every other month throughout the year.	Total Coliform	MPN/100 ml
		Fecal Coliform	MPN/100 ml
		Chloride	mg/l
		Nitrate Nitrogen	mg/l

E. BASELINE MONITORING

Pre-discharge monitoring of analyses specified in this program shall be performed for all G (groundwater) and S (seepage) stations once every month commencing August 1, 1973, except when a greater than 10% variation occurs in any required monitoring parameter as indicated in the program for any groundwater (G) or seepage (S) station. In this event sampling will take place every three weeks for the parameter or parameters at each station or stations where the variance occurs until the most current result again falls within the 10% variance limit. At this time the monitoring interval will revert to a monthly basis as originally planned. A copy of the data for each sampling station "G" and "S" will be submitted along with a tabulation of the data exceeding the 10% variance limit, if this occurs, upon completion of each monitoring run.

Upon the termination of the Baseline monitoring, a summary and evaluation of the data shall be submitted which will include (but not be limited to) for each parameter monitored at each station: (i) mean, (ii) median, (iii) standard deviation and (iv) 95% confidence intervals.

F. MISCELLANEOUS MONITORING

1. Report mean daily discharge of waste to the treatment facilities for each seven consecutive day period.

2. Report all discharges from the treatment facility other than those to the percolation basins or the spray disposal areas.

I, Fred H. Dierker, Executive Officer, hereby certify that the foregoing Self-Monitoring Program:

1. Has been developed in accordance with the procedure set forth in this Regional Board's Resolutions Nos. 70-43 and 70-44 in order to obtain data and document compliance with waste discharge requirements established in the Regional Board Order No. 72-55.

2. Has been agreed to in writing by the discharger on July 27, 1973 and becomes effective August 1, 1973.

3. May be reviewed at any time subsequent to the effective date upon written notice from either the Executive Officer or the discharger, and will be revised upon written agreement of the Executive Officer and the discharger.

FRED H. DIERKER
Executive Officer
California Regional Water Quality
Control Board
San Francisco Bay Region

Attachment:
Summary

REQUIREMENT COMPLIANCE SUMMARY - AN EXAMPLE

	PARAMETER		
WASTE EFFLUENT	Not more than 20% of the samples from any station shall exceed MPN of 1000/100ml in any 30-day period.	Coliform Organisms	
	Maximum of 15 mg/l	Grease	
	Median tolerance limit (TL_{50}) in terms of % waste concentration shall be greater than 100 D	Fish Toxicity 96-hr bicassay	
	Maximum of 1ml/l-hr — Any grab sample	Settleable Matter	
	0.5 ml/l-hr — Average of six or more samples on any day		
	0.4 ml/l-hr — 80% all samples in 30-day period		
RECEIVING WATER	Minimum of 5.0 mg/l	Dissolved Oxygen	
	Minimum of 7.0 Maximum of 8.5	pH	
	Maximum of 0.1 mg/l	Dissolved Sulfides	
	Not more than 20% of the samples from any station shall exceed MPN of 1000/100ml in any 30-day period	Coliform Organisms	
		Floating Solids or Foam	
		Floating Oil	
		Turbidity and/or Discoloration	
		Atmospheric Odor of Waste Origin	

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
Coliform Organisms	1/1(2)	0/1(2)	1/2(2)	0/1(2)						
Grease	4/4(3)	4/4(3)	0/4(4)	0/4(4)						
Fish Toxicity 96-hr bicassay										
Settleable Matter										
Dissolved Oxygen	2/2(5)	2/2(5)	2/2(5)	2/2(5)						
pH										
Dissolved Sulfides										
Coliform Organisms										
Floating Solids or Foam										
Floating Oil										
Turbidity and/or Discoloration										
Atmospheric Odor of Waste Origin										

REQUIREMENT COMPLIANCE SUMMARY - AN EXAMPLE

NOTE: (1) D is the minimum receiving water/waste effluent dilution ratio achieved by waste effluent diffuser at points where toxicity requirements apply.

(2) If more than 20% of samples collected for the month at any station (i.e., one or more stations) contained coliform MPN exceeding 1000/100ml, record as 1/1 - otherwise, record as 0/1.

