PHASE 1 - PILOT STUDY
WORK PLAN

TOWN OF RIVERHEAD
RIVERHEAD SEWER DISTRICT

ADVANCED WASTEWATER TREATMENT PLANT
WASTEWATER REUSE

FEBRUARY, 2004

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H2M

TOWN OF RIVERHEAD / RIVERHEAD SEWER DISTRICT
ADVANCED WASTWATER TREATMENT FACILITY - EFFLUENT REUSE
SUFFOLK COUNTY INDIAN ISLAND GOLF COURSE IRRIGATION
WORK PLAN

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1.0 DESCRIPTION

This project is being undertaken to satisfy one of the major recommendations of the Peconic Estuary Comprehensive Conservation and Management Plan (PECCMP); to reduce the annual mass loading of nitrogen to the Peconic Estuary.

The Riverhead Sewer District proposes to ultimately reuse approximately 350,000 GPD of effluent from the newly constructed Riverhead Advanced Wastewater Treatment Facility (RAWTF) and the pre-existing Scavenger Waste Treatment Plant to irrigate the adjacent Suffolk County operated Indian Island Golf Course. The wastewater will be reclaimed for reuse using an "add-on" treatment system generally consisting of advanced filtering, virus removal, and additional disinfection. Reducing the volume of discharge via the outfall sewer will reduce by approximately 25% (at full flow capacity) the mass loading of nitrogen during the irrigating season. This reduction is beyond the limits currently achievable through technological means.

This is the first effluent reuse program in Suffolk County. There are at least four (4) other golf courses in New York State that take advantage of reclaimed water for irrigation. The other New York state reuse projects can not be used solely as the basis to accept this project because of Long Island's unique reliance on a sole source aquifer for water supply, and because of the Town's and Suffolk County's concerns regarding the potential public health issues. The project must readily gain public acceptance for the project to be implemented on a full scale basis, and thus it was determined that a demonstration pilot study was prudent considering the pioneering nature of such a project on Long Island.

The Suffolk County Department of Health Services (SCDHS), the New York State Department of Environmental Conservation (NYSDEC), the Suffolk County Department

of Parks and Recreation (SCDPR), and the Town of Riverhead will place restrictions on the project to protect the:

- *general public using the golf course*
- *staff who maintain the fairways and greens*
- *adjacent homeowners*
- *turf and golf course plantings*
- *general environment*

The concerns that have come to light regarding an innovative project of this nature include:

- *waterborne disease outbreaks caused by bacteria and viruses naturally found in the treated wastewater*
- *land application and irrigation practical issues (i.e., sprinkler head clogging)*
- *the effects on the Peconic Estuary and the environment*
- *aerosol dispersion of pathogens*
- *public acceptance*
- *the lack of "personal" experience with effluent reuse projects.*

As explained later, although this project is innovative for Suffolk County, it is very common, expected, and sometimes required in other parts of the United States and the world.

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This Work Plan has been developed to help identify and start to address the concerns and the overall perception of applying highly treated wastewater to land that comes in contact with humans, animals, and fauna. The implementation of the resulting Pilot Study, and the subsequent published technical report that will follow the field study, is the basis for addressing all these concerns to the satisfaction of all stakeholders so that the full-scale project can be designed, constructed, and implemented according to the established criteria, guidance, and discharge limitations.

For these reasons, a pilot study is required. The pilot study is designated as *Sanitary Wastewater Reuse-Phase 1*. The construction of the 350,000 gpd full-scale system is designated as *Sanitary Wastewater Reuse-Phase 2*. The preliminary total project cost, at the writing of this document, is estimated at $1,500,000. The unique nature of the project, and the resulting limitations that will follow the study phase, dictate that the project cost be continually refined as additional information surfaces and guidance is supplied by the regulatory agencies.

2.0 SCOPE

The Pilot Study Phase is designed to provide background information and literature research, criteria for sizing of the full-scale treatment equipment, installation guides, and the actual testing of the proposed system to achieve the effluent discharge parameters that may be placed on the project should regulatory agency approval be granted.

Biological testing of the treated product has been identified as the prime objective of the study phase since public health and environmental impacts must be fully assessed prior to full-scale operation. The pilot plant equipment components will be evaluated relative to their ability to achieve reliable, uninterrupted, and guaranteed process performance. The effluent monitoring parameters and the effluent limits are to be generated in this infant phase of the project. The full-scale equipment needs will be determined and the project cost refined to account for the full-scale needs of the project.

A model golf course (fairway, tee and green) has already been constructed on the Riverhead treatment plant site by a landscaping company that does the actual landscaping for the Indian Island Golf Course. Every attempt has, and will be made, to mimic the full-scale project. This model area will be irrigated with the treated water using a scale modeled irrigation system, and the soils and plantings will be tested and evaluated throughout a 32 week period (March 15, 2004 – November 12, 2004). Circumstances may arise that either extends or decreases the test period, but will only be revised after approval by the Suffolk County Department of Health Services.

The Suffolk County Department of Parks has indicated that they will care for the pilot test area as they care for the golf course. The pilot area will be cut and fertilized on the same schedule, using the same equipment, with the same staff, as the golf course. The

staff will be making every attempt to duplicate the maintenance regime as they currently perform for the 18 hole course.

The pilot system will process up to 36 gallons per minute (gpm) of existing RAWTF effluent assuming that the RAWTF continues to produce a total nitrogen concentration of 10 mg/l or less. Current drinking water standards require that the total nitrogen concentration in the water be less than 10 mg/l for it to be allowed to be discharged to groundwater.

The test water will be diverted to the pilot plant via existing and new piping and pumps. Some of the equipment used to convey the side stream were designed and constructed into the Riverhead sewage treatment plant upgrade project, which started planning in 1998. The side stream will be pumped from the existing outfall chamber and conveyed to the first stage of the add-on system. The outfall chamber will be cleaned and disinfected before the pilot study starts.

The process that treats the RAWTF's effluent to the quality required for irrigation will incorporate three (3) different stages as discussed hereinafter. A schematic diagram of the pilot plant is provided as **Figure No. 1**. A hydraulic profile is provided as **Figure No. 2**. **Figure No. 3** provides a partial site plan of the Riverhead plant site that orients the reader to the physical site and shows the location of the pilot equipment relative to the existing facilities. **Appendix A** includes all the figures.

Manufacturer drawings and relevant additional information are appended to the Work Plan. This information supplements the technical content of this Work Plan.

2.1 Stage 1 - Cloth Media Filter

The first stage of the treatment system will consist of an Aqua-Disk Cloth Media Filter manufactured by Aqua-Aerobic Systems, Inc of Rockford, Illinois. The disc filter

removes particles above 10 microns (1/1,000 mm) in size and functions to protect downstream treatment units from fouling, which enhances the overall reliability of the treatment process to produce a consistent product. **Appendix B** includes technical information for this unit process.

2.1.1 Disk Filter Description

The AquaDisk filter is a gravity flow filtration device utilizing cloth media. The disk filter is utilized to reduce further the effluent solids from the Sequencing Batch Reactor (SBR) activated sludge system utilized at the RAWTF. The disk filter precedes the final filtration step provided by the membrane type filter described later.

The AquaDisk filter serves to reduce the solids loading to the membrane system, thereby increasing the hydraulic capacity of the membrane system. It produces a consistent product that then allows for the consistent operation of the membrane system by reducing the fouling, maintenance, and chemical requirements that the membrane system would incur without the disk filter. The disk filter also removes nutrients that are associated with the SBR biological solids.

The AquaDisk filter utilizes cloth media that incorporates a nominal 10 micron pore size to remove suspended solids and turbidity from the existing RAWTF SBR effluent. As the filter removes solids from the waste stream, a mat of solids builds up on the outside of the cloth disks. As the mat builds up, water elevation increases in the filter tank until the unit reaches a high water level, as sensed by a pressure transducer inside the tank. This mat is removed by utilizing the suction side of a backwash pump to "vacuum" the solids off the cloth. The backwash water represents approximately 3% of the forward flow of the unit. The backwash water is returned to the existing flow equalization tanks located downstream of the plant's headworks equipment.

The disk filter comes with an integral control panel with programmable logic controller (PLC). The unit operates in an automatic mode unless operator attention is required. Little operator intervention is required during the "AUTO" mode of operation.

2.1.2 Disk Filter Pilot Operation

Aqua-Aerobic Systems (AAS) will be supplying an AquaDisk model 12x1EPC filter unit with a capacity to treat up to 36 gpm. The unit will be supplied with one disk installed in the tank. The disk contains 12 square feet of filtration surface area. This equates to a filter surface loading rate of 3 gpm / sq. ft.

The pilot unit is supplied as a complete filtration system, including the tank, filtration media, a backwash pump, level sensing equipment, electric valves, influent pump, flow meter, influent piping, manual valves, and a control panel. The Riverhead Sewer District (District) will supply and install the electrical service to power the equipment and the piping to connect the filter to the rest of the pilot treatment system. A return line for the backwash water will be installed by AAS.

2.1.3 Testing Protocol

During the operation of the pilot plant various parameters will be measured to determine the effectiveness of the AquaDisk filter. An influent flow meter is provided which measures the wastewater flow to the unit. The plant operators will take samples of the filter influent and effluent and will monitor the unit to verify that the unit is operating properly. Routine maintenance will be provided as needed.

The filter influent and effluent will be tested for the following parameters:

1. Total Nitrogen
2. Phosphorus
3. Total Suspended Solids

4. COD
5. BOD
6. Coliform
7. Salinity
8. Total Dissolved Solids
9. Oil and Grease
10. Surfactants

AAS will supply a field technician to startup the pilot unit and train the District's staff on the operation of the unit. AAS will also monitor the filter operation remotely via modem from their factory in Rockford, Illinois. H2M will also be providing operational assistance during the entire pilot study phase. It is anticipated that SCDHS and NYSDEC will also be visiting the site to monitor the operation.

2.1.4 Electrical and Mechanical Requirements

The disk filter unit is shown on the drawings that accompany this Work Plan. The approximate dimensions are 86" high x 96-½" long x 76" wide.

- Electrical Requirements - Voltage: 460 VAC, 3-Phase, 60-hertz, 20-amp supply
- Water Connections: Influent – 3" Camlock, Effluent – 4" Camlock, Overflow – 4 Camlock, Backwash and reject water – 3" Camlock.

2.2 Stage 2 - Microfiltration and Ultrafiltration Pilot Unit

Stage 2 of the pilot treatment train filters the wastewater again using an Aqua-MB membrane system, marketed by Aqua-Aerobic Systems, Inc. and manufactured by Pall Water Processing of East Hills, New York. The pilot equipment can be operated as a microfiltration system or an ultrafiltration system by changing the membrane material.

The membrane material is the media which accomplishes the actual filtering. **Appendix C** includes technical information and manufacturer's drawings for the pilot unit.

2.2.1 Description

The pilot unit is Pall Corporation's 5" LGV Module test rig equipped with six 5-inch diameter by 80" long *microfiltration* modules. Only those modules necessary to process the pilot flow needs (up to 45 gpm) will be connected. The system also has the ability to accept two *ultrafiltration* modules. The unit operates automatically and accurately simulates the performance of a full-scale system. These types of units have been successfully used for long term continuous operation. It is fully equipped with automatic controls, data acquisition, and a modem for remote communications. A complete description of the pilot unit follows below.

The Pall Microza Multi-Station test rig is designed to demonstrate the efficiency and performance of the Pall Microza Hollow Fiber Membrane Filter as related to the Riverhead Wastewater Reuse Project.

The test rig is designed to produce micro/ultra filtered water and gather performance data to aid later design of full-scale filtration solutions. The rig is a self-contained, complete system, which is located downstream of the Disk Filter. The effluent from the Disk Filter discharges to a 1,200 gallon "break tank" and then pumped to the Pall unit. The test rig will deliver filtered product to the UV Disinfection stage as discussed hereinafter. The unit is designed to produce filtered water flows of up to approximately 45 gpm (depending on module selection).

Recommended flow rates for testing are determined by the module size and membrane type as well as the character of the filtration problem. Like Pall full-scale systems, the test system is automated and programmed to control all aspects of filter operation. Clean In Place (CIP) maintenance is operator-initiated with computer-aided cleaning functions.

The test system's controls provide the same full functionality and operator interface as the full-scale unit. The control system is a PLC/PC based controller with data logging, trend display graphs, and a remote monitoring modem connection for off-site Pall Technical Support. With this feature, Pall engineers will have access to view recent operation graphs, and if required, adjust operating parameters and the function of the pilot unit's computer. For example, the computer monitors and records trans-membrane pressure (TMP), flow rates, temperature, air scrub parameters (delivery pressure, flow rate and duration), turbidity and particle counts. All this information is available locally on the test rig and is simultaneously displayable at Pall's factory. This enables remote performance monitoring and Pall assisted optimization of operations.

2.2.2 Specifications

The summary of the unit's components is as follows:

- Filter Modules:

  Microfiltration - Hollow fiber PVDF membrane, 0.1 micron pore size, TMP ~2.5 bar, pH range 1-10 (operational), 6" diameter module supplying 538 square feet of membrane surface area

  Ultrafiltration - Hollow fiber PVDF membrane, 80,000 molecular weight cutoff, 5" diameter module supplying 441 square feet of membrane surface area

- Pre-filter: 304 SST bag filter housings with 400-micron polyester mesh bag filters.

- Feed Tank: 160 gallon, 304 Stainless Steel, flat bottom, closed top with hatch, manway, overflow, vent and stainless steel stand. Equipped with computer-managed fill system. Pressure type of level monitor/fill status. Optional 4KVA Immersion Heater for improved CIP performance.

- Reverse Filtration Tank: 160 gallon, 304 Stainless Steel, flat bottom, closed top with hatch, manway, overflow, vent and stainless steel stand. Equipped with computer-managed fill system.

- Chlorine Tank & Chemical Feed Pump: Blue White NOIR pump model T1506N (integrated with 7 Gallon Storage vessel), maximum flow rate - 3.1 oz. per minute.

- Piping:

  <1": Schedule 40, 316 SST, Threaded Schedule 80, PVC, solvent welded or threaded

  >1": Schedule 10, 316SST, butt welded or flanged Schedule 80, PVC, solvent welded or threaded

  Air piping: Stainless Steel tubing

- Pumps:

  Feed Pump - Gould's SST/4ST centrifugal, 316 SST, with 2 X 1.25" NPT connections, 5.0 hp, 3500rpm, 230/460 volts, 60 hertz, 3 phase inverter duty wash down motor, and ABB ACS-301 4P9-3 variable frequency drive.

  Reverse Filtration Pump - Gould's SST/4ST centrifugal, 316 SST, with 2 X 1.25" NPT connections, 5.0 hp, 3500rpm, 230/460 volts, 60 hertz, inverter duty wash down motor, and ABB ACS-301 4P9-3 variable frequency drive.

- Valves:

  Hand valves >1" - Keystone AR2 Series Butterfly with 316 SST disc & stem, EDPM liner, cast iron body, ten position handle

  Hand valves </=1' - SVF standard port lever handle, 3 piece 316 SS body, 316 SS ball & stem, Teflon seat and seals.

Automated valves - SVF standard port with lever handle, 3-piece 316 SST body, 316 SST ball & stem, TeflonTM seat & seals, pneumatic spring-return actuators with mechanical limit switches

- Air line: SVF 3-way automatic valve, ½" T7 6666-TT-Se 4 piece 316L body, 316 SST ball & stem, TeflonTM seat & seals

- Instrumentation:
  Level Switch (low) - Reverse Filtration Tanks Turck Euro Fast non-contact

  Level Transmitter - (Feed Tank level management, tank low indicator) – using Foxboro pressure transmitter #IGP10-A22C1F; 0-30 psi, 4-20 mA, 0.5" FPT

  Pressure Transmitters – Feed, Permeate, Excess Recirculation lines: Foxboro #IGP10-A22D1F; 0-300 psi, 4-20 mA, 0.5" FPT

  Temperature Transmitters - Pyromation RTD type.

  Influent and Effluent Flow Meters - Burkert Magnetic 426 522 G Sensor and union fitting, PVC, 150psi, 4-20 mA, 1.25 NPT

  Turbidimeter - Feed and Filtrate Continuous Sampling: (Qty 2) Hach 1720D.

  Particle Counter - Feed and Filtrate Continuous Sampling: (Qty 2): Met 1 PCX

- Air Preparation:
  GMD-5 Automatic Desiccant Dryer

  GEN OM 9520 AF Coalescing Filter

  GEN OM9220 PF Particulate Filter

  Numatics Flexi Blok 22 Series Regulators, pressure switch and final filter

- Controls: Allen Bradley SLC500 PLC with 6181 Industrial PC Interface running RSView 32; Housed in NEMA-4X enclosure

- Footprint Sizes:

  Pilot Unit: Operational 121" L x 68" W x 118" H
  Assembled 121" L x 46" W x 128" H on skid
  Air Compressor: 30" x 36" x 70"H
  Air Dryer: 31" x 9" x 32"H

- Weights:

  Pilot Unit: 2,500 lbs.(approx.)
  Air Compressor: 700 lbs.
  Air Dryer: 200 lbs.

2.2.3 Operating Parameters

Recommended operating parameters for this pilot test are based on previous pilot tests performed by Pall. Actual values will be determined at the time of testing. The following table summarizes the most probable operating parameters:

Table 1 - Operating Parameters for Microfiltration/Ultrafiltration Unit

Parameter	Expected Performance
Filtrate Turbidity (ntu)	0.03-0.04 NTU
Flux	TBD after Water Quality Review
Recovery	~95%
Transmembrane Pressure	7-45 psi
Reverse Filtration Frequency	15-30 min
Air Scrub Frequency	15-30 min
EFM Frequency	1-7 days (TBD)
CIP Cleaning Frequency	TBD

The pilot test report will provide the actual values derived from the pilot test.

2.2.4 System Recovery

The 5" LGV Module pilot rig is capable of producing up to 45 gpm of filtered water with an anticipated recovery of about 95%. The minimum recovery setpoint will be greater than 92%.

2.2.5 Process Start-up and Operator Supervision

Pall will provide technical support to ensure the success of this project. After unit delivery, a Pall field engineer will be on site to optimize system parameters and to provide operator training for two to five days. The initial Clean-In-Place (CIP) procedure will be performed by Pall. At that time, the procedure will be demonstrated to District's operators so that subsequent cleanings can be performed without Pall supervision.

2.3 Stage 3 - Ultraviolet Disinfection

The third stage of processing will be a second disinfection step. Both low-pressure mercury ultraviolet disinfection and pulsed xenon ultraviolet disinfection units will be evaluated side by side to determine the overall effectiveness of each component and the system.

2.3.1 Stage 3A - Mercury Vapor Ultraviolet Disinfection

The mercury vapor type ultraviolet disinfection system is manufactured by Trojan Technologies, Inc. of London, Ontario, Canada. The Trojan System UV3150K PTP™ contains one bank of three (3) modules in a stainless steel channel, each module holding two (2) UV lamps arranged horizontally. A power distribution center and three-inch PVC piping regime (with flow bypass) and flow meter are also supplied. The pilot unit's dimensions are 14'-2" x 4'-1" x 3'-8½" with an approximate weight 1,350 pounds. **Appendix D** includes technical information for this unit process.

At the proposed pilot plant flow of 36 gpm this system will provide a UV dose (third party bioassay validated) of approximately 125,000 μWs/cm2. Typical UV doses for reuse applications are in the range of 100,000 μWs/cm2 to 120,000 μWs/cm2.

UV Dose is calculated as follows: UV Dose = Intensity x Retention Time

The intensity in this equation represents the intensity provided by the system at the end of lamp life and also is corrected for quartz sleeve transmittance. Factors that affect the intensity are as follows: sleeve cleanliness, lamp age, power supply, water quality / hardness, and the treatment process upstream of the system.

Factors that affect the retention time are flow rate and the channel configuration where the system is installed.

Therefore, by decreasing the retention time, by increasing the flow rate, the UV dose provided by the system will be decreased. This will be necessary in order to provide the dose that will actually be required to achieve the desired level of disinfection. In order to obtain a useful dose – response curve, a number of different doses will be applied to the effluent to see what dose will actually provide the desired level of disinfection.

Fouling of the quartz sleeves will also affect the dose provided by the system. When the quartz sleeves become fouled, the amount of UV energy reaching the wastewater will be decreased. Provision must be made to ensure the quartz sleeves remain clean. The Town of Riverhead currently has an installed Trojan UV3000™ and they are familiar with the operation and maintenance of the Trojan equipment. Fouling depends on the interaction of hardness, pH, and temperature and is very hard to predict.

2.3.2 LightStream Xenon Pulsed Ultraviolet Disinfection

The Xenon Pulsed Ultraviolet Disinfection pilot unit is manufactured by LightStream Technologies, Inc. of Reston Virginia. These units are manufactured under ISO standards. The units also carry the UL®, CE and TÜV marks. LightStream LSi/LSx machines feature as standard a proprietary software program which enables the user to specify and program precise UV dose requirements as well as other UV process parameters. The precise data monitoring and display capabilities offered by the LSi/LSx units make it easier for the maintenance personnel to monitor the system for performance and compliance. The system is a chemical-free. The unit size is 1350 (53.2)" W x 1800 (70.9)" D x 2325 (91.6)" H and weighs 1660 kg (3,659 lbs.). **Appendix E** includes technical information for this unit process.

All equipment is self-contained in a stainless steel enclosure with a safety-interlocked service door and safety-interlocked service panel. The electrical input voltage is 380 to 500 VAC, 3-phase, 50/60 Hz with a maximum electrical input amperage of 65A at 380 VAC. Fail-safe UPS alarm, remote notification, and orderly shutdown are provided. Influent and effluent ports are 6" flanged connection. The unit is equipped with a communications link (Ethernet port). Gravity-fed non-potable water drain port via 1 ½" FNPT or 1 ½" ID hose nipple is provided.

The system is an ultra high-intensity UV process with a Guaranteed UV dose delivery via the Constant Optimum Dose™ (COD) methodology. Up to 99.9999% Bacterial Destruction (or 6-log reduction, as opposed to the 3-log reduction provided by conventional mercury-based, continuous-wave UV technology) can be achieved.

The disinfection is achieved with a single, non-fouling Xenon lamp. The control system is operated by a touch-screen control panel. The system has remote monitoring capabilities to diagnose and rectify any problem via remote access. The flow capacity is

up to 160m3/hr (1 MGD) optimized to the application. The unit is "plug and play" with disinfection achieved by Pulsed Ultraviolet Light (PUV) within a closed vessel. The lamp system is one Xenon flash lamp.

The operation is fully automated to provide a Constant Optimum Dose (COD™ in discrete pulses, 1 Hz to 30 Hz within real time. The average power usage is 2400 Watts UV-C (maximum) with a peak power of 6,000,000 Watts UV-C per pulse. Bulb replacement is performed with cassette changes and bulb cleaning is not required.

Since wastewater stream contains waste content, the quality of the wastewater is a very important consideration in applying UV technology. For the purpose of UV treatment, wastewater quality is determined through testing for its UV transmittance. UV transmittance is the measure of the ability of a fluid medium to transmit UV light through the medium. Naturally then, the greater the amount of UV-absorbing material (such as turbidity, TDS, suspended solids, colloidal matter, color/organics, metals, etc.) present in the water - and hence the more inferior the quality of the water - the lower is the UV transmittance value. When a light beam is shone through a medium, depending upon the degree of contamination present, part of the incident light is absorbed and the rest gets transmitted across. Contaminants such as color, total organic carbon, suspended solids (TSS), total dissolved solids (TDS), metals (especially iron and manganese), etc. are all excellent absorbers of UV radiation and would contribute toward decreasing the UV transmittance value.

While filtration of the sample will enhance the UV transmittance value of the sample (since filtration will remove some or most of the suspended matter present in the water), the degree of improvement in the transmittance value will greatly depend upon the levels of contamination present. LightStream uses the term T10 to express the degree of UV absorption of a fluid sample, which is used to compute the UV dose required for a

particular application. The T10 value can be determined using a freshly-calibrated UV-Visible spectrophotometer at the 254nm wavelength. Double-distilled water is typically used to calibrate the spectrophotometer. T10 represents the percentage transmittance through a 10 mm path length test-cell of the spectrophotometer and the test is usually performed at the 254nm wavelength, since the 254 nm is the 'Germicidal wavelength'. To put the concept of transmittance and T10 in perspective, a typical tap-water sample exhibits a T10 value of anywhere from 90 to 95%.

LightStream's LS units are specifically designed for the disinfection of treated wastewater. Even wastewater streams exhibiting low levels of UV transmittance can be successfully disinfected using LightStream's ultra high-intensity pulsed UV technology. The control system featured in a LightStream unit includes precise measurement of the UV transmittance as well as dose measurement hardware & software.

2.4 Miscellaneous and Ancillary Components

For the Riverhead Wastewater Reuse project, both system and individual equipment performances will be analyzed. The evaluations will be based upon criteria established hereinafter.

The evaluations will begin with microbiological evaluations of the existing treated effluent. This will be followed by microbial challenge studies of the systems and individual treatment units using novel microorganisms to characterize the efficiency of the piloted equipment both as individual units and as a system. Based upon the results of these challenge tests, equipment will be selected for the full-scale program. A 1,200-gallon "Break Tank" will be provided by the Town and will be installed between the Aqua Cloth Filter and the Pall Micro/Ultra filter. This will provide for flow control between the individual system components. The pilot equipment will be located on the paved roadway just west of the trickling filter tanks and south of the brick office/lab

building. The Town will construct a 40-foot by 18-foot tent with side walls around the pilot equipment.

Sufficient treated water from the pilot system will be stored in the two (2) existing abandoned trickling filter tanks and in seven (7) temporary storage tanks (swimming pools) to be purchased and installed by the Town. The trickling filter tanks are each 50 feet in diameter and 6.5 feet deep. They each have a volume of 95,465 gallons. The temporary tanks are oval shaped and sized at 33 feet long by 18 feet wide by 4 feet deep. These tanks have a storage volume of 15,690 gallons each. The total storage volume is 300,775 gallons. The temporary storage tanks will be located west of the trickling filter tanks along the west property line of the wastewater treatment plant site. All tanks will be covered to prevent algae growth, evaporation and air contamination. The Town will use a submersible pump (Grainger Item No. 3P639, 1/3 HP) to remove any accumulated rain water from the tank covers. The treated and stored water will be used as irrigation water for the model golf course over the remainder of the irrigation season. The irrigation system was designed and installed to mimic the performance of the system used by Suffolk County on the Indian Island Golf Course. The calculated irrigation rate on the golf course is 0.25 inches per day. This equates to a required volume of 244,350 gallons for the model area. Storage of 300,000 gallons will provide a 23% factor of safety if additional water is required to flush any accumulated salt deposits from the turf root systems or if water is lost due to conditions beyond control.

As the water is depleted from the trickling filter tanks, a temporary submersible pump (Grainger Item No. 1N193, Meyers Model ME50S-11, ½ HP) will be used to transfer water from the temporary storage tanks to replenish the tank system volume. A water booster pump will be installed adjacent to the Trickling Filter Tank No. 1. The 2 inch suction pipe will be installed into the tank sump and the 1-1/2 inch supply pipe will be connected to the existing 1 inch sprinkler system supply pipe. The connection will be

provided with double check valves, a pressure gauge, flow meter, gate shut-off valves and a globe valve. The water volume, pressure and durations will be regulated to match the golf course system.

Cornell Cooperative Services will be providing the testing and evaluation of the irrigated model golf course plantings. At the end of the study period, a report will be prepared and submitted to all regulatory agencies for approval. A design for the Phase 2 system will be initiated.

3.0 Wastewater Reclamation

Of the 1,357,506,000 km3 of water on the planet, only 0.65% (8,506,000 km3) is available as fresh water on land or in the air. Approximately 97.5 % of all fresh water is below ground.[1] The need to reuse water for beneficial purposes has been adopted throughout the world. Water must not be wasted!

In the warmer climates of the United States, fresh water is becoming very scarce. Water managers in 36 states are expecting water shortages in localities, regions, or statewide within the next ten (10) years.[2]

Water shortages make direct impacts on the economy, environment and society. As noted on the "Exhibit – 1" map, many areas of the continental United States have severe water shortage problems. Population growth is straining already limited facilities and availability. By the year 2025, eleven geographical areas have been identified as being highly likely to have conflicts over water. In fact, it is predicted that New York State will be among eighteen (18) states that will experience local water shortages within the next ten (10) years.[3]

Wastewater reclamation projects have been undertaken in many states. California, Florida, Texas, Arizona and South Carolina have the most projects. California is leading the way with wastewater reclamation. They have been involved in water conservation for the past 50 years. In 1969, the Porter-Cologne Act passed by the California Legislature declared its intent to "undertake all possible steps to encourage development of water recycling facilities". The California Department of Health Services established water quality standards and treatment reliability criteria for water

[1] Doxiadis, CA, 1967, Water and Environment, International Conference on Water for Peace, Washington, DC
[2] United States General Accounting Office, July 2003, Freshwater Supply – State's Views of How Federal Agencies Could Help Them Meet the Challenges of Expected Shortages

recycling under Title 22, Chapter 4, of the California Code of Regulations. With the adoption of a support resolution from the United States Environmental Protection Agency (EPA), Region 9; the California Water Resources Control Board; the California Department of Water Resources; the California Department of Health Services; the California Conference of Directors of Environmental Health; the United States Bureau of Reclamation; and the Water Reuse Association of California in 1994, these agencies affirmed their support for the pursuit and development of federal, state and local water reclamation policies and regulations that will reduce constraints and promote water reclamation projects in California. Water reuse in California is projected to achieve a level of production of 1,300,000 acre-feet by the year 2010.[4]

In Suffolk County, this is the first proposed water reclamation project. It is initiated by the conditions of the Peconic Estuary Program, rather than by a lack of water. The benefits from this program extend past the Peconic Estuary and nitrogen loading. As noted above, severe water shortages may change the water supply conditions that we now take for granted. At the present time, the golf course is irrigated from on-site wells. This procedure is bound to affect the salt water/clean water boundary. Over time, intrusion of salt water will be a problem. Irrigation with potable water from the local municipal systems is already too expensive and puts a stress on the existing facilities. Projected population increases throughout Suffolk County will make potable water supplies an issue. It is the Town of Riverhead's belief that now is the time for a local community to take the lead in water conservation to plan and be prepared before it is critical. This project will be a model for other areas when the time for action comes.

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[3] Ibid
[4] WateReuse Association – Statement of Support for Water Reclamation

TOWN OF RIVERHEAD / RIVERHEAD SEWER DISTRICT
ADVANCED WASTWATER TREATMENT FACILITY - EFFLUENT REUSE
SUFFOLK COUNTY INDIAN ISLAND GOLF COURSE IRRIGATION
WORK PLAN

Upon recommendations from the SCDHS, The Town of Riverhead contracted with Scientific Methods, Inc. to work on the Pilot Study. Testing will be performed on the existing wastewater, the advanced treated water, aerosol dispersions, soils and plantings as presented below.

4.0 BIOLOGICAL TESTING

The performance of the pilot plant as it relates to removals of indicator microorganisms and pathogens will be evaluated using a four-tiered approach: (1) microbial densities in the secondary effluent feeding the pilot treatment system will be determined to establish a reference baseline, (2) treated effluent from the pilot system will be monitored for indicator microorganisms (E. coli, total coliforms, heterotrophic bacteria, bacterial viruses and spore-forming bacteria) and pathogenic microorganisms (Cryptosporidium, Giardia, culturable viruses) to determine the quality of the finished effluent and to assess its appropriateness for golf course irrigation, (3) a microbial challenge study will be conducted to determine the precise removals of specific viral and bacterial surrogates through the unit treatment processes within the pilot system, and (4) upon activation of the model sprinkler system using treated effluent, bioaerosols within the sprinkler zone will be sampled to characterize the occurrence of relevant microorganisms in the air environment surrounding the irrigated test plot.

Preliminary microbiological testing will begin with baseline monitoring of the secondary effluent to identify the types and densities of indigenous microorganisms upstream of the pilot treatment system. USEPA methods will be employed to quantify pathogenic bacteria such as salmonella and shigella, and the densities of indicator bacteria will also be measured (heterotrophic bacteria, total aerobic spores, total coliforms and E. coli). Background levels of the pathogenic protozoan parasites Giardia and Cryptosporidium will be determined by collecting 15 liter volumes of the secondary effluent and transporting them in insulated coolers via overnight courier to the central analytic laboratory of SMI for quantitative analyses using USEPA Method 1623 modified for wastewater analyses. Total culturable viruses will be enumerated by collecting large volume samples (10-25 liter volumes) and filtering them through charge-modified

fiberglas filters (1MDS Virosorb). Filters will be transported to the analytic laboratory, eluted and subjected to cell culture assay using a most probable number (MPN) format to quantify culturable viruses. Bacterial virus (coliphage) densities will be measured from grab samples according to USEPA Method 1602. Data derived from the enumerative assays for the selected microorganisms will be used to establish a frame of reference for the microbial loading in the effluent that is currently subjected to UV disinfection before release into the Peconic Bay.

Once the pilot plant is operational, treated effluent will be monitored for a number of the microorganisms described above, including indicator microorganisms such as total coliform bacteria, E. coli and bacterial viruses, and pathogens such as the culturable viruses, select enteric bacteria, and the protozoans Cryptosporidium and Giardia. The rationale for including indicator microorganisms in the study is based upon their utility for assessing the performance of specific treatment processes within the pilot system using rapid, precise and economical analytical methods and due to the fact that it will not be feasible to determine the densities of all of the enteric microorganisms following each piloted treatment process. However, because indicator microorganisms can provide only limited predictive information on the removal of pathogens such as hepatitis A virus and certain parasitic protozoa, the monitoring program will include testing to identify the levels of specific pathogens. Pathogens will be monitored to ensure that the quality of the finished effluent is consistent with its intended purpose of golf course irrigation.

The third study phase will include microbial challenge studies in order to characterize the performance of the system and its unit processes without the restrictions of low concentrations of indigenous microorganisms typical of secondary effluent. Although the proposed expansion of the existing treatment plant will include additional filtration and disinfection that should be capable of achieving greater than 99% (>2.0 log10) microbial removals, it may not be possible to demonstrate actual removals of that magnitude in the

absence of relatively high indigenous levels of microorganisms (it is possible that microorganisms may be reduced to levels near the detection limits of the analytic assays before appreciable removals are demonstrated). Hence, the pilot study will include an experimental series where test microorganisms will be seeded into the effluent upstream of the piloted treatment systems. Test microorganisms will be introduced upstream of each unit process after the system reaches a steady state performance condition where influent and effluent particle concentrations are essentially stabilized. The microbial feed will be maintained for a time period determined by performing a tracer study to ensure that steady state conditions are achieved with respect to the concentration of test microorganisms within the system. Once steady state conditions are achieved, grab samples will be collected upstream and downstream of each unit process and transported in insulated shipping coolers to the analytic laboratory. Microbial densities in the influent and effluent samples will be derived from the results of the enumerative assays, normalized to standard volumes, and used to derive removal or inactivation rates as appropriate (e.g. removal rates will be computed for the filtration systems and inactivation rates will be computed for the disinfection components of the pilot system).

The fourth phase of the study plan will include limited bioaerosol sampling to identify the ambient airborne concentration of relevant microorganisms (e.g. enteric microorganisms that may be associated with respiratory infections, such as the adenovirus family). Although a comprehensive characterization of the distribution of microorganisms in the air surrounding the test plot is not feasible in the practical context of time and economy, air sampling will make it possible to characterize the approximate concentrations of select microorganisms that can be used to model the airborne route of disease transmission. Test analytes for air sampling may include enteric adenoviruses, culturable enteric viruses and E. coli.

4.1 Sample Collection

Sample collection for the indicator and pathogen monitoring component of the study will involve collection of medium volume (~500 mL) and large volume (5 L – 25 L) samples from the finished effluent released by the pilot plant just after final UV disinfection. For bacterial and coliphage sampling, 500 mL volume grab samples will be collected manually into sterile polypropylene sample bottles, stored in insulated coolers at 2-10oC using gel packs or wet ice, and transported to SMI's analytic laboratory for assay within 24 hours of receipt. Large volume samples will be collected for parasitic protozoa (Cryptosporidium and Giardia) and enteric virus testing. These samples will be subjected either to filtration/elution methods to recover pathogens for enumerative assay, or will be subjected to USEPA-approved methods for pathogen detection modified for application to waste water. Pathogenic protozoa will be tested according to USEPA method 1623 using continuous flow centrifugation as the sample concentration technique (15 liter volumes will be collected for each sample). Culturable enteric viruses will be tested according to the filtration/elution method approved by the USEPA for the 1996 Information Collection Rule using positively charged pleated cartridge filters. The method has been adapted for use with wastewater samples by the SMI research team.