(3) 4/4 means grease samples were collected on four days during each of the indicated months and all of them were found in violation of requirement.

(4) 0/4 means grease samples were collected on four days during each of the indicated months and none of them were found in violation of requirement.

(5) 2/2 means DO samples were collected on two days during each of the indicated months, and on each sampling day at least one station was found in violation of requirement.

Form S-6 (back)

APPENDIX C

PREVENTIVE MAINTENANCE RECORDS

APPENDIX C

PREVENTIVE MAINTENANCE RECORDS

Performance of the day-to-day operating functions, however competent that performance may be, is by no means the only obligation of the plant operator. Every item of operating equipment requires frequent attention, with emphasis particularly on lubrication and other services essential to maximum performance, minimum maintenance costs, and a long useful life. Neglected equipment is bound to fail sooner or later, resulting in needless expense and a reduction in overall efficiency.

It is virtually impossible for any one individual to remember the service requirements of every piece of equipment in the plant and when and how frequently such requirements should be met. Some means must be provided, therefore, of readily determining what to do, and what and how often to do it.

One of the simplest and most effective means of keeping a complete record of maintenance requirements is that of using a card file system. In addition to providing a permanent record of all maintenance work, such a system enables the advance scheduling of preventive maintenance for an entire year.

Basically, the maintenance record system itself consists of four parts. These are: (1) numerical file of preventive maintenance records; (2) file of edge-punched preventive maintenance cards; (3) numerical file of cards for each piece of equipment; and (4) numerical file of instructions for operation and maintenance of various items of equipment. Each of the four parts is described briefly below.

1. Numerical File of Preventive Maintenance Records

The numerical file of preventive maintenance records contains one sheet for each item of plant property which requires periodic attention or maintenance. Listed thereon are all pertinent requirements with respect to periodic maintenance, including frequency, number of men required, and the estimated time of performance. These sheets are to be filed numerically and maintained as a reference file. All additions, deletions, or corrections to the preventive maintenance work schedule should be entered promptly on the appropriate sheets.

2. Numerical File of Equipment Data Cards

These cards contain complete name plate data for each item of equipment. They may also be used to show the type of lubricant required, together with the nature of any special service requirements.

3. Operation and Maintenance Instruction File

This section consists of a numerical file of all data relating to maintenance, operation, and servicing of each item of equipment. It contains (1) all operation and maintenance manuals furnished by equipment manufacturers, (2) spare parts lists, and (3) other informative literature.

4. Importance of Records

It must be emphasized finally that any maintenance record system, if it is to fulfill its function properly, must be kept up-to-date faithfully and consistently. Service requirements can be expected to change as the equipment ages, flow rates increase, and modifications are incorporated in the treatment process. Operational experience will serve to reveal needed additions, deletions, and corrections in the records. If changes are not entered promptly and accurately as the need for them is ascertained, the entire system soon becomes obsolete and will lose much of its value.

Tables C-1 and C-2 show examples of preventive maintenance.

A complete set of prints of the "as constructed" drawings of the

TABLE C-1

EQUIPMENT RECORD FILE

BOLINAS TREATMENT PLANT

EQUIPMENT CODE NO:

EQUIPMENT LOCATION:

EQUIPMENT DESCRIPTION:

MANUFACTURER:

MAKE: TYPE: SER. NO.

DATE	HISTORY

TABLE C-2

EQUIPMENT SERVICE FILE

BOLINAS TREATMENT PLANT

EQUIPMENT CODE NO:

EQUIPMENT LOCATION:

EQUIPMENT DESCRIPTION:

EQUIPMENT MODEL NO:

DATE	WORK DONE	REMARKS

waste treatment and disposal facility will be furnished for the use of the plant operators. These prints contain a record of all changes that are made in the plant piping, equipment connections and electrical circuitry. A set of up-to-date plant drawings is invaluable not only as a time saver to the operators in case of personnel changes, but also as a cost saving to the community when the time comes to enlarge the plant.