4.2 Microbial Challenge Study

For the microbial challenge study test microorganisms will be propagated and purified to high concentration at the central research laboratory of Scientific Methods, Inc. Test microorganisms will include model bacteria (e.g. E. coli) and bacterial viruses (e.g. male-specific coliphage MS-2). Bacterial and coliphage cultures will be enumerated and then shipped to the Riverhead AWTF for challenge studies for the week of study. All shipments will include a trip control sample that will be returned to the laboratory upon

receipt and assayed immediately to confirm the stability of the test microorganisms prior to use in the pilot facility.

For the challenge studies, test cultures will be pumped into the effluent following secondary (biological) treatment. Adequate mixing of the test microorganisms in the bulk effluent will be assured by installing baffles in the tank upstream of the pilot systems. Mixing will ensure uniformity of microorganisms throughout the bulk effluent and an initial 1000 mL sample will be collected to establish a baseline after suitable time has elapsed to ensure that steady state microbial dynamics are achieved (or a close approximation thereof). Feed rates will be maintained for a period of time determined by an initial tracer study using sodium chloride and conductivity testing to characterize the hydraulic profile of the system. Once steady state equilibria are achieved with respect to microbial densities, grab samples will be collected upstream and just after the cloth filtration unit, downstream of the micro- or ultra-filtration units, and following each UV disinfection unit. At least three paired samples (prior to treatment and following treatment) will be collected for each challenge trial so that sampling variability and analytic variability can be assessed. Samples will be promptly transferred to insulated coolers with ice packs or wet ice and transported to the analytic laboratory using overnight express courier for immediate analyses. Upon receipt by the analytic laboratory, samples will be subjected to serial ten-fold dilutions and subjected to either bacterial assay or coliphage assay using triplicate plates per dilution (minimum of two samples per test condition). Following assay, microbial reductions will be computed by computing the logarithmic transformation of the ratio of effluent (Nt) and influent (No) microbial concentrations (log10 Nt/No). Transport controls will also be evaluated to ensure the microbiological stability of samples during shipping. Test microorganisms will be maintained on-site for no more than 10 days before use and will be replenished as appropriate.

4.3 Air Sampling

When the pilot systems are operational, bioaerosols will be sampled periodically from the test plot using glass impinger devices, with transfer of microorganisms from the ambient air directly to the collection/transport buffer. Impinger stations will be set up in duplicate and will be operated during at least two separate sprinkler cycles, with a sampling duration of 15-20 minutes. Sampling stations will be located at least 20 feet from the sprinkler heads, with specific locations determined based upon an assessment of the sprinkler spray patterns. The location of sampling stations will also consider the prevailing wind on the day of sampling, so as to ensure that impingers are not located within a 'dry zone'. Promptly following collection, buffers from the impinger bottles will be transferred to sterile polypropylene storage bottles and shipped on ice to the analytic laboratory for viral and bacterial analyses. Analytic procedures will follow the same methods described previously for enteric viruses and bacteria, with the exception of the enteric adenoviruses. In the case that testing is requested for this class of respiratory pathogens, samples will be subjected to a nucleic acid-based detection strategy that is capable of determining the presence of adenovirus DNA in water samples. The technique involves the use of the polymerase chain reaction™ for the visualization of viral DNA, with results expressed in a presence/absence format.

In the case that the results of the total culturable virus assays indicate measurable levels of culturable enteric viruses in the air stream when the sprinkler system is engaged, an additional sampling series will be scheduled to identify the time at which microorganisms can no longer be detected in the air stream following the end of the morning sprinkler cycle. Because the total culturable virus assay requires a minimum of two weeks of incubation for each sample concentrate and the pilot study is restricted to a one month period, it will be possible to perform this repeat testing only once.

5.0 PILOT TREATMENT SYSTEM

Figure No. 1 located in **Appendix A** presents a schematic of the pilot treatment system. This section of the Work Plan fits the system components and provides the technical data relative to the treatment train. Some of the information presented in **Section 2** has been repeated for ease of presentation and to summarize the treatment system.

5.1 Stage 1 – Cloth Media Filtration

Aqua-Aerobics Systems, Inc. will be supplying the equipment for the first stage of the advanced effluent treatment system. The Aquadisk Filter Model ADFP-12x2E-PC pile cloth media (10 micron) filter unit will be used to pre-filter the effluent before micro or ultra filtration. The unit has a footprint size of approximately 75 inches x 96 inches and is approximately 85 inches high. It is a complete system that includes internal piping, two (2) cloth disks, 2 HP waste pump, 2-inch electric backwash valve, 2-inch electric sludge valve, other miscellaneous valves and a control panel. It will be necessary for the District to supply and install the interconnecting external piping and the electric service. The pilot equipment will be housed in a tent like structure.

The filter can process up to 250 gallons per minute (gpm). The flow will be regulated to match the hydraulic limitations of the downstream units. The typical effluent quality of <5.0 mg/l TSS and effluent turbidity of less than 2 NTU (regardless of the influent turbidity) is expected. Backwash is initiated automatically while filtration continues. See **Appendix B** for additional information.

5.2 Stage 2A - Microfiltration

Aqua-Aerobics Systems, Inc. will also be supplying the equipment for the microfiltration process. The system is identified as the Aqua-MB Process with the filtration system as

manufactured by the Pall Corporation. The Pilot Test Rig is self-contained and comes complete. The unit has a footprint size of 102 inches x 35 inches and is 127 inches high. The unit has a 30-gallon feed tank, feed pump, flow meters, associated valves and a control panel. It will be necessary for the District to supply the external piping and the electric service. The unit will be covered as previously discussed.

This unit will process up to 45 gpm. The media pore size is 0.1 microns with the effluent turbidity expected to be less than 0.2 NTU.

5.3 Stage 2B - Ultra-filtration

The above system will be converted in the field to a ultrafiltration process. The system will be the same equipment as used above with a change to the smaller pore size filter media. This unit will also process up to 45 gpm. The media pore size is 0.01 microns with the effluent turbidity expected to be <0.2 NTU. The same challenge testing will be performed using this filter media.

5.4 Stage 3A – Ultraviolet Disinfection (Low Pressure, Mercury Vapor)

The final process stage is disinfection. Trojan will supply their model UV3150K PTP Packaged Ultraviolet System. This is a self-contained unit constructed of stainless steel. It has an influent box, 175 watt low pressure lamps mounted in a rack, self cleaning assembly, effluent box with weir and power/control/monitoring panel. The unit is 84" long, 12" wide and 20" high. The system will process up to 35 gpm. At a flow rate of 50,000 GPD and a TSS of 15 mg/l, the system is expected to meet a disinfection limit of 200 fecal coliforms per 100 ml. Our flow rate will be 36,000 GPD with a TSS <2 mg/l. The performance is expected to be exceeded because of the high quality influent flow stream.

5.5 Stage 3B – Ultraviolet Disinfection (Pulsed, High Intensity Xenon)

LightStream Technologies, Inc. will provide their LSi Pulsed Ultraviolet Disinfection System that will run in parallel with the Trojan system and will be challenge tested using the same test procedures. This is a stainless steel, self-contained unit. It has one (1) xenon, water-cooled bulb. The unit is a closed pumped system with computerized control that monitors UV transmittance and adjusts the dosage to provide the designated results. The unit can handle up to 1 MGD. Coordination, installation, operation and maintenance of the process equipment will be provided by the District. Mechanical piping connections for process, re-circulation and discharge waters are required.

6.0 PILOT STUDY PROCEDURES AND EXPECTATIONS

The following work is required to perform the pilot study:

- Sample and test the plant effluent for: total nitrogen, ammonia, organic nitrogen, nitrate, nitrite, phosphorus, total suspended solids, COD, BOD-5, total and fecal coliform, total salinity, total dissolved solids, oil & grease, surfactants, bacterial viruses, total aerobic spores, Cryptosporidium and Giardia, and total culturable viruses.

- A 70 foot by 100 foot area at the Riverhead AWTF site was "developed" as a typical golf course irrigation site, generally consisting of the grass species as used by Suffolk County on their tees, fairways, and greens, shrubs, and landscaping typical of the golf course plantings. An irrigation system scaled from the golf course system was installed.

- Install a pump system in the outfall chamber and side-stream approximately 36 gpm to the pilot treatment system.

- Treated effluent will be stored in significant volumes within the existing abandoned trickling filter tanks and 7 covered swimming pools prior to irrigation. Water quality will be monitored during storage (i.e. preventing growth of algae that may be associated with odor control problems and that may contribute to clogging of sprinkler systems). Characterization of the microbial reductions that occur during storage of the treated effluent will be performed so that the public health implications on spray irrigation practices can be precisely evaluated.

- Install a pump, timer, piping and sprinkler(s) to irrigate the test area at a rate to typify the irrigation program of the golf course system, (i.e. gpd per acre).

- The Indian Island Golf Course staff crew will fertilize, cut and aerate the pilot test area on the same schedule as used on the golf course.

- Prior to planting, measure soil pH and electrical conductivity to obtain base line information. On a weekly basis also test the soil for pH and electrical conductivity.

- Make daily visual observations of the condition of the plantings and record rainfall and temperature data.

- Develop a schedule for over-watering to leach soluble salts from the root areas of the plantings.

- Because control of enteric viruses may present a unique challenge during wastewater treatment, virus testing or testing of virus surrogates prior to and following UV disinfection will be provided. Pilot-scale treatment processes will be implemented as part of a staged process so that alternative treatments can be integrated based on preliminary findings.

- Bioaerosol sampling stations will be used to collect samples during spray irrigation practice to determine if measurable levels of airborne pathogens are present.

- Supporting information will be provided to the Suffolk County Dept of Health Services to characterize the public health impact of effluent reuse practices and the benefits of water reuse. Outreach services will include provision of supporting literature and interpretive assistance to justify the selection of the

targeted treatment processes. An environmental microbiologist will be available for stakeholder meetings with local residents and representatives from the regulatory community and will provide informational materials for distribution to stakeholders to illustrate successful water reuse projects in other communities.

- Because of the concerns surrounding the potential for aerosolization of microorganisms during spray irrigation, monitoring of airborne pollutants from bioaerosols generated by the sprinkler irrigation system will be conducted. Establishment of air sampling stations will be made for collection of air samples (1) prior to implementation of effluent irrigation practices to establish a baseline level of pollutants and (2) following implementation of the pilot, so that direct comparisons can be made to assess the public health implications of spray irrigation practices.

- The results of the study will be published for county and state review. The study will be used to evaluate the viability of installing a full-scale installation capable of providing 350,000 GPD of plant effluent for irrigation on the golf course. The existing trickling filter tanks may be modified for increased capacity and used to store the plant effluent for discharge during non-golfing hours.

7.0 REGULATORY APPROVAL

The major concern of the Suffolk County Department of Health Services is waterborne disease outbreaks caused by bacteria and viruses in the treated wastewater. Their involvement and approval of this study is necessary in order to progress to the full-scale use of effluent irrigation.

New York State Department of Environmental Conservation approval will also be required.

Due to the pioneering nature of this program, many issues need to be addressed prior to a full-scale program. The most important issues relate to the protection of the workers and general public and establishing the effluent limitations. Other program issues that will be addressed within the scope of this study include:

1. Documentation that ultraviolet disinfection after filtration meets the effluent limitations.
2. Establish frequency and type of sampling to be required by the regulatory agencies.
3. Determine if any wetlands or drinking water wells are located near the golf course.
4. Design an ultraviolet disinfection system to insure pathogen destruction to the required limits at full-scale flows.
5. Establish a Scope of Work for a full scale system to address/include:
6. Will a design report be necessary for the full scale project or can the results of the published pilot study be considered as the report?

7. What golf course modifications and additions may be necessary to protect the workers and general public? Will it include signs, protective drinking fountain covers, irrigation time restrictions, and notation on the scorecards?
8. Does the golf course contain any areas where ponding is a problem, thus increasing the chances of direct human contact to the effluent?
9. How should the program results be shared with the public?
10. This Work Plan is a continuing work in progress and will be updated and issued from time to time as a method of informing the project team of recent developments.

A: EPB | PM: FMR | LSB: FMR |
LSD: 2/6/2004 10:41 AM | LPD: 2/6/2004 10:41 AM | 6 FEBRUARY 2004| R#: 4 | P: 38 |
P:\RDSD\RDSD 03-04 WASTEWATER REUSE PILOT STUDY\DRAFT WORK PLAN\DRAFT WORK PLAN_06 FINAL.DOC |
WASTEWATER REUSE WORK PLAN | RDSD 03-04 |

Appendix A

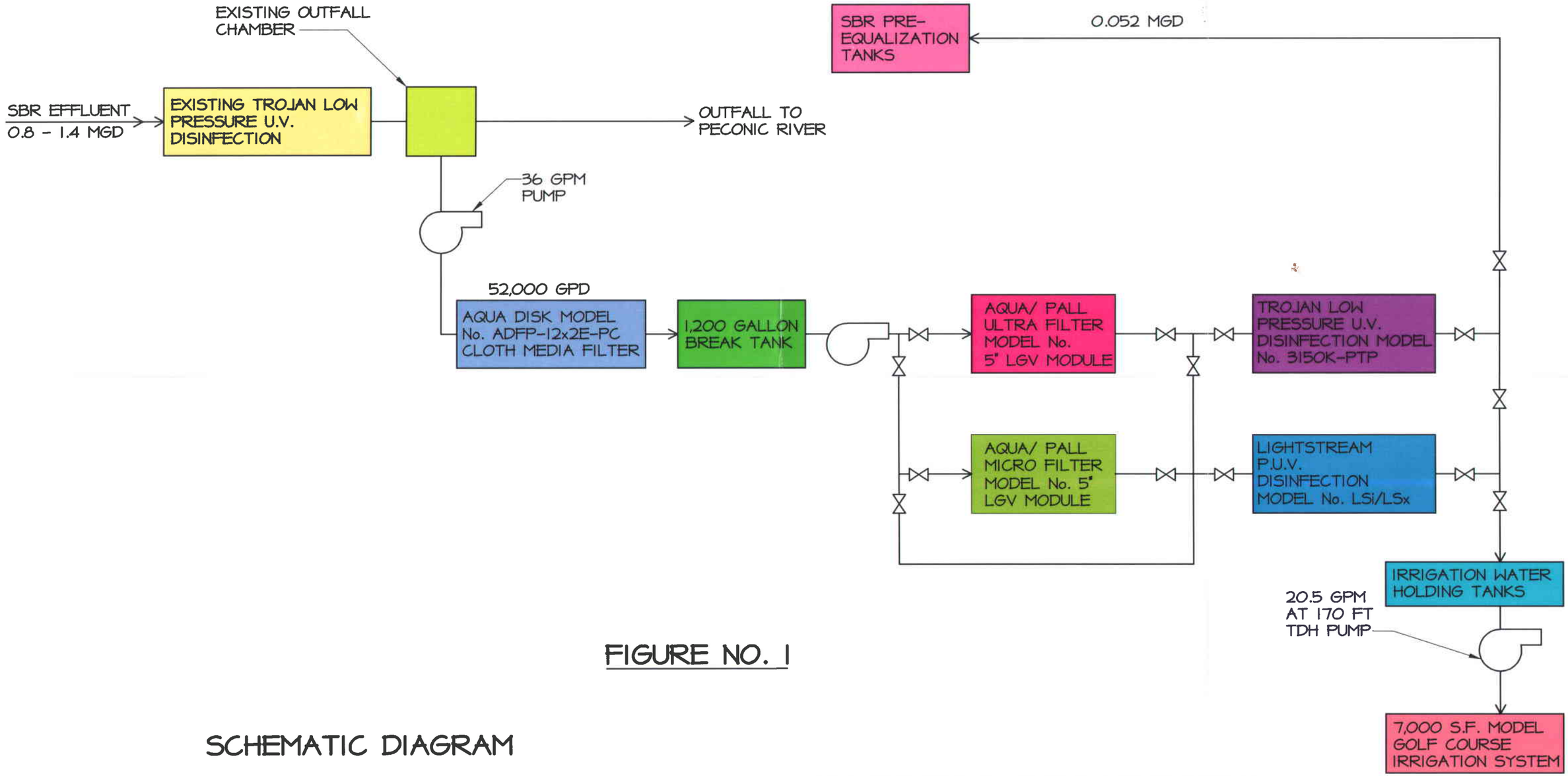
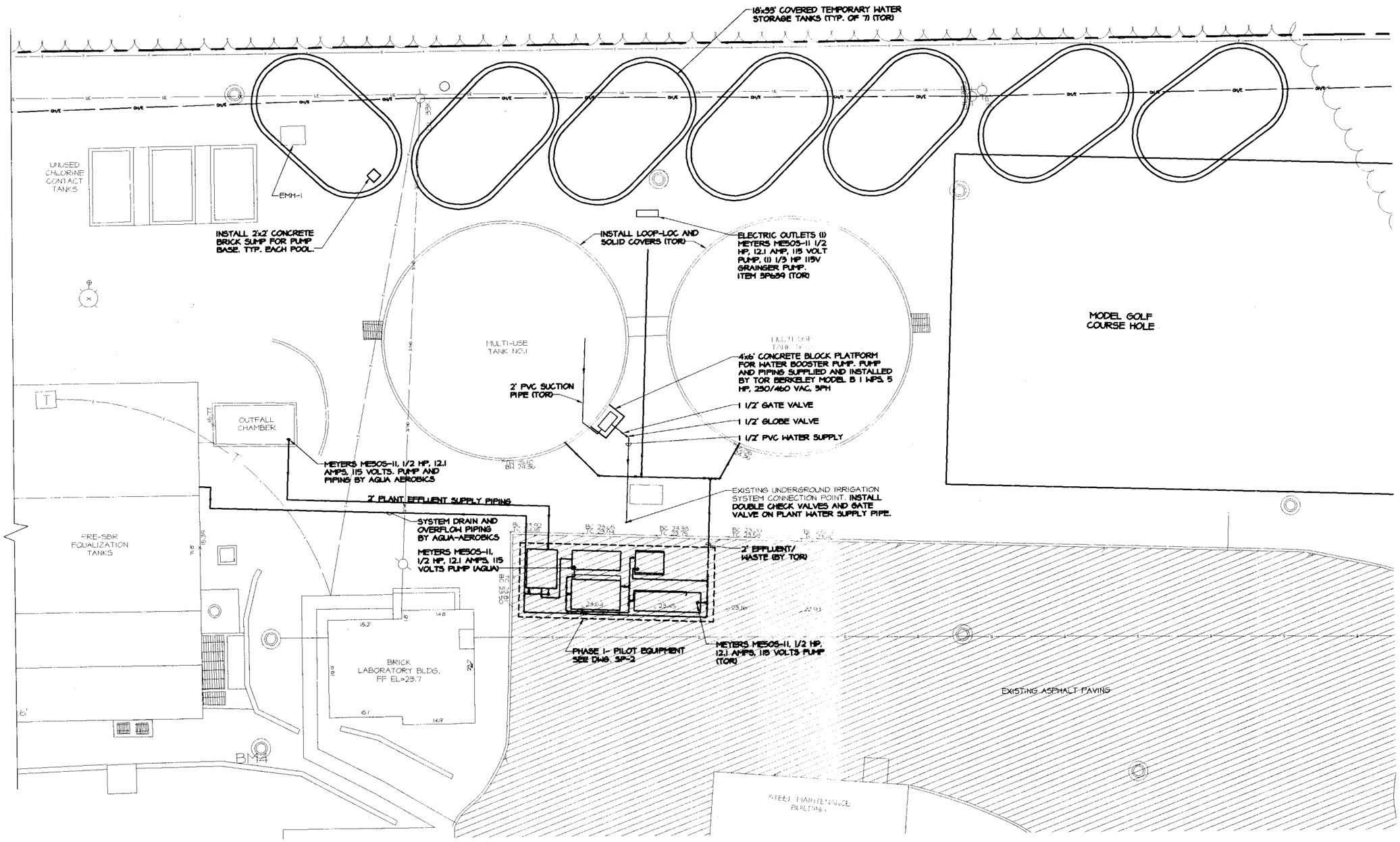


FIGURE NO. 1

SCHEMATIC DIAGRAM

TOWN OF RIVERHEAD - RIVERHEAD SEWER DISTRICT
WASTEWATER REUSE - PHASE I
ON-SITE IMPLEMENTATION

H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.



PARTIAL SITE PLAN
NO SCALE

FIGURE NO. 3

LEGEND:

- EXISTING PAVEMENT
- MANHOLE
- DRAINAGE BASIN
- LIGHT POLE (BY OTHERS)
- (EMH) ☐ ELECTRICAL MANHOLE
- ---- 16'x40' TENT PROVIDED BY TOR

H2MGROUP
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MELVILLE, N.Y. (631)-755-8000 ■
TOTOWA, N.J. (973)-942-0700 ☐

MARK	DATE	DESCRIPTION
1	11-24-03	SETUP DRAWING

ISSUE:	
PROJECT NO:	RDSD 0304
DATE:	FEBRUARY 2004
CAD DWG FILE:	RDSD_0304-SP-1-SITE.dwg
XREF DWG FILE:	XR_SITE.dwg
SCALE:	AS SHOWN
FILE LOCATION:	
DESIGNED BY:	EPB
DRAWN BY:	DP
CHECKED BY:	
REVIEWED BY:	

RIVERHEAD SEWER DISTRICT

WASTEWATER REUSE PHASE I ON-SITE IMPLEMENTATION

CONTRACT

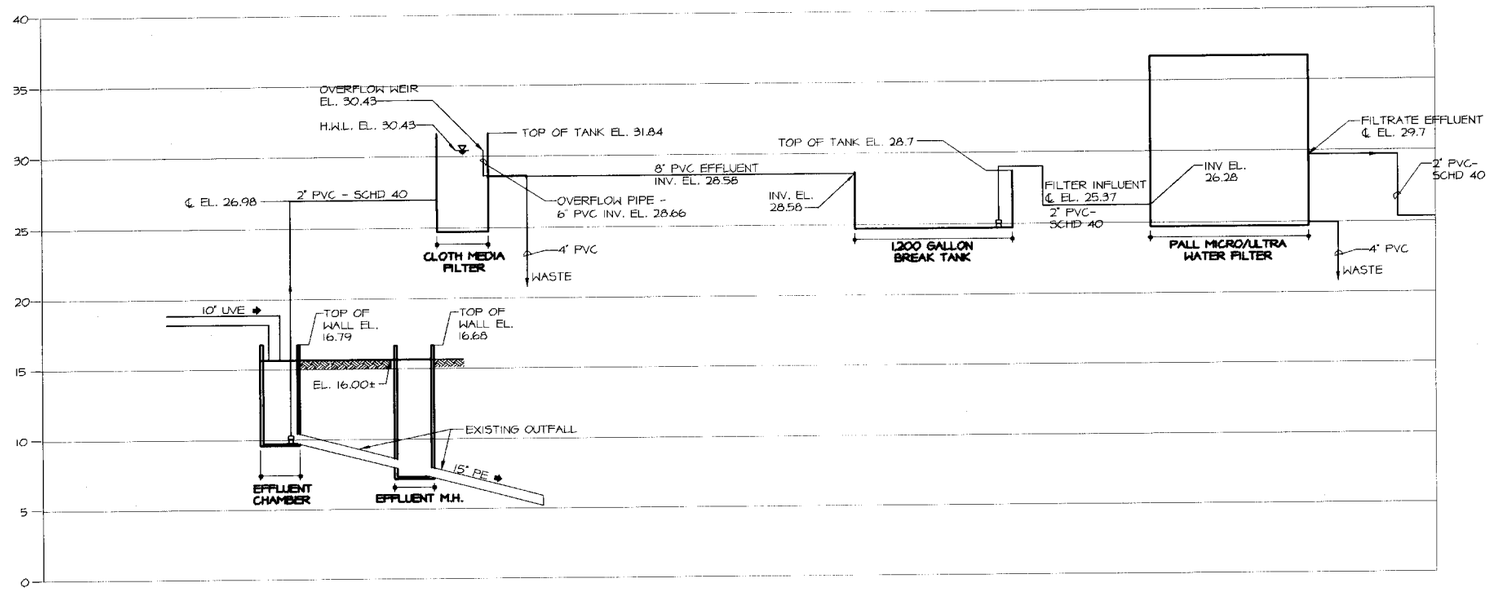
PILOT STUDY CONSTRUCTION

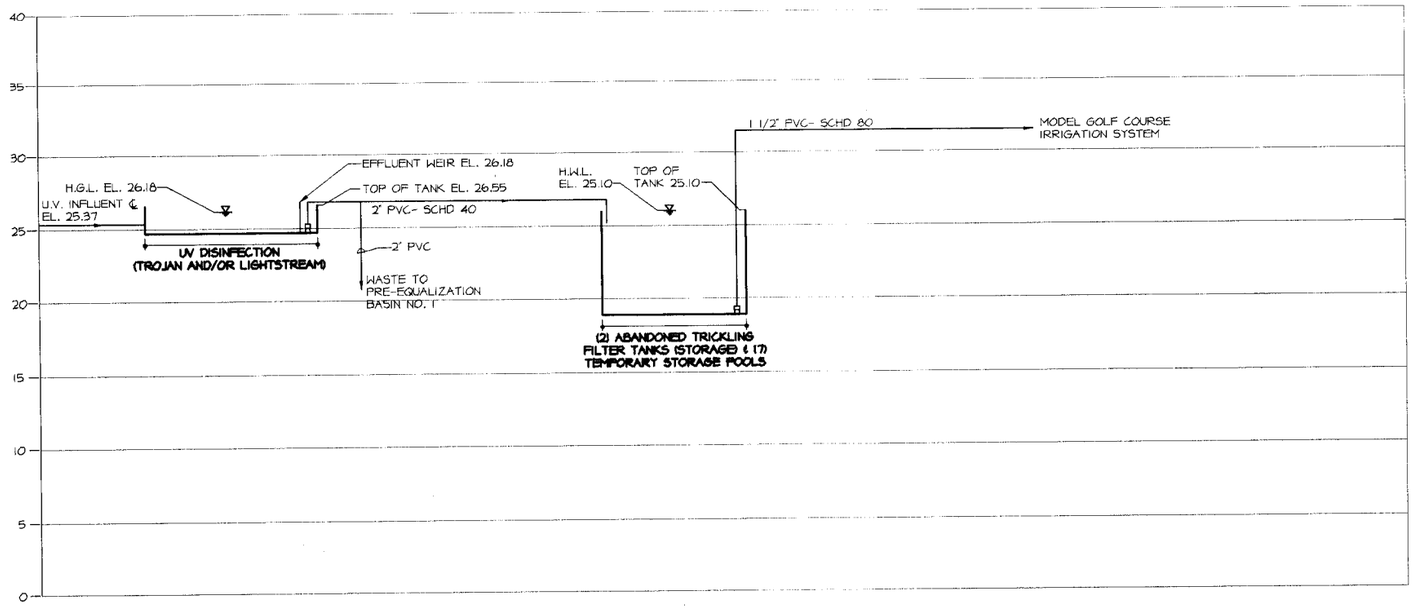
SHEET TITLE

PARTIAL SITE PLAN

SHEET NUMBER

SP-1





NOTE:
SEE PIPE ABBREVIATIONS ON DWG. PD-1.
H.G.L. = HYDRAULIC GRADE LINE
H.W.L. = HIGH WATER LEVEL

HYDRAULIC PROFILE
NO SCALE

FIGURE NO. 2

DESIGN FLOWS:
AVG. DAILY - 25 GPM
PEAK HOURLY 36 GPM

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TOTOWA, N.J. (973-942-0700) □

MARK	DATE	DESCRIPTION
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DATE:	FEBRUARY 2004
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SCALE:	AS SHOWN
FILE LOCATION:	
DESIGNED BY:	EPB
DRAWN BY:	DP
CHECKED BY:	
REVIEWED BY:	

RIVERHEAD SEWER DISTRICT

WASTEWATER REUSE PHASE 1 ON-SITE IMPLEMENTATION

CONTRACT

PILOT STUDY CONSTRUCTION

SHEET TITLE

HYDRAULIC PROFILE

SHEET NUMBER

HP-1

Appendix B

APPENDIX B

AQUA-AEROBICS, CLOTH MEDIA FILTER TECHNICAL INFORMATION

Disk Filter Description

The AquaDisk filter is a gravity flow filtration device utilizing cloth media that has been applied in the pilot system for the Riverhead beneficial reuse project. The disk filter will be utilized to reduce effluent solids from the AquaSBR system prior to final filtration by a membrane filter. The AquaDisk filter will serve to reduce the solids loading to the membrane system, thereby increasing the hydraulic capacity of the membrane system. At the same time, the Disk filter will reduce nutrient loading in the effluent, by removing the nutrients from the effluent that are associated with the effluent solids. In addition, the Disk filter will produce a consistent product to the membrane system, that will allow for consistent operation of the membrane system as well as reducing the fouling, maintenance, and chemical requirements that the membrane system would incur without the Disk filter.

The AquaDisk filter utilizes cloth media, that incorporates a nominal 10 micron pore size to remove suspended solids and turbidity from the SBR effluent. As the filter removes solids from the waste stream, a mat of solids builds up on the outside of the cloth disks. As the solids build up on the outside of the cloth, head builds up in the filter until the unit reaches a high water level, as sensed by a pressure transducer inside the filter tank. This mat of solids is removed by utilizing the suction side of a backwash pump to "vacuum" the solids off the cloth. The backwash water represents approximately 3% of the forward flow of the unit, and the backwash water will be sent to the headworks of the plant. The disk filter comes with an integral control panel and PLC. The unit typically operates in an automatic mode of operation, where it basically runs itself.

Disk Filter Pilot Operation

For the Riverhead Pilot Study Aqua will be supplying an AquaDisk model 12x1EPC filter unit with a capacity to treat up to 36 gpm at average flow. The unit will be supplied with one disk installed in the tank and the disk will supply 12 square feet of filtration surface area. The pilot unit is supplied as a complete filtration system, including the tank, filtration media, a backwash pump, level sensing equipment, electric valves and a control panel. It will be necessary for the District to supply and install electrical service to power the equipment, and to hook up piping for the influent and effluent to the filter, as well as piping for the backwash.

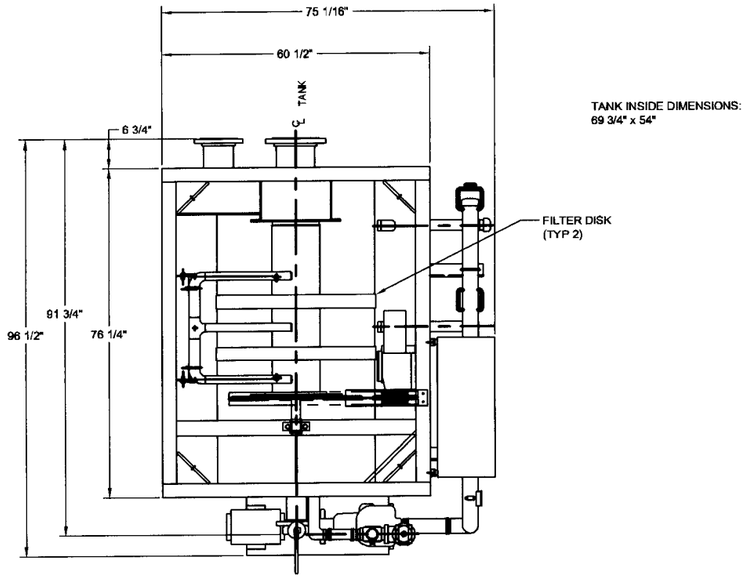
Pilot Protocol

During the operation of the pilot various parameters will be measured to determine the effectiveness of the AquaDisk filter. An influent flow meter will be provided which will measure the influent flow to the unit. The plant operators at the Riverhead plant will take samples of the influent and effluent from the filter, as well as monitor the unit to verify that the unit is operating properly. The influent and effluent from the pilot unit will be measured for parameters such as Total Nitrogen, phosphorus, total suspended solids,

COD, BOD, coliform, salinity, total dissolved solids, oil and grease, and surfactants. Aqua Aerobic Systems will supply a field technician at the startup of the pilot unit operation to help startup the unit and train the plant operators on the operation of the Disk filter unit. Aqua will also monitor the filter remotely via modem.

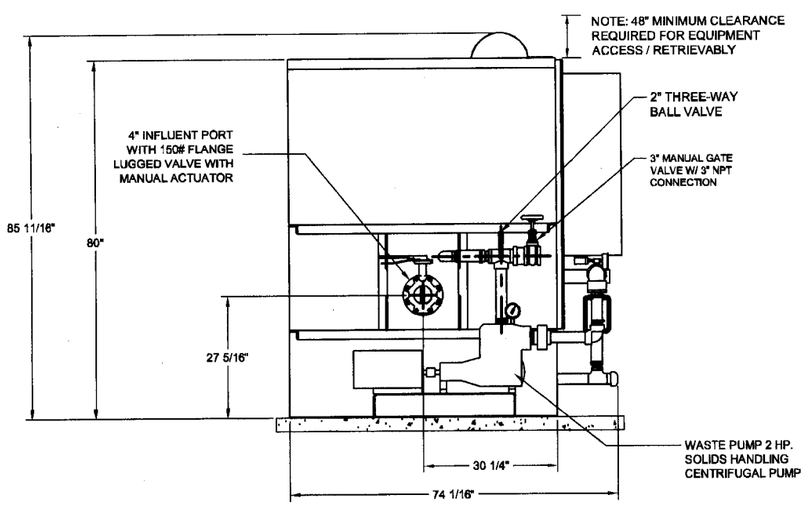
FREEZE NOTE

IF FREEZING IS A CONCERN, AQUA-AEROBIC SYSTEM RECOMMENDS THE FILTERS BE PLACED IN A HEATED BUILDING.

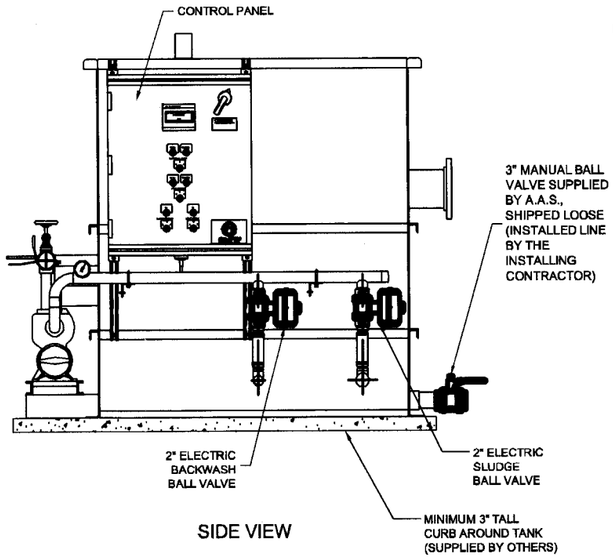


TANK INSIDE DIMENSIONS:
69 3/4" x 54"

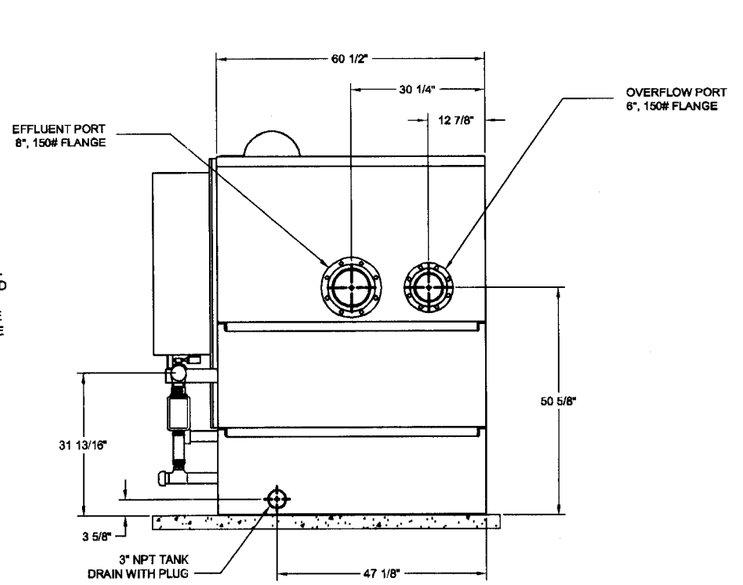
TOP VIEW



INFLUENT END VIEW



SIDE VIEW



EFFLUENT END VIEW

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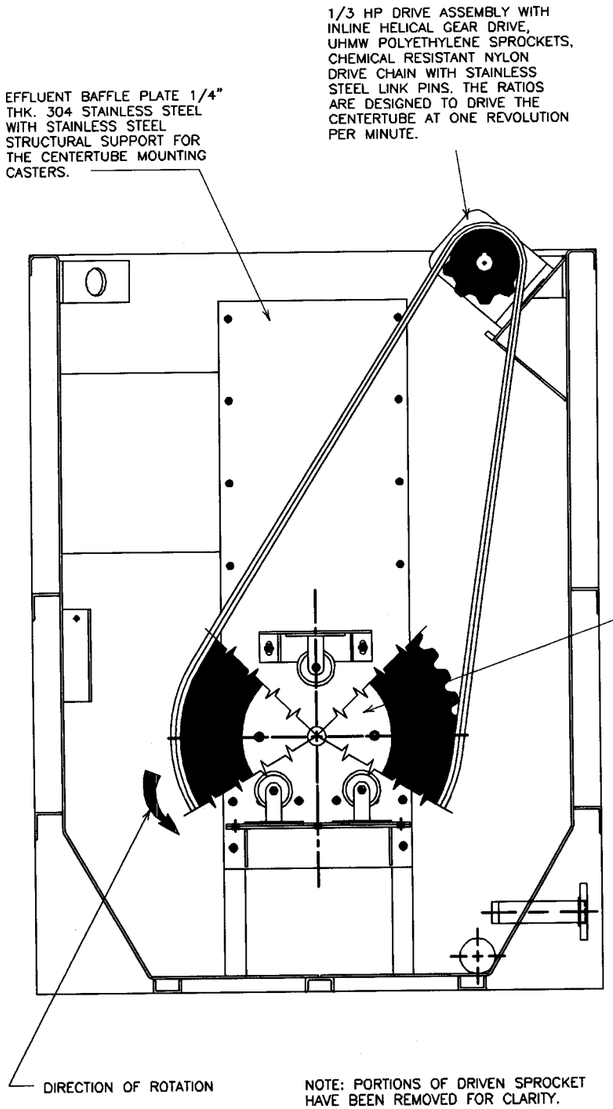
JOB LOCATION:					DRN BY: JRA	DATE: 4/30/01	
ENGINEERS:					CKD BY:	ACT WT:	NAME: AQUADISK FILTER
					SCALE:		MODEL ADFP-12-2E-PC
					SIMILAR:		PILE CLOTH
					REF:		SHEET 1 OF 4
REF	ECO	DATE	BY	REVISION	MFR/SUP:		DWG. NO.: 2801560
					TYPE:		

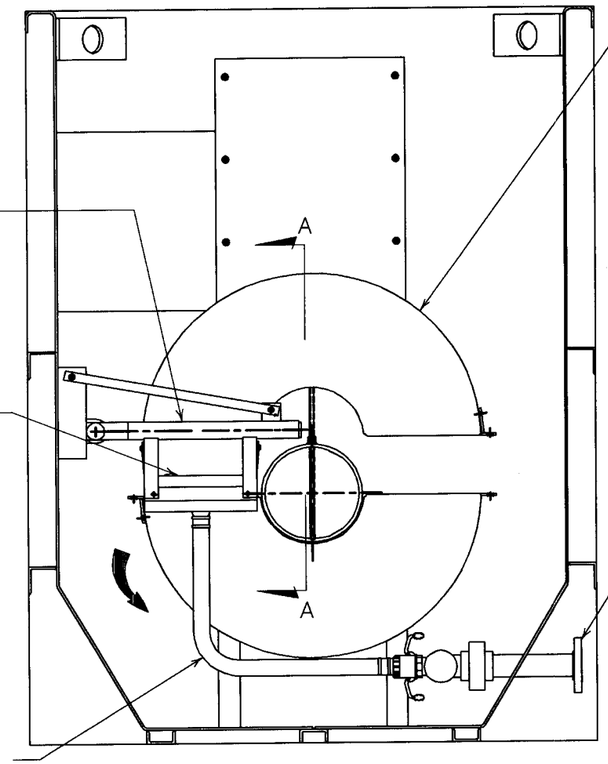


FRONT MOUNTING AND DRIVE
CROSS SECTION

THE BACKWASH NOZZLE SUPPORT MANIFOLD WELDMENT IS MANUFACTURED OF TYPE 304 STAINLESS STEEL WITH ALL BRACKETS AND CLAMPS MADE OF STAINLESS STEEL.

BACKWASH NOZZLE

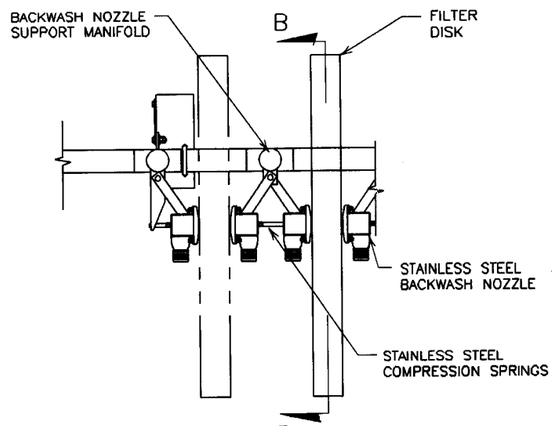
THE BACKWASH NOZZLE PLENUM IS ATTACHED TO THE BACKWASH NOZZLE BY USE OF SEAMLESS NITRILE HOSE WITH GLASS REINFORCED NYLON CAM LOCK FITTING.



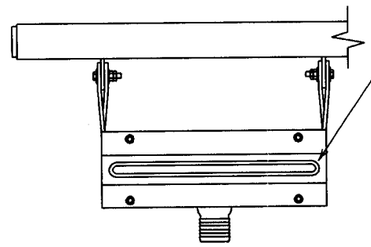
THE FILTER DISK IS COMPOSED OF 2 IDENTICAL (REMOVABLE) HALVES, EACH ONE HELD TO THE CENTERTUBE BY A 1/2" DIAMETER STAINLESS STEEL ROD AND (2) "TACK" STRIPS BOLTED TOGETHER. EACH DISK HALF HAS A RIGID STAINLESS STEEL FRAME TO SUPPORT THE POLYESTER FILTER MEDIA THE (2) "TACK" STRIPS ARE ALSO USED TO STRETCH AND HOLD THE FILTER MEDIA TO THE FRAME.

BACKWASH & SLUDGE COLLECTION MANIFOLD

BACKWASH MANIFOLD CROSS SECTION



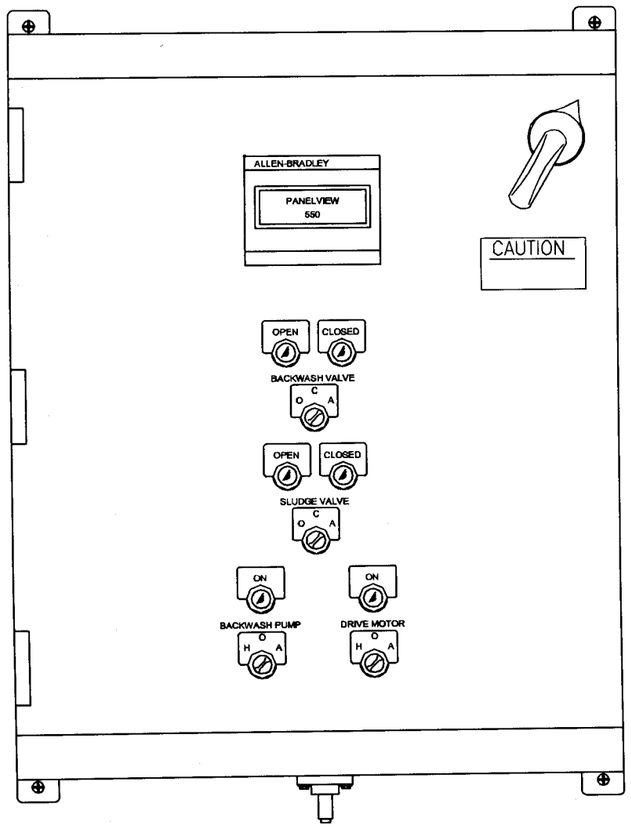
VIEW A–A



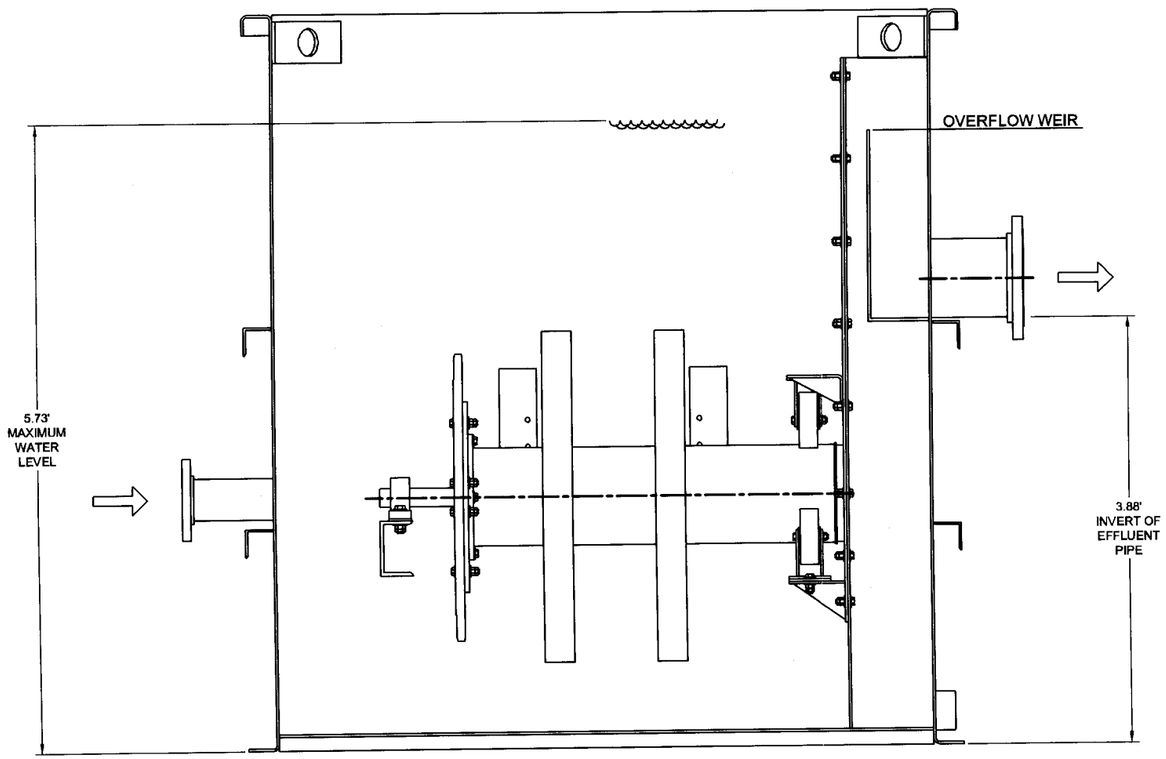
THE BACKWASH NOZZLE PLENUM IS FABRICATED FROM TYPE 304 STAINLESS STEEL, THE NOZZLE FACE AREA IS 4" WIDE UHMW POLYETHYLENE PLASTIC WITH SMOOTH ROUNDED EDGES.

VIEW B–B

JOB NAME:						DO NOT SCALE DRAWING	AQUA-AEROBIC SYSTEMS, INC. MANUFACTURERS OF WASTEWATER TREATMENT EQUIPMENT
JOB LOCATION:						DRN BY: DATE:	
ENGINEERS:						CKD BY: ACT WT:	
						SCALE:	NAME: AQUADISK FILTER
						SIMILAR:	MODEL ADFP-12x2E-PC
						REF: 2801560	PILE CLOTH
-						HPSIZE:	SHEET 2 OF 4
REF	ECO	DATE	BY	REVISION		TYPE:	DWG. NO.: 2801560



CONTROL PANEL



HYDRAULIC PROFILE

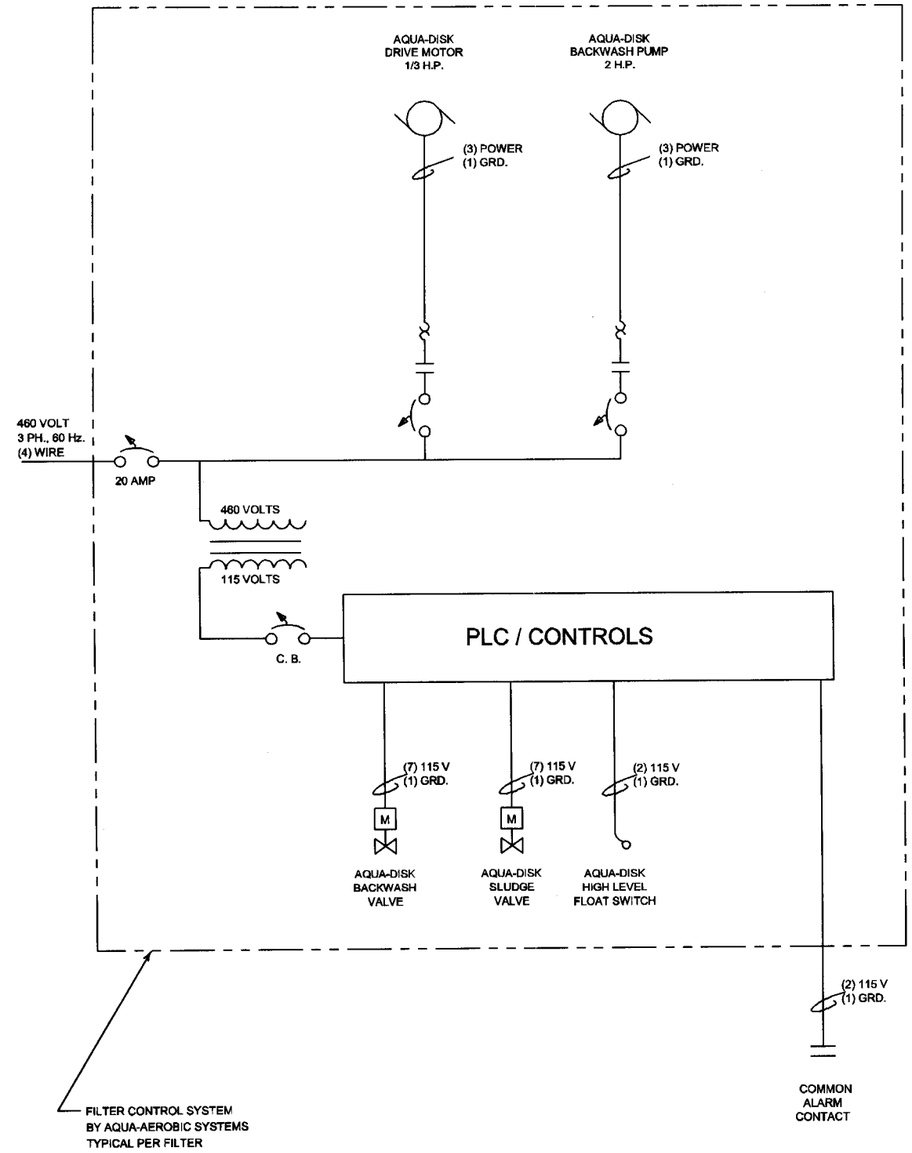
(OPERATING LEVELS @ 6 GPM PER SQUARE FOOT)

JOB NAME:					DO NOT SCALE DRAWING		AQUA-AEROBIC SYSTEMS, INC. MANUFACTURERS OF WASTEWATER TREATMENT EQUIPMENT
JOB LOCATION:					DRN BY: JRA	DATE: 4/30/01	
ENGINEERS:					CKD BY:	ACT WT:	NAME AQUADISK FILTER
					SCALE:		MODEL ADFP-12x2E-PC
					SIMILAR:		PILE CLOTH
					REF: 2801580		SHEET 3 OF 4
-					HARDNESS:		
REF	ECO	DATE	BY	REVISION	TYPE:		DWG. NO.: 2801580

SYMBOL KEY

	MOTOR		CIRCUIT BREAKER		ELECTRICAL DISCONNECT	VFD	VARIABLE FREQUENCY DRIVE		PRESSURE TRANSDUCER	M	MOTOR OPERATED WEIR		STARTER CONTACTOR
M	MOTOR OPERATED VALVE		D.O. SENSOR PROBE		MOTOR OVERLOAD	P	PNEUMATIC OPERATED VALVE		FUSE		TRANSFORMER	P	PNEUMATIC OPERATED WEIR

NOTE: SOME SYMBOLS MAY NOT BE APPLICABLE



JOB NAME:					DO NOT SCALE DRAWING		AQUA-AEROBIC SYSTEMS, INC.
JOB LOCATION:					DRN BY: JRA	DATE: 4/30/01	
ENGINEERS:					CKD BY:	ACT WT:	
					SCALE:		NAME: AQUADISK FILTER
					SIMILAR:		MODEL ADFP-12x2E-PC
					REF: 2801580		PILE CLOTH
-					HYSIZE:		SHEET 4 OF 4
REF	ECO	DATE	BY	REVISION	TYPE:		DWG. NO.: 2801580

Appendix C

PART 2: TECHNICAL PROPOSAL

Description of Pall Corporation Microfiltration and Ultrafiltration Pilot Unit

The pilot unit proposed is Pall's standard Model WPM-2 test rig equipped with two 6-inch diameter by 80" long microfiltration modules. The system will also have the ability to accept two ultrafiltration modules. The unit operates automatically and accurately simulates the performance of a full-scale system. These types of units have been successfully used for long-term continuous operation. It is fully equipped with automatic controls, data acquisition, and a modem for remote communications. A more complete description of the pilot unit is presented on the subsequent pages.

Recommended Operating Parameters

Note: Recommended operating parameters for this pilot test are based on previous Pall's pilot tests. Actual values will be determined at the time of testing.

Parameter	***Expected Performance***
Filtrate Turbidity (ntu)	0.03-0.04 NTU
Flux	TBD after Water Quality Review
Recovery	~95%
Transmembrane Pressure	7-45 psi
Reverse Filtration Frequency	15-30 min
Air Scrub Frequency	15-30 min
EFM Frequency	1-7 days (TBD)
CIP Cleaning Frequency	TBD

System Recovery

The WPM-2 pilot rig is capable of producing up to 45 gpm of filtered water with an anticipated recovery of about 95%. The minimum recovery set-point will be greater than 92%.

Rental Agreement

Customer: **Town of Riverhead**
Project: **Water Membrane Pilot Study**
Equipment: **WPM-2 Pilot Unit**
Date: **12/1/03**

(A) Equipment Technical Specifications

One Pall Model WPM-2 Pilot Unit for Microfiltration applications.

Based on your requirements, Pall offers our WPM-2 unit for the pilot program. The WPM-2 unit utilizes Pall Microza MF / UF hollow fiber membrane modules. This unit is skid mounted, fully automated and can be remotely monitored. Pall's proposal includes layout drawings and a P&ID.

This pilot unit is a self-contained, complete system, which can take a process inlet at pressure and deliver product to either a surge tank or directly forward to pump suction. Included in the system is a PLC/PC based control, data logging and remote monitoring system, which is programmed to automatically control all aspects of the process, with the exception of Clean In Place (CIP). The unit is designed to deliver membrane filtered water flows of up to 45 gpm depending on feed water quality, pre-treatment, and module selection.

Pall's pilot units are equipped with our remote-monitoring feature. With this feature, Pall scientists will have access to multiple operating parameters via modem connection to the pilot unit's computer. The computer will monitor and record trans-membrane pressure, flow rate and turbidity for performance monitoring. In addition, the computer will monitor operating temperature, air scrub parameters (delivery pressure, flow rate and duration) and other parameters (e.g. particle counts) useful for optimizing operation.

(B) Process Start-up and Operator Supervision

As with all our test programs, Pall will provide the highest level of technical support to ensure the success of this project. Pall can provide technical support as required from our Service Facilities.

After unit delivery, a Pall field engineer will be on site to optimize system parameters and to provide operator training for two to five days. The initial Clean-In-Place (CIP) procedure will be performed by Pall. At that time, the procedure can be demonstrated to operators so that subsequent cleanings can be

performed without Pall supervision. Pall will fully coordinate and plan such procedures in advance.

(C) Pall's Scope of Supply

General guidance concerning Pall's scope of supply is attached.

- WPM-2 Pilot Unit
- Break tank Booster Pump with controls (tank is located between Aqua Disk and Pall Pilot Skid)
- Two Microfiltration modules and Two Ultrafiltration module
- On-Skid Turbidity Meters, HACH Model 1720D (inlet and outlet)
- On-Skid Particle Counters, Met 1 PCX or equal (inlet and outlet)
- EFM / CIP Water Heater skid
- Air Compressor skid
- Cleaning Chemicals for Reverse-Filtration, EFM, and CIP
- Freight, Start-up assistance and training

(D) Renter's Scope of Supply

Provided is a general guideline to include the following:

- Utility supply and plumbing and electrical connections as required, noted herein.
- Break tank (tank sizing requirements will be provided by Pall)
- Access to a dedicated phone line for remote monitoring
- Assistance with procedures.
- Unloading & reloading of delivered equipment. Forklift to unload from truck.
- Unpacking and repacking of pilot unit.
- Heated shelter for pilot unit. (Unit must be protected from freezing)
- Weekly transmission of manually recorded data.
- A copy of the project test protocol will be supplied to Pall prior to shipment.

All parties agree to the terms of this agreement. Riverhead agrees that Pall will determine the appropriate membrane flux rate, warrantee terms and other design parameters during the pilot, and these parameters will be used in any future full-scale system design and/or bidding procedure.

This agreement is subject to Pall's Standard Terms and Conditions (Included in Section 6.2).

System Description

The Pall Microza Multi-Station test rig is designed to demonstrate the efficiency and performance of Pall Microza Hollow Fiber membrane filter when applied to a customer's water source. Various filter membrane types are available to meet specific filtration needs. It is anticipated that the test rig will run two, 6-inch diameter by 80-inch long Microza™ membrane modules. The test rig is designed to produce micro/ultra-filtered water and gather performance data to aid later design of full-scale filtration solutions. Testing Pall filters on problems at customer site's, assures Pall's final production system design will be accurately engineered and manufactured to meet customer stringent requirements.

The rig is a self-contained, complete system, which connects to a pressurized water supply. The test rig delivers filtered product to either a customer collection tank or to the pump suction of downstream water operations. The unit is designed to produce filtered water flows of up to approximately 45 gpm (depending on module selection). Recommended flow rates for testing are determined by the module size and membrane type as well as the character of the filtration problem.

Like Pall full-scale systems, the test system is automated and programmed to control all aspects of filter operation. Clean In Place (CIP) maintenance is operator-initiated with computer-aided cleaning functions.

The test system's controls provide the same full functionality and operator interface as Pall provides with the full-scale design solutions. The control system is a PLC/PC based controller with data logging, trend display graphs and a remote monitoring modem connection for off-site Pall Technical Support.

With this feature, Pall engineers will have access to view recent operation graphs, and if required, adjust operating parameters and the function of the pilot unit's computer. For example, the computer monitors and records trans-membrane pressure (TMP), flow rates, temperature, air scrub parameters (delivery pressure, flow rate and duration), turbidity and particle counts. All this information is available locally on the test rig and is simultaneously display-able at Pall support computers. This enables remote performance monitoring and Pall-assisted optimization of operations.

Component Description

- **Filter Modules**:
  Pall supplies Microza™ filter modules:

  Microfiltration -- hollow fiber PVDF membrane, 0.1 micron pore size, TMP ~2.5 bar, pH range 1-10 (operational), 6" diameter module supplying 538 square feet of membrane surface area

  Ultrafiltration --- hollow fiber PVDF membrane, 80,000 molecular weight cutoff, 5" diameter module supplying 441 square feet of membrane surface area

- **Pre-filter:**
  304 SST bag filter housings with 400-micron polyester mesh bag filters.

- **Feed Tank:**
  160 gallon, 304 Stainless Steel, flat bottom, closed top with hatch, manway, overflow, vent and stainless steel stand. Equipped with computer-managed fill system. Pressure type of level monitor/fill status. Optional 4KVA Immersion Heater for improved CIP performance.

  Reverse Filtration Tank:
  160 gallon, 304 Stainless Steel, flat bottom, closed top with hatch, manway, overflow, vent and stainless steel stand. Equipped with computer-managed fill system.

- **Chlorine Tank & Chemical Feed Pump:**
  Blue White NOIR pump model T1506N (integrated with 7 Gallon Storage vessel), maximum flow rate - 3.1 oz. per minute.

- **Piping:**
  <1": Schedule 40, 316 SST, Threaded
  Schedule 80, PVC, solvent welded or threaded

  >1": Schedule 10, 316SST, butt welded or flanged
  Schedule 80, PVC, solvent welded or threaded

  Air piping: Stainless Steel tubing.

- **Pumps:**
  Feed Pump – Gould's SST/4ST centrifugal, 316 SST, with 2 X 1.25" NPT connections, 5.0 hp 3500/230/460/60/3 ph inverter duty wash down motor, and ABB ACS-301 4P9-3 variable frequency drive.

Reverse Filtration Pump – Gould's SST/4ST centrifugal, 316 SST, with 2 X 1.25" NPT connections, 5.0 hp 3500/230/460/60/3 ph inverter duty wash down motor, and ABB ACS-301 4P9-3 variable frequency drive.

- **Valves:**

  Hand valves >1": Keystone AR2 Series Butterfly with 316 SST disc & stem, EDPM liner, cast iron body, ten position handle

  Hand valves </=1': SVF standard port lever handle, 3 piece 316 SSt body, 316 SST ball & stem, Teflon seat and seals.

  Automated valves:
  SVF standard port with lever handle, 3-piece 316 SST body, 316 SST ball & stem, Teflon™ seat & seals, pneumatic spring-return actuators with mechanical limit switches

- **Air line:**
  SVF 3-way automatic valve, ½" T7 6666-TT-Se 4 piece 316L body, 316 SST ball & stem, Teflon™ seat & seals

- **Instrumentation:**
  1. Level Switch (low) -- Reverse Filtration Tanks Turck Euro Fast non-contact
  2. Level Transmitter -- (Feed Tank level management, tank low indicator) – using Foxboro pressure transmitter #IGP10-A22C1F; 0-30 psi, 4-20 mA, 0.5" FPT
  3. Pressure Transmitters – Feed, Permeate, Excess Recirculation lines: Foxboro #IGP10-A22D1F; 0-300 psi, 4-20 mA, 0.5" FPT
  4. Temperature Transmitters -- Pyromation RTD type.
  5. Flow meters -- Burkert Magnetic 426 522 G Sensor and union fitting, PVC, 150psi, 4-20 mA, 1.25 NPT
  6. Turbidimeter -- Feed and Filtrate Continuous Sampling: (Qty 2) Hach 1720D.
  7. Particle Counter -- Feed and Filtrate Continuous Sampling: (Qty 2): Met 1 PCX

- **Air Preparation**:
  1. GMD-5 Automatic Desiccant Dryer
  2. GEN OM 9520 AF Coalescing Filter
  3. GEN OM9220 PF Particulate Filter
  4. Numatics Flexi Blok 22 Series Regulators, pressure switch and final filter

- **Controls:**

Allen Bradley SLC500 PLC with 6181 Industrial PC Interface running RSView 32; Housed in NEMA-4X enclosure

Membrane Filter Physical Description

Footprint Sizes (approx):

- **Pilot Unit:**
  - Operational — 121" L x 68" W x 118" H assembled
    121" L x 46" W x 128" H on skid
- **Air Compressor:** — 30" x 36" x 70"H
- **Air Dryer** — 31" x 9" x 32"H

- **Weights:**
  - Pilot Unit — 2,500 lbs. (approx.)
  - Air Compressor — 700 lbs
  - Air Dryer — 200 lbs

Interconnection and Utility Requirements for Pall Filtration Unit:

Utility requirements will vary depending on the final configuration, but the following estimate is based on the most likely scenario:

Connection	Qty	Rate	Fit-up	Notes
Feed	1	10 to 55 gpm	1.50" diameter, 150 lb. Flange	Feed may utilize optional lift pump for non-pressurized water source.
Filtrate	1	9 to 45 gpm	1.50" diameter, 150 lb. Flange	
Drain	1	90-gpm max Instantaneous	4" ANSI Class 150 Flange PVC or FPT	Fit-up may vary
Air (Customer House Air)	1	Below 10 SCFM inst. @ 90 psig, max 18 scfm	½" NPT	Instrument grade per ISA RP 7.7 (Drier on-skid consumes ~10% of air)
Pall Air compressor	1	Below 10 SCFM inst. @ 90 psig, max 18 scfm	Pall Scope fit-up	
Electrical (Test Rig)	1	460 VAC	3 Phase, 30 amp max service (4 wire: 3 Hots-1ground), 50/60 Hz, 8 Ga.	
Electrical-Pall Air compressor	1	230 / 460 VAC	3 Phase, 30 AMP max service, 50/60 Hz	
Electrical- Air Dryer	1	120 VAC internal to skid (No customer connection)	Single Phase, 15 AMP	50/60 Hz usual fit up
6) Telephone	1	Dedicated Telephone Line Connection	Tone	For remote dial-in monitor/data link
7) Cleaning water (CIP)	As need	90 gal batch, 4 batches per clean	Flexible hose into feed tank opening	Potable water. Hardness >180 90°F

Electrical and Mechanical Requirements for AquaDisk Filter Pilot

The disk filter unit is defined on the attached drawings, but will have approximate dimensions of 86" high x 96 ½" long x 76" wide.

1. Specification of Electrical Requirements for Disk Filter Pilot

   Voltage: 460 VAC, 3-Phase, 60-hertz, 20-amp supply required.

   Connection to the pilot unit shall be by Aqua personnel. Power supply and connector shall be by the Renter.

2. Water Connections

   a. Influent - 3" Camlock.
   b. Effluent - 4" Camlock.
   c. Overflow - 4" Camlock.
   d. Backwash and reject water - 3" Camlock

   Connections shall be by Aqua personnel and will include all pumps, hoses and appropriate fittings.

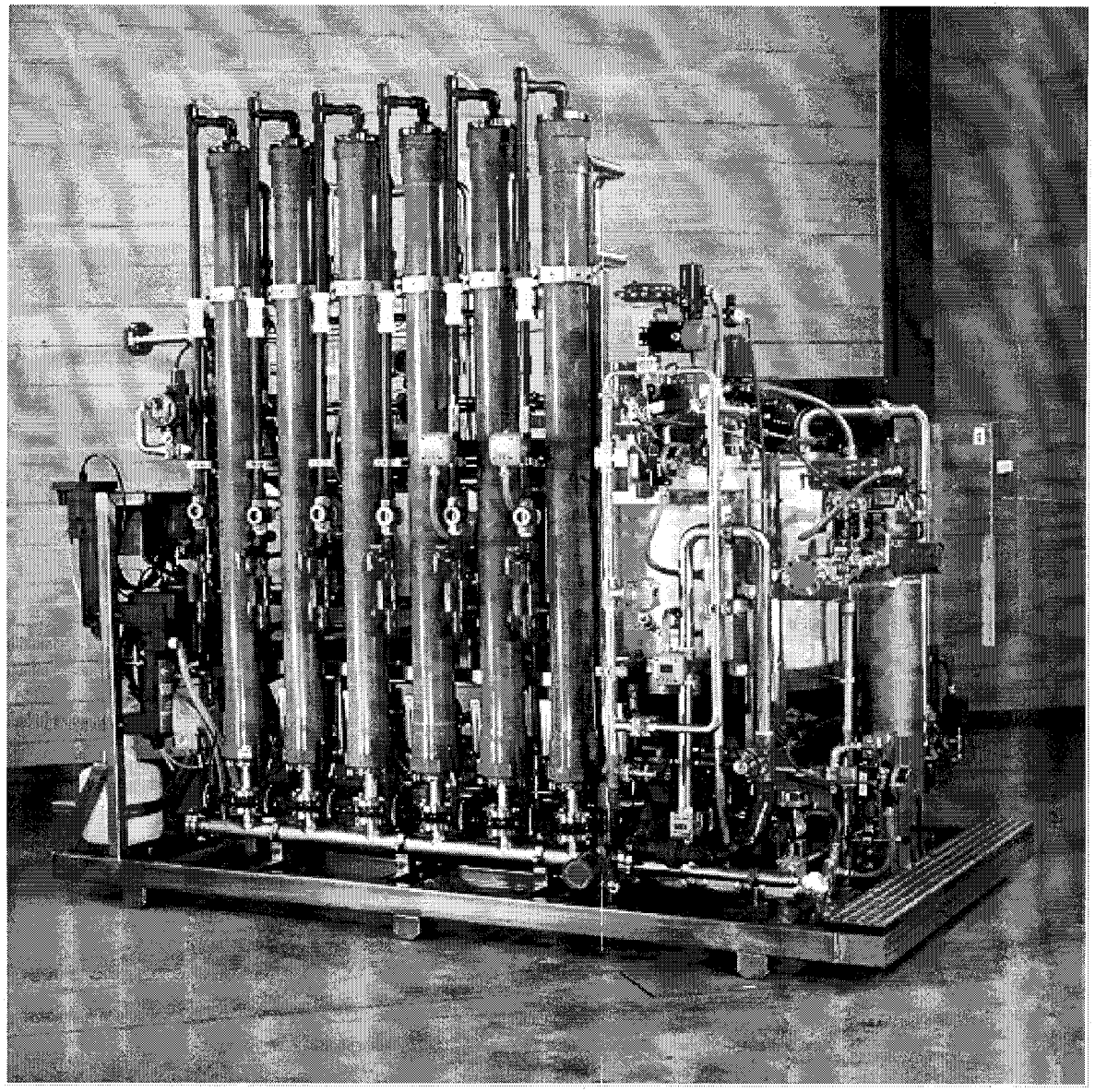
EXHIBIT 1

DRAWINGS

Please pull appropriate drawing and insert here.

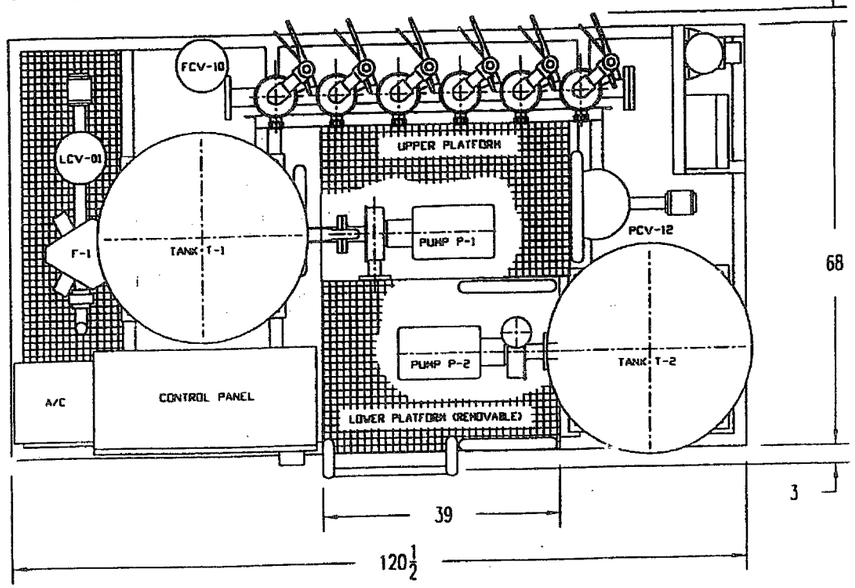
Pilot Unit

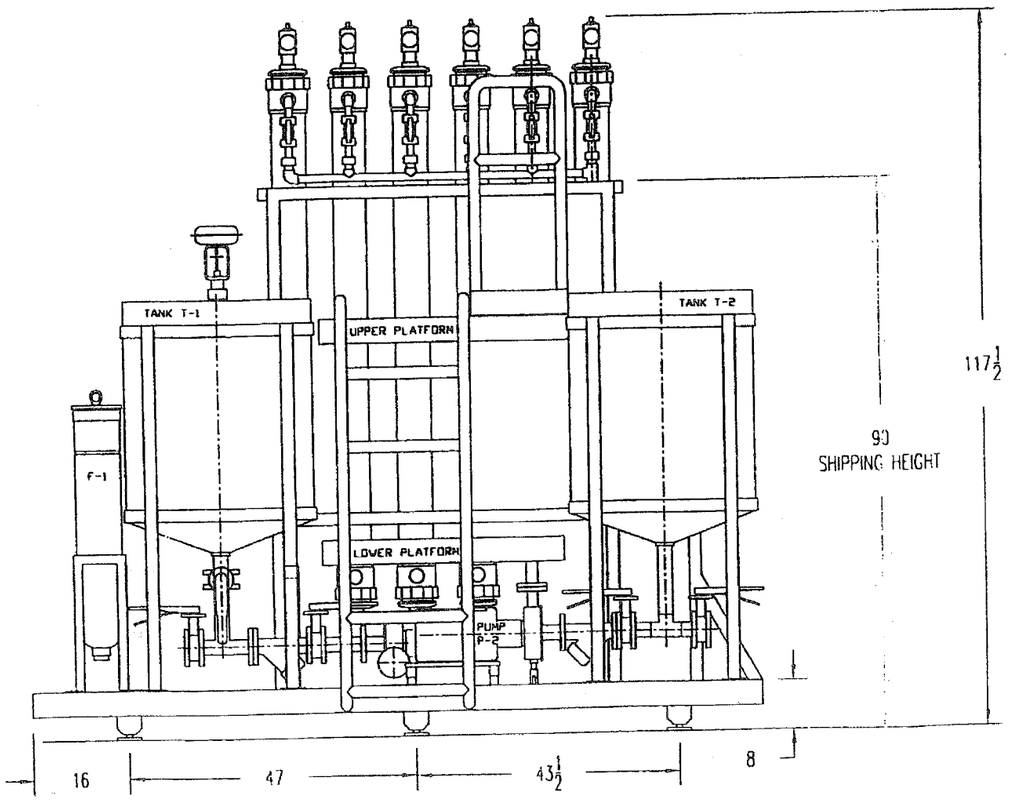
Membrane
Test
System



PALL Water Processing

WPM-2 PILOT LAYOUT DWG.