One last important point is that the maintenance card file system, however complete and informative it might be, will not eliminate the need for reading and utilizing the maintenance manuals furnished by the equipment manufacturers. A card file is nothing more than a key to remind the operator of his duties under the maintenance program. In all cases, the manufacturer's insutructions must be referred to for detailed information concerning the manner and method of performance. A Pond Maintenance and Monitoring Equipment List is presented in the following pages:

Table C-1 presents an overview of the preventative maintenance schedule for the pumping station and ponding system. Tables C-2 and C-3 can be used to compile data relative to operation, maintenance and servicing of the various equipments. A pond maintenance list is presented on pages C-10 and C-11.

TABLE C-1

Preventive Maintenance Schedule

Frequency	Item	Operation	Reference
1. PUMPING STATION			
Daily	communitor	hose the screen and cutter blades	
	Moyno pumps	check for leaks and equipment deterioration; check for burned out indicator lamps	
	wet well	check for odors; remove and bury coarse solids accumulated around the communitors	
Weekly	stand-by diesel generator	test generator and let it run for 20 minutes; servicing and lubing done as per manufacturer's manual	Kohler Form 5-73-10M, pp 2
	Moyno pumps	run the standby pump for 30 minutes	This manual, pp 24
	air compressor	inspect air compressor for safety features	Autocon 3-1660-4, pp 1-2
	air filter	check for leakage	Autocon 3-1660-3, pp 1
	communitor	check for wear, grease shaft bearings per manufacturer's manual; run the standby communitor for 30 minutes.	Chicago Pump, pp 11
	dry well	check for leaks on the floor	

Frequency	Item	Operation	Reference
Monthly	ventilation fans	grease the fan	
	influent stop gates	check for corrosion	
Annually	Moyno pumps*	grease pump bearings as per the manufacturer's manual	Robbins & Myers Form 3045 - C revised pp 2
	Bubbletron tube	purge air at a high pressure to remove any clogged matter	Autocon 3-1660, pp 5
	fire extinguisher	check condition	
2. POND SITE			
Daily	all recorders (flow meter and depth meters)	record the flow rate and the total flow; record the flow depth for each pond	
	all ponds	check for appearance and persistent malodors	this manual, pp 52, 62
	spray area (during irrigation months)	check for water-logged areas; pump excess water (use the portable pump) to pond 3	
	weather observations	record temperature, rain, wind direction and velocity	
	daily data sheet	complete daily data sheets	this manual, Appendix D

*Note: Under normal use, it is recommended that no lubrication be necessary for the first twelve months of operation.

Frequency	Item	Operation	Reference
Semi-weekly/ weekly	weed removal for ponds	manual, and with hose	this manual, pp 58, 59
	scum removal	hose down any scum on ramps	
	floating sludge	breakdown floating sludge in ponds by hosing	this manual, pp 54
Monthly	stopgates	check for corrosion	
	manholes	hose down any settled matter	
	pond-to-pond transfers	check for clogged materials	this manual, pp 55, 57, 58
	liquid level probes (in weir manholes)	check for corrosion	Condra Tech, Inc., pp 2,3
	embankments and levees	check for erosion (check for animal burrows	this manual, pp 55
	irrigation pumps	operate each pump for 20 minutes follow the manufacturer's manual for routine maintenance (essential especially during the non-irrigation period)	Westinghouse, pp 8
	fence	check for crawl holes	
	data sheet	complete monthly data sheet*	

*Note: The operator should summarize the monthly operations and send a copy of the report, together with the data sheet to the Engineer and to the Superintendent.

Frequency	Item	Operation	Reference
Semi-annually	aerator units	lubricate the upper and lower motor bearings as per the manufacturer's instructions	Peabody-Welles, pp 16, 17
	site area	clean and rake entire area, haul detritus to dump	
	test kits	clean, repair and replace test kits	
	spray field	check spray nozzles and solenoid control valves	Hydro-rain, pp 2
	week-spraying	use only the recommended weed killers	this manual, pp 59
Annually	fire extinguishers in laboratory	check for condition	
	water supply	flush hot water heater to purge any mineral deposit	
	nuisance-insects control	introduce mosquito fish (available from mosquito control districts) in ponds during spring	this manual, pp 60
	monitoring data	file the annual report with the Regional Board by January 30	this manual, Appendix D

B. Reference, Materials, and Equipment List (Cont'd)

Test items for pond side monitoring station:

1. Weather and vandal-proof monitoring box
2. Secchi disk
3. Dial thermometers (2)
4. Sulfide test kit with instructions
5. Dissolved oxygen test kit with instructions
6. pH test kit or pH meter with instructions
7. Clean sample bottles for analytical samples
8. Sterile sample bottles for fecal MPN determinations
9. Imhoff cones (5)
10. Distilled water source
11. Misc. pipettes and laboratory glassware for preparing samples.