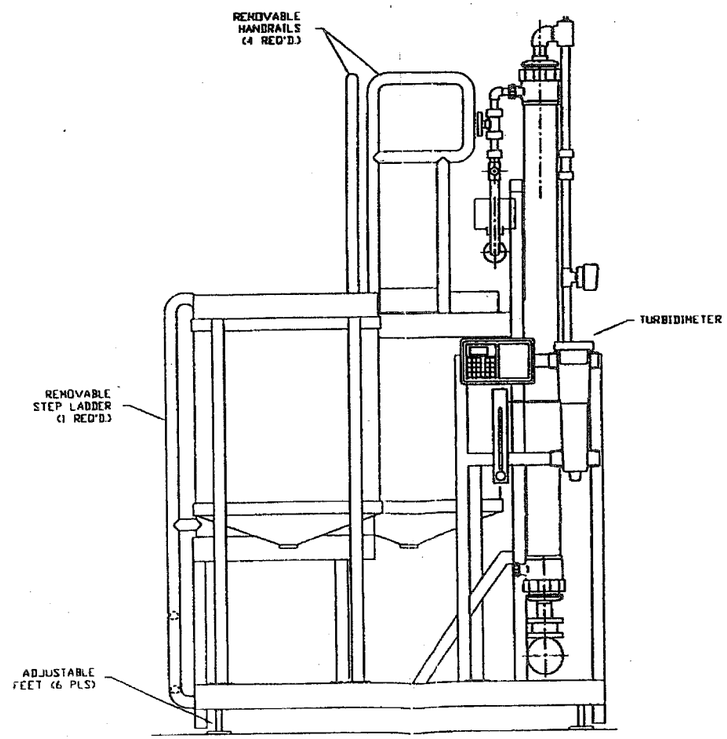


REV	CHG NO	DESCRIPTION	CHG BY	PROJ ENG	APVD	QC	RELEASE

1) PANEL IS MOUNTED SUCH THAT THE DOOR, HANDLES & EXTERNAL FIXTURES ARE WITHIN THE PERIMETER OF THE SKID BASE FOOTPRINT.

2) BASE TO SERVE AS FOUNDATION TO SHIPPING CRATE AND BE FURNISHED WITH CRATE FASTENING POINTS.

3) BASE TO ACCEPT STANDARD FORKS OF LIFT TRUCK.



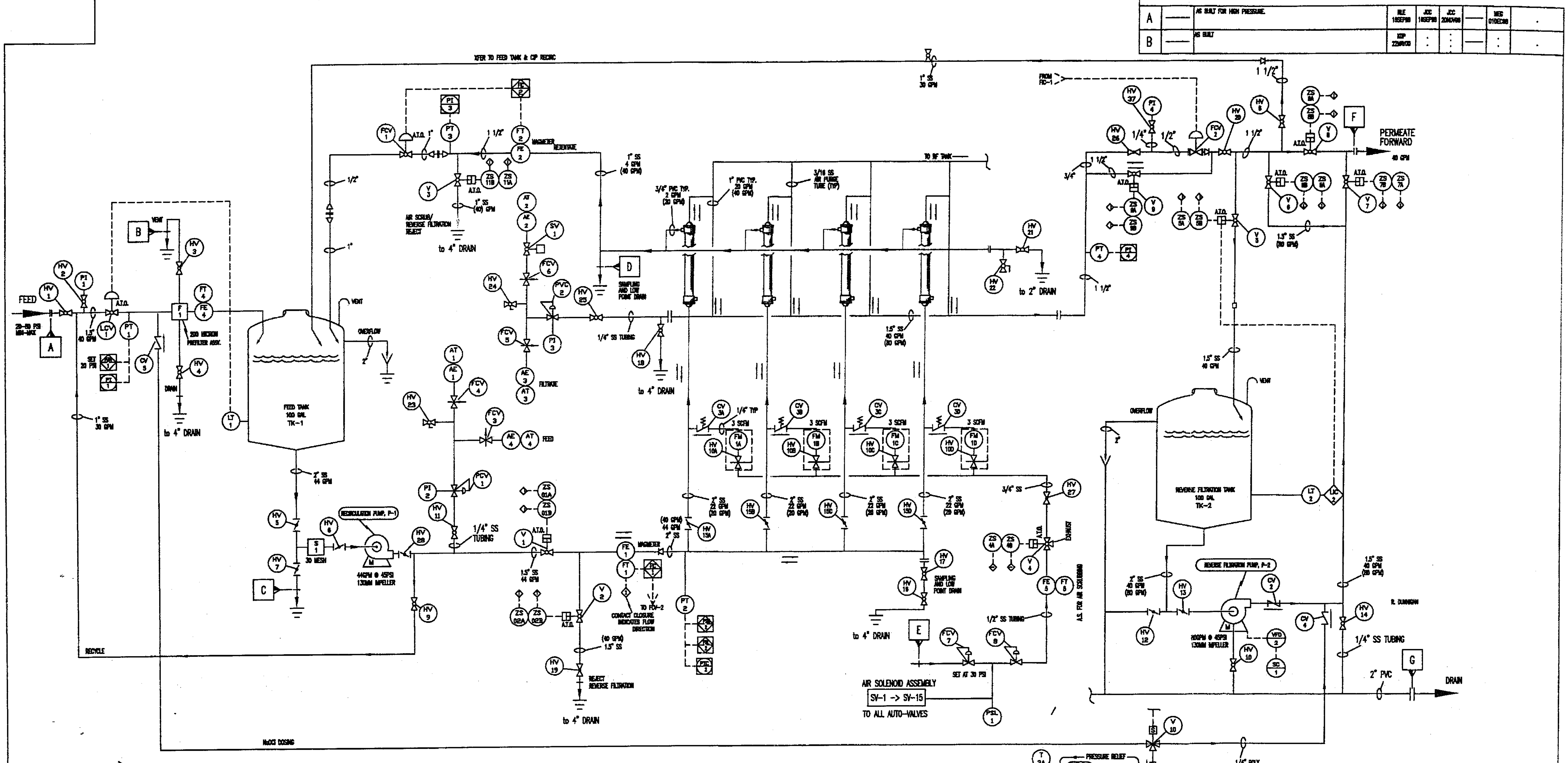
DISTRIBUTION	DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED			CODE IDENT. NO. 17238	NAME	DATE
PALL CORP	SURFACE FINISH µin ☐ (µm) ☐ ✓	DIMENSIONS ARE IN INCHES ☐ [mm] ☐		DRAWN BY		
PCI				PROJ ENGR		
PDH				CHECKER		
PEL	APPLICABLE SPECIFICATIONS	DECIMALS	mm / INCHES	ENGR. MGR.		
PFF		X	± / ±	MANUFACTURING		
PFR		.XX	± / ±	V.P. ENGR.		
PLF		.XXX	± / ±	QUALITY CONTROL		
PPL		FRACTIONS	±	RELEASED		
PVS		ANGLES	± °			
CODE CALCS				THIRD ANGLE PROJECTION		

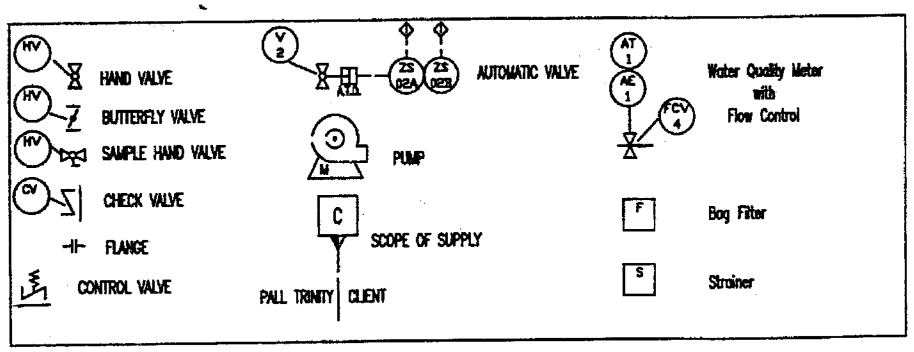
DWG NAME: 5" LGV MODULE - SKID LAYOUT

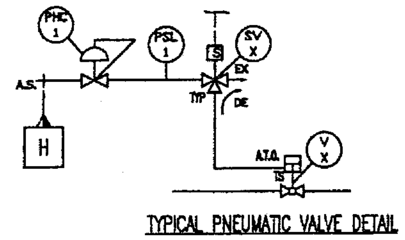
PART NUMBER

DWG TYPE	DWG NO	REV	SIZE
T	W	02	D

SCALE	CAT NO	FILE NO	SHEET OF
1" = 1'			1 1







ITEM	DESCRIPTION	LOCATION
K	ALTERNATE REVERSE FILTRATION SUPPLY	C3
J	DRAIN	B2
H	PERMEATE LINE DRAIN & SAMPLE	C3
G	FEED LINE DRAIN & SAMPLE	B4
F	PREFILTER VENT	D7
E	RETENTATE SAMPLING AND MODULE VENTING	C4
C	AIR SUPPLY	B4
B	PERMEATE FORWARD	D1
A	FEED	C8

MAX USAGE – (4) UF @ 11 GPM ea. FOR 44 GPM TOTAL
OR – (2) MF @ 22 GPM ea. FOR 44 GPM TOTAL

MIN USAGE – 1 MF @ 22 GPM ea. FOR 22 GPM

R. SAFFORD 15SEP'97
17SEP'98
J. CORNELIUS 17SEP'98
Q.A.
M. GIBBONS 23SEP'98

LGV MODULE PILOT SKID, 5"

4U4D40004-18, LGV-5A

T W D601817W B

1.0X 2114925 601817W1 1 1

Xref c:/acad/xref/Dformat

SEE SHEET 1 FOR REVISIONS

VALVE SYMBOLS

- GATE VALVE OR MISCELLANEOUS
- GLOBE VALVE
- CHECK VALVE
- SPRING LOADED CHECK VALVE
- PLUG VALVE
- 3-WAY PLUG VALVE
- ROTARY/BALL VALVE
- BUTTERFLY VALVE (W/ PNEUMATIC ACTUATOR)
- BUTTERFLY VALVE (HAND)
- NEEDLE VALVE
- ANGLE VALVE
- CONTROL VALVE
- FLOAT VALVE
- AIR RELEASE VALVE
- BACKFLOW PREVENTER
- DIAPHRAGM VALVE
- SAFETY RELIEF VALVE
- 2 WAY SOLENOID VALVE
- 3 WAY SOLENOID VALVE (DE, EX)
- 4 WAY SOLENOID VALVE
- PNEUMATIC ACTUATOR CONTROL VALVE
- PRESSURE REDUCING VALVE (REGULATOR)
- POSITIONER & CYLINDER AIR TO CLOSE SINGLE ACTING (A.T.C.)
- POSITIONER & CYLINDER AIR TO OPEN SINGLE ACTING (A.T.O.)
- POSITIONER & CYLINDER AIR TO AIR DOUBLE ACTING (A.T.A.)

TYPICAL SYMBOLS

- CONTAINMENT
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- COMPRESSED AIR PIPING
- ELECTRIC SIGNAL
- FIELD MOUNTED DEVICE
- PANEL FACE MOUNTED DEVICE
- INSIDE OF PANEL MOUNTED DEVICE
- DEVICE MOUNTED ON AUXILIARY PANEL FACE
- DEVICE MOUNTED INSIDE OF AUXILIARY PANEL
- PROGRAMMABLE LOGIC CONTROLLER IN MAIN PANEL
- PROGRAMMABLE LOGIC CONTROLLER IN AUXILIARY PANEL
- DISPLAY ON MAIN PANEL
- COMPUTER FUNCTION PRIMARY LOCATION
- COMPUTER FUNCTION AUXILIARY LOCATION
- MESSAGE DISPLAY ON CRT
- ELECTRIC OPERATOR (M)
- INTERLOCK
- MAGNETIC FLOWMETER W/ INTEGRAL ELECTRONICS (FE)
- VARIABLE AREA FLOWMETER
- GEAR/DISPLACEMENT FLOWMETER
- ACTUATOR, W/ TRAVEL STOPS
- ACTUATOR, AIR TO CLOSE (SINGLE ACTING) (A.T.C.)
- ACTUATOR, AIR TO OPEN (SINGLE ACTING) (A.T.O.)
- ACTUATOR, AIR TO CLOSE & AIR TO OPEN (DOUBLE ACTING) (A.T.A.)
- TWO (2) ITEMS IN ONE (1) DEVICE
- FLOW CONVERTER (ADD IDENTIFYING INFORMATION OUTSIDE BALLOON TO CLARIFY FUNCTION OF ITEM INSIDE BALLOON, EXT. I/P: CURRENT TO PNEUMATIC CONVERTER). (FY, I/P)
- MANWAY

TYPICAL SYMBOLS

- DRAIN
- HUB DRAIN
- DIAPHRAGM SEAL
- BUTTERFLY VALVE WITH FIXED ORIFICE IN DISC
- SLIP JOINT/EXPANSION CONNECTION
- MANUAL VALVE OPERATOR
- CUSTOMER CONNECTION (CUSTOMER) (PALL)
- ELECTRICAL CONNECTION (CUSTOMER) (PALL)
- SPRAY BALL
- AIR VENT
- PILOT LIGHT (R)

COLOR CODE
R=RED
A=AMBER
G=GREEN
B=BLUE
W=WHITE

- SIGHT GLASS
- SWING ELBOW
- INSULATED EQUIPMENT
- STEAM OR ELECTRICAL TRACED WITH INSULATION
- ELECTRICAL HEAT TRACE
- ITEM OR EQUIPMENT NO.
- EDUCTOR (W/ GATE VALVE & FUNNEL)

TYPICAL SYMBOLS

- ANTIFOAM INLET
- "Y" STRAINER
- STRAINER/FILTER
- CONSTANT FLOW FITTING
- FLEXIBLE CONNECTOR/ EXPANSION JOINT
- FLEXIBLE REDUCER
- REDUCER
- FLANGED CONNECTION
- AIR GAP
- CAPPED OR PLUGGED CONNECTION

PUMP SYMBOLS

- CENTRIFUGAL PUMP
- ROTARY PUMP
- (TUBING) PERISTALTIC PUMP
- DOUBLE HEAD PERISTALTIC PUMP
- MOTORIZED DIAPHRAGM PUMP
- PNEUMATIC DIAPHRAGM PUMP
- METERING PUMP
- VERTICAL PUMP
- SUBMERGED PUMP

FLOW INSTRUMENTS

FC	FLOW CONTROLLER (BLIND)
FCV	FLOW CONTROL VALVE
FE	FLOW ELEMENT
FFC	FLOW RATIO CONTROLLER
FG	FLOW SIGHT GLASS
FI	FLOW INDICATOR
FIC	FLOW INDICATOR CONTROLLER
FIT	FLOW INDICATOR TRANSMITTER
FM	FLOW METER
FQ	FLOW TOTALIZER
FQC	FLOW TOTALIZER CONTROLLER
FR	FLOW RECORDER
FRC	FLOW RECORDER CONTROLLER
FSH	FLOW SWITCH HIGH
FSHH	FLOW SWITCH HIGH HIGH
FSL	FLOW SWITCH LOW
FSLL	FLOW SWITCH LOW LOW
FT	FLOW TRANSMITTER (BLIND)
FX	FLOW INTEGRATOR

PRESSURE INSTRUMENTS

DSPI	DIFFERENTIAL SET POINT INDICATOR
PC	PRESSURE CONTROLLER (BLIND)
PCV	PRESSURE CONTROL VALVE
PDC	PRESSURE DIFFERENTIAL CONTROLLER
PDH	DIFFERENTIAL PRESSURE HIGH
PDHH	DIFFERENTIAL PRESSURE HIGH HIGH
PDI	DIFFERENTIAL PRESSURE INDICATOR
PDS	DIFFERENTIAL PRESSURE SWITCH
PHC	PRESSURE HAND CONTROL (REGULATOR)
PI	PRESSURE INDICATOR
PIC	PRESSURE INDICATING CONTROLLER
PIS	PRESSURE INDICATING SWITCH
PIT	PRESSURE INDICATING TRANSMITTER
PLH	PRESSURE LIMIT HIGH
PR	PRESSURE RECORDER
PRC	PRESSURE RECORDER CONTROLLER
PSH	PRESSURE SWITCH HIGH
PSHH	PRESSURE SWITCH HIGH HIGH
PSL	PRESSURE SWITCH LOW
PSLL	PRESSURE SWITCH LOW LOW
PT	PRESSURE TRANSMITTER (BLIND)

LEVEL INSTRUMENTS

LC	LEVEL CONTROLLER (BLIND)
LCV	LEVEL CONTROL VALVE
LE	LEVEL ELEMENT
LG	LEVEL GAGE GLASS
LI	LEVEL INDICATOR
LIC	LEVEL INDICATOR CONTROLLER
LIT	LEVEL INDICATING TRANSMITTER
LR	LEVEL RECORDER
LRC	LEVEL RECORDING CONTROLLER
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW LOW
LSM	LEVEL SWITCH MID
LT	LEVEL TRANSMITTER (BLIND)

TEMPERATURE INSTRUMENTS

TC	TEMPERATURE CONTROLLER (BLIND)
TCV	TEMPERATURE CONTROL VALVE
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
TIC	TEMPERATURE INDICATING CONTROLLER
TIT	TEMPERATURE INDICATING TRANSMITTER
TLH	TEMPERATURE LIMIT HIGH
TR	TEMPERATURE RECORDER
TRC	TEMPERATURE RECORDER CONTROLLER
TSH	TEMPERATURE SWITCH HIGH
TSHH	TEMPERATURE SWITCH HIGH HIGH
TSL	TEMPERATURE SWITCH LOW
TSLL	TEMPERATURE SWITCH LOW LOW
TT	TEMPERATURE TRANSMITTER

MISCELLANEOUS

AE	ANALYTICAL ELEMENT
AIT	ANALYTICAL INDICATING TRANSMITTER
A.S.	AIR SUPPLY
A.T.A.	AIR TO ACTIVATE
A.T.C.	AIR TO CLOSE
A.T.O.	AIR TO OPEN
DE	DE-ENERGIZE
DPI	DIFFERENTIAL PRESSURE INDICATOR
E	ENERGIZE
EX	EXHAUST
H	HEATER
HV	HAND VALVE (MANUAL)
I/P	CURRENT TO PNEUMATIC TRANSDUCER
LS	LIMIT SWITCH
M	MECHANICAL DEVICE/MISCELLANEOUS
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
NV	NEEDLE VALVE
O/C/A	OPEN-CLOSE-AUTO
ORP	OXIDATION REDUCTION POTENTIAL
P	PUMP
P/A	PULSE TO ANALOG
P/I	PNEUMATIC TO CURRENT TRANSDUCER
PRD	PRESSURE RUPTURE DISK
PS	PUMP SPEED
REV.	REVERSING
SG	SIGHT GLASS
S.P.	SET POINT
SS	SELECTOR SWITCH
SV	SOLENOID VALVE
T	TANK
TS	TRAVEL STOP
TYP	TYPICAL
UA	MULTIVARIABLE ALARM
UON	UNLESS OTHERWISE NOTED
V	VALVE (ACTUATED)
VFC	VOLT FREE CONTACT
VFD	VARIABLE FREQUENCY DRIVE
Y	CONVERTER

CODE INDENT. NO. 17238	NAME	DATE
DRAWN BY	SP SMITH	24SEP2001
PROJECT ENGINEER	T. NATOLI	03OCT2001
CHECKER	M. POOLE	03OCT2001
MANUFACTURING		
ENGINEERING MANAGER		
QUALITY CONTROL		
RELEASED BY	G. PERRY	04OCT2001

--> DO NOT SCALE DRAWING <--

UNLESS OTHERWISE SPECIFIED THE FOLLOWING INFORMATION PERTAINS ONLY TO THIS SHEET

DIMENSIONS ARE IN: INCH ONLY

SPECIFICATIONS:

TOLERANCE: XXX ±, FRACTION ±, X ±, XX ±, ANGLE ±, SURFACE FINISH √ µIN: (µm)

DRAWING NAME: SYSTEM, MF (ARIASMI AP2 P&ID) (TEMPLATE, LEGEND)

DISTRIBUTION

Pall Corporation
PALL TRINITY MICRO
CORTLAND, NEW YORK

PART NUMBER: ARIASMI AP2 TEMPLATE SYSTEM — DWG SIZE: D

DRAWING NUMBER: D604952W — SCALE: NONE — REVISION: C

THIRD ANGLE PROJECTION — CAT NUM: 2212294 — SHEET: 6

CAD FILE NAME: 604952W1 — OF SHEET: 6

Appendix D

Trojan Technologies Inc.
World Leader in UV Disinfection Systems

MEMO

To: Michael P. Reichel, Superintendent of the Riverhead Sewer District
From: Todd Bartlett
cc: Peter Pastore of G.A. Fleet / Fogarty-LaValle
E-mail: tbartlett@trojanuv.com
Date: December 4, 2003
Re: **Riverhead AWTF, NY – Pilot Study Technical Considerations**

Mr. Reichel,

This memo was prepared to discuss some of the technical issues with running the UV3150K-PTP pilot unit at the Town of Riverhead's pilot program.

A layout drawing has been provided to give an indication of the dimensions and configuration of the pilot unit. This drawing should help with the overall pilot study layout. The Pilot Study Agreement indicates what the electrical requirements are for the pilot unit (see page 2).

At the proposed pilot plant flow of 25 gpm (36,000 gpd), this system will provide a UV dose (third party bioassay validated) of approximately 180,000 $\mu Ws/cm^2$. Typical UV doses for reuse applications are in the range of 100,000 $\mu Ws/cm^2$ to 120,000 $\mu Ws/cm^2$. In order to achieve doses lower than this, the flowrate will have to be greater than 25 gpm. The use of a holding tank upstream of the UV system may provide enough effluent to create a higher flow through the UV system and allow the UV system to deliver a lower dose.

UV Dose is calculated as follows:

UV Dose = Intensity x Retention Time

Note: the intensity in this equation represents the intensity provided by the system at the end of lamp life and also needs to be corrected for quartz sleeve transmittance.

Factors that affect the intensity are as follows:

- Sleeve cleanliness
- Lamp age
- Power supply
- Water quality / hardness
- Treatment process

Factors that affect the retention time are as follows:

- Flow rate
- Reactor configuration

Therefore, by decreasing the retention time, by increasing the flowrate, the UV dose provided by the system will be decreased. This will be necessary in order to provide the dose that will actually be required to achieve the desired level of disinfection. In order to obtain a useful dose – response curve, a number of different doses should be applied to the effluent to see what dose will actually provide the desired level of disinfection. A typical dose – response curve can be seen in the attached document entitled, " Upstream Process Impacts on UV Disinfection" (page 2 of 3).

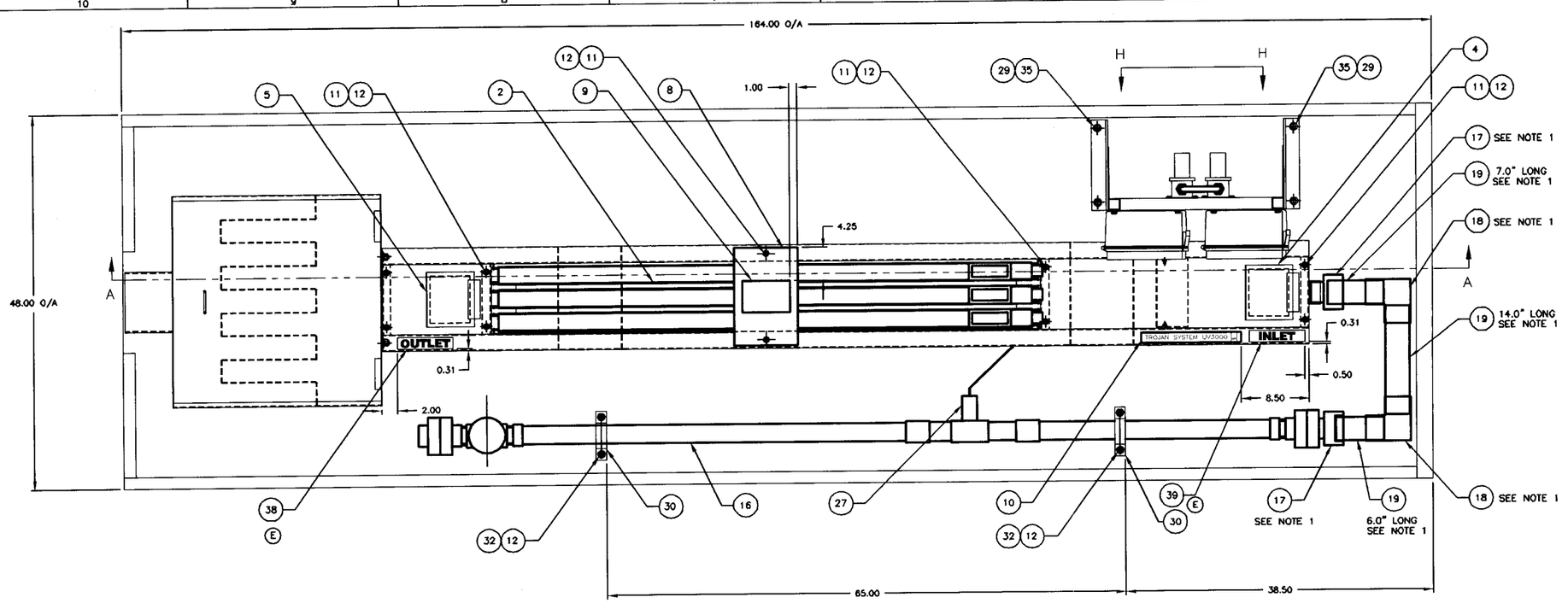
Fouling of the quartz sleeves will also affect the dose provided by the system. When the quartz sleeves become fouled, the amount of UV energy reaching the effluent will be decreased. Provision must be made to ensure the quartz sleeves remain clean. Since the Town of Riverhead currently has an installed Trojan UV3000™, I am assuming that the same cleaning operation can be used for the pilot system. Some manufacturers will state that chemical cleaning is not required. This is simply untrue. The issue of fouling is an inexact science. It does not simply depend on the temperature of the quartz sleeves. If this were true, the entire wastewater plant should be clean and never require cleaning. Fouling depends on the interaction of hardness, pH, temperature, etc. and is very hard to predict. Some manufacturers will maintain that cleaning is not an issue because, due to their system design, cleaning the quartz sleeves is not an easy task. If a system must be taken off line for cleaning, flow must be shut off for a certain period of time, or a redundant reactor must be provided to ensure non-stop flow. Please refer to the attached document entitled, "Advances in UV Cleaning Technology" for more information. I have also provided a Trojan UV3000™Plus brochure. The Trojan UV3000™Plus includes an optional automatic chemical and mechanical cleaning system that ensures the quartz sleeves remain clean at all times. This system is definitely worth looking in to for the full scale UV system at Riverhead.

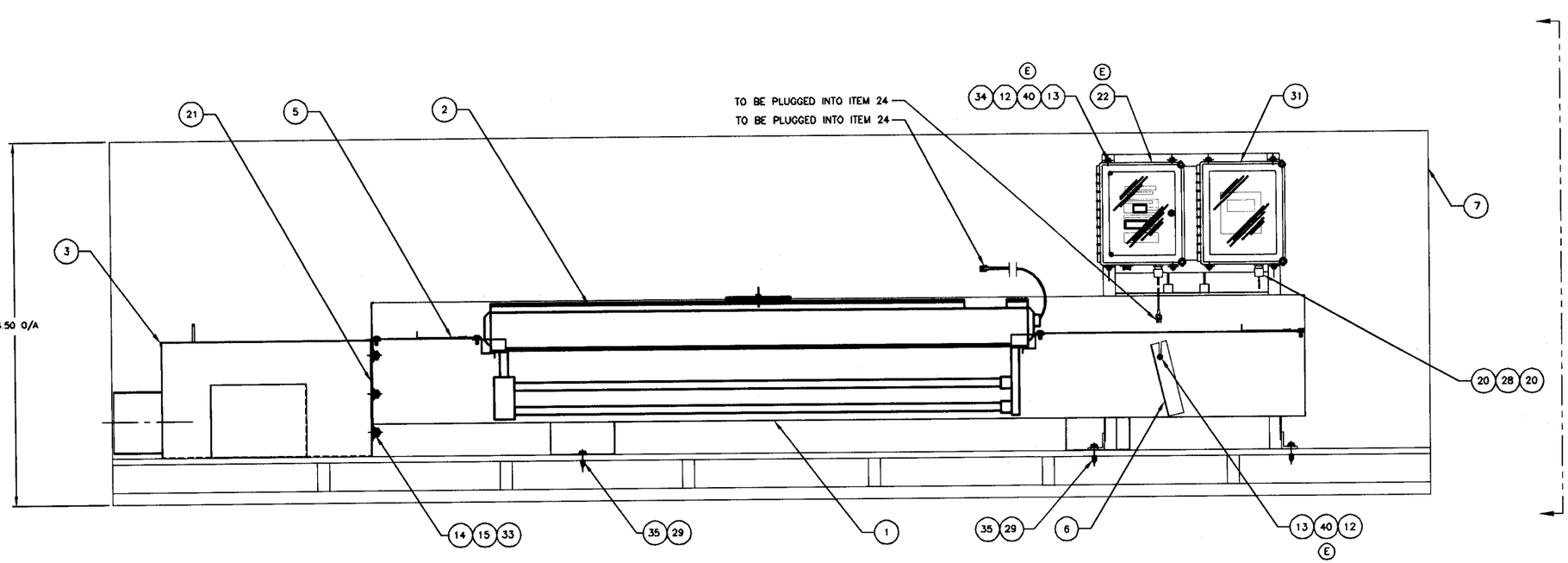
Trojan will be available for discussion regarding the operation and technical aspects of running the pilot unit in order to achieve the desired results.

If you have any questions, please do not hesitate to call.

Regards,
Trojan Technologies Inc.

Todd Bartlett, B.Sc., P.Eng.





SECTION A-A

(E) NOTE:
1/ MALE ADAPTOR (ITEM 17), 90° ELBOW (ITEM 18), AND 3"PIPE (ITEM 19) ARE TO BE SOLVENT WELDED AT ASSEMBLY.

REV	REVISION DESCRIPTION	LOG NO.	REV BY	CHK BY	APPROVAL AND DATE
A	DRAWING RELEASED	95-526	MS	MS	--
B	STAND ADDED, BOM UPDATED	95-541	MS	MS	--
C	FASTENERS ADDED, QTYS CORRECTED(SEE ECN)	96-002	MS	MS	--
D	DELETED 700108 AND 908010	96-011	JAW	JAW	--
E	1/ TITLE WAS 3150 PILOT ASSY - AMBLER WWTP 2/ MOVED VIEW H TO SHEET 2 OF 2 DELETED: 3/ PT#308558 QTY 1 4/ PT#308101 QTY 1 5/ SECTION R-R ADDED: 6/ PT#308819 QTY 1 7/ PT#015073 QTY 1 8/ PT#901193 QTY 1 9/ PT#901194 QTY 1 10/ PT#600618 QTY 14 11/ NOTE 1 12/ VIEW R ON SHEET 2 OF 2 QUANTITY CHANGES: 13/ PT#600619 QTY 36 WAS 40	96-1064	MS	RC	GFD 96SE12

	ITEM	QTY	ITEM DESCRIPTION	PART NUMBER	DRAWING NUMBER
(E)	40	14	WASHER, SPLITLOCK 1/4 SST304	600618	-----
(E)	39	1	LABEL, 'INLET' 2x7 ADH BACK	901194	901194
(E)	38	1	LABEL, 'OUTLET' 2x7 ADH BACK	901193	901193
	37	9ft	WIRE #16Ga TEW STRANDED	262001	-----
	36	1	STAND, P.U. MON/FLOW SYS & PDR'S	308709	308709
	35	8	WASHER, FLAT 3/8 304SST	600638	-----
	34	8	BOLT 1/4-20UNC X 2.5 LG 304 SST	010010	-----
	33	7	WASHER 1/2" SPLITLOCK 304 SST	600640	-----
	32	4	BOLT, LAG 0.25-10x1.0 LG 304SST	010074	-----
	31	1	FLOWMETER 0-180 ENCLOSURE ASSEMBLY	907064	-----
	30	2	BRACKET, PIPE SUP PILOT UNIT	308649	308649
	29	8	BOLT, LAG 0.38-7x2.0 LG 304SST	010075	-----
	28	1	STRAIN RLF, .08-.24"DIA,3/8NPT	700144	-----
	27	1	SIGNET 515 FLOW SENSOR	907035	-----
	26	3	STRAIGHT CONNECTOR T&B5332	908010	-----
	25	4ft	LIQUIDTIGHT COND. 1/2" CSA 050	908009	-----
	24	2	POWER DISTR RECEPT 2-ASSY	308162	-----
(E)	23	1	PROBE ASSY, 16ft UV3000 PTP	015073	015073
(E)	22	1	PTP MON ASSY, CD 9'OUT 4-20mA	308819	308819
	21	1	GASKET PTP3075/3150 FLANGE BOX	308176	308176
	20	2	LOCKNUT, 3/8"	600098	-----
	19	3ft	PIPE 3" SCH40 PVC	002034	-----
	18	2	3.0" 90 DEG ELBOW SCH40 PVC	308633	-----
	17	2	3.0" MALE ADAPTOR SCH80 PVC	002002	-----
	16	1	3.0" FLOW METER PIPE ASSY	907074	907074
	15	7	WASHER 1/2" FLAT 304 SST	600641	-----
	14	7	NUT 1/2-13UNC HEX 304 SST	600642	-----
	13	14	NUT HEX 1/4-20UNC 304 SST	600616	-----
(E)	12	36	WASHER 1/4 FLAT SST304	600619	-----
	11	14	BOLT 1/4-20 x 3/4" HEX SST304	600614	-----
	10	1	UV3000 TROJAN LOGO LABEL 12.5"	301203	-----
	9	1	LABEL UV LIGHT 4 x 6 ENGLISH	222381	-----
	8	1	ACCESS PLATE FOR 3M (3075&3150)	308064	308062G
	7	1	CRATE, 3150 PILOT, AMBLER WWTP	308706	308706
	6	1	STILLING PLATE 3150 PILOT UNIT	308632	308632
	5	1	SAMPLING COVER - AFTER MODS 3150	308630	308630
	4	1	SAMPLING COVER - BEFORE MODS 3150	308631	308631
	3	1	3150 PILOT WEIR	308554	308554
	2	3	MOD ASSY, PTP 2-64 G#3 120V	308022	-----
	1	1	CHANNEL WLDT, 3150 PILOT UNIT	308552	308552

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: 2 PL DEC ± 0.13
3 PL DEC ± N/A
ANGLE ± 5.0°
REMOVE ALL BURRS
ALL CORNERS R 0.010 OR BREAK
▽ DENOTES CRITICAL DIMENSIONS

TROJAN TECHNOLOGIES INC.
LONDON, ONTARIO, CANADA

DESCRIPTION: PILOT UNIT ASSY, PTP 3150

Xref LOG02.DWG

THIRD ANGLE PROJECTION | 1.0" ON ORIGINAL DWG | SCALE: 1:8 | SHEET 1 OF 2 | SIZE D | DWG NO. 308705 | REV E

Appendix E

APPENDIX E
LIGHTSTREAM PULSED UV TECHNICAL INFORMATION

Inherent Attributes and Advantages of LightStream's Pulsed UV Technology As Applied For Wastewater Reuse Disinfection

1. Quality	1. LightStream's units are manufactured under ISO standards. The units also carry the UL®, CE and TÜV marks. These international quality marks are reflective of LightStream's commitment to supplying our municipal customers with UV equipment of world-class quality. These marks are very important for municipal utilities.
2. Precision	1. LightStream LSi/LSx machines feature as standard a proprietary software program which enables the user to specify and program precise UV dose requirements as well as other UV process parameters. This would provide the municipality's maintenance crew the freedom to change the UV dose selection at any time, should the application or change in the process parameters warrant a change in the UV dose. In essence, the LS units afford the user the ability to continually analyze and adjust the critical operating parameters. 2. The precise data monitoring and display capabilities offered by the LSi/LSx units would also make it easier for the maintenance personnel to monitor the system for performance and compliance. The control system is also capable of being connected to the SCADA system of the utility's central/master control system. 3. Another great benefit is that it substantially helps the system/process validation. LightStream's measurement and control systems help ease the validation process.
3. Safety	1. Chemical-free, mercury-free and worry-free process. These are great attributes of the LS units, given that two of the main reasons for applying Pulsed UV technology are that (1) the PUV process does not involve any chemicals and added substances as well as (2) that it is inherently environment-friendly. The presence of mercury in conventional/archaic UV systems would void and defeat the 'environment-friendly' claims and also potentially expose the utility to serious risk and danger of accidental mercury contamination of the water and to the resultant liability.