Books or manuals:

1. One copy of this manual
2. Standard Methods for Examination of Water and Sewage, American Public Health Association, 13 ed., 1971.
3. Kit instructions.
4. Flow meter and recorder instructions.
5. White, Clifford Geo, 1972. Handbook of Chlorination. Van Nostrand Reinhold Company.

Weather Monitoring Equipment:

1. Rain gauge, standard
2. Wind direction and speed indicator
3. Evaporation gauge 6" x 6".

Records:

A supply of triplicate printed copies of forms 1, 2, and 3.

B. Reference, Materials, and Equipment List (Cont'd)

Books or manuals:

1. One copy of this manual
2. Standard Methods for Examination of Water and Sewage, American Public Health Association, 13 ed., 1971.
3. Kit instructions.
4. Flow meter and recorder instructions.
5. White, Clifford Geo, 1972. Handbook of Chlorination. Van Nostrand Reinhold Company.

Weather Monitoring Equipment:

1. Rain gauge, standard
2. Wind direction and speed indicator
3. Evaporation gauge 6" x 6".

Records:

A supply of triplicate printed copies of forms 1, 2, and 3. Forms 1 through 6 (see Appendix D).

APPENDIX D

OPERATING RECORDS FOR MONITORING PROGRAM

TABLE

RECORD OF DAILY VISITS AND WEATHER OBSERVATIONS

Consecutive week _____ Month _____ Year _____

Date	Pond Observations								Weather Observations***							Summary of Maintenance Work	Initials
	Color*				Odor**				Temp, °C		Wind		Type*	Rain Inch	Evap. Inch		
	1A	1B	2	3	1A	1B	2	3	Air	Pond I	Vel.	Dir.					
				Total												Remarks:	
				Average													
				Maximum													
				Minimum													

Weather code: C-clear; F-fog; O-overcast; PC-partly cloudy; D-drizzle, R-rain

Odor Code: H-hydrogen sulfide; P- "pig pen" odor; O-no odor, S-stale (sewage), N-pondlike, swampy (not objectionable)

Color Code: G-green, DG-dark green, LG-light green, BG-blueish green, YB-yellowish brown, P-pink

TABLE

DAILY FLOW RECORD

Consecutive week _____ Month _____ Year _____

Date	Influent Flow, GPD x 100					Effluent Flow to Spray Field GPD x 100	Remarks
	24 hrs Total	Max. Flow		Min. Flow			
		Rate	Time Occurred	Rate	Time Occurred		
Total							
Average							
Maximum							
Minimum							

Note: Indicate suitably in the remarks column if the influent or effluent flow exceeded 50% of the design capacity.

TABLE

WEEKLY OBSERVATIONS OF LEVEE (L) AND PERIMETER (P) STATIONS

Month _____ Year _____

Date	Station Identification	Odor (if any)			Wind Direction & Est. Velocity	Evidence of Seepage or Runoff			Evidence of Bird Activity (water fowl, etc)	Other
		Type	Source	Travel Distance		From Ponds	From Disposal Area	Other		

*Indicate the height of faceboard at the lowest point of dike and the condition of the levee, etc.

TABLE

MONTHLY SUMMARY OF OBSERVATIONS OF LAB ANALYSES

(Influent, Final & Pond Effluents)

Month _____ Year _____

Parameter	Value	Influent	Final Effluent	Pond Stations			
				1A	1B	2	3
[a]Flow, MGD	Min.						
	Ave.						
	Max.						
[b]Biochemical oxygen demand mg/l (lb/day)	Min.						
	Ave.						
	Max.						
[b]Total suspended solids mg/l (lb/day)	Min.						
	Ave.						
	Max.						
[b]pH	Min.						
	Ave.						
	Max.						
[b]Dissolved oxygen mg/l	Min.						
	Ave.						
	Max.						
[b]Oil & grease	Min.						
	Ave.						
	Max.						
[b]Total sulfides mg/l	Min.						
	Ave.						
	Max.						
[b]Dissolved sulfides mg/l	Min.						
	Ave.						
	Max.						
[b]Total Coliform	Min.						
	Ave.						
	Max.						
[b]Fecal Coliform	Min.						
	Ave.						
	Max.						
Other	Min.						
	Ave.						
	Max.						