	2. No harmful by-products formation 3. Environmentally-responsible technology 4. Non-corrosive (unlike chemical disinfection methods). This ensures that no scaling takes place and that the overall system is clean.
4. Performance	1. Ultra high-intensity UV system 2. Guaranteed UV dose delivery via the Constant Optimum Dose™ (COD) methodology. 3. Up to 99.9999% Bacterial Destruction (or 6-log reduction, as opposed to the 3-log reduction provided by conventional mercury-based, continuous-wave UV technology). This is a great benefit in wastewater reuse applications where, naturally, microbial control is of paramount concern. 4. Negligible pressure-drop. The inherent advantage here is that the use of the LSi would not be a burden on the pumps and piping systems. 5. Available on-demand 24/7. The LightStream units' ability to operate on a 24/7 basis would be in line with the utility's operations.
5. Simplicity	1. Single, Non-fouling Xenon lamp 2. No messy chemicals 3. Easy-to-operate touch-screen control system. The control system is also capable of being connected to the SCADA system of the utility's central/master control system. This would help the operators and maintenance crew immensely.
6. Value	1. Guaranteed performance and efficiency. The customer would have one less thing to worry about. 2. 2-year warranty
7. Service	1. Fully-trained and knowledgeable local Value-Added Resellers (VARs) in your area 2. Remote monitoring capabilities. Would help the utility's maintenance team obtain diagnosis and rectification of any problem via remote access.

LSi Specifications

General

Flow Capacity:	Up to 160m^3/hr (1 MGD) Optimized to application
Installation:	"Plug & Play"
Disinfection:	Pulsed Ultraviolet Light (PUV)
Reactor:	Closed vessel
Lamp:	One Xenon flash lamp
Process Control:	Real time, performance confirmed

System Control:	Real time
Control Tools:	Dose measure, adjust, verify, report
Scalability:	Parallel units, single control
Operation:	Automated
Head Loss	Zero - VSD Pump Included

Mechanical & Electrical

Size, W x D x H, mm (in):	1350 (53.2) W x 1800 (70.9) D x 2325 (91.6) H
Weight, kg (lbs.):	1660 kg (3659 lbs.)
Unit Construction:	Stainless steel
Maintenance Access:	Safety-interlocked service door
Electrical Access:	Safety-interlocked service panel
Electrical Input Voltage:	380 to 500 VAC 3-phase 50/60 Hz
Max. Electrical Input Amperage:	65 A at 380 VAC
Electrical Interruption:	Fail-safe UPS, alarm, remote notification, orderly shutdown
Service Connections:	Influent & effluent ports (150 mm, flanged) AC power, 3-phase, 4-wire, 65 A (max) Communications link (Ethernet port) Gravity-fed non-potable water drain port, 1½" FNPT or 1½" ID hose nipple

System Components

UV Reactor

Reactor:	Closed vessel
Flow Characteristic:	Optimized collinear, multiple impact
Lamp:	One Xenon flash lamp
Wavelengths:	Broadband UV-C, 200 nm to 300 nm
Average Power:	2400 Watts UV-C (maximum)
Peak Power:	6,000,000 Watts UV-C per pulse
Replacement:	Cassette
Cleaning:	Not Required
UV Dosing Method:	Constant Optimum Dose (COD™)
UV Dose Delivery:	Discrete pulses, 1 Hz to 30 Hz
UV Dose Measurement:	Real time
UV Power Adjustment:	Real time, full operating range

Control Unit

Controls:	Touch screen PC
Control Access:	Local, SCADA, Ethernet

Operation:	Automated
Languages:	Chosen by operator (22)

Management

Process Performance:	Real-time confirmed
System Response:	Real time
Control Tools:	Dose measure, adjust, verify, report
Control Measurements:	UV power, UVT%, flow rate, UV dose electricity use, system functions, alarms
Service Reporting:	Components, performance, maintenance

Other General Specifications

Treatment Capacity Range:	175 GPM to 700 GPM (0.25 MGD to 1 MGD)
Installation Strategy:	Transportable, self-contained "plug & play" machine
Reactor Type:	Single, closed vessel
Disinfection Source:	Pulsed ultra-violet (PUV) Light
Lamp Type:	Mercury-free, xenon flash lamp
Process Control Method:	Actual performance-based operation, full accountability
System Control:	Real-time, closed-loop, sub-second response
Control Toolkit:	Dose measurement, adjustment, verification, reporting
System Scalability:	Yes. Paralleled units, single system control point
Control/Reporting Access:	Local, SCADA, Ethernet, Modem, Satellite
System Operator Requirements:	Fully-configurable automated operation (hands-free)
Process Water Head-Loss:	Zero. Unit includes automated VSD pump
International Product Standards:	UL, CSA, IEC, CEMark
International Water Standards:	Designed to accommodate present/emerging standards (USEPA ETV, DVGW, WRI/AWWARF, and others)

System Component Specifications

UV Generator

Lamp Type:	Mercury-free, xenon flash lamp

Germicidal Wavelengths:	Broadband UV-C, 200 nm to 300 nm
UV-C Average Power, Max.:	2400 Watts UV-C
UV-C Peak Output Per Pulse:	6,000,000 watts Peak Power per pulse
Lamp Replacement Scheme:	"No-touch" cassette replacement
Lamp Life Cycle:	3 months based on continuous use
User Lamp Cleaning:	None
Lamp Cooling Method:	Direct, closed-loop water jacket
Lamp Sleeve Temperature:	Low: Influent water temperature + 15 C

UV Reactor Design

Design Scheme:	Single-lamp construction
Flow Characteristic:	CFD-optimized collinear, multiple impact
UV Dosing Method:	Constant Optimum Dose (COD™)
COD Technique:	Differential UVT, PID control
UV Dose Measurement:	Discrete pulse energy measurement
COD Response Time:	Sub-second at pulse-to-pulse intervals
UV Dose Delivery:	Discrete pulses, 1 Hz to 30 Hz
UV Power Adjustment Response:	Instant, across entire power operating range

System Control Unit

Human Interface:	Graphical User Interfaced (GUI) touch screen PC
System Control Access:	Local, SCADA, Ethernet, Modem, Satellite
System Operator Requirements:	Fully-configurable automated operation (hands-free)
Automated Software Updates:	via Local, SCADA, Ethernet, Modem, Satellite
Languages:	Chosen by administrator during configuration (22)
System-to-Unit Control Method:	Ethernet
Unit Control Method:	As per configuration instructions from the System Control Unit, a dedicated PLC handles all unit-level operation parameters, including monitoring, dose management, verification, alarms, and fail-safe controls

System Control Management Methods & Accountability

Process Control Method:	Actual performance-based operation

System Control Response:	Sub-second response in real-time
Management Control Tool Kit:	Dose measurement, adjustment, verification, reporting
Control Measurements:	UV Power, UVT, reactor flow rate, UV Dose, power consumption, system housekeeping functions, alarms
Service Reporting:	Components inventory, performance, maintenance
Size, W x D x H, mm (in):	1350 (53.2) W x 1800 (70.9) D x 2325 (91.6) H
Weight, kg (lbs.):	567 kg (1250 lbs.)
Unit Construction:	Integrated stainless steel case/pallet
Scheduled Maintenance Access:	Safety-interlocked service door
Electrical Access:	Safety-interlocked service panel
Exposed Exterior Finishes:	Integrated stainless steel case/pallet
Transportability:	Integral fork lift pickup points within the unit
Electrical Input Voltage:	380 VAC – 500 VAC 3-phase 50/60 Hz
Max. Electrical Input Amperage:	65 A at 380 VAC
Electrical Consumption:	Varies per application; $\leq 0.1 kw/m^3$
Electrical Interruption Capability:	Remote notification and 10 minutes of fail-safe system control (via UPS) prior to orderly shutdown

Service Connections:

- Process water influent & effluent ports (150 mm, flanged)
- AC power, 3-phase, 4-wire, 65 A (max)
- Communications link (Ethernet port)
- Gravity-fed non-potable water drain port, 1½" FNPT or 1½" ID hose nipple

The Application of LightStream's Technology Within A Waste Water Treatment Plant (WWTP)

Sewage is the wastewater released by residences, businesses and industries in a community. It is 99% percent water, with less than 1% of the wastewater comprising of dissolved and suspended solid material. The turbidity or cloudiness of sewage is caused by suspended particles which in untreated sewage ranges from 100 to 350 mg/L. A measure of the strength of the wastewater is biochemical oxygen demand, or BOD_5. The BOD_5 measures the amount of oxygen microorganisms require in five days to break down sewage. Untreated sewage has a BOD_5 ranging from 100 mg/L to 300 mg/L. Pathogens or disease-causing organisms are present in sewage. Coliform bacteria are used as an indicator of disease-causing organisms. Sewage also contains nutrients (such as ammonia and phosphorus), minerals, and metals. Ammonia can range from 12 to 50 mg/L and phosphorus can range from 6 to 20 mg/L in untreated sewage.

Sewage treatment is a multi-stage process to renovate wastewater before it reenters a body of water, is applied to the land or is reused. The goal is to reduce or remove organic matter, solids, nutrients, disease-causing organisms and other pollutants from wastewater. Each receiving body of water has limits to the amount of pollutants it can receive without degradation. Therefore, each sewage treatment plant must hold a permit listing the allowable levels of BOD_5, suspended solids, coliform bacteria and other pollutants. The discharge permits are called NPDES permits which stands for the National Pollutant Discharge Elimination System (Ref. 1).

Preliminary Treatment

Preliminary treatment to screen out, grind up, or separate debris is the first step in wastewater treatment. Sticks, rags, large food particles, sand, gravel, toys, etc., are removed at this stage to protect the pumping and other equipment in the treatment plant. Treatment equipment such as bar screens and grit chambers are used as the wastewater first enters a treatment plant. The collected débris is usually disposed of in a landfill (Ref. 1).

Primary Treatment

Primary treatment is the second step in treatment and separates suspended solids and greases from wastewater. The wastewater is held in a 'quiet tank' for several hours allowing the particles to settle to the bottom and the greases to float to the top. The solids drawn off the bottom and skimmed off the top receive further treatment as sludge. The clarified wastewater flows on to the next stage of wastewater treatment. Clarifiers and septic tanks are usually used to provide primary treatment.

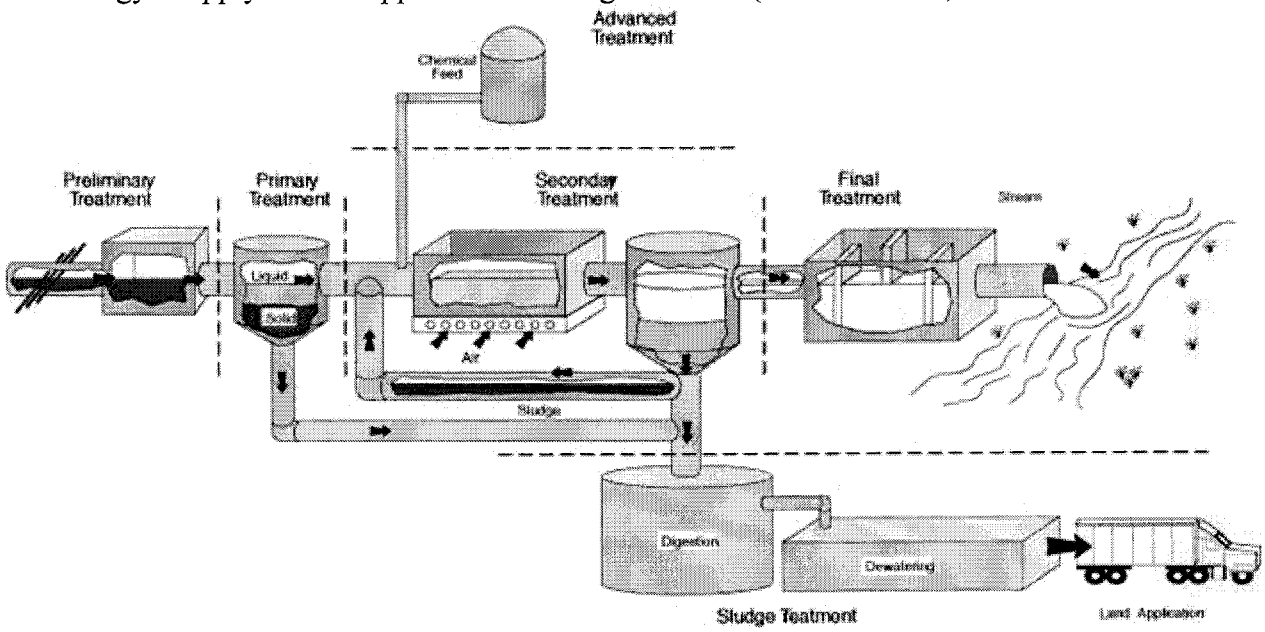
Secondary Treatment

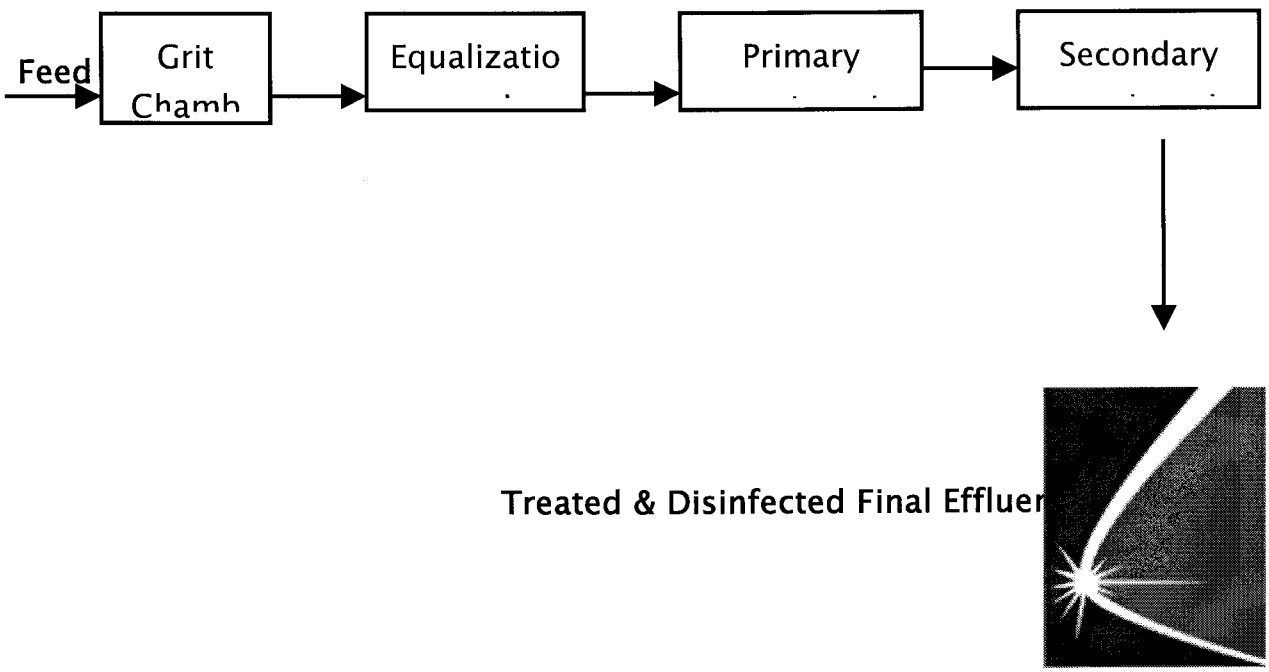
Secondary treatment is a biological treatment process to remove dissolved organic matter from wastewater. Sewage microorganisms are cultivated and added to the wastewater. The

microorganisms absorb organic matter from sewage as their food supply. Three approaches are used to accomplish secondary treatment: fixed film, suspended film and lagoon systems (Ref. 1).

Final Treatment

Final treatment focuses on removal of disease-causing organisms from wastewater. Treated wastewater can be disinfected by chlorine or by using ultraviolet light. High levels of chlorine may be harmful to aquatic life in receiving streams. Therefore, UV treatment is the right technology to apply for this application. See figure below (Source: Ref. 1).





WASTEWATER QUALITY AND THE SIGNIFICANCE OF UV TRANSMITTANCE

By definition, a wastewater stream contains waste content, however low, and therefore, the quality of the wastewater is a very important consideration in applying UV technology. For the purpose of UV treatment, wastewater quality is determined through testing for its UV Transmittance. UV Transmittance is the measure of the ability of a fluid medium to transmit UV light through the medium. Naturally then, the greater the amount of UV-absorbing material (such as turbidity, TDS, suspended solids, colloidal matter, color/organics, metals, etc.) present in the water - and hence the more inferior the quality of the water - the lower is the UV transmittance value. When a light beam is shone through a medium, depending upon the degree of contamination present, part of the incident light is absorbed and the rest gets transmitted across. Contaminants such as Color/Total Organic Carbon, Suspended solids (TSS), Total Dissolved solids (TDS), metals (especially iron and manganese), etc. are all excellent absorbers of UV radiation and would contribute to toward decreasing the UV Transmittance value.

UV Transmittance = *f* (Turbidity, Color/TOC, Colloidal matter, TSS, TDS, Iron, etc.)

While filtration of the sample will enhance the UV Transmittance value of the sample (since filtration will remove some or most of the suspended matter present in the water), the degree of improvement in the Transmittance value will greatly depend upon the levels of contamination present. In line with industry practices, at LightStream, we employ the term T_{10} to express the degree of UV absorption of a fluid sample, which we then use to compute the UV dose required for a particular application. The T_{10} value can be determined quite easily using a freshly-calibrated UV-Visible spectrophotometer at the 254nm wavelength. Double-distilled water is typically used to calibrate the spectrophotometer. **T_{10}** represents the percentage transmittance through a 10 mm pathlength test-cell of the spectrophotometer and the test is usually performed at the 254nm wavelength, since the 254 nm is the 'Germicidal wavelength'. To put the concept of Transmittance and T_{10} in perspective, a typical tap-water sample exhibits a T_{10} value of anywhere from 90 to 95%.

LightStream's LS units are specifically designed for the disinfection of treated wastewater. Even wastewater streams exhibiting low levels of UV Transmittance can be successfully disinfected using LightStream's ultra high-intensity pulsed UV technology. The complex control system featured in a LightStream unit includes precise measurement of the UV Transmittance as well as dose measurement hardware & software. This is an invaluable tool for SCADA systems, which are a critical part of the operation of a wastewater treatment plant.

Other Applications

LightStream's Pulsed UV technology can also be deployed to destroy trace amounts of the following chemical contaminants present in drinking water / wastewater streams:

1. Aldehydes (e.g. formaldehyde)
2. Alkanes
3. Aromatic hydrocarbons, etc.
4. Atrazine
5. Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
6. Chlorine / Chloramine
7. Formic acid
8. Ketones (e.g. acetone)
9. MTBE (the gasoline additive that's contaminating groundwater in several U.S. states such as California, New York, Pennsylvania, North Carolina and Connecticut)
10. NDMA
11. Perchlorates
12. Solvents (e.g. carbon tetrachloride)
13. TCE
14. VOCs in general

In these applications, the design of a LightStream application solution would depend upon the following variables:

1. Flowrate or Batch volume
2. %UV T_{10} value of the wastewater stream
3. Concentration of the contaminant(s) to be removed/reduced
4. Desired concentration of the contaminant(s)
5. Any other relevant process parameter(s)

After a review of the above-listed variables, LightStream can provide a Pulsed UV technology solution that is tailor-made for the particular application.

Bibliography/References

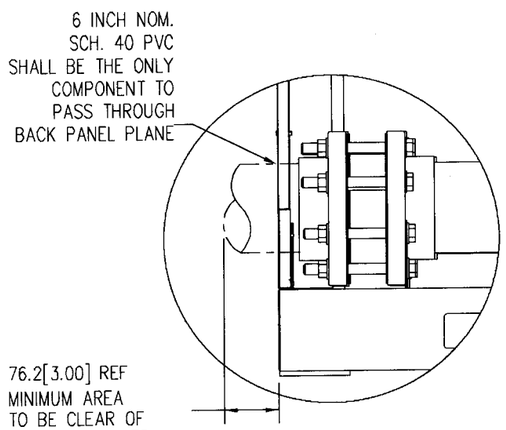
1. 'Wastewater Treatment Principles and Regulations', Ohio State University, Food, Agricultural and Biological Engineering online FactSheet – AES-768-96, Columbus, Ohio (http://ohioline.osu.edu/aex-fact/0768.html).

2. 'LightStream Pulsed UV vs. Medium and Low Pressure Mercury UV' – LightStream Technologies, Inc., Reston, Virginia.

DWG NO. DG008134 REV

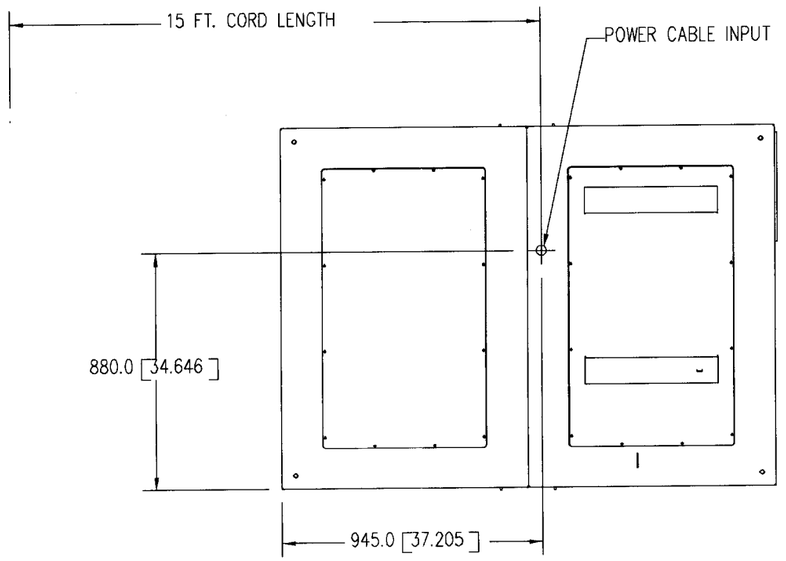
REVISIONS

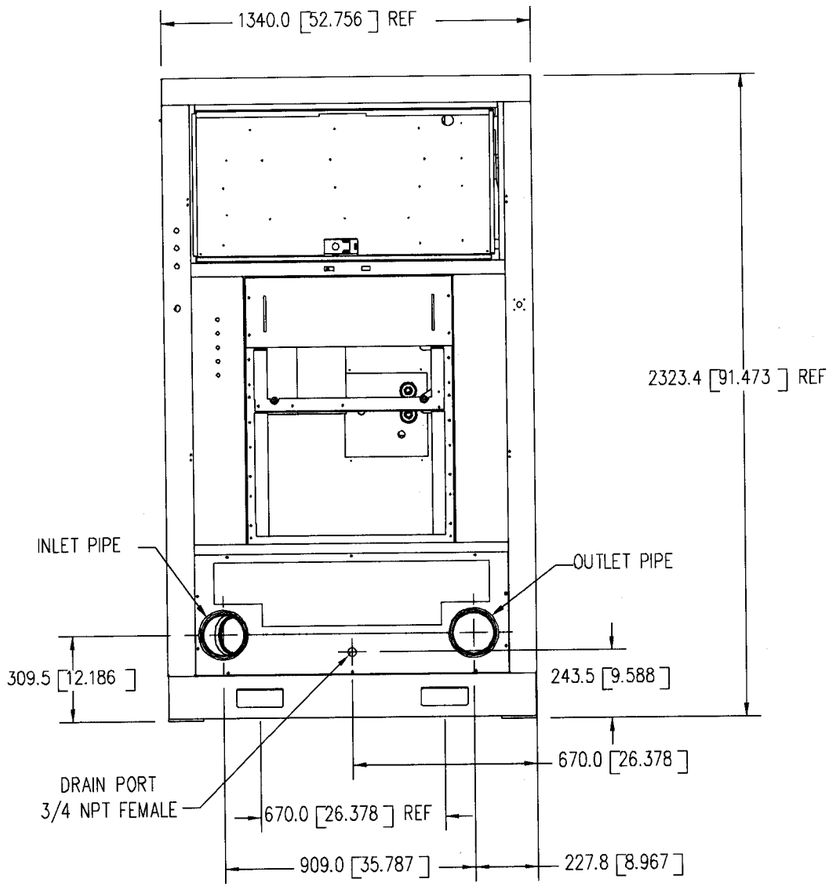
REV	DESCRIPTION	DATE	APP'D

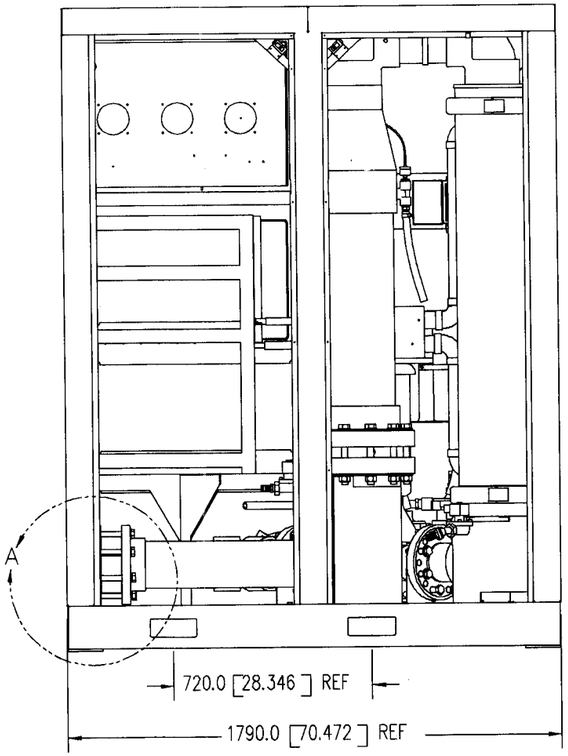


DETAIL A
SCALE 1 : 5

INLET / OUTLET PIPE CONNECTION DETAIL
(DG006311_14 REMOVED FOR CLARITY)







NOTES

1. DOUBLE-WIDE INDUSTRIAL ACCESS DOORS REQUIRED TO BE 96" H MIN.
2. FORK LIFT MINIMUM LIFT CAPACITY TO BE 4000 LBS.
3. UNIT REQUIRES THAT LOCKED STORAGE CAPACITY BE MADE AVAILABLE IN RELATIVE CLOSE PROXIMITY TO ACCOMMODATE A SPARE REACTOR CHAMBER AND RELATED ACCESSORIES. MINIMUM STORAGE AREA DIMENSIONS SHALL BE 78"H X 60"W X 36"D.
4. DRAIN PORT OUTPUT SHALL BE PIPED TO UNTREATED WATER SYSTEM.
5. ELECTRICAL INPUT REQUIREMENT: 480 VAC / 100 AMP / 3-PHASE
6. UNIT WEIGHT: 2500 LBS.

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMETERS.
TOLERANCES:
DECIMALS X.X ± .01, X.XX ± .005, X.XXX ± .0005
ANGULAR ±°
DO NOT SCALE DRAWING

LightStream Technologies, Inc.
12200 Sunrise Valley Drive, Suite 100
Reston, VA 20191 USA

MATERIAL	DESIGN	DATE	DWG NAME	FACILITIES DRAWING	
SURFACE TREATMENT	CHECKER	DATE	SIZE A1	DWG NO. DG008134	REV
COLOR	APPROVAL	DATE	SCALE 1:10	SHT 1 OF 1	

D:\Projects\DesignightStreamgrold Asm Backup\DG008134

SOLIDWORKS

Appendix F

Item Details

Ba

Product Category: Pumps & Plumbing > Sump and Sewage > Sump Pumps

Description
Submersible Sump Pump, Power Rating 1/3 HP, Flow @ Total Head 2750 GPH, Water Flow @ 5 Feet of Head 46 GPM, Water Flow @ 10 Feet of Head 29 GPM, Water Flow @ 15 Feet of Head 13 GPM, Discharge NPT 1 Inch, Impeller Material Nylon, Housing Material Cast Iron, Top Material Polycarbonate, Shut Off 18.0 Feet, Base Material Polypropylene, Cord Length 8 Feet, Operation Automatic, Height 6 Inches, Width 9 1/2 Inches

Grainger Item: 3P639
Price (ea) : $105.10
Manufacturer: LITTLE GIANT
Mfg. Model#: 6-CIA

Ship Qty : 1
Sell Qty (Will-Call) : 1
Usually Ships : Today
Catalog 394 Page: 2860

Select Qty.

Add to Personal List ADD TO ORDER

Price shown may not reflect your price. *Log-in* above, or click here to register.

NOTES & RESTRICTIONS

Repair Parts Info available for this product.

See Catalog 394 Page for application and/or safety information.

REQUIRED ACCESSORIES

Description
Sump Pump Hose, 1 1/2 Inches Inside Diameter, 24 Feet Polyethylene

Price (ea): $9.53
Grainger Item#: 4P972

Usually Ships : Today

Select Qty.

Add to Personal List ADD TO ORDER

OPTIONAL ACCESSORIES

Description
Sump Pump Check Valve, Screw In, With One Reversible Rubber Pipe Adapter which Fits 1 1/4 or 1 1/2 Inches OD Pipe, Molded Body with Male Threads to Fit

Price (ea): $8.69
Grainger Item#: 4UN78

Usually Ships : Today

Select Qty.

Add to Personal List ADD TO ORDER

Description
Sump Pump Check Valve, In Line, With Two Reversible Rubber Pipe Adapters to Fit 1 1/4 or 1 1/2 Inches Pipe, 4 Steel Hose Clamps

TECHNICAL SPECIFICATI

Base Material: Polypropylene

Cord Length (Feet): 8

Discharge NPT (Inches) 1 1/2

GPM of Water @ 10 Feet of H 29

GPM of Water @ 15 Feet of H 13

GPM of Water @ 5 Feet of H 46

Height (Inches): 6

HP: 1/3

Width (Inches): 9 1/2

Housing Material: Cast Iron

Impeller Material: Nylon

Operation: Automatic

Top Material: Polycarbonate

Shut-Off (Feet): 18.0

Amps:

Price (ea): $10.74 Usually Ships : Today
Grainger Item#: 4UN79
Select Qty.
Add to Personal List ADD TO ORDER

ALTERNATE PRODUCTS

Description
Sump Pump, Power Rating 3/10 HP, Current Rating 9.6 Amps, Voltage Rating 115 Volts, Maximum Flow 43 GPM, Phase Single, Off Point 3 1/4 Inches, On Point

Price (ea): $116.65 Usually Ships : Today
Grainger Item#: 2P547
Select Qty.
Add to Personal List ADD TO ORDER

Description
Submersible Sump Pump, Power Rating 4/10 HP, Flow @ Total Head 3250 GPH, Water Flow @ 5 Feet of Head 54 GPM, Water Flow @ 10 Feet of Head 42 GPM, Water

Price (ea): $215.75 Usually Ships : Today
Grainger Item#: 3P641
Select Qty.
Add to Personal List ADD TO ORDER

Description
Effluent Sump Pump, Power Rating 4/10 HP, Voltage @ 60 Hz 115 VAC, Water Flow @ 5 Feet of Head 57 GPM, Water Flow @ 10 Feet of Head 53 GPM, Water Flow

Price (ea): $263.00 Usually Ships : Today
Grainger Item#: 4RK90
Select Qty.
Add to Personal List ADD TO ORDER

Description
Effluent Sump Pump, Power Rating 1/3 HP, Voltage @ 60 hz 115 Volts, Flow @ Total Head 3000 GPH, Water Flow @ 5 Feet of Head 50 GPM, Water Flow @ 10 Feet

Price (ea): $121.80 Usually Ships : Today
Grainger Item#: 4XK40
Select Qty.
Add to Personal List ADD TO ORDER

9

Diameter (Inches):
9 1/2

GPM of Water @ 20 Feet of H
-

GPM of Water @ 25 Feet of H
-

GPM of Water @ 40 Feet of H
-

Maximum Head (Feet):
18

Off Point (Inches):
3

On Point (Inches):
10

Switch Type:
Diaphragm

Volts:
115

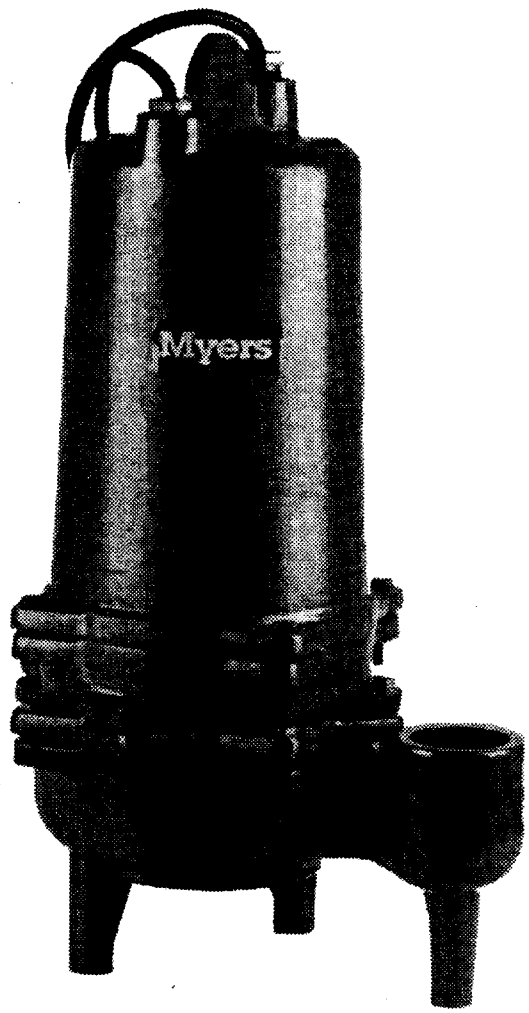
Myers®

MWH50 - MW200 SERIES
ME33 - ME150 SERIES
Submersible Sump, Effluent & Sewage Pumps

Installation and Service Manual

Single and double seal. Single and three phase power.

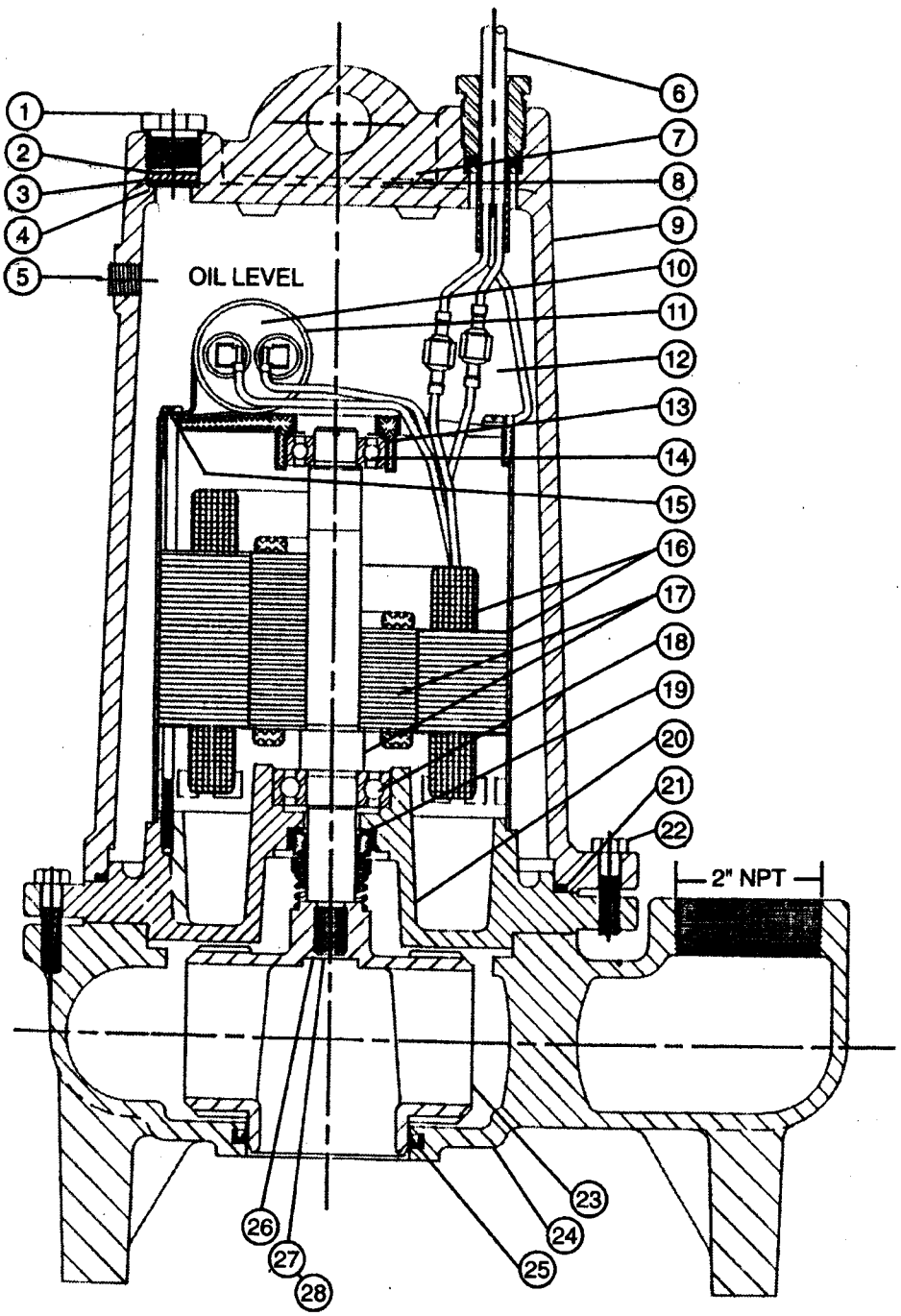
SINGLE SEAL PUMP
ME33S, ME50S, ME75S
ME100S, ME150S,
MWH50, MW100,
MW150, MW200



DOUBLE SEAL PUMP
ME33D, ME50D, ME75D
ME100D, ME150D,
MWH50D, MW100D,
MW150D, MW200D

23833A278

TYPICAL SECTION DRAWING FOR ME/MW33-200 SINGLE SEAL PUMPS



SINGLE SEAL REPAIR PARTS LIST

Ref. No.	Description	No. Req'd.	Part Numbers
1	Nut, cord plug, solid	1	25341A002
2	Washer, 1/32" Thk.	1	05030A234
3	Gasket, rubber	1	05014A193
4	Washer, 3/32" Thk.	1	05030A235
5	Plug, 1/4" pipe	1	05022A009
6	Cord, power	1	See Chart
7	Screw, drive	2	05160A004
8	Nameplate, blank, 1 Ph	1	25488A000
8	Nameplate, blank, 3 Ph	1	25499A000
9	Housing, motor (ME33-150/MWH50-200)	1	25327D000
10	Capacitor (1 Ph only)	1	See Chart
11	Clip, capacitor (1 Ph only)	1	See Chart
12	Oil, transformer (5 gal.) (ME33-50)	.8 gal.	11009A006
12	Oil, transformer (5 gal.) (ME/MWH50-200)	1 gal.	11009A006
12A	Connectors (3 Ph only)	3/6	15781A001
13	Washer, bearing	1	19331A005
13B	Ring, retaining (ME33-50)	2	12558A021
14	Bearing, ball, upper	1	08565A013
15	Screw, ST, #10 x 3/8	2	09822A032
16	Stator with shell	1	See Chart

Ref. No.	Description	No. Req'd.	Part Numbers
17	Rotor with shaft	1	See Chart
18	Bearing, ball, lower (ME33-50)	1	08565A013
18	Bearing, ball, lower (ME75-150/MWH50-200)	1	08565A022
19	Seal, shaft (ME33-50)	1	22447A020
19	Seal, shaft (ME/MWH50-200)	1	25370A000
20	Plate, brg. & seal (ME33-50)	1	25364D000
20	Plate, brg. & seal (ME/MWH50-200)	1	25367D000
21	Gasket, tetraseal, 7 x 6-3/4 x 1/8	1	05014A181
22	Screw, cap, 5/16 x 1-1/4	8	19100A012
23	Impeller, plastic (std. series)	1	See Chart
23	Impeller, BRASS ('B' series)	1	See Chart
24	Case, volute (ME33-50)	1	25357D000
24	Case, volute (ME75-150)	1	25331D000
24	Case, volute (MWH50-200)	1	26057D000
25	Cup, U, HUVA (ME33-150)	1	22835A005
25	Cup, U, HUVA (MWH50-200)	1	22835A009
27	Nut, Jam (ME50)	1	19109A070
28	Sealant (Grade 271 Loctite)	1	14550A001

SINGLE SEAL ME SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	⑥ Cord, Power	⑩ Capacitor	⑪ Clip, Capacitor	⑯ Stator w/shell	⑰ Rotor w/shaft	㉓ Impeller, Plastic (standard)	㉓ Impeller, Brass ("B" series)
ME33S-11	25325D000	25338B004	23838A000	20333A004	25482C000	25486B004	25333B010	25333B110
ME33S-11B	25325D100							
ME33S-01	25325D001	25338B005	23839A000	20333A006	25482C001	25486B004	25333B010	25333B110
ME33S-01B	25325D101							
ME33S-21	25325D002	25338B005	23838A000	20333A004	25482C001	25486B004	25333B010	25333B110
ME33S-21B	25325D102							
ME33S-01 L/P	25325D033	25338B006	23839A000	20333A006	25482C001	25486B004	25333B010	25333B110
ME33S-01B L/P	25325D133							
ME33S-21 L/P	25325D034	25338B006	23838A000	20333A004	25482C001	25486B004	25333B010	25333B110
ME33S-21B L/P	25325D134							
ME33S-03	25325D003	25338B003	–	–	25482C002	25486B005	25333B010	25333B110
ME33S-03B	25325D103							
ME33S-23	25325D004	25338B003	–	–	25482C002	25486B005	25333B010	25333B110
ME33S-23B	25325D104							
ME33S-43	25325D005	25338B003	–	–	25482C002	25486B005	25333B010	25333B110
ME33S-43B	25325D105							
ME33S-53	25325D006	25338B003	–	–	25482C003	25486B005	25333B010	25333B110
ME33S-53B	25325D106							

SINGLE SEAL ME SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	⑥ Cord, Power	⑩ Capacitor	⑪ Clip, Capacitor	⑯ Stator w/shell	⑰ Rotor w/shaft	㉓ Impeller, Plastic (standard)	㉓ Impeller, Brass ("B" series)
ME50S-11	25325D007	25338B004	23838A000	20333A004	25482C004	25486B006	25333B005	25333B100
ME50S-11B	25325D107							
ME50S-01	25325D008	25338B005	23839A000	20333A006	25482C008	25486B006	25333B005	25333B100
ME50S-01B	25325D108							
ME50S-21	25325D009	25338B005	23838A000	20333A004	25482C005	25486B006	25333B005	25333B100
ME50S-21B	25325D109							
ME50S-01 L/P	25325D035	25338B006	23839A000	20333A006	25482C008	25486B006	25333B005	25333B100
ME50S-01B L/P	25325D135							
ME50S-21 L/P	25325D036	25338B006	23838A000	20333A004	25482C005	25486B006	25333B005	25333B100
ME50S-21B L/P	25325D136							
ME50S-03	25325D010	25338B003	–	–	25482C006	25486B007	25333B005	25333B100
ME50S-03B	25325D110							
ME50S-23	25325D011	25338B003	–	–	25482C006	25486B007	25333B005	25333B100
ME50S-23B	25325D111							
ME50S-43	25325D012	25338B003	–	–	25482C006	25486B007	25333B005	25333B100
ME50S-43B	25325D112							
ME50S-53	25325D013	25338B003	–	–	25482C007	25486B007	25333B005	25333B100
ME50S-53B	25325D113							
ME75S-11	25325D014	25338B000	23839A000	20333A006	25484C002	25487B002	25348B020	25348B120
ME75S-11B	25325D114							
ME75S-01	25325D015	25338B001	23839A000	20333A006	25484C003	25487B002	25348B020	25348B120
ME75S-01B	25325D115							
ME75S-21	25325D016	25338B001	23838A000	20333A004	25484C003	25487B002	25348B020	25348B120
ME75S-21B	25325D116							
ME75S-01 L/P	25325D037	25338B002	23839A000	20333A006	25484C003	25487B002	25348B020	25348B120
ME75S-01B L/P	25325D137							
ME75S-21 L/P	25325D038	25338B002	23838A000	20333A004	25484C003	25487B002	25348B020	25348B120
ME75S-21B L/P	25325D138							
ME75S-03	25325D017	25338B003	–	–	25484C004	25487B003	25348B020	25348B120
ME75S-03B	25325D117							
ME75S-23	25325D018	25338B003	–	–	25484C004	25487B003	25348B020	25348B120
ME75S-23B	25325D118							
ME75S-43	25325D019	25338B003	–	–	25484C004	25487B003	25348B020	25348B120
ME75S-43B	25325D119							
ME75S-53	25325D020	25338B003	–	–	25484C005	25487B003	25348B020	25348B120
ME75S-53B	25325D120							
ME100S-01	25325D021	25338B001	23838A000	20333A004	25484C012	25487B004	25348B010	25348B110
ME100S-01B	25325D121							
ME100S-21	25325D022	25338B001	23838A000	20333A004	25484C006	25487B004	25348B010	25348B110
ME100S-21B	25325D122							
ME100S-01 L/P	25325D039	25338B002	23838A000	20333A004	25484C012	25487B004	25348B010	25348B110
ME100S-01B L/P	25325D139							
ME100S-21 L/P	25325D040	25338B002	23838A000	20333A004	25484C006	25487B004	25348B010	25348B110
ME100S-21B L/P	25325D140							
ME100S-03	25325D023	25338B003	–	–	25484C007	25487B005	25348B010	25348B110
ME100S-03B	25325D123							
ME100S-23	25325D024	25338B003	–	–	25484C007	25487B005	25348B010	25348B110
ME100S-23B	25325D124							
ME100S-43	25325D025	25338B003	–	–	25484C007	25487B005	25348B010	25348B110
ME100S-43B	25325D125							
ME100S-53	25325D026	25338B003	–	–	25484C008	25487B005	25348B010	25348B110
ME100S-53B	25325D126							
ME150S-01	25325D027	25338B001	23838A000	20333A004	25484C013	25487B004	25348B000	25348B100
ME150S-01B	25325D127							
ME150S-21	25325D028	25338B001	23838A000	20333A004	25484C009	25487B004	25348B000	25348B100
ME150S-21B	25325D128							
ME150S-01 L/P	25325D041	25338B002	23838A000	20333A004	25484C013	25487B004	25348B000	25348B100
ME150S-01B L/P	25325D141							
ME150S-21 L/P	25325D042	25338B002	23838A000	20333A004	25484C009	25487B004	25348B000	25348B100
ME150S-21B L/P	25325D142							
ME150S-03	25325D029	25338B003	–	–	25484C010	25487B006	25348B000	25348B100
ME150S-03B	25325D129							
ME150S-23	25325D030	25338B003	–	–	25484C010	25487B006	25348B000	25348B100
ME150S-23B	25325D130							
ME150S-43	25325D031	25338B003	–	–	25484C010	25487B006	25348B000	25348B100
ME150S-43B	25325D131							
ME150S-53	25325D032	25338B003	–	–	25484C011	25487B006	25348B000	25348B100
ME150S-53B	25325D132							

SINGLE SEAL MW SERIES PUMPS CHART

Pump Catalog Numbers	Pump Engineer. Numbers	② Cord, Power	⑥ Capacitor	⑦ Clip, Capacitor	⑬ Stator w/shell	⑭ Rotor w/shaft	㉕ Impeller (standard)**	㉕ Impeller, Brass**
MWH50-01 L/P	26089D039	25338B002	23839A000	20333A006	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-01B L/P	26089D139							
MWH50-01P	26089D013	25338B001						
MWH50-01BP	26089D113							
MWH50-21 L/P	26089D040	25338B002	23838A000	20333A004	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-21B L/P	26089D140							
MWH50-21P	26089D014	25338B001						
MWH50-21BP	26089D114							
MWH50-01	26089D015	25338B001	23839A000	20333A006	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-01B	26089D115							
MWH50-21	26089D016	25338B001	23838A000	20333A004	25484C003	25487B002 25487B012*	26029B003	26029B103
MWH50-21B	26089D116							
MWH50-03	26089D017	25338B003	-	-	25484C004	25487B003 25487B013*	26029B003	26029B103
MWH50-03B	26089D117							
MWH50-23	26089D018	25338B003	-	-	25484C004	25487B003 25487B013*	26029B003	26029B103
MWH50-23B	26089D118							
MWH50-43	26089D019	25338B003	-	-	25484C004	25487B003 25487B013*	26029B003	26029B103
MWH50-43B	26089D119							
MWH50-53	26089D020	25338B003	-	-	25484C005	25487B003 25487B013*	26029B003	26029B103
MWH50-53B	26089D120							
MW100-01 L/P	26089D041	25338B002	23838A000	20333A004	25484C012	25487B004 25487B014*	26029B002	26029B102
MW100-01B L/P	26089D141							
MW100-21 L/P	26089D042	25338B002	23838A000	20333A004	25484C006	25487B004 25487B014*	26029B002	26029B102
MW100-21B L/P	26089D142							
MW100-03	26089D023	25338B003	-	-	25484C007	25487B005 25487B015*	26029B002	26029B102
MW100-03B	26089D123							
MW100-23	26089D024	25338B003	-	-	25484C007	25487B005 25487B015*	26029B002	26029B102
MW100-23B	26089D124							
MW100-43	26089D025	25338B003	-	-	25484C007	25487B005 25487B015*	26029B002	26029B102
MW100-43B	26089D125							
MW100-53	26089D026	25338B003	-	-	25484C008	25487B005 25487B015*	26029B002	26029B102
MW100-53B	26089D126							
MW100-01	26089D021	25338B001	23838A000	20333A004	25484C012	25487B004 25487B014*	26029B002	26029B102
MW100-01B	26089D121							
MW100-21	26089D022	25338B001	23838A000	20333A004	25484C006	25487B004 25487B014*	26029B002	26029B102
MW100-21B	26089D122							
MW150-01 L/P	26089D043	25338B002	23838A000	20333A004	25484C014	25487B004 25487B014*	26029B001	26029B101
MW150-01B L/P	26089D143							
MW150-21 L/P	26089D044	25338B002	23838A000	20333A004	25484C015	25487B004 25487B014*	26029B001	26029B101
MW150-21B L/P	26089D144							
MW150-03	26089D029	25338B003	-	-	25484C016	25487B006 25487B016*	26029B001	26029B101
MW150-03B	26089D129							
MW150-23	26089D030	25338B003	-	-	25484C016	25487B006 25487B016*	26029B001	26029B101
MW150-23B	26089D130							
MW150-43	26089D031	25338B003	-	-	25484C016	25487B006 25487B016*	26029B001	26029B101
MW150-43B	26089D131							
MW150-53	26089D032	25338B003	-	-	25484C017	25487B006 25487B016*	26029B001	26029B101
MW150-53B	26089D132							
MW150-01	26089D027	25338B001	23838A000	20333A004	25484C014	25487B004 25487B014*	26029B001	26029B101
MW150-01B	26089D127							
MW150-21	26089D028	25338B001	23838A000	20333A004	25484C015	25487B004 25487B014*	26029B001	26029B101
MW150-21B	26089D128							
MW200-01 L/P	26089D045	25338B002	23839A000	20333A006	25484C014	25487B004 25487B014*	26029B000	26029B100
MW200-01B L/P	26089D145							
MW200-21 L/P	26089D046	25338B002	23839A000	20333A006	25484C015	25487B004 25487B014*	26029B000	26029B100
MW200-21B L/P	26089D146							
MW200-03	26089D035	25338B003	-	-	25484C016	25487B006 25487B016*	26029B000	26029B100
MW200-03B	26089D135							
MW200-23	26089D036	25338B003	-	-	25484C016	25487B006 25487B016*	26029B000	26029B100
MW200-23B	26089D136							
MW200-43	26089D037	25338B003	-	-	25484C016	25487B006 25487B016*	26029B000	26029B100
MW200-43B	26089D137							
MW200-53	26089D038	25338B003	-	-	25484C017	25487B006 25487B016*	26029B000	26029B100
MW200-53B	26089D138							
MW200-01	26089D033	25338B001	23839A000	20333A006	25484C014	25487B004 25487B014*	26029B000	26029B100
MW200-01B	26089D133							
MW200-21	26089D034	25338B001	23839A000	20333A006	25484C015	25487B004 25487B014*	26029B000	26029B100
MW200-21B	26089D134							

* If unit manufacture date is after May 1996, order indicated rotor/shaft assembly designated with asterik (*).

** If impeller is required for unit built prior to May 1996, a replacement rotor/shaft assembly must be ordered as well. Order rotor/shaft assembly designated with asterik (*).

GENERAL DESCRIPTION AND APPLICATION

Myers ME and MW series pumps are available in both a single seal design and double seal design with leak detector. The ME33-150 models are designed for Effluent dosing, Septic Tank Effluent Pumping (S.T.E.P.) or normal sump and general dewatering applications where higher pressure is required. These units are designed to handle 3/4" spherical solids. The MWH50-MW200 models are designed for raw sewage applications and can pass 2" spherical solids. These units can also be used for sump and general dewatering applications where larger solids capabilities are required.

When used in Effluent dosing or S.T.E.P. applications, the pump must be installed in a separate tank or compartment at the discharge side of the septic tank. NEVER INSTALL PUMP IN MAIN TANK WHERE SLUDGE COLLECTS.

These pumps are available in single phase and three phase, and either in single seal or double seal with seal leak detector. All three phase units, all double seal units and all duplex installations must be used with a control box. All power cords and seal leak detector cords are 20 feet long.

The ME model impellers are enclosed two vane type to handle 3/4" spherical solids and are available made of engineered thermoplastic or cast brass. All pumps have a 2" NPT discharge tapping.

The MW model impellers are enclosed two vane non-clog style, designed to handle 2" spherical solids. The MW pumps are available with standard cast iron or optional cast brass impellers.

These pumps are NOT for use in swimming pools or fountains.

AIR LOCKING

A sump pump is said to be air locked if water traps air in the pump and it cannot get out, thus preventing the pump from operating.

In installation of this type a 1/8" hole should be drilled in the discharge pipe below the check valve. The check valve should be 12 to 18 inches above pump discharge. Do not put check valve directly into pump discharge opening.

PACKAGING

Each pump is packaged separately in a carton marked with a catalog number and Myers engineering number.

LEVEL CONTROLS

All pumps must use sealed level control switches for automatic operation. MLC and MFLC controls have sealed switches that are 1 HP rated at 230 volts. ALC and AWS-1 controls have sealed mechanical switches that are rated 2 HP at 230 volts.

Simplex single phase pumps can be made automatic by attaching MFLC or MLC controls to the pump. These switches have a fixed draw off level of 8 to 10 inches and can be used up to 1 HP. For higher horsepower ratings two mercury switches (or SMNO) controls with a magnetic starter can be used. Simplex systems may also use on/off pilot mercury control switches with control box and magnetic starter. The ALC and AWS-1 controls can be used for simplex single phase pumps with ratings up to 2 HP. All duplex systems must use pilot mercury control switches with control box and magnetic starters.

Plug-in cords can be used on all the single phase pumps with a single seal (does not have a seal leak detector). This cord has a GROUND pin that plugs into a grounded receptacle. The grounded receptacle cannot be used in the wet sump or basin due to DANGER of current leakage. Sealed junction boxes must be used in wet sumps or basins to make connections to motor cord. The AWS-1 control also acts as a sealed junction box for connecting power cord to pump cord.

DOUBLE SEAL PUMPS

All pumps in this series "ME--D" or "MW--D" have two seals with an oil chamber between the seals so that the seal faces of both the lower and upper seals are oil lubricated for longer life and greater protection against water leaking into the motor windings. These double seal units are all made with a seal leak detector.

The leak detector in the oil seal chamber detects any water leakage into the chamber and turns on a red signal light in the control panel. Pumps should be removed from the sump and seals replaced after the seal light shows in the panel. Control panels must be used for pumps having the seal leak detectors, and seal leak detectors **must** be wired as illustrated in these instructions.

DESIGN OF PRESSURE SEWER SYSTEMS

MYERS has available complete computer SOFTWARE for designing PRESSURE SEWER SYSTEMS. This gives pipe sizes to use and gives exact flow from any pump or group of pumps in the system when operating simultaneously.

This design DISK for IBM® or COMPATIBLE computers is available to engineers on request.

MOTOR TYPE

Motors are 3/4 frame, 1/3 – 2 HP single or three phase, 60 Hertz, 3450 R.P.M. with class B insulation. All single phase motors are permanent split-capacitor (PSC) type with built-in on-winding overload protection and do not require a start switch or start relay. The three phase pump motors require a magnetic starter with 3 leg overload protection. All motors have upper and lower ball bearings and all are oil-cooled and lubricated.

SAFETY WARNINGS

WARNING: Risk of electric shock. Pumps with a single seal are supplied with a grounding conductor and grounding-type attachment plug on the power cord. To reduce the risk of electric shock, be certain that it is connected only to a properly grounded, grounding-type receptacle. DO NOT cut off ground pin or use an adapter fitting. DO NOT use an extension cord with this pump. Entire plug may be cut off if a control panel is used. All double seal pumps, all duplex installations and all three phase pumps require a control box.

When wiring this pump follow all local electrical and safety codes and ordinances as well as the most recent National Electric Code (NEC-ANSI/NFPA 70).

All pumps have a GROUND WIRE that is connected to a screw in the metal motor housing. This wire goes to the receptacle or control box which must be connected to a good outside GROUND such as a metal water pipe or GROUND STAKE driven at least 8 feet into the ground.

UL AND CSA APPROVAL

All pumps have UL and CSA approval pending. Myers is a SSPMA certified pump member.

INSTALLATION

WARNING: Basin or tank must be vented in accordance with local plumbing codes. These pumps are not designed for and CANNOT be installed in locations classified as hazardous in accordance with the National Electric Code ANSI/NFPA 70.

CAUTION: Never enter pump chamber after sewage or effluent has been in basin. Sewage water can give off methane, hydrogen sulfide and other gasses which are highly poisonous.

For this reason, Myers recommends installing the ME series effluent pumps with a quick removal system. The quick removal system may be a union or Cam-lok coupling if the pipe or discharge hose is within reach from the surface, or a rail system type quick disconnect on deeper installations. See installation drawings for suggested installation.

The dosing tank or pumping chamber must be constructed of corrosion resistant materials and must be capable of withstanding all anticipated internal and external loads. It also must not allow infiltration or exfiltration. The tank must have provisions for anti-buoyancy. Access holes or covers must be of adequate size and be accessible from the surface to allow for installation and maintenance of the system. Access covers must be lockable or heavy enough to prevent easy access by unauthorized personnel. The pumping chamber holding capacity should be selected to allow for emergency conditions.

The discharge pipe must be the same size as the pump discharge (2 inches) or larger. In order to insure sufficient fluid velocity to prevent any residual solids from collecting in the discharge pipe, it is recommended that a minimum flow of 2 feet per second be maintained. (21 GPM through 2" pipe and 46 GPM through 3" pipe). It is recommended that PVC or equal pipe is used for corrosion resistance. A full flow (ball or gate) shut off valve must be installed to prevent back flow of effluent if the pump must be removed for service. A check valve must be installed on pressure sewer systems and on other systems where conditions allow to prevent backflow and to reduce wear on the pump system.

A high water alarm must be installed on a separate circuit from the pump circuit. The alarm should have the ability to be tested for proper operation.

SPECIAL INSTRUCTIONS FOR THREE PHASE PUMPS

(1) F. E. Myers recommends three phase pumps to be installed by qualified personnel. **CAUTION: Risk of electric shock. Do not remove cord and strain relief. Do not connect conduit to pump.**

(2) Three phase pumps are always installed with control boxes having magnetic starters with 3 leg overload protection. DO NOT TRY TO RUN THREE PHASE PUMPS DIRECTLY ACROSS THE LINE.

(3) **To Connect Pump**: Run wire from pump to the bottom of control box or appropriate junction box suitable for enclosing splice connections. A hole must be cut into the control box for the wires. With power to control box off, connect green (ground) line to ground lug. Connect black (power) wires to power lead terminals. Note: for a typical CE style control box, these terminals are marked M1, M2 and M3. Make sure that all wires are inside control box and not in a position to be pinched or shorted when the door is closed.

(4) All three phase motors can run either direction. ROTATION can be changed by interchanging any two line leads at magnetic starter. **BE SURE CIRCUIT BREAKER IS OFF BEFORE MAKING THIS CHANGE.** To find if rotation is correct operate pumps and check delivery operation. If flow and head is low (refer to pump curves shown in this manual) the rotation is wrong. With duplex pumps check operation of both pumps.

(5) All pump impellers either single or three phase must turn counterclockwise when looking into pump inlet. If uncertain of rotation, TURN OFF POWER and lift pump from basin with cord connected and lay pump on side so impeller can be seen. Turn on power and start pump using hand position of H-O-A switch. Turn on and off fast so that coast of impeller can be seen. **NEVER PUT HAND OR FINGERS ON THE IMPELLER.** Interchange any two line leads at the magnetic starter to change rotation.

POINTS TO CHECK IF PUMP DOES NOT RUN OR DOES NOT RUN PROPERLY

(1) Pump does not run or start when water is up in tank.

(a) Check for blown fuse or tripped circuit breaker.
(b) Check for defective level switch.
(c) Where control panel is used be sure H-O-A switch is in the AUTO position. If it does not run, turn switch to the HAND position and if the pump runs then the trouble is in the automatic electrical system. Have an ELECTRICIAN make electrical checks.
(d) Check for burned out motor. Occasionally lightning can damage a motor even with lightning protection.
(e) Where plug-in cords are used be sure contact blades are clean and making good contact. DO NOT USE PLUG-IN CORDS INSIDE A SUMP OR WET WELL.
(f) Level control ball or weight may be stuck on side of basin. Be sure it floats freely.

(2) Pump runs but does not deliver flow.

(a) Check air lock. Start and stop pump several times, if this does not help it may be necessary to loosen a union in the discharge line to relieve air lock.
(b) Check valve may be installed backwards. Check flow arrow on valve body. Check shut-off valve. It may be closed.
(c) Check vertical elevation. It may be higher than pump can develop. (See pump curve).
(d) Pump inlet may be plugged. Remove pump to check.

CAUTION: ALWAYS UNPLUG POWER CORDS OR TURN OFF ALL MAIN AND BRANCH CIRCUIT BREAKERS BEFORE DOING ANY WORK ON THE PUMP. If control panel is remote from pump, disconnect lead wires to motor so that no one can turn the circuit breaker back on. If motor is three phase mark the leads so they can be replaced in the same order.

BEFORE DISMANTLING PUMP FOR REPLACEMENT OF PARTS

Clean pump thoroughly. Knock off all scale and deposits. Use sandblast if possible. Submerge complete unit in Clorox solution for one hour before taking apart.

TO REPLACE CAPACITORS ONLY

All of the single phase motors are of the permanent split capacitor type and have no relays or starting switch. They have only a starting capacitor that is in the circuit for both starting and running conditions.

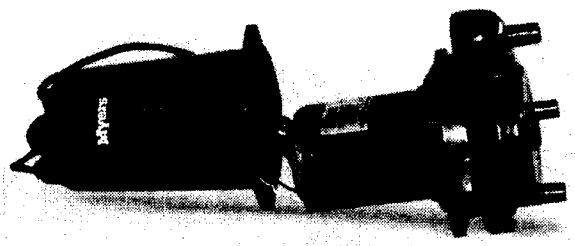
(1) Remove oil fill plug near the top of the motor and pour the oil out.

(2) Loosen the plug nuts around the cords until they are loose enough to push the cords down inside of the motor housing.

(3) Remove the four bolts from the motor housing and bump the housing with a plastic hammer to loosen. Lay the pump on its side.

(4) Remove the housing carefully to be sure that enough cord is pushed into the housing to create no tension on the cords.

(5) Slide motor housing up far enough to expose the capacitor and to be able to lay the housing down.



(6) Disconnect wiring from capacitor and loosen capacitor clamp and slide out capacitor. Replace with new capacitor, tighten and re-connect. Wiring diagram is given in these instructions.

(7) Check all wiring connectors to be sure they are secure.

(8) Be sure tetraseal gasket is in place.

(9) Slide motor housing back onto pump while pulling the cords out slowly. Assembly the motor housing with the four bolts.

(10) Re-assemble cord nuts. Be sure washers are seated and cords are pulled up to stop against the washers. Tighten nuts securely.

(11) Put pump upright and refill motor with Myers submersible motor oil. DO NOT OVER FILL WITH OIL. With pump upright fill oil to bottom of oil fill tapping. Replace oil fill plug.

(12) Be sure pump turns freely before connecting to power. Turn pump on side and turn impeller, using screwdriver in slotted shaft. Plug pump into receptacle to test operation. Pump must run quiet and free of vibration.

TO REPLACE POWER CORD AND/OR SEAL LEAK DETECTOR CORD

(1) Remove motor housing as described above. Disconnect the push-together terminals and remove the ground screw from the power cord if being replace.

(2) Completely unscrew cord bushing to be replaced and remove cord assembly from housing. Be sure remaining terminals are secure on the wires.

(3) Replace with proper cord with fittings. Push cord into the motor housing far enough to make proper connections. Re-connect ground wire if replacing power cord and securely connect the wires correctly. See wiring diagram in these instructions.

(4) Assemble cords and motor housing as described in "Capacitor Replacement". Fill with oil as noted and be sure pump turns freely before connecting to power.

TO REPLACE MOTOR STATOR AND SHELL

(1) Remove motor housing as described above.

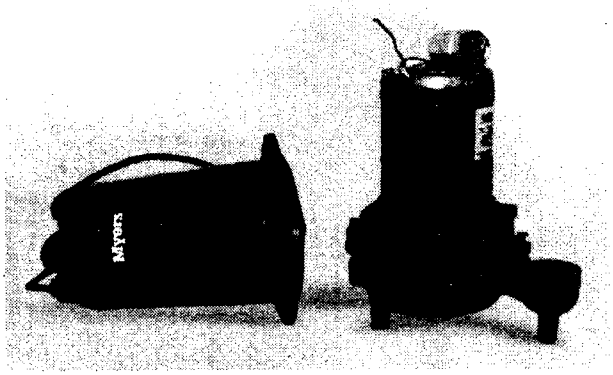
(2) Disconnect all leads from power and seal leak cords and ground wire and set pump upright.

(3) Loosen the four long screws holding the motor and remove slowly. If unit has seal leak probes be sure to feed the wires through the slots as the motor is being removed.

(4) Either remove previous capacitor and clamp from old motor and assemble onto new stator and shell or replace with a new capacitor and assemble the two capacitor leads per wiring diagram.

(5) Position bearing spring washer on top of upper ball bearing. (For 3/4 – 1-1/2 HP.)

(6) Tighten terminal screws of seal leak probes and feed wires through the motor slots.



(7) Position the "stator with shell" into place and line up screws with the bosses and tighten the (4) long screws. Extend probe wires out through the slots. Lay unit down in line with motor housing.

(8) Be sure pump turns freely with screwdriver in impeller end of shaft.

(9) Re-connect all terminals securely per wiring diagram.

(10) Be sure tetraseal gasket is in place.

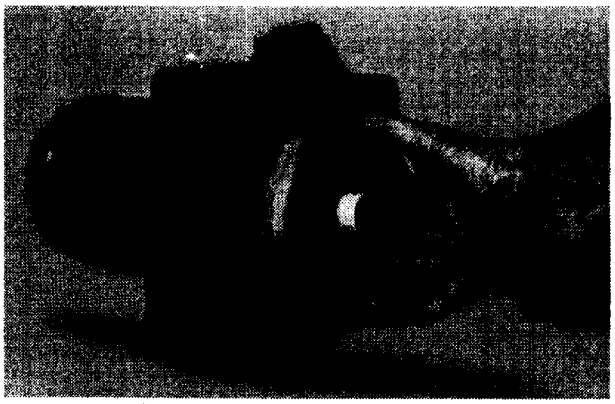
(11) Reassemble motor housing and fill with oil as noted above in "capacitor replacement".

NOTE: On three phase motors always check unit for proper rotation. With pump on its side apply power by turning on, then off, quickly. Impeller must turn counterclockwise when looking into the impeller inlet. If not, interchange any two leads in the control box.

SHAFT SEAL REPLACEMENT

(1) Remove plugs in motor housing and in seal housing (for double seal units) and drain oil.

(2) Remove four bolts holding the volute case and bump with a plastic hammer to loosen and remove case.



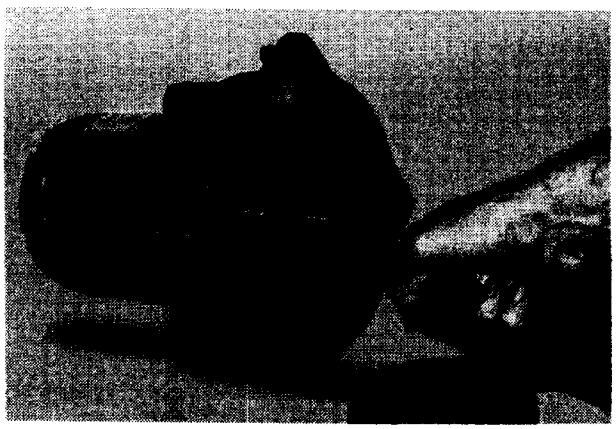
(3) Hold impeller and unscrew impeller locking screw or jam nut. Turn counterclockwise to loosen.

(4) Pry off seal bellows and ceramic seat. Break seats if necessary to get out since they must be replaced with new parts.

(5) NEVER USE OLD SEAL PARTS. USE ONLY COMPLETELY NEW SEALS. (Do not use seal spring retainer plate on single seal pump or lower seal of double seal pump.)

(6) For single seal pumps or if only replacing the lower seal of a double seal pump it is not necessary to disassemble further and on a double seal pump it is not necessary to drain oil out of the motor housing, just the seal housing.

(7) On a double seal pump to remove the upper seal, remove four bolts holding the bottom plate and remove bottom plate.



(8) Remove snap ring with snap ring pliers. Pry off upper seal bellows and ceramic seat.