All are grab samples except the influent which is 8 hour composite

[a]from Form 2

[b]from Form 6

TABLE

MONTHLY SUMMARY[a] OF OBSERVATIONS & LAB ANALYSES

(Seepage & Ground Water Stations)

Month _____ Year _____

Parameter	Value	Seepage Streams		Ground Water	
		S_1	S_2	G_1	G_2
Total Coliform MPN/100 ml	Min.				
	Ave.				
	Max.				
Fecal Coliform MPN/100 ml	Min.				
	Ave.				
	Max.				
Chloride mg/l	Min.				
	Ave.				
	Max.				
Nitrate Nitrogen, mg/l	Min.				
	Ave.				
	Max.				
Estimated Flow, gpm	Min.				
	Ave.				
	Max.				
Other	Min.				
	Ave.				
	Max.				

All are grab samples

[a] from lab records (form 4)

TABLE

TABULATION OF LABORATORY RESULTS

INFLUENT SAMPLES*

Year _____

Date	Flow MGD	BOD_5		Suspended Solids			Oil & Grease		Settleable Solids**	Other**
		mg/l	lb/day	Total mg/l	lb/day	Volatile** mg/l	mg/l	lb/day		

* 8 hour composite unless otherwise specified

** See recommended tests in Table .

TABLE

TABULATION OF LABORATORY RESULTS

FINAL EFFLUENT* TO SPRAY FIELD

Year ____

Date	Flow MGD	Diss. Oxygen mg/l	pH	Total and Dissolved Sulfide, mg/l	BOD_5		TSS		Coliform no./100 ml		Oil & Grease		Other
					mg/l	lb/day	mg/l	lb/day	Total	Fecal	mg/l	lb/day	

* Grab sample collected at 10 a.m. unless otherwise specified

** See recommended tests in Table

EFFLUENT DISINFECTION RECORD

Month _____

Date and Time of Sample Collection	Effluent Flow Rate	Chlorine			Coliform MPN	
		Dosage mg/l	Dosage lb/day	Residual mg/l	Total no./100 ml	Fecal no./100 ml
Mean						
				Median Value		
				Geometric Mean		
				Model Value		

APPENDIX E

PERSONNEL

PERSONNEL

One person shall be officially designated as pond operator for the treatment and disposal systems. Qualifications of this person should be a high school diploma or equivalent, and at least three years experience in municipal maintenance. Operation of the ponds and disposal area is a part-time job, but the portion of the job allocated to pond maintenance must not be neglected.

In addition to the operator, there shall be at least two additional persons who can act as assistant operators. They should be sufficiently familiar with operation and maintenance of the system to operate it on a temporary basis in the operator's absence or to assist the operator when special procedures requiring more than one person are being carried out.

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Problems or information not covered in this manual should be referred to the engineer or in the engineer's absence, to the project consultant.

APPENDIX F

SATURATION DISSOLVED OXYGEN VALUES AT VARIOUS TEMPERATURES

Saturation Dissolved Oxygen Values at Various Temperatures

Temperature in °C	Saturation D.O., mg/l
0	14.6
1	14.2
2	13.8
3	13.5
4	13.1
5	12.8
6	12.5
7	12.2
8	11.9
9	11.6
10	11.3
11	11.1
12	10.8
13	10.6
14	10.4
15	10.2
16	10.0
17	9.7
18	9.5
19	9.4
20	9.2
21	9.0
22	8.8
23	8.7
24	8.5
25	8.4
26	8.2
27	8.1
28	7.9
29	7.8
30	7.6
31	7.5
32	7.4
33	7.3
34	7.2
35	7.1
36	7.0
37	6.9
38	6.8
39	6.7
40	6.6