(9) If no water has entered motor housing (check winding with ohmmeter or megger) wipe seal chambers thoroughly and replace seals. (Use seal retainer plate on upper seal only, do not use on lower seal.) Clean seal faces and use light oil on face before installing bellows part of seal.

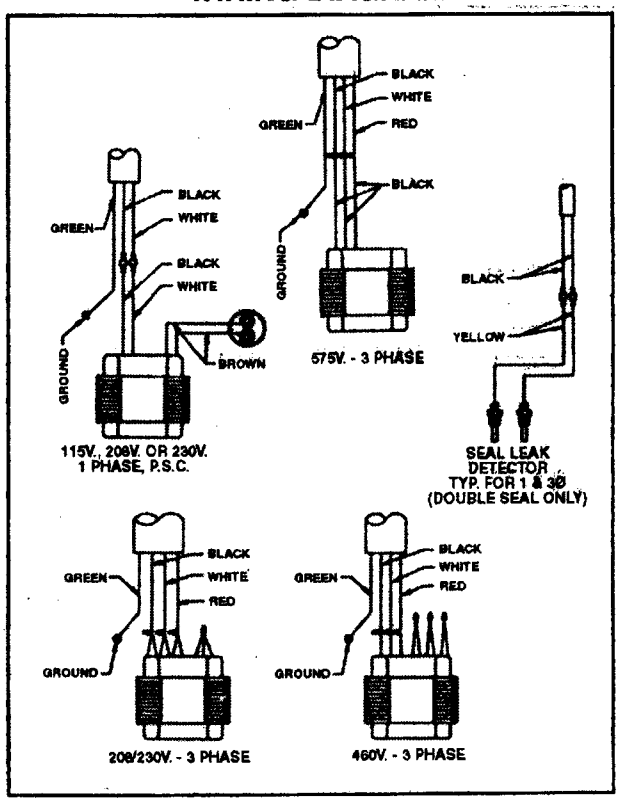
(10) Check HUVA cup seal in volute case inlet. If worn, replace.

(11) Be sure tetraseal seal is in position (replace if worn) and reassemble.

(12) Replace oil in motor housing and seal chamber. Use only Myers submersible oil.

(13) Be sure pump turns freely before connecting to power. After connecting, check for proper rotation noted under "Stator Replacement".

WIRING DIAGRAM



3 PHASE DUAL VOLTAGE WINDING

	LEADS			
VOLTAGE	BLACK	WHITE	RED	TOGETHER
208 & 230	1 & 7	2 & 8	3 & 9	4 & 5 & 6
460	1	2	3	4 & 7, 5 & 8, 6 & 9

ME SERIES

1/2 through 1-1/2 HP
Effluent Pumps

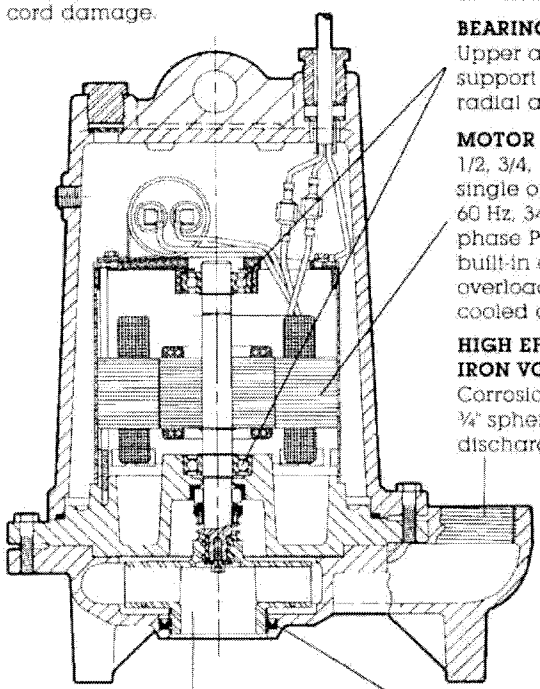
POWER CORD
Jacket sealed with compression fittings. Individual wires potted with epoxy to prevent wicking in case of cord damage.

MOTOR HOUSING
Cast iron for efficient heat transfer and corrosion resistance.

BEARINGS
Upper and lower ball support rotor. Take radial and thrust loads.

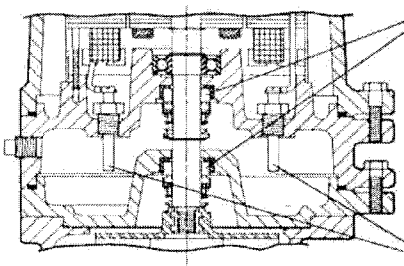
MOTOR
1/2, 3/4, 1 and 1-1/2 HP single or three phase. 60 Hz, 3450 RPM. Single phase PSC motors have built-in on winding overload protection, oil-cooled and lubricated.

HIGH EFFICIENCY CAST IRON VOLUTE
Corrosion resistant. Passes ¾" spherical solids. 2" NPT discharge.



ENCLOSED TWO VANE IMPELLER
high efficiency. Passes ¾" spherical solids with stainless steel wear ring. Optional bronze construction available.

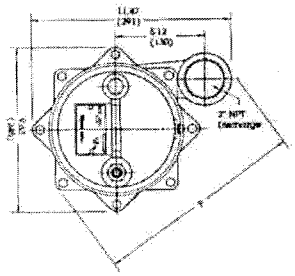
VOLUTE/IMPELLER SEAL RING
Maintains high efficiency and reduces recirculation. Replaceable.

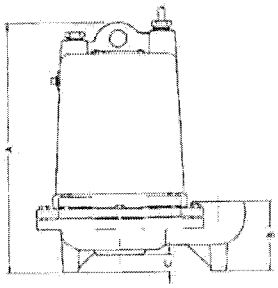


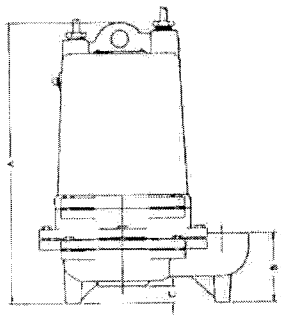
SHAFT SEAL(S)
Carbon and ceramic faces. Optional dual tandem seals. Extends motor life.

SEAL LEAK PROBES
Optional probes (dual seal only) detect water leakage in seal housing. Activates warning light.

DIMENSIONS

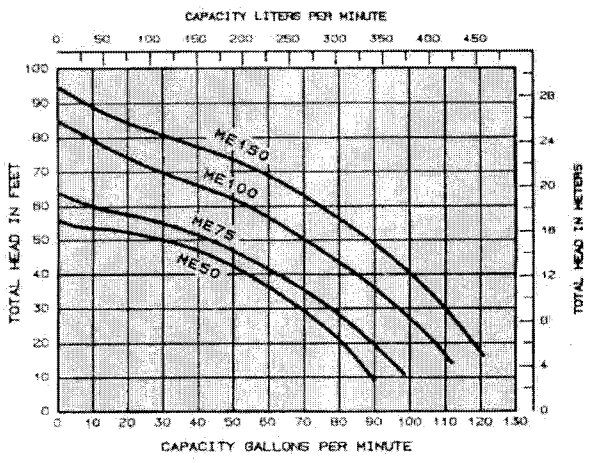






Model Series	Inches (millimeters)			
	A	B	C	F
ME50S	16.8 (427)	4.09 (104)	1.03 (26)	12.13 (308)
ME50D	18.6 (472)	4.09 (104)	1.03 (26)	12.13 (308)
ME75S, ME100S, ME150S	16.8 (427)	4.0 (102)	1.06 (27)	12.5 (318)
ME75D, ME100D, ME150D	18.6 (472)	4.0 (102)	1.06 (27)	12.5 (318)

PERFORMANCE CURVE



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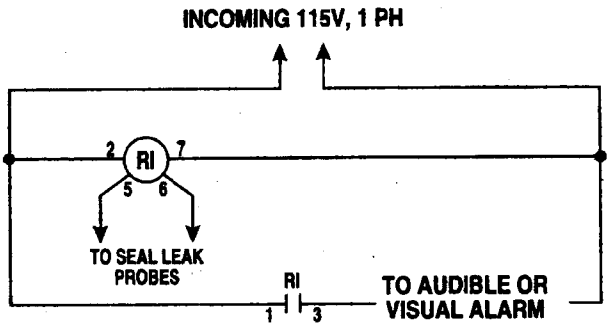
Myers (Canada), 269 Trillium Drive, Kitchener, Ontario N2G 4W5
519/748-5470, FAX: 519/748-2553



ME SERIES DIMENSIONS

Model Series	Inches (millimeters)			
	A	B	C	F
ME33S & ME50S	16.8 (427)	4.09 (104)	1.03 (26)	12.13 (308)
ME33D & ME50D	18.6 (472)	4.09 (104)	1.03 (26)	12.13 (308)
ME75S, ME100S, ME150S	16.8 (427)	4.0 (102)	1.06 (27)	12.5 (318)
ME75D, ME100D, ME150D	18.6 (472)	4.0 (102)	1.06 (27)	12.5 (318)

MOISTURE SENSOR SEAL PROBE CIRCUIT

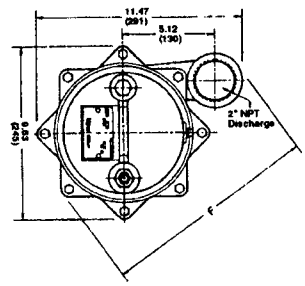
Relay - SSAC Inc. #LLC44A5A
Socket - Standard 8-pin plug-in type
If Myers panel is used, see below.

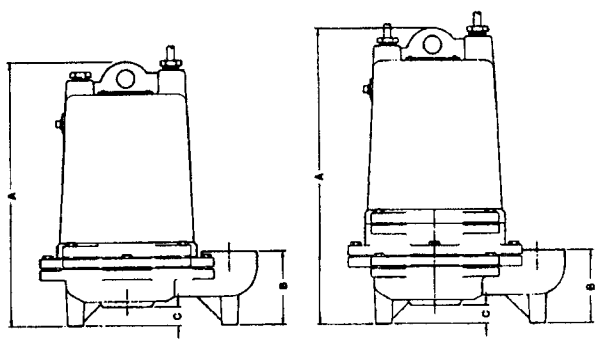
Pumps: ME33D-11,
ME50D-11,
ME75D-11
Required Panel:
CMEP (SL)-11S, -11SW, -11D or -11DW

Pumps: ME33D-01, ME33D-21,
ME50D-01, ME50D-21,
ME75D-01, ME75D-21,
ME100D-01, ME100D-21,
ME150D-01, ME150D-21,
MWH50D-01, MWH50D-21,
MW100D-01, MW100D-21,
MW150D-01, MW150D-21,
MW200D-01, MW200D-21
Required Panel:
CMEP(SL)-21S, -21SW, -21D or -21DW

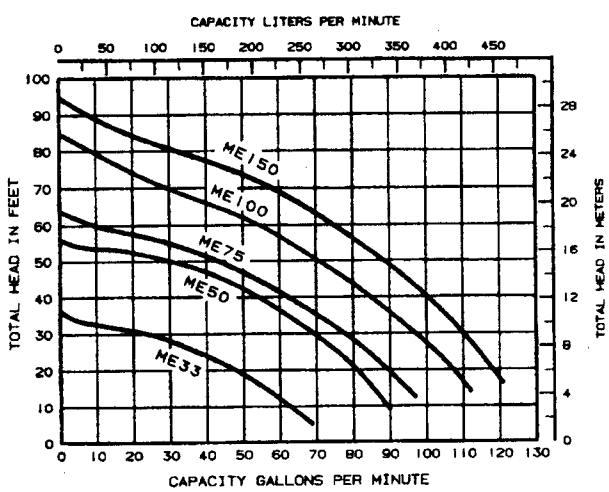
Pumps: ME33D-03, ME33D-23,
ME50D-03, ME50D-23,
ME75D-03, ME75D-23,
ME100D-03, ME100D-23,
ME150D-03, ME150D-23,
MWH50D-03, MWH50D-23,
MW100D-03, MW100D-23,
MW150D-03, MW150D-23,
MW200D-03, MW200D-23
Required Panel:
CMEP(SL)-23S, -23SW, -23D or -23DW

Pumps: ME33D-43,
ME50D-43,
ME75D-43,
ME100D-43,
ME150D-43,
MWH50D-43,
MW100D-43,
MW150D-43,
MW200D-43
Required Panel:
CMEP(SL)-43S, -43SW, -43D or -43DW

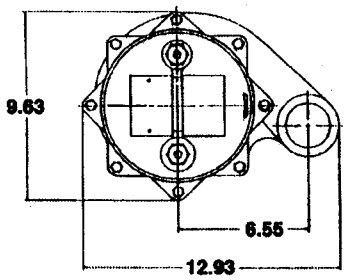


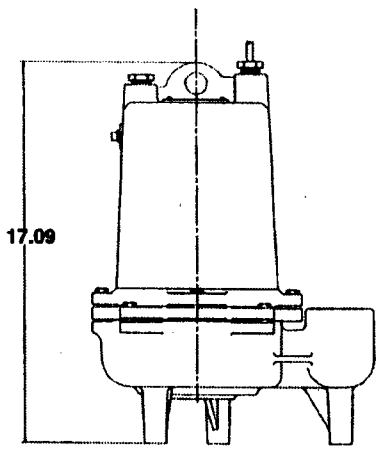


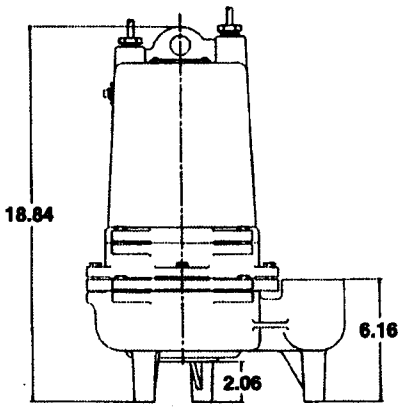
ME PERFORMANCE CURVE



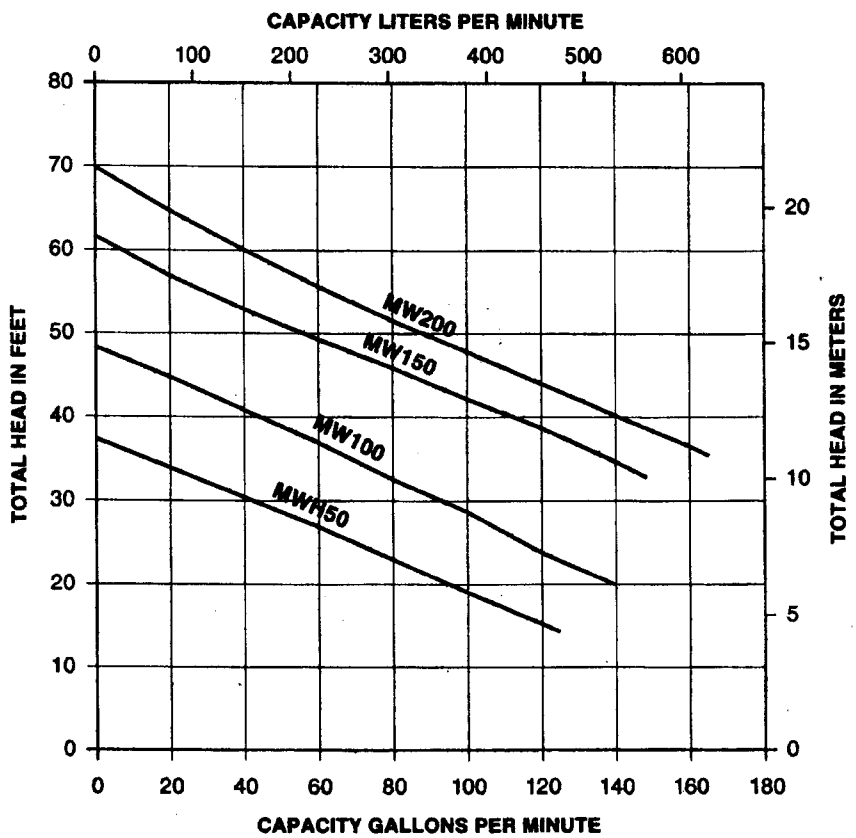
MW SERIES DIMENSIONS







MW PERFORMANCE CURVE



MOTOR DATA CHART

H.P.	SPEED	VOLTS	PHASE	STACK HEIGHT	WINDING RESISTANCE IN OHMS			MAX. AMPS	LOCKED ROTOR AMPS
					MAIN BLACK TO WHITE	START – 1Ø BRN. TO BRN. OR PURPLE / BLACK TO RED – 3Ø	WHITE TO RED		
ME SERIES									
1/3	3450	115	1	1-1/4	2.4	20.5	–	8.4	13.5
1/3	3450	208/230	1	1-1/4	11.4	7.0	–	4.7/4.2	6.7
1/3	3450	208/230	3	1-1/4	15.8	15.8	15.8	2.4/2.2	10.8
1/3	3450	460	3	1-1/4	63.2	63.2	63.2	1.1	5.4
1/3	3450	575	3	1-1/4	98.8	98.8	98.8	0.9	4.3
1/2	3450	115	1	1-5/8	.9/.8	14.7	–	12.1	29.6
1/2	3450	208	1	1-5/8			–	6.7	16.5
1/2	3450	230	1	1-5/8	9.8	19.7	–	6.0	15.0
1/2	3450	208/230	3	1-5/8	11.3	11.3	11.3	3.5/3.2	12.8
1/2	3450	460	3	1-5/8	45.4	45.4	45.4	1.6	6.4
1/2	3450	575	3	1-5/8	71.0	71.0	71.0	1.3	5.1
3/4	3450	115	1	2-1/4	.85	4.9	–	13.8	30.4
3/4	3450	208/230	1	2-1/4	4.5	12.0	–	7.6/6.9	16.2
3/4	3450	208/230	3	2	7.6	7.6	7.6	5.2/4.7	20.2
3/4	3450	460	3	2	30.1	30.1	30.1	2.3	10.1
3/4	3450	575	3	2	47.0	47.0	47.0	1.9	8.1
1	3450	208	1	2-3/4			–	10.3	21.0
1	3450	230	1	2-3/4	3.0/2.6	16/14	–	9.3	19.0
1	3450	208/230	3	2-1/2	5.3	5.3	5.3	6.6/6.0	29.0
1	3450	460	3	2-1/2	21.2	21.2	21.2	3.0	14.5
1	3450	575	3	2-1/2	33.1	33.1	33.1	2.4	11.6
1-1/2	3450	208	1	2-3/4			–	14.1	
1-1/2	3450	230	1	2-3/4	2.4	12.0	–	12.8	23.0
1-1/2	3450	208/230	3	2-3/4	4.5	4.5	4.5	8.8/8.0	30.0
1-1/2	3450	460	3	2-3/4	16.0	16.0	16.0	4.0	15.0
1-1/2	3450	575	3	2-3/4	25.0	25.0	25.0	3.2	12.0
MW SERIES									
1/2	3450	208	1	2-1/4	4.5	12.0	–	7.6	16.2
1/2	3450	230	1	2-1/4	4.5	12.0	–	6.9	16.2
1/2	3450	208	3	2	7.6	7.6	7.6	5.2	20.2
1/2	3450	230	3	2	7.6	7.6	7.6	4.7	20.2
1/2	3450	460	3	2	30.1	30.1	30.1	2.3	10.1
1/2	3450	575	3	2	47.0	47.0	47.0	1.9	8.1
1	3450	208	1	2-3/4	2.2	11.5	–	10.3	21.0
1	3450	230	1	2-3/4	2.8	15.0	–	9.3	19.0
1	3450	208	3	2-1/2	5.3	5.3	5.3	6.6	29.0
1	3450	230	3	2-1/2	5.3	5.3	5.3	6.0	29.0
1	3450	460	3	2-1/2	21.2	21.2	21.2	3.0	14.5
1	3450	575	3	2-1/2	33.1	33.1	33.1	2.4	11.6
1-1/2	3450	208	1	2-3/4	2.1	9.3	–	14.8	39.9
1-1/2	3450	230	1	2-3/4	1.6	7.4	–	12.8	33.4
1-1/2	3450	208	3	2-3/4	4.5	4.5	4.5	7.7	30.0
1-1/2	3450	230	3	2-3/4	4.5	4.5	4.5	7.0	30.0
1-1/2	3450	460	3	2-3/4	18.0	18.0	18.0	3.5	15.0
1-1/2	3450	575	3	2-3/4	28.0	28.0	28.0	2.8	12.0
2	3450	208	1	2-3/4	2.1	9.3	–	15.3	39.9
2	3450	230	1	2-3/4	1.6	7.4	–	13.1	33.4
2	3450	208	3	2-3/4	4.5	4.5	4.5	8.5	30.0
2	3450	230	3	2-3/4	4.5	4.5	4.5	7.7	30.0
2	3450	460	3	2-3/4	18.0	18.0	18.0	3.9	15.0
2	3450	575	3	2-3/4	28.0	28.0	28.0	3.1	12.0

MYERS
LIMITED WARRANTY
GRINDERS, NON-CLOG SEWAGE and WASTEWATER PUMPS

F. E. MYERS warrants that its products are free from defects in material and workmanship for a period of twelve (12) months from the date of purchase or eighteen (18) months from the date of manufacture.

During the warranty period and subject to the conditions hereinafter set forth, **MYERS**, will repair or replace to the original user or consumer parts which prove defective due to defective materials or workmanship of **MYERS**. Contact your nearest authorized **MYERS** distributor or **MYERS** for warranty service. At all times, **MYERS** shall have and possess the sole right and option to determine whether to repair or replace defective equipment, parts or components..

Start up reports and electrical system schematics may be required to support warranty claims. Warranty effective only if **MYERS** supplied or authorized control panels are used.

LABOR, ETC. COSTS: MYERS shall IN NO EVENT be responsible or liable for the cost of field labor or other charges incurred by any customer in removing and/or reaffixing any **MYERS** product, part or component thereof.

THIS WARRANTY WILL NOT APPLY: (a) to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printed instructions provided; (b) to failures resulting from abuse, accident or negligence; (c) to normal maintenance services and the parts used in connection with such service; (d) to units which are not installed in accordance with applicable local codes, ordinances and good trade practices; or (e) if the unit is moved from its original installation location and (f) unit is used for purposes other than for what it was designed and manufactured.

RETURN OR REPLACED COMPONENTS: any item to be replaced under this Warranty must be returned to **MYERS** in Ashland, Ohio, or such other place as **MYERS** may designate, freight prepaid.

PRODUCT IMPROVEMENTS: MYERS reserves the right to change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such a change or improvement.

WARRANTY EXCLUSIONS: MYERS MAKES NO EXPRESS OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. MYERS SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE.

Some states do not permit some or all of the above warranty limitations and, therefore, such limitations may not apply to you. No warranties or representations at any time made by any representatives of Myers shall vary or expand the provision hereof.

LIABILITY LIMITATION: IN NO EVENT SHALL **MYERS** BE LIABLE OR RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES RESULTING FROM OR RELATED IN ANY MANNER TO ANY **MYERS** PRODUCT OR PARTS THEREOF. PERSONAL INJURY AND/OR PROPERTY DAMAGE MAY RESULT FROM IMPROPER INSTALLATION. MYERS DISCLAIMS ALL LIABILITY, INCLUDING LIABILITY UNDER THIS WARRANTY, FOR IMPROPER INSTALLATION -- MYERS RECOMMENDS INSTALLATION BY PROFESSIONALS.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

In the absence of suitable proof of this purchase date, the effective date of this warranty will be based upon the date of manufacture.

Myers

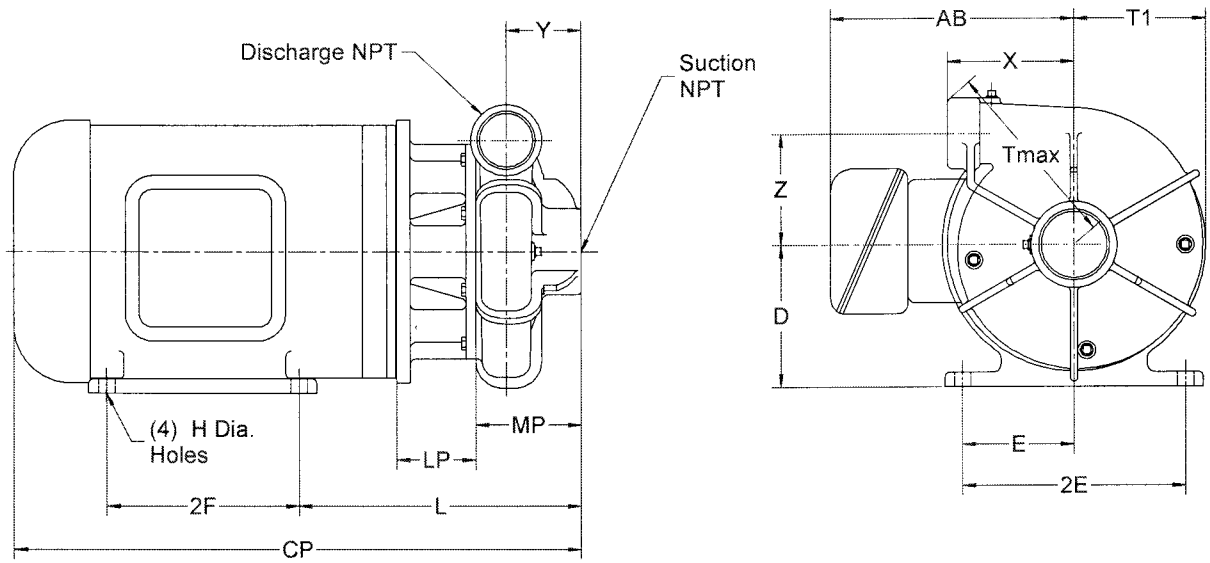
F. E. Myers, 1101 Myers Parkway, Ashland, Ohio 44805-1969
419/289-1144, FAX: 419/289-6658, TLX: 98-7443

Printed in U.S.A. 5/96
23833A278

Berkeley Dimensional Drawing

Date	Job/Ref.
2/6/04	Riverhead Wastewater Reuse

Model	Fittings	HP	RPM	Phase	Encl.	Frame Size
B1WPS	NPT	5	3600	3	ODP	182JM



Note: Dimensions in inches. Drawing is typical and NOT to scale.

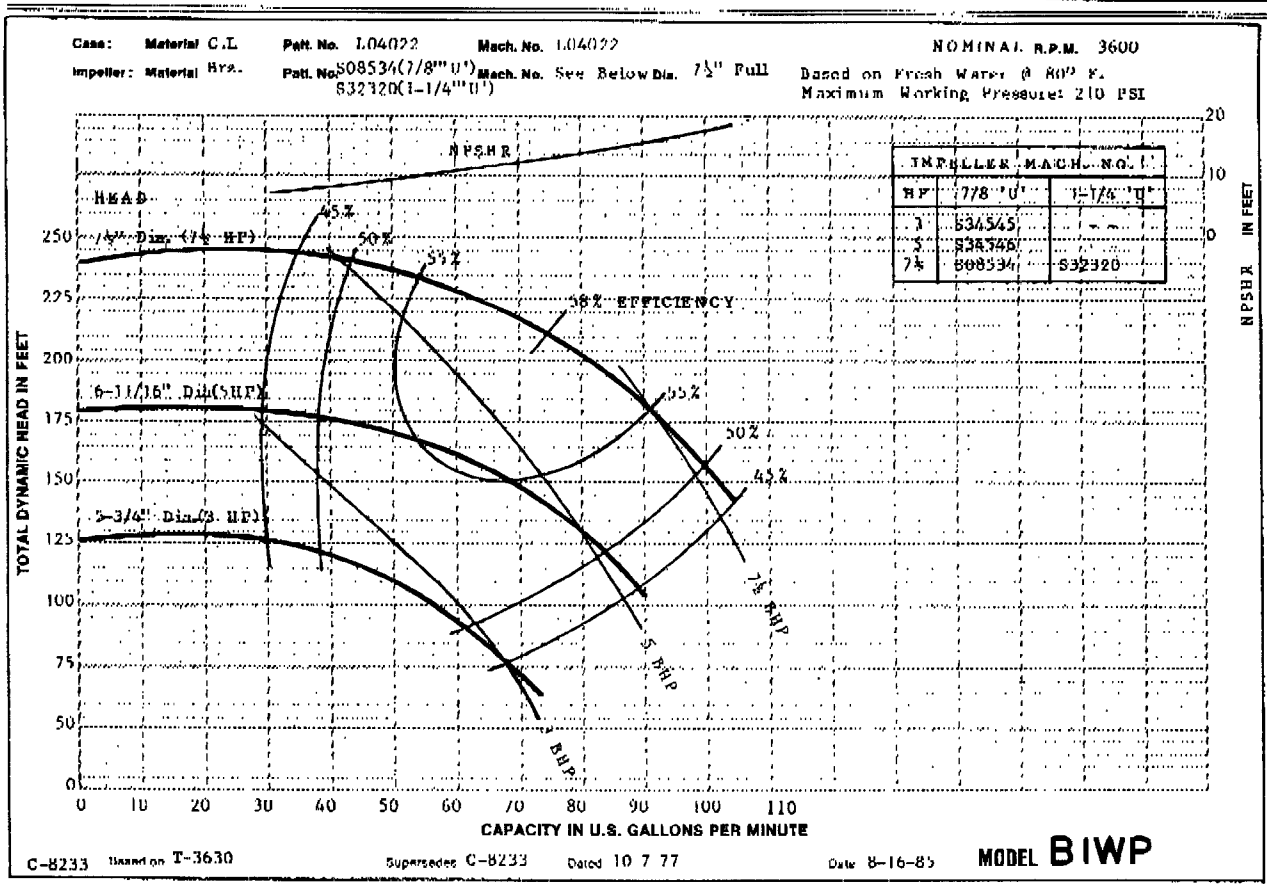
AB	CP	D	E	2E	2F	H	L	LP	MP	T1	Tmax	X	Y	Z	Suct	Disch
7.19	17.83	4.50	3.75	7.50	4.50	0.34	10.22	2.38	4.19	4.94	7.01	5.00	2.50	4.12	1½	1

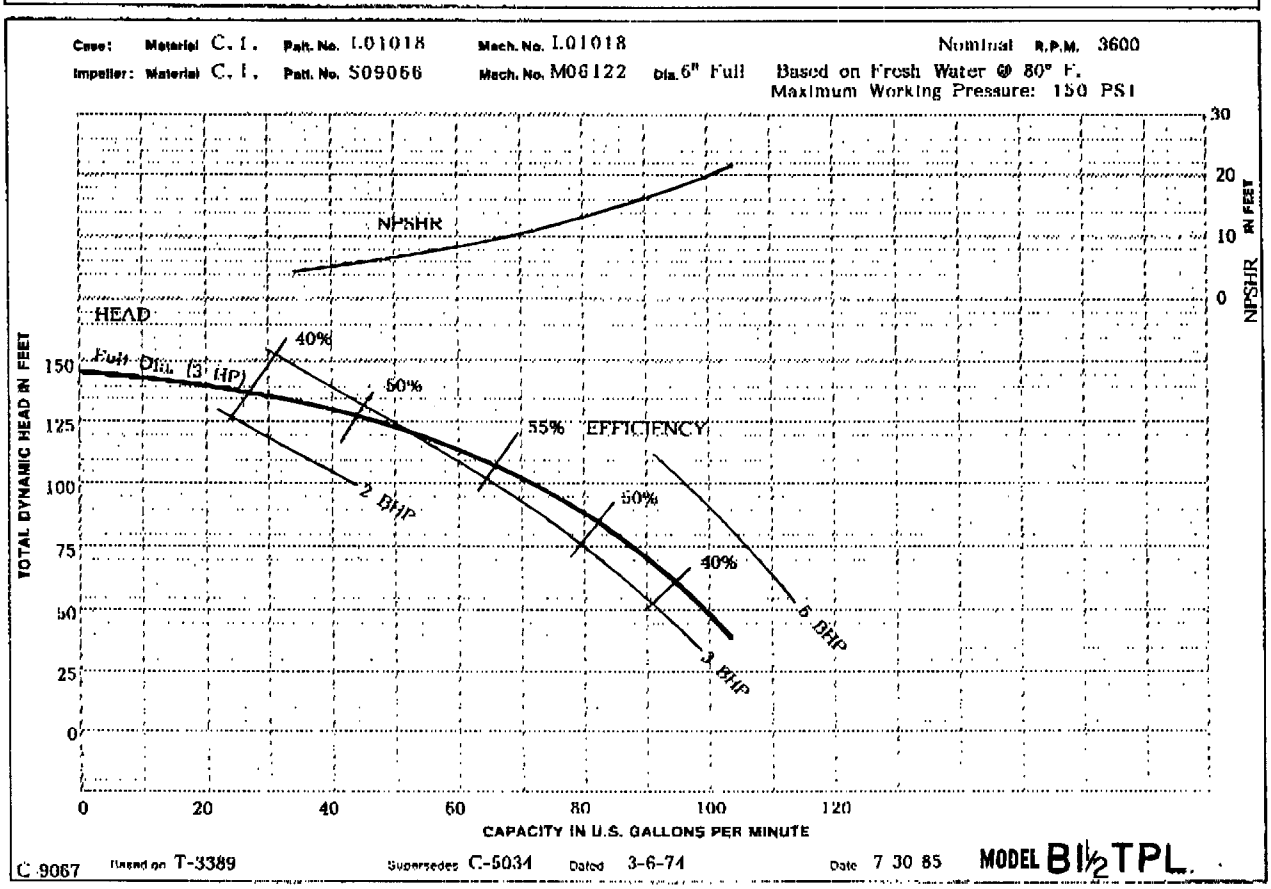
Notes

BERKELEY PUMPS

TYPE "B" RATING CURVES
MOTOR DRIVE

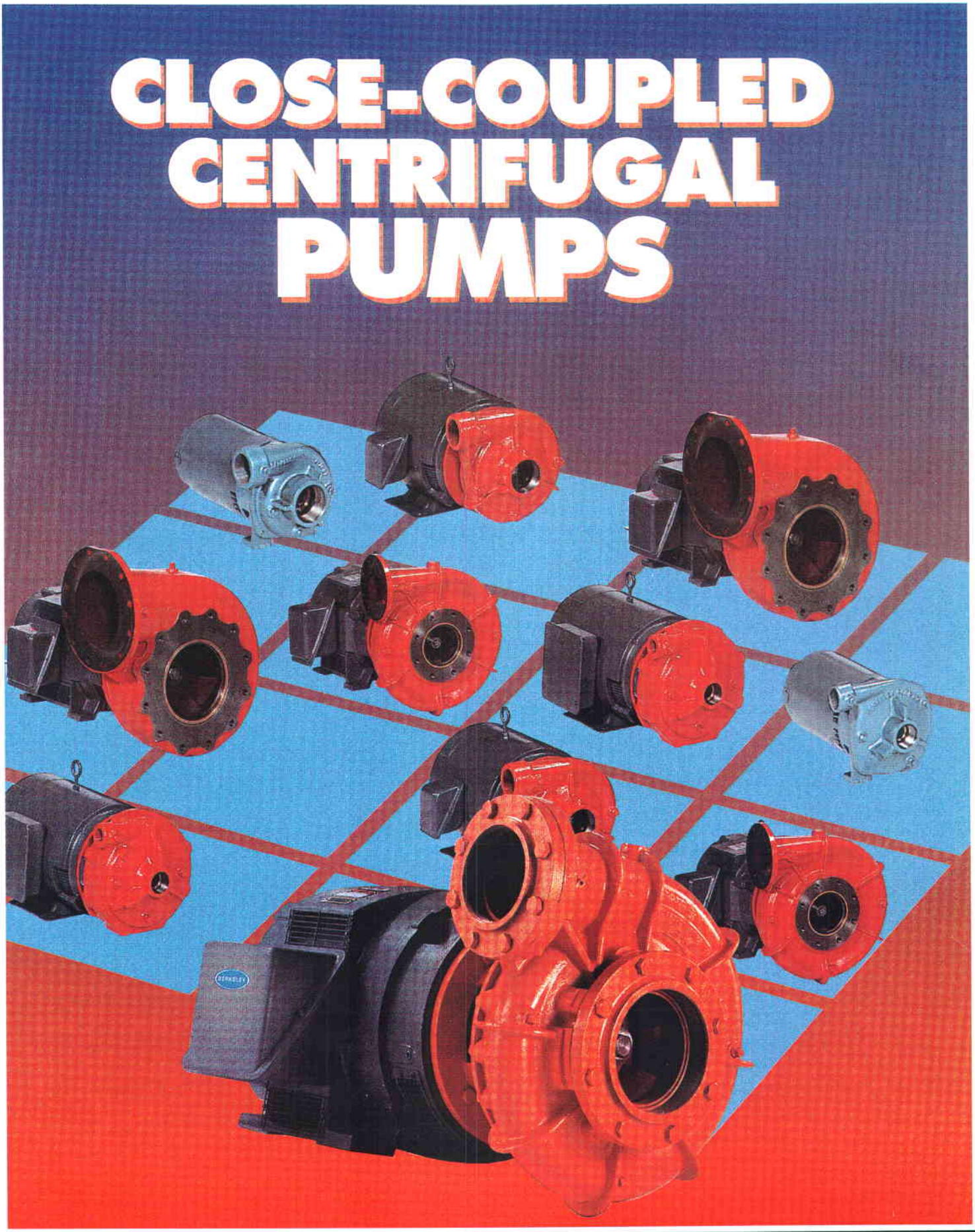
CURVE	4075
DATE	1-2-86
PAGE	1.01
SUPERSEDES	
All previously issued	
4075 Curves	





BERKELEY®

CLOSE-COUPLED CENTRIFUGAL PUMPS



TYPE B CLOSE-COUPLED END-SUCTION CENTRIFUGAL PUMPS

Berkeley's Type B close-coupled end-suction centrifugal pumps are ideal for most applications requiring high performance, easy maintenance and moderate initial cost. Cast iron construction with unique back pull-out design permits access to the impeller without disturbing the piping.

MOTOR BRACKET is close-grained cast iron, providing the strength necessary to minimize deflection and maintain positive alignment. Precision machined to assure proper component sealing.

NEMA STANDARD MOTORS carefully selected by our team of engineers, to meet our high standards for durability, reliability and longevity. High efficiency, low maintenance and smooth, quiet performance are but a few of the many criteria we use to select motors.

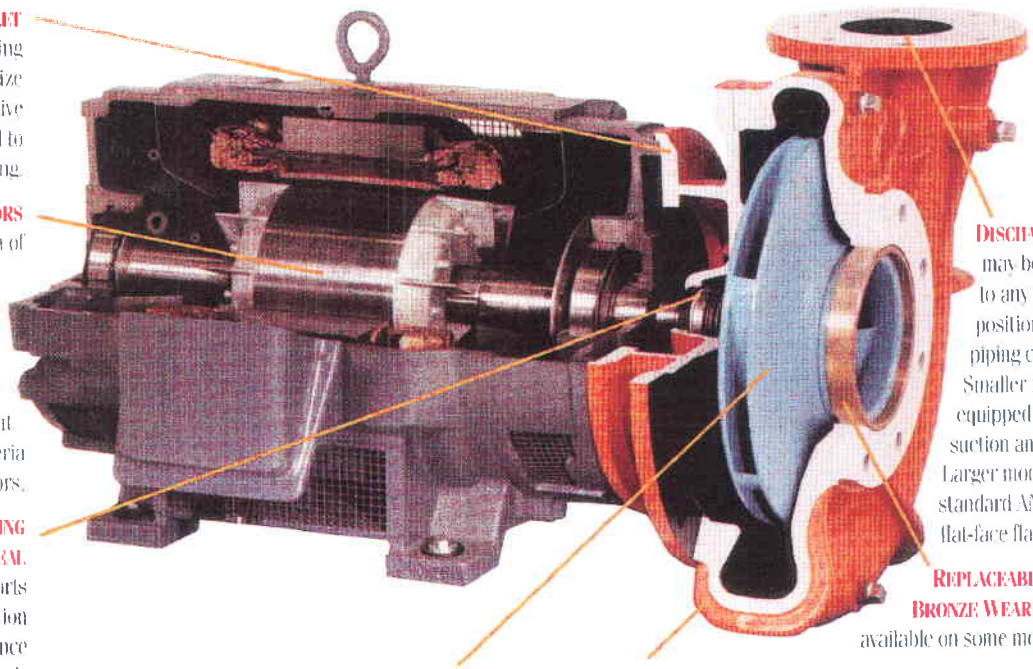
HIGH-QUALITY, SELF-LUBRICATING MECHANICAL SHAFT SEAL with corrosion-resistant metal parts provides maintenance-free operation and maximum abrasion resistance without leaking. Optional seals available for special applications.

MULTIPLE TAPS supplied for easy priming and draining.

HIGH-QUALITY LEAD-FREE/ CHROMATE-FREE PRIMER AND PAINT provide durable finish.

GRAPHITE-IMPREGNATED PTFE PACKING eases break-in, and accommodates a wide pH and temperature operating range.

REPLACEABLE STAINLESS STEEL SHAFT SLEEVE provides maximum corrosion resistance and protects shaft from wear.



DISCHARGE may be rotated to any of four positions for piping convenience. Smaller models are equipped with tapped suction and discharge. Larger models have standard ANSI 125# flat-face flange.

REPLACEABLE BRONZE WEAR RING available on some models.

ENCLOSED IMPELLER designed and machined to optimize performance and operating efficiencies. Mechanically balanced to reduce bearing loads and increase life. Keyed and locked to motor shaft. Trimmed for maximum efficiency of both pump and motor.

VOLUTE CASE incorporates precise geometric design for increased hydraulic efficiency. Made from thick-walled close-grained cast iron to handle the stresses of everyday use. Back pull-out design allows easy removal and repair without disturbing piping connections, and completely exposes the impeller for flushing or service.

CLOSE-COUPLED TYPE B: MATERIALS OF CONSTRUCTION

Part Name	Iron Construction		Bronze Fitted Construction	
	Common Material	Specification	Common Material	Specification
Volute Case	Cast Iron	ASTM A48 Class 30	Cast Iron	ASTM A48 Class 30
Wear Ring	Bronze	ASTM B584 (UNS C87500)	Bronze	ASTM B854 (UNS C87500)
Impeller	Cast Iron	ASTM A48 Class 30	Bronze	ASTM B584 (UNS C87500)
Seal Retainer	Cast Iron	ASTM A48 Class 30	Cast Iron	ASTM A48 Class 30
Adaptor Bracket	Cast Iron	ASTM A48 Class 30	Cast Iron	ASTM A48 Class 30
Shaft Sleeve	416 S.S.	AISI 416SS	416 S.S.	AISI 416SS
Lantern Ring	Teflon®		Teflon®	
Mechanical Shaft Seal	18-8 S.S. metal parts, "Buna-N" rubber bellows, ceramic stationary, carbon rotating face.		18-8 S.S. metal parts, "Buna-N" rubber bellows, ceramic stationary, carbon rotating face.	
Packing Gland	Bronze	ASTM B584 (UNS C87500)	Bronze	ASTM B584 (UNS C87500)
	Cast Iron	ASTM A48 Class 30	Cast Iron	ASTM A48 Class 30
Packing	PTFE packing with Graphite Impregnation		PTFE packing with Graphite Impregnation	
Close Coupled Motor Shaft	Carbon Steel	AISI C1045	Carbon Steel	AISI C1045

SELF-PRIMING CENTRIFUGAL PUMPS

Fast priming pump with rugged, all iron construction for superior resistance to erosion and corrosion from most liquids. Built for continuous dependable performance and ease of repair. High lift design allows suction lifts up to 25 feet at sea level. Ideal for transfer applications, standby fire protection, dewatering, and irrigation.

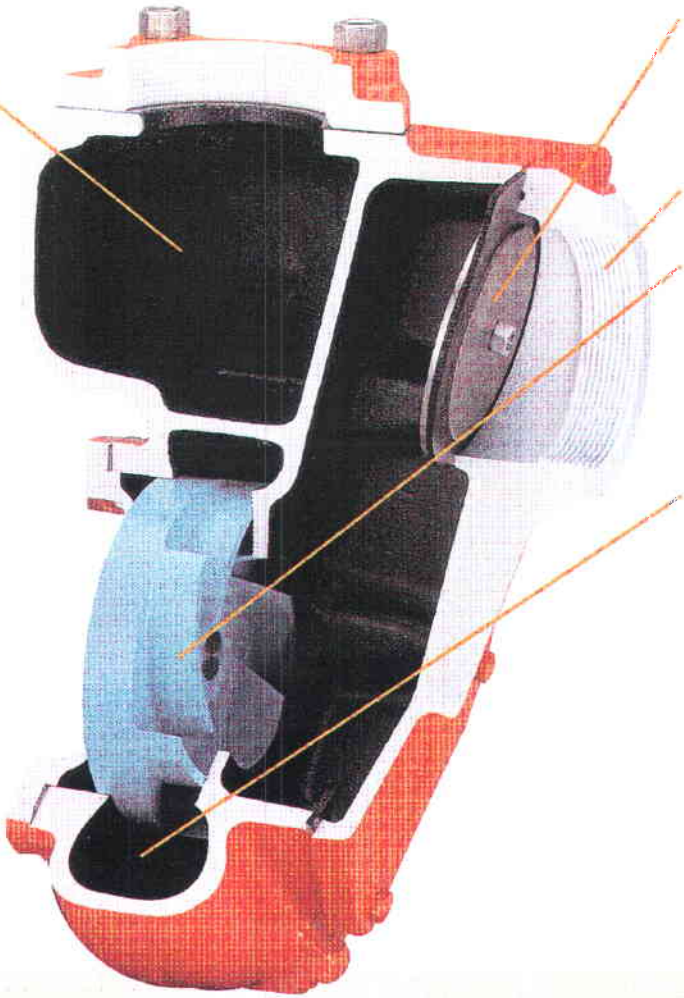
Extra-Large Priming Chamber
for faster, trouble-free priming and repriming. Provides additional shaft seal protection.

Priming Port
enables priming without removing the discharge hose.

Motor Bracket
is close-grained cast iron, providing the strength necessary to minimize deflection and maintain positive alignment. Precision machined to assure proper component sealing.

High-Quality Lead-Free/ Chromate-Free Primer And Paint
provide durable finish.

Drain Plug
enables casing to be completely drained for flushing and freeze protection.



Built-In Check Valve
prevents siphoning and need for re-priming. External check valve not required. Designed for easy replacement.

Intake
placed high for faster priming

Semi-Open Impeller
design for larger solids handling capability. Mechanically balanced to reduce bearing loads and increase life. Threaded to the shaft and locked in place with a special locking capscrew for trouble-free operation.

Volute
incorporates precise geometric design for increased hydraulic efficiency. Made from thick-walled ASTM A-48 class 30 cast iron to handle the stresses of everyday use. Back pull-out design allows easy repair without disturbing piping, completely exposing impeller for flushing or service.

TYPE C CLOSE-COUPLED CENTRIFUGAL PUMPS

The Type C is an efficient, horizontal, single stage, centrifugal pump close-coupled to an electric motor. Removal of readily accessible bolts (back pull-out construction) permits removal of the pumping element, exposing the impeller and seal for inspection without disturbing the piping.

VOLUTE CASE incorporates precise geometric design for increased hydraulic efficiency. Made from thick-walled close-grained cast iron to handle the stresses of everyday use. Back pull-out design allows easy removal and repair without disturbing piping connections, and completely exposes the impeller for flushing or service.

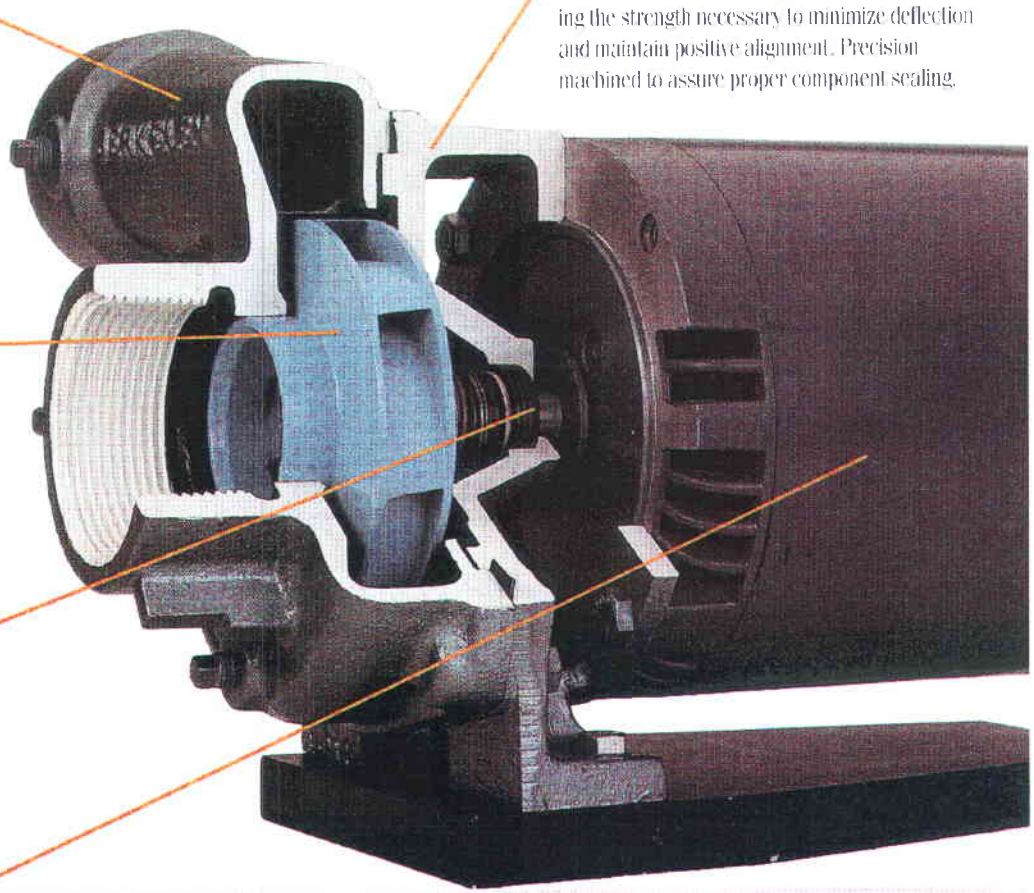
ENCLOSED IMPELLER designed and machined to optimize performance and operating efficiencies. Mechanically balanced to reduce bearing loads and increase life. Keyed and locked to motor shaft. Trimmed for maximum efficiency of both pump and motor.

QUALITY, SELF-LUBRICATING MECHANICAL SHAFT SEAL with corrosion-resistant metal parts provides maintenance-free operation and maximum abrasion resistance without leaking. Optional seals available for special applications.

NEMA STANDARD MOTORS carefully identified and selected by our team of engineers, to meet our high standards for durability, reliability and longevity. High efficiency, low maintenance and smooth, quiet performance are but a few of the many criteria we use to select motors.

REPLACEABLE STAINLESS STEEL SHAFT SLEEVE provides maximum corrosion resistance and protects shaft from wear.

MOTOR BRACKET is close-grained cast iron, providing the strength necessary to minimize deflection and maintain positive alignment. Precision machined to assure proper component sealing.

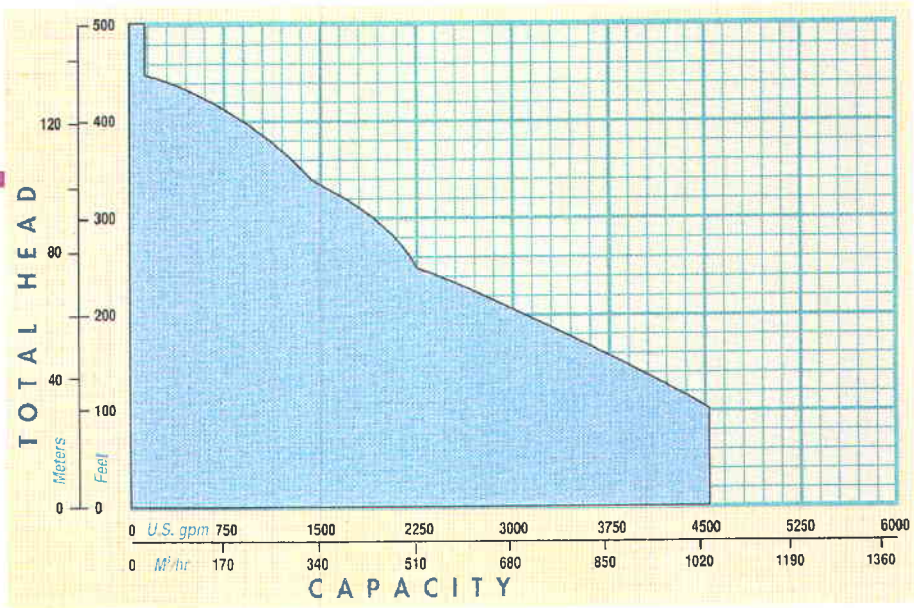


TYPE C CLOSE-COUPLED: MATERIALS OF CONSTRUCTION

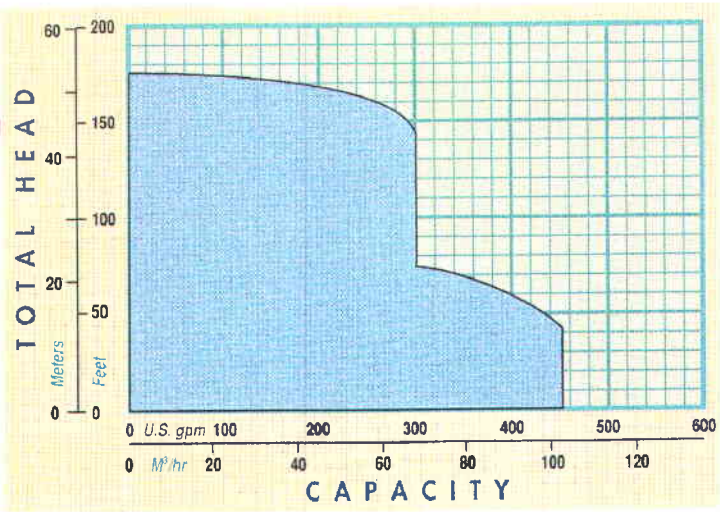
Part Name	Common Material	Specification
Volute Case	Cast Iron	ASTM A48 Class 30
Impeller	Bronze	ASTM B584 (UNS C87500)
Motor Shaft	Stainless Steel	
Bracket	Cast Iron	ASTM A48 Class 30
Mechanical Shaft Seal	18-8 S.S. metal parts, "Buna-N" rubber bellows, ceramic stationary, carbon rotating face.	

PERFORMANCE RANGES

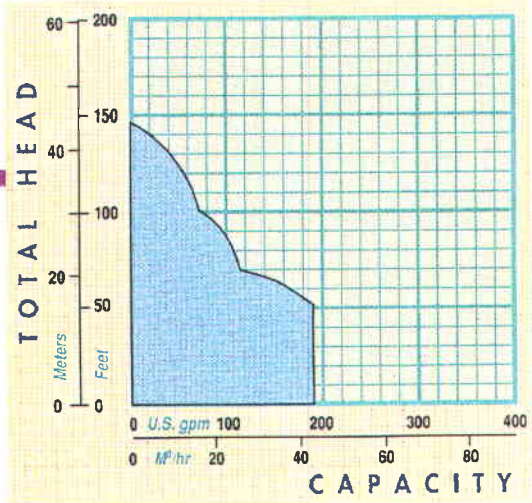
End-Suction Type B Centrifugals



Self-Priming Centrifugals



End-Suction Type C Centrifugals



Consult catalog for individual pump performance ranges.

THE BERKELEY STORY

BERKELEY®

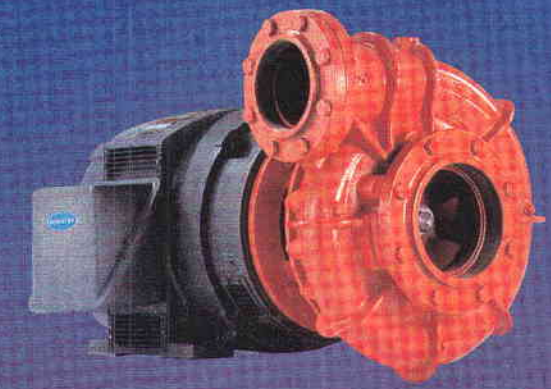
For more than half a century now, distinctive-orange Berkeley pumps have earned a worldwide reputation for rugged construction and dependable performance in the most demanding installations. Berkeley pumps can be found in building services, firefighting, dewatering, irrigation, process liquid transfer, municipal water supply and many other applications.

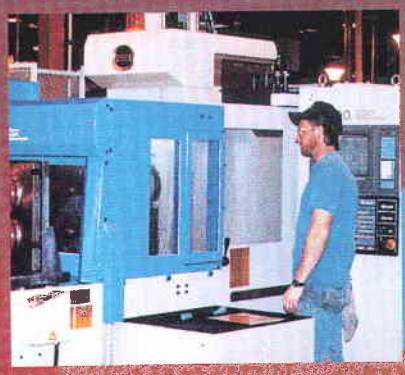
Today's Berkeley—better than ever

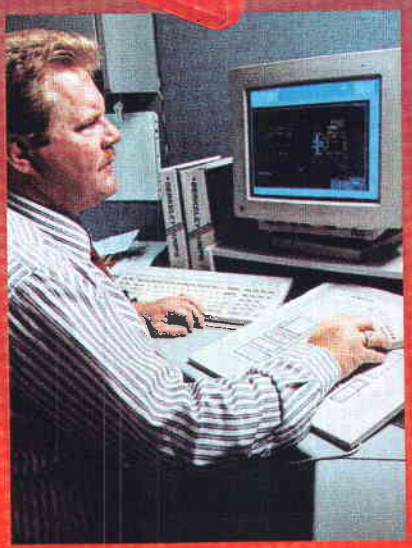
Today, Berkeley Pumps is driven by our customers. We focus on what is most important—superior product performance, efficient customer service, and professional technical support and training.

Our engineering, manufacturing and quality assurance teams work together to meet the ever-changing demands of industry today. Highly efficient inventory systems make it possible to deliver pumps or parts when ***you*** need them. Berkeley customer service representatives are easily accessible through our toll-free number, and provide the support you need to select the right pump for the job.

Berkeley...
let our team work for you.







BERKELEY PUMPS
293 Wright Street
Delavan WI USA 53115 1-888-BERKELEY
Mississauga, Ont., Canada 1-800-363-PUMP

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B1515

Exhibit I

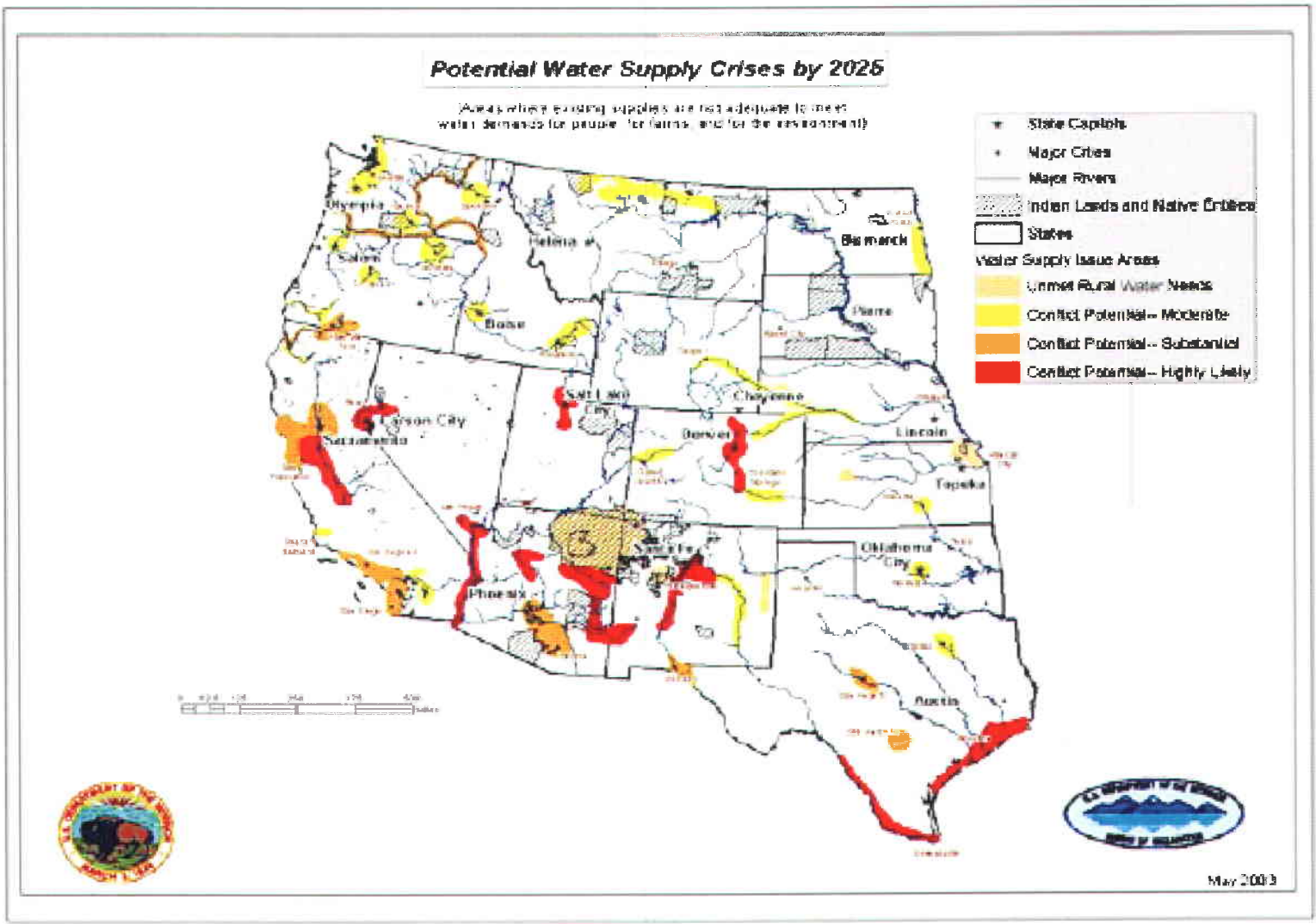
Potential Water Supply Crises by 2025
Areas where surface supplies are not adequate to meet water demands for people, for farms, and for the environment
State Capitols
Major Cities
Major Rivers
Indian Lands and Native Tribes
States
Water Supply Issue Areas
Unmet Rural Water Needs
Conflict Potential-- Moderate
Conflict Potential-- Substantial
Conflict Potential-- Highly Likely
Olympia
Salem
Helena
Bismarck
Boise
Pierre
Carson City
Sacramento
Salt Lake City
Cheyenne
Denver
Lincoln
Topeka
Santa Fe
Oklahoma City
Phoenix
Austin
May 2003

Exhibit II

H2M

Memorandum

TO: MICHAEL P. REICHEL, SUPERINTENDENT
RIVERHEAD SEWER DISTRICT

FROM: EDWARD P. BYRNE, P.E.

DATE: AUGUST 20, 2003

RE: TOWN OF RIVERHEAD / RIVERHEAD SEWER DISTRICT
WASTEWATER REUSE – PILOT STUDY – IRRIGATION DESIGN

On August 19, 2003 I received information from the Suffolk County Department of Parks and Recreation on the existing irrigation system for the Indian Island Golf Course. What they provided are the models and sizes of the sprinkler heads for each area, the operating pressure (Avg. 95 psi) the average daily usage (350,000 GPD) and the irrigation duration (9:30 PM to 5:00 AM). From this information I was able to calculate the precipitation rates as applied to the golf course areas. The Tees are irrigated at a rate of 0.37 inches per hour. The Greens and Fairways are each irrigated at a rate of 0.55 inches per hour.

Researching the 2003 Toro Products Catalog I was able to select sprinkler heads that, at 55 psi, would mimic the golf course system for our pilot study. This information should be passed to the landscaper for his use in laying out the pilot irrigation system. For the Tee area, Toro model S700C-XC-45-FA head in a triangular pattern is suggested for use; for the Fairway and Green areas, TORO model S700C-XC-60-FA head in a square pattern is suggested for use.

It is recommended that prior to construction, you copy this office with the layout design for review. If you have any questions, please feel free to call.

Cc: F. Russo, P.E.

Exhibit III

System Summary

Influent Pump

Maximum & Minimum Static Heads For New Pipe

(Note: All values in this table must be in feet of water.)

		Point No.1	Point No. 2	Point No. 3	Point No. 4	Point No. 5
		10	20	30	37	50
	SYSTEM CURVE FOR C =	120	120	120	120	120
Misc. Loss Here:	Flow Meter (In pipe loss calcs)	0	0	0	0	0
Misc. Loss Here:			0	0	0	0
Misc. Loss Here:			0	0	0	0
	Discharge Pipe Loss	0.36	1.29	2.74	3.93	7.04
	+ Discharge Minor Loss	0.11	0.42	0.95	1.40	2.63
	hfd =	**0.46**	**1.71**	**3.68**	**5.34**	**9.67**
	Suction Pipe Loss	0.00	0.00	0.00	0.00	0.00
	+ Suction Minor Loss	0.00	0.00	0.00	0.00	0.00
	hfs =	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

System Head Curve @ Maximum Static Head Condition

	hsd (Static Discharge Head)	20.50	20.50	20.50	20.50	20.50
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Max. Static Head	**TDH = (hsd - hs) + hfs + hfd + misc.**	**20.96**	**22.21**	**24.18**	**25.84**	**30.17**

System Head Curve @ Minimum Static Head Condition

	hsd (Static Discharge Head)	20.50	20.50	20.50	20.50	20.50
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Min. Static Head	**TDH = (hsd - hs) + hfs + hfd + misc.**	**20.96**	**22.21**	**24.18**	**25.84**	**30.17**

Input the static discharge head and static suction (or lift) in the yellow cells.

Remember: If the free level of the fluid source is below the inlet of the pump, "hs" will be negative (-).

System Summary — Brake Tank Transfer Pump

Maximum & Minimum Static Heads For New Pipe

(Note: All values in this table must be in feet of water.)

		Point No.1	Point No. 2	Point No. 3	Point No. 4	Point No. 5
		10	20	30	37	50
	SYSTEM CURVE FOR C =	120	120	120	120	120
Misc. Loss Here:	Flow Meter (In pipe loss calcs)	0	0	0	0	0
Misc. Loss Here:			0	0	0	0
Misc. Loss Here:			0	0	0	0
	Discharge Pipe Loss	0.58	2.10	4.45	6.39	11.44
	+ Discharge Minor Loss	0.14	0.57	1.29	1.91	3.59
	hfd =	0.73	2.67	5.74	8.31	15.03
	Suction Pipe Loss	0.00	0.00	0.00	0.00	0.00
	+ Suction Minor Loss	0.00	0.00	0.00	0.00	0.00
	hfs =	0.00	0.00	0.00	0.00	0.00

System Head Curve @ Maximum Static Head Condition

	hsd (Static Discharge Head)	5.00	5.00	5.00	5.00	5.00
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Max. Static Head	TDH = (hsd - hs) + hfs + hfd + misc.	5.73	7.67	10.74	13.31	20.03

System Head Curve @ Minimum Static Head Condition

	hsd (Static Discharge Head)	5.00	5.00	5.00	5.00	5.00
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Min. Static Head	TDH = (hsd - hs) + hfs + hfd + misc.	5.73	7.67	10.74	13.31	20.03

Input the static discharge head and static suction (or lift) in the yellow cells.

Remember: If the free level of the fluid source is below the inlet of the pump, "hs" will be negative (-).

System Summary

Effluent Discharge Pump

Maximum & Minimum Static Heads For New Pipe

(Note: All values in this table must be in feet of water.)

		Point No.1	Point No. 2	Point No. 3	Point No. 4	Point No. 5
		10	20	30	37	50
	SYSTEM CURVE FOR C =	120	120	120	120	120
Misc. Loss Here:	Flow Meter (In pipe loss calcs)	0	0	0	0	0
Misc. Loss Here:			0	0	0	0
Misc. Loss Here:			0	0	0	0
	Discharge Pipe Loss	0.99	3.56	7.53	10.82	19.37
	+ Discharge Minor Loss	0.14	0.57	1.29	1.90	3.57
	hfd =	**1.13**	**4.13**	**8.81**	**12.72**	**22.94**
	Suction Pipe Loss	0.00	0.00	0.00	0.00	0.00
	+ Suction Minor Loss	0.00	0.00	0.00	0.00	0.00
	hfs =	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

System Head Curve @ Maximum Static Head Condition

	hsd (Static Discharge Head)	4.00	4.00	4.00	4.00	4.00
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Max. Static Head	**TDH = (hsd - hs) + hfs + hfd + misc.**	**5.13**	**8.13**	**12.81**	**16.72**	**26.94**

System Head Curve @ Minimum Static Head Condition

	hsd (Static Discharge Head)	4.00	4.00	4.00	4.00	4.00
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Min. Static Head	**TDH = (hsd - hs) + hfs + hfd + misc.**	**5.13**	**8.13**	**12.81**	**16.72**	**26.94**

Input the static discharge head and static suction (or lift) in the yellow cells.

Remember: If the free level of the fluid source is below the inlet of the pump, "hs" will be negative (-).

System Summary

Pool Transfer Pump

Maximum & Minimum Static Heads For New Pipe

(Note: All values in this table must be in feet of water.)

		Point No.1	Point No. 2	Point No. 3	Point No. 4	Point No. 5
		20	30	40	50	60
	SYSTEM CURVE FOR C =	120	120	120	120	120
Misc. Loss Here:	Flow Meter (In pipe loss calcs)	0	0	0	0	0
Misc. Loss Here:			0	0	0	0
Misc. Loss Here:			0	0	0	0
	Discharge Pipe Loss	5.71	12.08	20.57	31.09	43.56
	+ Discharge Minor Loss	0.65	1.46	2.60	4.07	5.86
	hfd =	6.36	13.55	23.18	35.16	49.42
	Suction Pipe Loss	0.00	0.00	0.00	0.00	0.00
	+ Suction Minor Loss	0.00	0.00	0.00	0.00	0.00
	hfs =	0.00	0.00	0.00	0.00	0.00

System Head Curve @ Maximum Static Head Condition

	hsd (Static Discharge Head)	4.00	4.00	4.00	4.00	4.00
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Max. Static Head	TDH = (hsd - hs) + hfs + hfd + misc.	10.36	17.55	27.18	39.16	53.42

System Head Curve @ Minimum Static Head Condition

	hsd (Static Discharge Head)	4.00	4.00	4.00	4.00	4.00
	- hs (Static Suction or Lift)	0.00	0.00	0.00	0.00	0.00
Min. Static Head	TDH = (hsd - hs) + hfs + hfd + misc.	10.36	17.55	27.18	39.16	53.42

Input the static discharge head and static suction (or lift) in the yellow cells.

Remember: If the free level of the fluid source is below the inlet of the pump, "hs" will be negative (-).

System Summary

Irrigation Pump

Maximum & Minimum Static Heads For New Pipe

(Note: All values in this table must be in feet of water.)

		Pipe Segment Flow	Pipe Segment Flow	Pipe Segment Flow	Pipe Segment Flow	Suction Pipe Flow
		4.1	8.2	12.3	20.5	20.5
	SYSTEM TDH FOR C =	120	120	120	120	120
Misc. Loss Here:	Flow Meter (In pipe loss calcs)	0	0	0	0	0
Misc. Loss Here:			0	0	0	0
Misc. Loss Here:			0	0	0	0
	Discharge Pipe Loss	2.40	1.16	6.12	20.37	0.00
	+ Discharge Minor Loss	0.20	0.48	0.09	7.26	0.00
	hfd =	2.61	1.64	6.21	27.63	0.00
	Suction Pipe Loss	0.00	0.00	0.00	0.00	0.51
	+ Suction Minor Loss	0.00	0.00	0.00	0.00	0.25
	hfs =	0.00	0.00	0.00	0.00	0.75

System Duty Point @ Maximum Static Head Condition

	hsd (Static Discharge Head)				124.00	
	- hs (Static Suction or Lift)				-8.00	
Max. Static Head	TDH = (hsd - hs) + hfs + hfd + misc.				170.84	

System Duty Point @ Minimum Static Head Condition

	hsd (Static Discharge Head)				124.00	
	- hs (Static Suction or Lift)				-1.00	
Min. Static Head	TDH = (hsd - hs) + hfs + hfd + misc.				163.84	

Input the static discharge head and static suction (or lift) in the yellow cells.

Remember: If the free level of the fluid source is below the inlet of the pump, "hs" will be negative (-).